Review Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2025.63.009919

Sustainable Sugarcane Production in Somalia: Current Practices and Future Prospects

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ARTICLE INFO

Received: September 10, 2025

Published: October 22, 2025

Citation: Abdikadir Musa Jama and Ibrahim Isse Ali. Sustainable Sugarcane Production in Somalia: Current Practices and Future Prospects. Biomed J Sci & Tech Res 63(4)-2025. BJSTR. MS.ID.009919.

ABSTRACT

Sugarcane is one of the most often produced industrial crops in tropical and semitropical regions. It is a member of the Poaceae family, a group of tracheophyte grasses that include sorghum, rice, maize, and wheat. It is cultivated in over 120 countries, covering 27 million hectares. It plays a pivotal role in global agriculture and is not only a source of sugar production but also a source of bagasse, which is utilized as a biofuel for the generation of heat, energy, and power and the production of building materials. Additionally, it is a significant source of livelihood and economic growth in many developing countries. In many African countries, including Somalia, sugarcane production faces several challenges ranging from climate variability and water scarcity to limited access to modern agricultural technologies. Somalia ranks 11th among sugarcane producers in East Africa, 30th in Africa, and 72nd globally. This review demonstrates the current practices of sugarcane cultivation in Somalia, highlighting traditional methods, irrigation systems, and processing techniques while identifying critical challenges such as environmental challenges, technical and infrastructural limitations, socioeconomic constraints, and the effects of political instability. Furthermore, it showcases the market potential of this crop, offering opportunities to boost farmers' incomes and guide policymakers, researchers, and stakeholders in revitalizing Somalia's sugarcane sector. Additionally, the study emphasizes the urgent need for sustainable solutions, including adopting climate-smart agricultural practices, introducing innovative technologies, and developing resilient water management systems. Finally, this paper underscores how sugarcane supports economic growth, environmental resilience, and food security in Somalia, sharing recommendations with future researchers and farmers.

Keywords: Sugarcane production; Sustainable agriculture; Agricultural innovation; Africa, Somalia

Introduction

Sugarcane, which is a tall perennial grass belonging to the genus Saccharum and the family Poaceae, is indigenous to warm, moderate to tropical locations with humid climates in South and Southeast Asia and is characterized by a robust, fibrous stalk that is 2–6 meters long, jointed, and contains sugar (AK, et al. [1,2]). Due to its strategic importance and diverse applications, sugarcane is a common feature in everyday life across nations worldwide and serves as a significant crop for both economic and nutritional purposes (OE, et al. [3,4]). There are distinct stages of sugarcane growth: germination, tillering, main growth, and maturity and ripening phases. Each of these phases requires different temperatures, humidity levels, soil conditions, nutrient availability, and water supply (AK, et al. [1]). Sugarcane is cultivated across all continents, with Asia producing 875,830,429 tons, followed closely by South America with 867,118,725 tons. Africa ranks third with 95,168,375 tons, while Oceania produces 34,481,143 tons, and North America has the lowest production at 29,897,180 tons, as illustrated in (Figure 1 and Table 1). This crop is also grown in over 120 countries, with Brazil leading in production in 2023 at 782,585,836 tons, accounting for 38.63% of total global sugarcane production. It was followed by India (490,533,351 tons), China (104,565,500 tons), Thailand (93,981,770 tons), Pakistan (87,637,669 tons), Mexico (55,977,193 tons), Indonesia (34,700,000 tons), Australia (32,589,391 tons), Colombia (32,415,575 tons), and the USA (29,897,180 tons), as shown in Table 2 (FAO [5]).

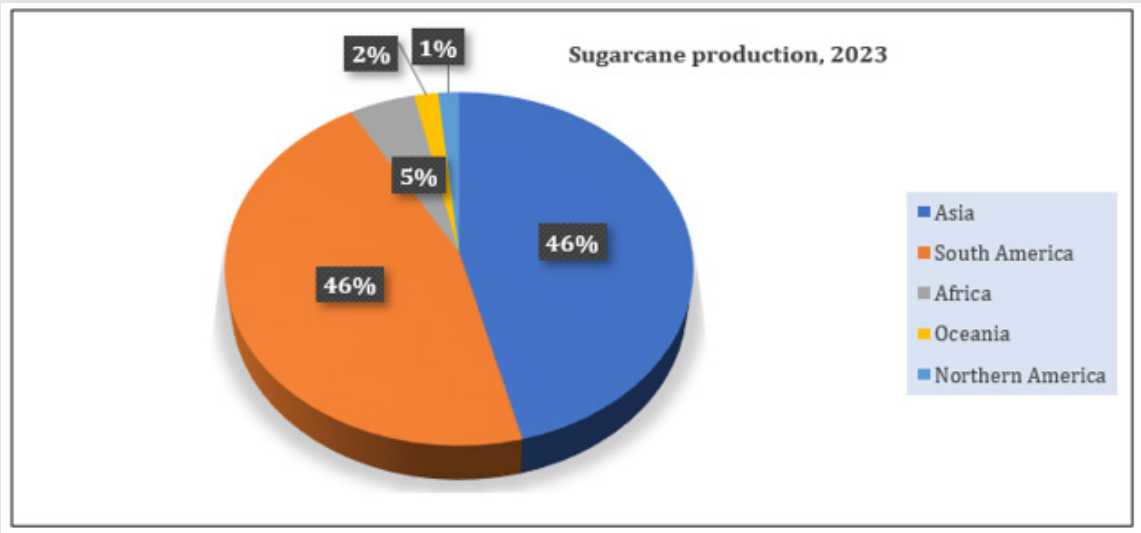

Figure 1: The leading sugarcane-producing continents in the world (FAO [5]).

Table 1: Top sugarcane-producing continents globally (FAO [5]).

No.	Continents	Production (T)
1	Asia	875,830,429.71
2	South America	867,118,725.23
3	Africa	95,168,375.16
4	Oceania	34,481,143.08
5	Northern America	29,897,180.00

Table 2: Top Sugarcane-Producing Countries in the World (FAO [5]).

No.	Countries	Production (T)	Percentage (%)
1	Brazil	782,585,836	38.63
2	India	490,533,351	24.22
3	China	104,565,500	5.16
4	Thailand	93,981,770	4.64
5	Pakistan	87,637,669	4.33
6	Mexico	55,977,193	2.76
7	Indonesia	34,700,000	1.71
8	Australia	32,589,391	1.61
9	Colombia	32,415,575	1.6
10	USA	29,897,180	1.48
11	others	280,914,000	13.86
12	World (total)	2,025,797,465	100

Travella SR, et al. [6]) reported that approximately 5% of global sugar production comes from African countries, with Sub-Saharan Africa accounting for 80% of that amount. According to FAO [5]) statistics, South Africa, Egypt, Uganda, Zimbabwe, and Eswatini were the top sugarcane-producing countries in 2023, as shown in Table 3. In Somalia, sugarcane is an important cash crop that contributes to the country's agricultural sector and economy. Major plantations like the Jowhar and Afgoye sugar estates have historically been at the heart of Somalia's sugarcane production, essential to the country's domestic sugar supply and employment creation. Additionally, the crop grows well in Somalia's warm environment, especially in areas where the Juba and Shabelle rivers provide enough water. However, sugarcane production in Somalia faces several challenges, and this paper highlights the current state of sugarcane production in Somalia, focusing on existing agricultural practices, challenges, and opportunities. It also aims to emphasize sustainable farming methods, including adopting climate-smart agricultural practices, introducing innovative technologies, and developing resilient water management systems to improve productivity, environmental sustainability, and economic benefits. Finally, the paper underscores how sugarcane supports economic growth, environmental resilience, and food security in Somalia, offering recommendations for future researchers and farmers.

Table 3: Top 10 Sugarcane-Producing Countries in Africa (FAO [5]).

No.	Countries	Production (T)	Percentage (%)
1	South Africa	17,944,000	18.86
2	Egypt	15,269,137	16.04
3	Uganda	6,189,665	6.5
4	Zimbabwe	5,670,266	5.96
5	Eswatini	5,621,184	5.91
6	Kenya	5,556,100	5.84
7	Zambia	4,652,869	4.89
8	Sudan	4,373,454	4.6
9	Tanzania	3,588,874	3.77
10	Madagascar	3,214,794	3.38
11	Others	23,088,031	24.26
11	Africa (total)	95,168,375	100

Global and African Sugarcane Production

Sugarcane is one of the most important commercial crops worldwide, primarily cultivated for sugar, ethanol, biochemicals, bioplastics, and bioenergy production (Ahmad, et al. [7-11]. In the global, the area planted with sugarcane expanded from 8,911,979 hectares to 27,028,428 hectares between 1961 and 2023, while production increased from 44.7 MMT to 2,025.8 MMT (FAO [5]). The livelihood of sugarcane farmers has greatly improved because of this increasing productivity. Approximately 80% of the world's sugar comes from tropical and subtropical regions, while the remaining 20% is derived from sugar beets cultivated in temperate areas (Anderson, et al. [6,12]). Based on continents, Asia and South America are the leading producers, with 46% of global sugarcane production, while Africa, Oceania, and Northern America account for 5%, 2%, and 1%, respectively, as illustrated in Figure 1 and Table 2. According to Table 2, Brazil which is the world's largest sugarcane producer, accounts for nearly 39% of global sugarcane production and ranks second in ethanol production at 28%, behind the USA, which accounts for 58% (Bordonal [13]). India is the second-largest sugarcane producer, accounting for 24.22% of global production. The average sugarcane yield per hectare is 69.4 tons, contributing to the socio-economic development of farmers in rural areas (Ulhas [14]).

Additionally, China, Thailand, Pakistan, Mexico, Indonesia, Australia, Colombia, and the USA also produce significant amounts of sugarcane, representing 5.16%, 4.64%, 4.33%, 2.76%, 1.71%, 1.61%, 1.60%, and 1.48%, respectively, of global production, as shown in (Table 2). The global sugarcane industry supports millions of farmers in both developed and developing countries and plays a crucial role in the food and energy sectors. Several developing countries in Africa also cultivate sugarcane for various purposes. For example, South Africa, the leading country, produces 17,944,000 tons, representing 18.86% of the total sugarcane production in African nations. Egypt, Uganda, Zimbabwe, Kenya, Zambia, Sudan, Tanzania, and Madagascar are also top producers, with production figures of 15,269,137 tons, 6,189,665 tons, 5,670,266 tons, 5,621,184 tons, 5,556,100 tons, 4,652,869 tons, 4,373,454 tons, 3,588,874 tons, and 3,214,794 tons, respectively, as shown in Table 3. Many African countries, such as South Africa, Egypt, Tanzania, Kenya, Ethiopia, Somalia, and others, use sugarcane to produce molasses, animal feed, bioenergy, ethanol, sugar, and other products for industrial development (Abdelhady, et al. [15-21]. The provinces of Mpumalanga and KwaZulu-Natal in South Africa are the main producers of sugarcane, which supports the economic growth of the sugar sector (Olivier, et al. [22]).

Additionally, sugarcane serves as a source of bagasse, which is utilized as a biofuel for generating heat, energy, and power, as well as for producing building materials. From every 1,000 kg of sugarcane, approximately 280 kg of bagasse is produced. Globally, around 55 million dry tons of bagasse are generated each year. An estimated 6 million tons of raw bagasse are generated each year in South Africa alone (Wazeer [23]). In Egypt, sugarcane is primarily cultivated along the Nile River, from Middle Egypt, especially in the Minia Governorate, down to the Aswan Governorate in the south. Until 1982, when sugar beet was first cultivated on a modest scale, sugarcane was Egypt's sole source of raw materials for sugar manufacturing (Mehareb, et al. [24]). East African countries such as Uganda, Zimbabwe, Kenya, Zambia, and Tanzania are the top five sugarcane-producing nations, which make up 16.46%, 15.08%, 14.78%, 12.37%, and 9.54% of Africa's total production, respectively, as shown in Table 4. Sugarcane production in Uganda rose from 1.4 million tons in 2000 to 6.19 million tons in 2023. Similarly, production increased in Zimbabwe, Kenya, Zambia, Tanzania, and Somalia from 4,227,500, 3,941,524, 1,600,000, 1,355,000, and 220,000 tons in 2000 to 5,670,266, 5,556,100, 4,652,869.47, 3,588,874, and 241,169.98 tons in 2023, respectively (FAO [5]). Day by day, sugarcane production is increasing in East African nations. However, it still faces several challenges, including water scarcity, soil degradation, pests and diseases, poor infrastructure for transportation and storage, and limited access to modern farming technologies (Dhillon, et al. [18,25,26-28].

Table 4: Top five sugarcane-producing countries in Eastern Africa (FAO [5]).

No.	Countries	Production (T)	Percentage (%)
1	Uganda	6,189,665	16.46
2	Zimbabwe	5,670,266	15.08
3	Kenya	5,556,100	14.78
4	Zambia	4,652,869	12.37
5	Tanzania	3,588,874	9.54
6	Others	11,944,620	31.77
7	Eastern Africa (total)	37,602,394	100

Somalia Sugarcane Production

Somalia, a country located in the Horn of Africa, has a hot and dry climate. Most of the country is arid, while some areas experience a tropical wet and dry climate. Like other East African countries, Somalia cultivates sugarcane, which is a significant cash crop (Abdi, et al. [16,29]). Somalia ranks 11th among East Africa's sugarcane producers, with an annual output of 241,169.8 tons, representing 0.64% of the region's total. Furthermore, it is ranked 30th in Africa, contributing 0.25% of the continent's production, and 72nd globally, accounting for just 0.01% of worldwide sugarcane production, as shown in Table 5. Before the Civil War, Somalia's sugarcane production peaked in certain years, particularly in 1970, 1971, 1982, 1988, and 1989, reaching 450,400 tons, 463,000 tons, 483,200 tons, 450,000 tons, and 450,000 tons, respectively, as shown in Figure 2. At that time, the country had an industry that produced sugar. After the long postwar

period, agricultural equipment and infrastructure collapsed, leaving the entire country facing significant challenges, including recurrent floods, droughts, deforestation, lack of financial support and investment, as well as pathogens and insect pests (Abdullahi, et al. [16,30,31]. In the past six years (2018–2023), as illustrated in Figure 2 and Table 6, sugarcane production in Somalia has begun to recover. However, it has not yet reached the levels recorded between 1970 and 1989 due to ongoing challenges. According to Table 6, From 2018 to 2023, sugarcane production in Somalia showed fluctuations in both harvested area and total output, while yield per hectare steadily increased.

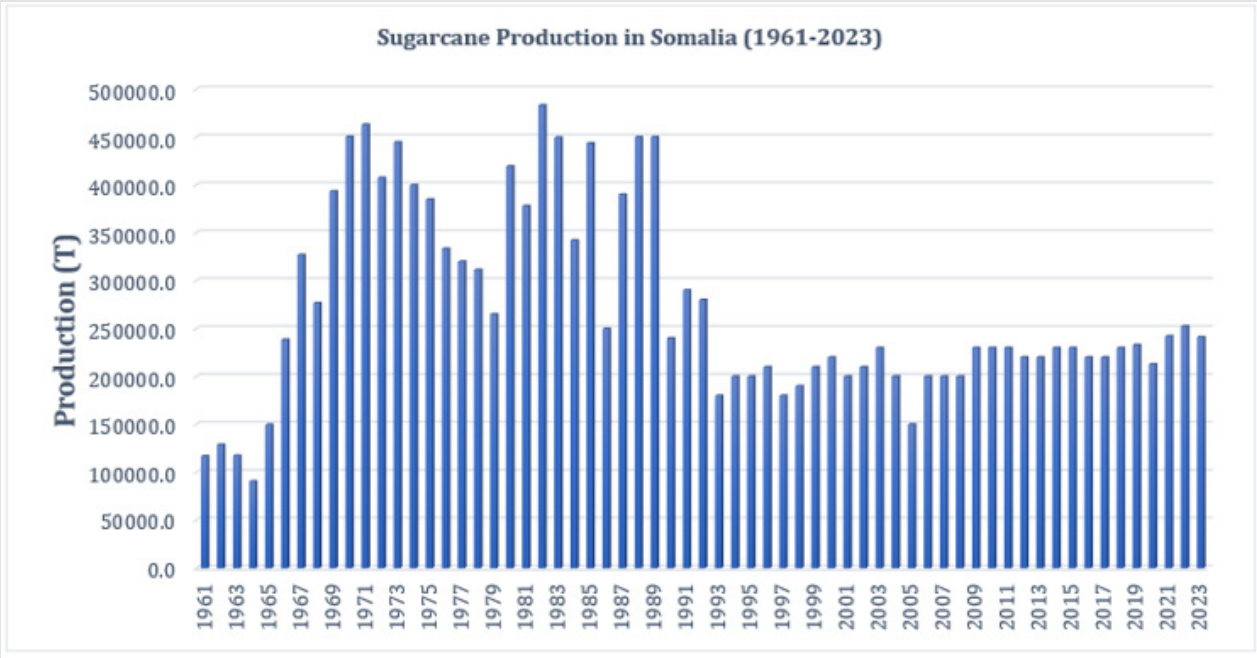

Figure 2: Somalia Sugarcane production in 1961-2023 (FAO [5]).

Table 5: Somalia's Position in Regional, African, and Global Sugarcane Production (FAO [5]).

Region	Countries	Production (t)	Percentage (%)	Position
Eastern Africa	Uganda	6,189,665	16.46	1st
	Zimbabwe	5,670,266	15.08	2nd
	Kenya	5,556,100	14.78	3rd
	Zambia	4,652,869	12.37	4th
	Tanzania	3,588,874	9.54	5th
	Somalia	241,169.80	0.64	11th
	Eastern Africa (Total)	37,602,394	100	
Africa	South Africa	17,944,000	18.86	1st
	Egypt	15,269,137	16.04	2nd
	Uganda	6,189,665	6.5	3rd
	Zimbabwe	5,670,266	5.96	4th
	Eswatini	5,621,184	5.91	5th
	Somalia	241,169.80	0.25	30th
	Africa (Total)	95,168,375	100	
World	Brazil	782,585,836	38.63	1st
	India	490,533,351.10	24.22	2nd
	China	104,565,500	5.16	3rd
	Thailand	93,981,770	4.64	4th
	Pakistan	87,637,669	4.33	5th
	Somalıa	241,169.80	0.01	72nd
	World (Total)	2,025,797,465	100	

Tablo 6: Somalia's Sugarcane Production (2018–2023) (FAO [5]).

Year	Area Harvested (ha)	Yield (kg/ha)	Production (t)
2018	6,512	35,319.40	230,000
2019	6,582	35,402.20	233,000
2020	5,986	35,580.90	213,000
2021	6,774	35,756.90	242,200
2022	7,040	35,852.70	252,400
2023	6,709	35,948.60	241169.8

The area harvested varied from 6,512 ha in 2018 to a peak of 7,040 ha in 2022 before slightly declining to 6,709 ha in 2023. Yield improved consistently from 35,319.4 kg/ha in 2018 to 35,948.6 kg/ha in 2023, reflecting enhanced productivity. As a result, total production increased from 230,000 tons in 2018 to a high of 252,400 tons in 2022, before slightly decreasing to 241,169.8 tons in 2023, likely due to changes in cultivation area and external challenges such as climate variability and resource availability. Based on data from Report Linker [32], Somalia ranked 96th in 2021 globally, behind Burkina Faso, which produced 20,080 metric tons. Currently, it is ranked 72nd, as shown in Table 5 and Figure 3, indicating an increase in its ranking over the past few years. There are several types of sugar from sugarcane such as raw sugar, refined sugar, and brown sugar (Grunow, et al. [33-35]). Many countries, including Somalia, import these sugars to obtain higher purity, better quality, longer shelf life, and improved consistency for industrial use, household consumption, and sugar confectionery production. According to the recent data from FAO [5], Somalia imported a significant quantity of sugar products to meet domestic demand. Refined sugar was the most imported sugar type in Somalia, with 509,370.44 tons imported, worth $325.11 million. 203,163.65 tons of raw cane or beet sugar (centrifugal only) were also imported, valued at $115.79 million.

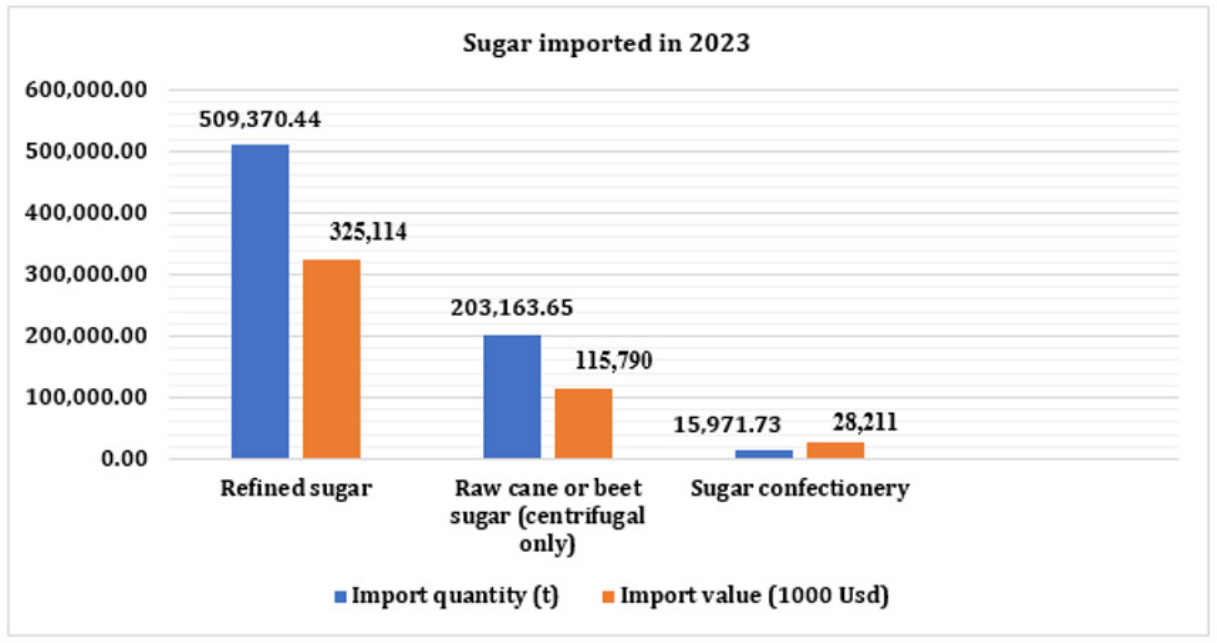

Figure 3: Somalia's Sugar Imports by Type, Quantity, and Value (FAO [5]).

Furthermore, sugar confectionery was imported at 15,971.73 tons, valued at $28.21 million (FAO [5]). Sugarcane producers in Somalia face numerous challenges, including infrastructure destruction due to prolonged civil war, which hinders transportation to local and international markets (Ibrahim Isse, et al. [31]). Additionally, recurring droughts and floods caused by climate change have significantly affected overall crop yields, including sugarcane production, posing further challenges to achieving food security (Abdi, et al. [29,30]). Farmers also struggle with limited access to quality seeds, fertilizers, and modern farming equipment, relying on traditional methods and hand tools due to a lack of mechanization, which is crucial for large-scale sugarcane production (Abdullahi, et al. [16,30]). Additionally, insufficient financial support, pests and diseases, market barriers, and low processing capacity force Somalia to depend heavily on sugar imports to meet domestic demand [36-37]. To overcome these challenges and enhance sugarcane production in Somalia, it is essential to rebuild roads and bridges, implement modern irrigation systems, improve transportation, ensure market access, and mitigate the effects of recurrent droughts. Additionally, using drought-tolerant sugarcane varieties, introducing government subsidies and microfinance programs, and encouraging private sector investment to support farmers are also crucial for sugarcane producers. Furthermore, to reduce import dependency and create employment opportunities for Somali people, investing in sugar mills and refining facilities is crucial.

Conclusion

Sugarcane is not only a significant crop in developing and developed countries but also a key source of bioethanol, a raw material for sugar production, feed for livestock, a creator of employment opportunities, and an important factor in sustainable agriculture. Although

Somalia has been facing a prolonged civil war, political instability, climate change, limited access to modern agricultural practices, poor infrastructure, water scarcity, soil degradation, pest and pathogen, and lack of access to credit and markets, sugarcane production has steadily increased over the past six years, as shown in Table 6 and Figure 2. Additionally, the increasing demand for sugar in Somalia, coupled with the country's agricultural potential, can contribute to sustainable solutions for enhancing local production. Overcoming these challenges is essential not only for economic growth but also for achieving food security, rural development, and reducing dependency on imports. To enhance the future of sugarcane production in Somalia, climate-smart agricultural practices, improved infrastructure, mechanization, and investment in irrigation must be adopted across the entire country. Furthermore, continued research and innovation in sustainable agricultural practices, biological pest control, and drought-resistant sugarcane varieties are also essential. Finally, government policies and private-sector involvement are also unforgettable to reach a self-sufficient sugar industry, reducing reliance on imports, and expanding Somalia's capacity to produce sugar in the region.

Acknowledgement

This paper was presented at the 4th International Conference on Frontiers in Academic Research, which took place in Konya, Turkey, on December 13–14, 2024. We sincerely appreciate the conference organizers for providing us with the opportunity to present our review.

Conflict of Interest

The author declares no conflict of interest regarding the publication of this paper.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.63.009919

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Biomed J Sci & Tech Res