

## Review Article

# Tea (*Camellia sinensis*) Production, Opportunities, Challenges, and Future Prospects in Ethiopia

**Nagassa Dechassa and Misgana Merga** 

*Ethiopian Institute of Agricultural Research, Ambo Agricultural Research Centre, Ambo, Ethiopia*

Correspondence should be addressed to Misgana Merga; [misganamerga@gmail.com](mailto:misganamerga@gmail.com)

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Tea is one of the most commonly consumed stimulants in the world. It is cultivated commercially at Wushwush, Gumero, and Chewaka tea estate plantations, in Ethiopia. Over 150,000 hectares of Ethiopian land are available for the production of high-quality tea, but only 3,099 hectares are currently under cultivation. In Ethiopia, tea clones MLk-1, MLk-2, 11/56, S-15/10, FNF, 11/4, 6/8, L6, B9, Chai, BB-35, and SR-18 are commercially grown. Ethiopia's favorable environmental conditions for high-quality tea production increased the availability of tea throughout the year, and the availability of a sufficient labor force is a significant opportunity for tea companies. However, tea production is still infant because it needs huge capital to establish the tea plantations and production, the pest problems, limitations of improved technologies like cultivars, and lack of tea genetic resources. Besides, there is a limitation of comprehensive research to develop innovative technologies in the case of tea agronomic, breeding, and pest management for Ethiopian conditions. Thus, the government should invite investors and facilitate necessary things for the investors to increase the tea industry in the country. The tea research should be strengthened for the development and implementation of the appropriate technologies.

## 1. Introduction

Tea (*Camellia sinensis*) is one of the most regularly consumed stimulants by people of all age groups [1, 2]. Every day, more than three billion cups of tea are consumed worldwide [3]. Tea was first consumed in China as a medicinal drink and later as a refreshment [4]. It contains about 700 useful compounds, including flavonoids, amino acids, vitamins (C, E, and K), caffeine, and polysaccharides, all of which are linked to human health [5]. The health benefits of including the prevention of tooth decay, cancer, blood clotting, intestinal disorders, and heart disease, as well as the reduction of blood cholesterol, blood pressure, and blood glucose activity, and the normalization of diabetes [5]. Tea, like water, helps maintain a balance of body fluids and thus contributes to overall good health, as it contains no sodium, fat, carbonation, or sugar unless added by the consumer [6].

Tea (Assam type) was introduced to Ethiopia for the first time in 1927 and is grown in the Oromia Region, Ilu Aba Bora Zone, Alle District, near Gore Town [7]. In 1989, Wushwush and Gumero tea estates began commercial tea production in Ethiopia, and the tea industry quickly spread to other parts of the country [8]. Except for burgeoning out-growers around tea corporations, Ethiopian tea plantations are owned by large-scale investors. In contrast to other nations such as Assam, Ceylon, and Indonesia, Ethiopia produces tea in a monoculture with no shade trees [8]. The crop grows best in areas with at least 1,500 mm of annual rainfall, mean air temperatures of 18–20°C, average humidity of 70–90%, and five hours of sunlight per day [9].

Tea production has the potential of land that covers over 150,000 hectares of Ethiopian land [10]. However, tea production by estate farms and surrounding out-growers covered only around 3,099 hectares of the country's land [11]. Even though Ethiopia has the potential land to grow

tea, the total area covered by tea is low. Several confounding problems are contributing to the low tea production in Ethiopia. The establishments of tea plantations require huge capital, and the high production costs reduce the investor's interest in investing in tea. Besides, the scarcity of technology like ideal cultivars due to the narrow genetic base in the country remains the yield low [12]. Climate change, pest infestation (disease, insect, and weed) [8, 13–15], and weak adoption of tea production packages due to the lack of adequate extension service [16] are also the problems facing the production of tea. This review provides a brief explanation of the status, gaps, and opportunities of tea production and the challenges facing tea research and production in Ethiopia.

## 2. Tea Production in Ethiopia

*2.1. Tea Producing Areas.* In Ethiopia, there are three largest tea producers' private companies: Wushwush, Gumaro, and East Africa (Chewaka) tea estate plantations located in the southwestern part of the country (Figure 1). Tea estate plantations have taken up a total of 2,660 hectares of land. Furthermore, 581 out-growers are growing tea on 439 hectares around the three large-scale tea plantations [11]. Small-scale farmers have also formed a group to produce and distribute green leaves to enterprises.

Wushwush tea plantation has suitable environmental conditions for producing high-quality highland tea. It began as an experiment in 1973 and grew to 1,249 hectares. It is located in the Kaffa Zone in the southern region, 460 kilometers from Addis Ababa to the Southwest, at an altitude of 1,900 meters above sea level (m.a.s.l.), with an annual rainfall of 1,820 mm and minimum and maximum temperatures of 12 and 24°C, respectively. It has fertile soil with adequate drainage, a red-brown color, and high organic matter content [17].

Gumaro tea plantation is also located in the Ilu Aba Bora Zone, Oromia Region, 637 kilometers from Addis Ababa to the Southwest. The farm is currently 860 hectares in size. It has a rainfall of 2,089 mm and an altitude of 1,718 m.a.s.l. The minimum and maximum temperatures are 12 and 24°C, respectively. It has fertile soil with adequate drainage, a red-brown tint, and high organic matter content. In addition, Gumaro has 761 hectares of eucalyptus trees grown as fuel for the tea companies' drying processes. Out-growers are also located near these plantations [17].

Chewaka Tea Estate (formerly known as East African Agribusiness) is a private company established in 1997 in the Southern Nation Nationalities and Peoples Representatives Region (SNNPR) in Masha district, around 650 kilometers from Addis Ababa to the Southwest. The estate comprises a tea plantation of 541 hectares and a eucalyptus plantation of 210 hectares [18].

*2.2. Potential Areas for Tea Production in Ethiopia.* Ethiopian tea is the best and similar to teas from other countries of a higher grade. Its conviction is backed up by worldwide peers who have proven, via research and testing,

that the assertion was right and that the inherent quality of tea is comparable to the best in the world. Tea cultivation could be possible on more than 150,000 hectares of Ethiopian land indicated in Table 1. However, its production has taken up 2,660 hectares of land owned by tea estate farms and 439 hectares owned by nearby out-growers [11]. Ethiopia exclusively produces black tea but also can grow all sorts of tea [19]. However, a joint venture agreement to develop tea, additional 5,000 hectares of land in the Ilu Aba Bora Zone of the Oromia Region is currently signed between Chewaka tea estate company and Dubai World Trading Company [19].

## 3. Opportunities for Tea Production in Ethiopia

Tea production helps to generate income and creates employment opportunities for many Ethiopians. Every year, Ethiopia produces 7,000 tons of black tea, and out of 7,000, approximately 5,000 tons are consumed in the country. Ethiopian tea exports account for 30% of the total country with about 12 countries [10]. Ethiopia earned \$738,000 by exporting tea in 2019, making it the world's 83rd-highest exporter of tea. Tea was Ethiopia's 93rd most exported product in the same year. Ethiopia's primary tea export destinations are Pakistan (\$404,000), Kenya (\$188,000), the United Kingdom (\$61,300), Kuwait (\$40,800), and the United States (\$19,800) [20].

At the tea estates in Southwestern Ethiopia, the tea development has provided revenue for 581 out-growers and employment possibilities for 7,139 temporary and 1,157 permanent workers [10]. Since the cultivation of tea requires intense human labor, the availability of a large labor force in the country creates an opportunity for companies [11]. Tea companies require a lot of labor, which is an enormous opportunity for an alarmingly expanding number of jobless workers.

Ethiopia's favorable environmental condition for producing high-quality tea is one of the opportunities for the country's investors. Fertile soil with a high organic matter content and an adequate drainage system is an opportunity for the producers to produce a competitive organic tea in the global market. More than 98% of the 150,000 hectares of Ethiopian land suitable for tea production is waiting for investors for tea industry investment. It is also an excellent opportunity to use tea as an alternate crop in the country's coffee diversification initiative. In addition, it gives coffee producers the ability to earn a consistent income from their tea production, which is available every 10 to 15 days.

## 4. Challenges of Tea Production in Ethiopia

*4.1. Lack of Improved Technology.* Despite Ethiopia's favorable environmental conditions for producing high-quality tea, production and productivity have remained stagnant. Ethiopia had the lowest tea yield of 1,300 kg·ha<sup>-1</sup>, whereas Sri Lanka had the highest tea output of 6,700 kg·ha<sup>-1</sup>, followed by Bolivia with 2,586 kg·ha<sup>-1</sup> [1]. Only about 15 tea clones were introduced to Ethiopia from Kenya and India [12] and have been under production for 25

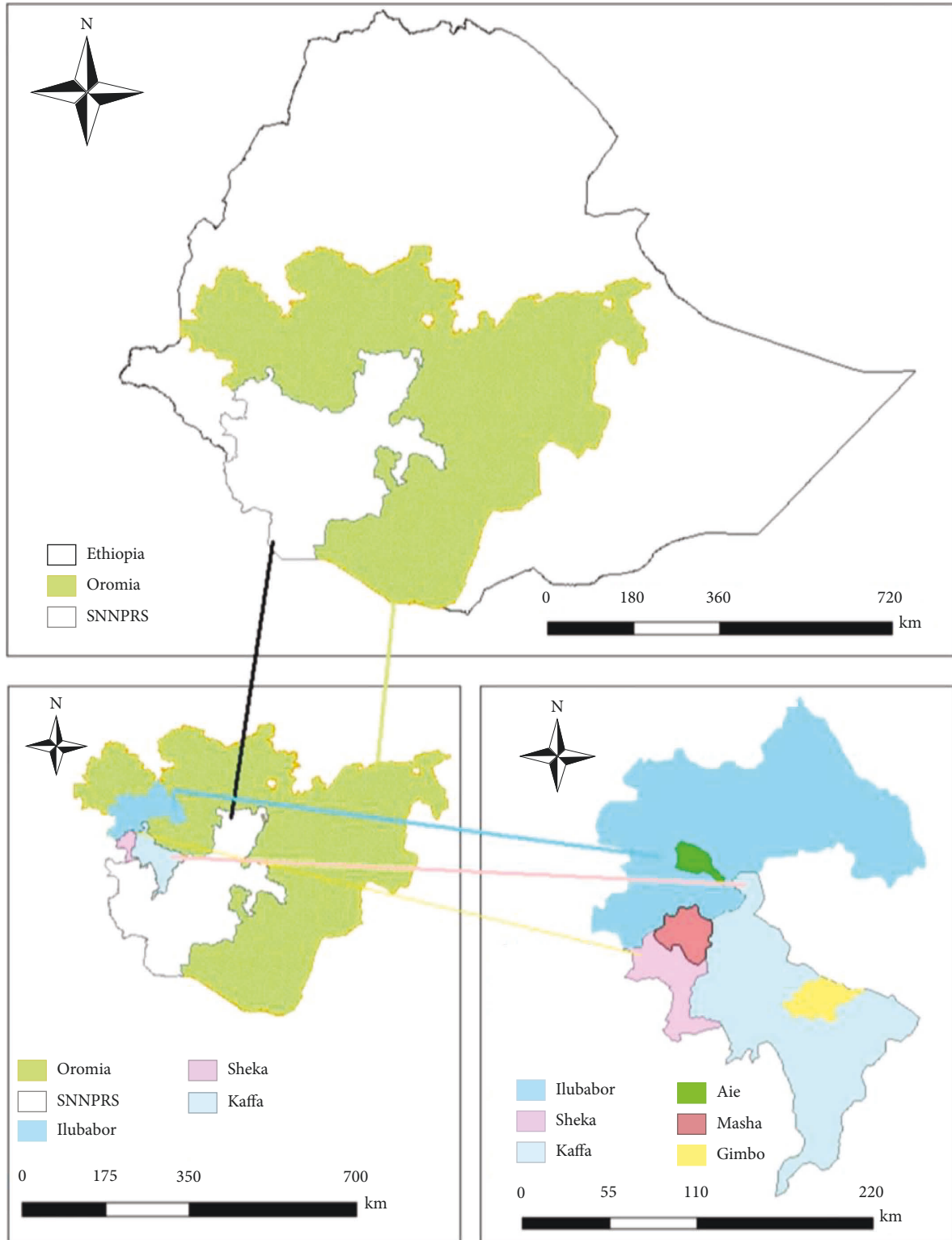


FIGURE 1: Map of Ethiopia showing regions, zones, and districts of Southwest Ethiopia known for tea production [13].

to 100 years. There are no improved cultivars of tea developed so far in the country. A lack of genetic resources for tea is one of the main challenges to improving the low yield of tea. Genetic resources are a necessary starting point for crop improvement. There are several research approaches

applied to broadening the genetic resources. Collection, introduction, characterization, and utilization of tea genetic resources are relevant activities in a breeding program. Besides, advanced techniques like genetic mapping, high-throughput, omics, genetic transformation, and mutagenesis

TABLE 1: Estimated tea production potential of Ethiopia by region, area, and specific location.

Regions	Area in hectares			Specific locations identified
	Identified	Cultivated	Submitted to interested companies	
Oromia	55,000	1,623	10,000	Anfilo, Berbere, Gera, Didu, and aAlle
SNNPR	75,000	1,478	—	Gewata, Maji, Masha, Andaracha, and Decha
Amhara	5,000	—	—	Guanga and Ankasha
Gambela	15,000	—	5,000	Gambela
Total	150,000	3,099	15,000	

Source: [10, 11].

are helpful for tea improvement. However, tea breeding in the country is not mature and needs more attention to strengthen further the breeding program.

**4.2. Requires Large Capital.** Tea investment requires large capital. The demands of a large sum of money, land, labor, and lack of infrastructure are not attracting the investors investing on tea. Tea out-growers near tea estate farms confront issues such as high production costs, a lack of accessible roads to tea processing factories, so their products cannot be delivered on time [16]. There is no better tea plucking machine, and manual tea plucking is a drudgery that accounts for 58–71% of overall tea production costs [16].

**4.3. Climate Change.** The trend of climate variables such as temperature, precipitation, and solar radiation in Ethiopia is not uniform throughout the country. Over 50 years of historical data show that the mean temperature increased by 1.3°C between 1960 and 2006, at an average rate of 0.28°C per decade, and by 0.3°C per decade in the southwestern region [21]. The amount of precipitation from the winter and summer seasons has also declined by 15–20% since the mid-1970s and late 2000s in the southern, southwestern, and southeastern where tea is dominantly grown [21].

Climate change has the potential to hurt tea production and productivity. Tea largely depends on microclimatic conditions. Climate change affects the quality and quantity of tea production [22]. It influences the concentration of secondary metabolites, which are most important for the quality of tea. The dilution of phytochemicals as a consequence of more frequent extreme rains adversely changes the taste of tea [22]. It produces sun scorch, which lowers tea yields and quality by increasing the frequency of extreme weather occurrences like droughts, hail storms, floods, frosts, extreme rainfall, and landslides [23, 24]. It has the potential to alter the suitability of existing tea-growing locations [24]. Shortage of rainfall can cause irretrievable yield losses by reducing the shoot extension, leaf area expansion, and the number of lateral branches and decreases the quality of tea. Furthermore, the combined impacts of climate change will likely reduce the tolerance of tea and make it more susceptible to altered environmental conditions. It also has further impact on the producers leading to financial and food insecurity [25, 26].

**4.4. Pest Problem.** Many fungal pathogen-caused diseases are a major constraint to tea production and productivity in Ethiopia. *Fusarium* wilt, black rot, bird's eye spot,

brown blight, grey blight, and algal leaf spot diseases are caused by *Fusarium oxysporum*, *Corticium koleroga*, *Cercospora theae*, *Colletotrichum camelliae*, *Cercospora theae*, and *Cephaleuros virescens*, respectively, were identified diseases of tea plants in the country [8, 13]. Tea yield loss is linked to fusarium wilt, black rot, and bird's eye spot disease. *Cephaleuros virescens*-caused algal leaf spot disease was observed on the older leaves of aged tea trees at the Gumaro Tea Estate Farm [8, 13].

Various insect pests that feed different tea parts limit tea production and productivity. In Ethiopian tea plants, tea aphids, termites, flea beetles, red ants, serpentine leaf miners, leaf skeletonizers, soft brown scales, orange scale, metallic leaf beetles, and grasshoppers were identified [14]. Although the majority of the insects observed throughout the study period was classified as minor pests, they are possible that any of the minor pests could become economically important pests depending on environmental conditions [14]. Therefore, before implementing any control strategy in tea plantations, it is critical to understand the ecological roles of insect pests in the tea ecosystem and to identify important determinants of biotic and abiotic factors for their abundance.

About 32 weed species were identified as economically important to tea production in the country [15]. The majority of the identified weed species in tea fields were annuals in nature [15]. The most common and economically important weed species in tea fields are *Ageratum conyzoides*, *Hydrocotyle americana*, *Commelina benghalensis*, *Galinsoga parviflora*, *Bidens Pilosa*, and *Polygonum nepalense* [15].

In general, although many pests are found in Ethiopia [8, 13–15], there is no scientifically suggested pest control solution for managing pests and increasing tea yield. Therefore, research attention is highly required to develop the management system of these pests.

## 5. Conclusions

Tea is one of the most commonly consumed stimulants, next to water, by people of all ages. Since its first introduction to Ethiopia, tea has been commercially cultivated by Wushwush, Gumero, and Chewaka tea estate farms and surrounding tea out-growers. The favorable environmental conditions for high-quality tea production, the availability of cultivation land, the use of tea as an alternate crop in the country's coffee diversification initiative, and the availability of a large number of labor forces are the major opportunities for tea production in Ethiopia. However, huge capital is

needed to establish the tea industry, shortage of improved technology, impacts of climate change, pest infestation, and weak extension service are identified as the major challenges facing tea production and productivity.

## 6. Future Perspectives

- (1) Future Ethiopian tea research should focus on studying, developing, and implementing innovative agronomic and breeding technologies suitable to Ethiopian environments. Comprehensive investigations on distant hybridization, genetic transformation, marker-assisted selection, high-throughput techniques, omics tools (genomic, transcriptomic, proteomic, and metagenomics), and QTL mapping are imperative to improve the low yield and quality of tea.
- (2) The attention of tea research should be on the identification and development of appropriate management options for pests (diseases, weeds, and insects) in the country.
- (3) The Ethiopian government is advised to invite and facilitate conditions for investors to establish tea industries in the country.
- (4) Ethiopian investment should be directed towards investing in tea industries in the identified suitable areas for tea production in the country.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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