Cotton Agronomy and Production

Yayeh Bitew and Alemu Abate

Abstract In Ethiopia, there is immense potential for the cultivation of cotton, considering its suitable agro-ecological zones and the presence of water. However, there is a significant disparity between the potential and the actual production when it comes to Ethiopia's share of global production. Limited availability of research and extension services, insufficient supply of inputs, inability to produce high-quality products, and inadequate infrastructure and finance are some of the factors contributing to this gap. The following comprehensive agronomic management recommendations are proposed to achieve at least the optimal yield of the typical output: on average, it takes 20–50 heat units (degree-days) from cotton planting to 60% boll opening. Cotton thrives in deep arable soils with good drainage, organic matter, and high moisture-retention capacity. Among the different cotton varieties, G. hirsutum is the suitable and predominant species, accounting for approximately 90% of global production alone. Seed selection is a prerequisite for cotton cultivation. After selecting the seeds, purity should be above 95% and germination should be above 85%. Seed rate and plant spacing vary depending on the cotton species. Cotton is planted at a depth of 1.5−2 cm in humid conditions and 3−4 cm in dry conditions. At the field level, specific crop management practices need to be followed from sowing to emergence, including management during the seedling stage, flower and bud formation stage, flowering stage, and boll opening stage.

Keywords Production level · Cultivated species · Climatic and soil requirement

Y. Bitew · A. Abate (✉)
Department of Plant Sciences, College of Agriculture and Environmental Sciences, Bahir Dar University, P.O. Box 79, Bahir Dar, Ethiopia
e-mail: abatalem@yahoo.com

Y. Bitew
e-mail: yayehbitew@gmail.com

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1 Introduction

Cotton is a significant cash crop in numerous developed and developing nations. It has a notable impact on reducing poverty, as it is grown on small family farms in areas with limited opportunities for growing other crops and low per capita income [10]. In 2007, cotton was cultivated in 90 countries. The cost of cotton cultivation in Africa is lower compared to other countries. However, African countries only contribute 12% to the global market [33]. In this continent, cotton is typically grown by small-scale farmers as the primary cash crop on rain-fed land, with minimal use of purchased inputs like chemicals and fertilizer [3]. According to [30], cotton production in sub-Saharan Africa increased by a factor of 8.5 from 200,000 tonnes per year to over 1,700,000 in 2004/05, while global production volume only tripled. However, over the past decade, yields have stagnated at approximately half of the world's production due to a lack of irrigation and inconsistency in input provision and advice across the region. Additionally, the author demonstrated that the area of land dedicated to cotton is expanding while cotton productivity in Africa remains only half of the world's production (Ibid). Ethiopia is also among the sub-Saharan African countries that cultivate and export cotton. It has a long history of cotton cultivation, with an estimated area of over 2.6 million hectares suitable for cultivation. The primary markets for Ethiopian cotton are Africa, Asia, and Europe, with Asia alone accounting for 67% of total exports [7]. Currently, the price of Ethiopian cotton is determined by the textile industry development institute as Grade "A" ($1.47/kg), Grade "B" ($1.43/kg), and Grade "C" ($1.40/kg). However, Ethiopia only contributes 5% to the total production in Africa (Ethiopian Investment Agency [7, 8]). Based on these reports, despite having ample land for abundant cotton production, Ethiopia has performed poorly in terms of cotton production and marketing.

1.1 Production Levels and Major Production Areas in Ethiopia

Cotton is one of the few agricultural products whose production and consumption are almost entirely global in scope. Cotton is growing in more than 70 countries, including Ethiopia, and many developed and developing countries rely on lint imports for their spinning and textile industries. Cotton production and consumption have increased significantly over the last four decades, rising from 9.8 million tonnes in 1960/61 to 18.5 million tonnes in 1998/99 and 21.1 million tonnes in 2001/02 [4].

The major cotton producers are concentrated in the developed world, with the United States far and away the largest producer, followed by China, India, Pakistan, Uzbekistan, and West African countries. Only 30% of total global production is exported annually, as most producers are becoming major consumers of their own production and even import cotton due to their expanding spinning and textile industries. This has resulted in a significant shift in trade flows away from the main exporting regions and towards the leading producers and importers of cotton, such as those in Asia [12].

Ethiopia, too, has a huge potential for cotton production due to its suitable agro-ecological zones and water availability. According to the Ministry of Agriculture, the suitable cotton production area is estimated to be 2,575,810 ha, which is comparable to Pakistan, the fourth largest producer. Despite this enormous potential, Ethiopia produces only 77,000–84,000 MT of raw cotton per year from a total area of 42,371 acres [1]. The disparity between existing potential and actual practice is more apparent when we consider Ethiopia's share of international cotton production and marketing, with an average share of only 0.13% of total cultivated land and 0.1% of cotton produced from 1998 to 2000 [14]. In terms of international trade in lint cotton, Ethiopia has a 0.1% export share and a 0.06% revenue share for the same year. There could be several reasons for the country's poor performance in cotton production and marketing. Among the few are the limited availability of research and extension services, as well as an insufficient supply of inputs and a lack of capacity to supply quality products, as well as the presence of inadequate infrastructure and finance [1].

Despite its poor performance, the cotton sub-sector remains a unique opportunity for Ethiopia in terms of serving as a bedrock upon which the country can shift to high value-added technological transformation due to its strong backward and forward linkages with various sectors and its provision of employment opportunities for a large number of rural poor. Against this backdrop, the Ethiopian government wishes to make a concerted effort and take action to stimulate the growth and potential of this sub-sector in order to make cotton one of the country's major commercial crops.

Ethiopia is ideal for cotton cultivation due to favourable natural conditions (climate, fertile soils and water availability) and a millennium-long tradition of producing cotton and textile fabrics (Fig. 1). Only 3% of the total 2.6 million ha potentially suitable for cotton production are currently under cultivation in the country. Cotton is typically grown in rotation with sesame, sunflower, sorghum and mung beans. The national seed cotton production in the 2018/2019 campaign was estimated to be 95,750 t. Lint and then yarn are made from seed cotton, as are cotton oilseeds, from which cotton oil and cake are made, and planting seeds (Fig. 2). The main variety of seed cotton cultivated in Ethiopia (DP90), like in West Africa, produces medium lint. Aside from that, cotton produced in the country is generally of low quality (heterogeneous, irregular and contaminated with foreign material) [9].

1.2 Agronomic Requirements and Practices

1.2.1 Abiotic Environment

Cotton, despite its origins in the tropics and subtropics, has come to be cultivated primarily in subtropical and warm-temperate zones, which account for more than half of global production. The species' photoperiod had to change for this geographical

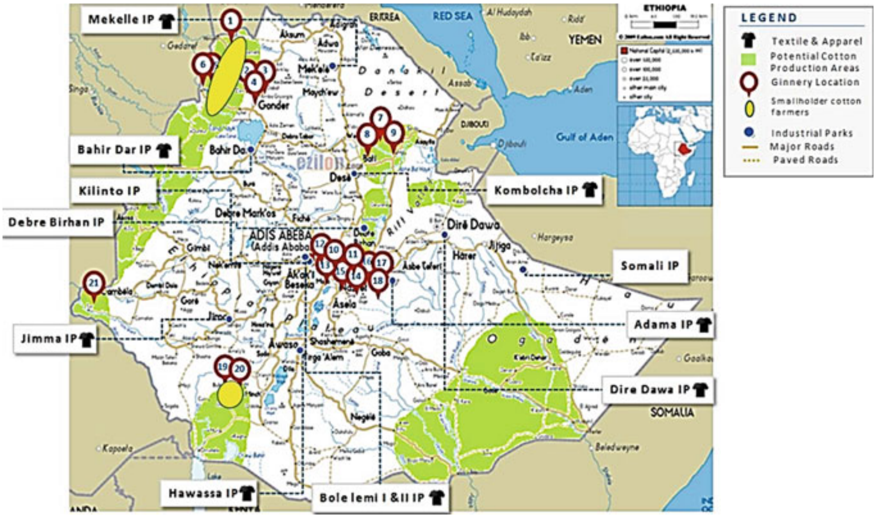

Fig. 1 Distribution of Ethiopia's Industrial Parks (IPs), potential cotton-growing sites and ginnery locations (*Source* TIDI, Overview of the Ethiopian Cotton Sector 2017)

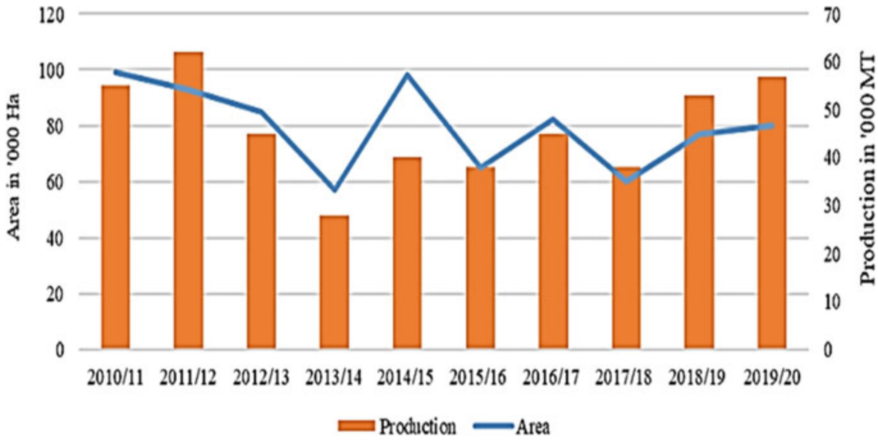

Fig. 2 Ethiopian's cotton production trends: 2010–2020

shift to be possible as a crop—the naturally short-day plant became a day-neutral plant that could be cultivated as an annual crop in the longer summers [28].

1.2.2 Climate Requirements

The main climatic factor determining the geographical range in which cotton can be grown is temperature. In general, the plant is extremely temperature sensitive

(Reddy et al. 2006). Seeds do not germinate, nor do seedlings begin to grow, until the temperature rises to 15 °C; above 38 °C, they are delayed. *Gossypium barbadense* seedling development is generally not sensitive to temperatures ranging from 15 °C to 40 °C in the first 2 weeks, but 3 weeks after emergence, the young plants are more sensitive than *G. hirsutum* (having fewer fruiting branches at 35°/27 °C than at 30°/22 °C, and none at 40°/32 °C). Nonetheless, *G. barbadense* cultivars with heat tolerance comparable to *G. hirsutum* exist [31]. The optimum daytime temperature range for *G. hirsutum* is 30–35 °C, with a loss of fruit above 35 °C and a 50% yield reduction at 25 °C [22]. For *G. hirsutum*, 180–200 frost-free days are required after planting, with an average of 150 days of suitable temperatures (i.e. 1200 heat units above 15.5 °C accumulated); for G. barbadense, 200–250 days are required [33]. Although the values vary by variety, the required minimum is 2050 heat units (degree-days or day-degrees) from cotton planting to 60% boll opening [20]. Cotton prefers full sun because it is a short-day plant. Cotton's light saturation point is 70,000–80,000 lax.

1.2.3 Soil and Water

Cotton plants are grown in a wide range of soil types, but the crop grows best in deep arable soils with good drainage, organic matter and a high moisture-retention capacity. Cotton is a salt-tolerant plant, with *G. barbadense* being more salt tolerant than *G. hirsutum.* Nonetheless, salinity stress has a negative impact on germination and emergence [2], the most common stress effect is general stunting of plant growth. Cotton crops grown on dry land (non-irrigated) require at least 500 mm of rainfall during the growing season [6].

Cotton is also grown as an irrigated crop, and sprinklers with fixed or mobile outlets with total coverage are still widely used. Irrigation enables cultivation in poor-quality soils by providing the necessary moisture and nutrients in a controlled manner. Irrigation is done primarily at ground level, flooding the furrows, which necessitates adequate field levelling. The use of drip irrigation has increased, allowing for water savings and the use of less-than-ideal soil (due to a sloping surface, a lack of fertility or an excessively high salt content). *G. barbadense* has similar water requirements to *G. hirsutum* in general; however, the longer growing season of *G. barbadense* may necessitate additional irrigation to mature its later-set bolls [26]. The application of water at the right time optimizes the plant's vegetative growth, flowering and boll production. Flower and boll formation in *G. barbadense* is aided by short periods of direct sunlight, high minimum humidity and a slow evaporation rate [25].

1.3 Cultivated Species

Cotton has four cultivated species: *Gossypium arboreum, G. herbaceum, G. hirsutum* and *G. barbadense.* The first two species are diploid (2n = 26) and indigenous to the old world. They are also known as Asiatic cottons due to their origins in Asia. The last two species are tetraploid (2n = 52) and are also known as New World Cottons. *G. hirsutum* is also known as American cotton or upland cotton, and *G. barbadense* as Egyptian cotton, Sea Island cotton, Peruvian cotton, Tanguish cotton, or quality cotton. *G. hirsutum* is the dominant species, accounting for roughly 90% of total global production. Perhaps India is the only country in the world where all four cultivated species are grown commercially (OECD 2021).

1.4 Cultivation

1.4.1 Sowing

Before beginning anything, seed selection is required for cotton production. Smaller, imperfect, impurity, disease and insect-damaged ones should be removed. After seed selection, the purity and germination should be greater than 95 and 85%, respectively. Seed treatment should be performed if necessary. Among the techniques are: sun dry—to some extent, this kills bacteria and fungi and increases water absorption ability. The acid treatment is used to delint all of the linter, make the seed shine, improve germination capacity, remove dormancy, control seed-borne disease, and save labour for replanting.

Cotton planting necessitates careful soil preparation in order to achieve sufficient moisture for favourable germination and rapid root development. Pre-prepared ridges are recommended for adequate water drainage and temperature control. Temperature determines the best sowing date. Temperature is the most important factor influencing the development and yield of cotton plants (Robertson et al. 2007). Sowing can begin when the minimum soil temperature at a depth of 10 cm exceeds 14 °C for at least 3 days in a row. Lint yield is reduced if *G. hirsutum* is planted too early (due to cold temperatures) or too late (due to a shortened growing season). Because G. barbadense prefers a longer growing season (>200 days) for increased yield, it is more sensitive to planting delays [26]. Table 1 shows how seed rate and plant spacing differ between cotton species. Cotton planted at a sowing depth of it ranges from 1.5 to 2 cm in humid conditions and from 3 to 4 cm in dry conditions. Cotton is planted manually as well as in planters.

1.4.2 Field Management

From sowing to emergence: Make the surface soil friable and loose to encourage emergence, strengthen the drainage system and avoid flooding and logging.

Management at seedling stage: Maintaining full and uniform stands encourages plant development. An early thinning out and a suitable time of final singling are required. After a uniform emergency, it is preferable to begin first thinning out at the 1–2 true leave stage and second thinning out at the 3–4 true leave stage to achieve

Table 1 Seed rate for various cotton species

Species	Growing conditions	Seed rate (kg/ha)	Spacing (cm)
G. hirsutum	Irrigated	20–22 10–15	75 × 15 75 × 30 75 × 45
	Rain fed	18–20	60 × 30
G. *arboreum*	Irrigated	10–12	60 × 30
G. *herbaceum*	Rain fed	12–15 12–15	45 × 30 60 × 30
G. barbadense	Irrigated	8–10 12–15	90 × 30 75 × 30
Hybrids	Irrigated	2–3	45 × 60 90 × 60 45 × 30
		2–3.5	120 × 40 120 × 60
		3–3.5	67.5 × 67.5
	Rain fed	3–3.5 2.5–3	150 × 60 120 × 60
Bt hybrids	Irrigated	1.5	90 × 60 120 × 40 120 × 60

a single plant. Weeding and inter-row tillage are carried out. Inter-row tillage is required once after rainfall or irrigation.

a. The first inter-row tillage and weeding is done in conjunction with thinning out. This is done at a depth of about 4–5 cm.
b. A second round of inter-row tillage and weeding is performed in conjunction with the final singling at a depth of 6–7 cm.
c. A third round of inter-row tillage and weeding is performed before squaring, with a depth of up to 7–8 cm. Fertilizer application at around 3–4 true leaves stage connected with the second time of inter-row tillage for each plant by applying 0.5–1 g of urea is critical.

Management at flower and bud forming stage: This is to control luxuriant growth and to encourage measures to achieve strong growth through various mechanisms.

Inter-Tillage and Weeding:

- To have a normal cotton plant field, deep inter-row tillage with a depth of 10 cm is required, as well as weeding.
- To obtain vigorous cotton plants, the depth of inter-row tillage must be increased.
- Shallow inter-row tillage results in weak cotton plants in cotton plant fields.
- Hilling up of the plant:

This is done from the final singling to the beginning of the flower stage. It aids in drainage, fertilizer application and removal of leaf branches. It is possible to control the luxuriant growth by.

(i) Deep inter-tillage to cut some of the root in order to reduce the plant's absorbing ability.
(ii) Pinching the top to reduce dominance and control plant growth.
(iii) Spraying an artificial plant regulator (growth regulator), such as cycagon.

Management at Flowering Stage

This is to encourage early boll formation and maturation, as well as to reduce shedding of flower buds and young bolls by.

- Applying a large amount of fertilizer when the first bolls bloom.
- Spraying the plants with 0.2% borate and 0.2% KH_2PO_4.
- Topping—the removal of the plant's terminal point (apex). The timing of topping varies depending on the species. *Hirsutum spp.*, for example, is when the plant has 15–16 fruiting branches, whereas *Barbadense spp.* is when the plant reaches a height of 1–1.2 m, or 80–90 days after emergence.
- Chemical control: apply 60–70 ppm DPC after topping.
- Clearing away any dead leaves and branches.

Management at Boll Opening Stage

This is done to promote early maturation and to prevent premature decay by

- Pruning of old leaves and empty branches to remake aerial condition.
- Spraying 0.5–1% urea on the leaves to prevent premature decay.
- Avoiding severe drought. If there is a severe drought, provide adequate and timely irrigation to the field. However, excessive vegetative growth, which delays maturity and extends the harvesting period of the plant, should be avoided.

Irrigation is required when rainfall is less than 450 mm and erratic in nature. There should be an adequate amount of moisture for good yield and growth. Furrow irrigation is widely used and effective at distributing water throughout a field.

1.4.3 Fertilizers

Phosphorus (P) and potassium (K) are applied at the base of the plants based on soil content. Nitrogen (N) is applied to the plant's base and top at a rate of up to 200 or 250 units of N, depending on environmental and crop conditions. *Gossypium barbadense* requires slightly more nitrogen, phosphorus and potassium per unit of lint produced. It is, however, more sensitive to a slight excess of N, which can stimulate increased vegetative growth and delay maturity [16]. Furthermore, deep application of compost as basal manure accounts for 50–60% of the total amount of fertilizers.

1.4.4 Crop Rotation

Cotton crop rotation is typically accomplished by alternating with other traditional crops grown in the area. Contrary to best agricultural practices, cotton is sometimes planted in the same field again, for 2 years or longer. The crop damage caused by diseases, particularly *Verticillium wilt*, limits the number of repetitions [16].

1.5 Biotic Environment

1.5.1 Vesicular Arbuscular Mycorrhizae (VAM)

Cotton crop growth in most soils is dependent on the interaction with mycorrhizal fungi [15]. Fungi (such as *Glomus mosseae*) grow intercellularly in the root cortex. They form vesicular arbuscules with the plasma membrane in cortical cells, which serve as sites of mineral exchange from the fungus to the plant and carbohydrate exchange from the plant to the fungus. The main advantage for cotton plants is improved phosphate uptake [15].

1.5.2 Insect Pests and Nematodes

Pest and disease control is expensive [19], and repeated applications of insecticides and fungicides may be used. Cotton is a favourite food for a variety of insect pests. Insects that are natural enemies of pests are encouraged as part of integrated pest management systems. Cultivation of varieties with genetically engineered insect resistance has been a significant advancement in crop management against some major pests. Arthropod pests can have an impact on boll production or fibre quality. Aphids (*Aphis gossypii, Aphis craccivora, Myzus persicae*) and the silverleaf whitefly *Bemisia tabaci* are the most common pests that affect fibre quality, producing sticky cotton with dark stains if not controlled late in the season. The pink bollworm *Platyedra gossypiella*, various Hemiptera such as Lygus bugs and various mites such as the two-spotted spider mite, *Tetranychus urticae,* all reduce fibre yield and quality. Cotton bollworms (*Helicoverpa armigera, H. punctigera*) and the spiny bollworm are major pests affecting boll production. *Earias insulana* primarily reduces fibre production. In some areas, the cotton boll weevil *Anthonomus grandis* is a very aggressive pest. Other significant pests include the leafhopper, *Empoasca lybica* (the cotton jassid) [18].

Nematodes that cause damage in some regions or areas include particularly the root-knot nematodes—*Meloidogyne incognita* (as well as M. *acronea)*, *reniform* nematode—*Rotylenchulus reniformis*, lance nematodes—Hoplolaimus columbus (and several other spp.) and sting nematode—*Belonolaimus longicaudatus* [24], as well as associated ring nematodes—*Criconemella spp.*, spiral nematodes—*Helicotylenchus spp.*, needle nematode—*Longidorus africanus*, stunt nematodes—*Merlinius* *spp.* and *Tylenchorhynchus spp.*, stubby-root nematodes—Paratrichodourus *spp.*, pin nematode—*Paratylenchus hamatus*, lesion nematodes—*Pratylenchus spp.*, spiral nematodes—*Scutellonema spp.* and American dagger nematodes—the *Xiphinema americanum* group [24].

In Africa, there are approximately 150 insect species that attack cotton. The following are the most serious:

I. Leaf suckers (*Aphis gossypii*).
II. Jassids (*Empoasca spp.*).
III. American bollworms (*Heliothis armigera*).
IV. Red bollworms (*Diparopsis and castanea*).
V. Spiny bollworms (*Pectinophora and gossypiella*).
VI. Stainers (*Dysdercus spp.*).

Control measures include crop rotation and field sanitation. Supplementary measures, such as the application of appropriate pesticides, are usually required.

1.6 Diseases

The most common cotton disease is Verticillium wilt, which is caused by Verticillium dahliae [11]. This fungal disease is widely distributed in areas where G. hirsutum is grown, conventionally bred resistant varieties are available [20]. Other diseases, such as damping off, are caused by a complex of pathogens that have a significant impact on the crop. The primary pathogens are Rhizoctonia solani, Pythium ultimum, Thielaviopsis basicola and Fusarium spp. Many other fungi have been linked to cotton diseases, either as primary agents or secondary invaders: *Alternaria spp., Ascochyta gossypii, Aspergillus flavus, Brasilomyces malachrae, Cladosporium herbarum, Fusarium spp.* (e.g. *F. oxysporum f. sp. vasinfectum*), *Glomerella gossypii (anamorph Colletotrichum gossypii), Lasiodiplodia theobromae (synonym Diplodia gossypina)*, *Leveillula taurica (anamorph Oidiopsis haplophylli* [*synonyms O. gossypii*, *O. sicula]*), *Macrophomina phaseolina, Mycosphaerella spp., Nematospora spp., Phakopsora gossypii, Phymatotrichopsis omnivora, Phytophthora spp., Puccinia cacabata* and *P. schedonnardi, Pythium spp.* and *Sclerotium rolfsii.*

Boll rot caused by these diseases causes significant losses in production. Damage is more severe in crops grown in high humidity and low light intensity environments, and it worsens if the bolls have mechanical lesions. The main problem that these fungi cause is fibre contamination, especially if open bolls are exposed to rain or high humidity for an extended period of time. These agents, in addition to causing undesirable discoloration of the fibre, may cause enzyme degradation in some basic components, as is common in cellulose. Cotton diseases caused by bacteria, such as Xanthomonas campestris pv. malvacearum, and viruses, such as abutilon mosaic geminivirus, cotton leaf crumple geminivirus, cotton leaf curl geminivirus, cotton yellow mosaic geminivirus and cotton anthocyanosis virus, are also common. The etiology of cotton bunchy top, cotton leaf mottle and cotton leaf roll diseases is unknown [18].

Disease is much less important in Ethiopian cotton-growing areas than insects. Cotton's main diseases are.

a. Bacterial blight—*Xanthomonas malvacearum.* This can result in the death of leaves and branches, the shedding of young bolls and the premature opening of bolls. The primary control methods are seed dressing and clean cultivars.
b. Fusarium wilt—Fusarium oxysporum causes Fusarium wilt. It has the potential to kill or stunt the plant. The most effective method of control is to select highly resistant cultivars.
c. Leaf curl—Leaf curl is caused by a virus. It is spread by the white fly (*Bemisia tabaci*). To control this disease, resistance cultivars and clean cultivars are the best options.

1.7 Weeds

Weed control in cotton fields is critical, and it is done mechanically by passing through the crop rows, as well as chemically [18]. Many different herbicides are used in cotton cultivation, with their application occurring during pre-sowing and/ or pre-emergence of seedlings, or, less frequently, post-emergence. Various herbicides can be applied during land inclusion and pre-sowing, pre- and post-sowing, immediately post-sowing, pre-sowing and pre-emergence, pre-emergence, pre- and post-emergence, immediately post-sowing and post-emergence, and post-emergence [16]. Crop rotations and farm hygiene are examples of integrated weed management measures that include crop rotations and farm hygiene to prevent weed seed spread [5, 23]. The cultivation of herbicide-tolerant varieties developed through genetic engineering has also significantly improved crop weed management. The most common and troublesome weeds vary greatly depending on region and management practices. Table 2 lists genera that frequently have species of significant concern in areas.

1.8 Harvest and Processing (Ginning, Crushing)

To facilitate harvest and subsequent ginning (freeing of fibres from seed to obtain lint), the plant is chemically defoliated. This improves both the cleanliness and the quality of the fibres. Spindle picker machines in two or four rows are used for mechanized harvest. The cotton is then ginned in saw gins to produce bales classified according to grade and length of fibre. The separated cottonseed is further processed by first separating the hulls from the kernels. The kernels are crushed, and the oil extracted and processed for use in human food or other products. The hulls are used for livestock feed or industrial products, while the remaining kernel (high in protein) is converted into cottonseed meal for livestock. In the case of *G. hirsutum*, the fuzzy

Table 2 Genera of weeds in cotton

Dicotyledons	Monocotyledons
Abutilon	*Alopecurus*
Achyranthes	*Cenchrus*
Alternanthera	*Commelina*
Amaranthus	*Cynodon*
Boerhavia	*Cyperus*
Capsella	*Dactyloctenium*
Celosia	*Digitaria*
Chamaesyce (Euphorbia)	*Echinochloa*
Chenopodium	*Eleusine*
Convolvulus	*Leptochloa*
Croton	*Lolium*
Datura	*Panicum*
Desmodium	*Paspalum*
Diplotaxis	*Poa*
Fumaria	*Rottboellia*
Geranium	*Setaria*
Heliotropium	*Sorghum*

seed (i.e. seed with linters) is delinted, which means that the linters are removed mechanically or chemically. These residual short fibres are used for a variety of applications, including cellulose bases for food and other consumer products. Picking and ginning techniques for *G. barbadense* cotton differ from those used for *G. hirsutum* cotton in order to maintain its superior fibre quality. Because *G. barbadense* does not produce linters, its seed is available in two forms: unprocessed "seed cotton" and processed black seed [16, 18].

2 Summary

Cotton is one of the scarce agricultural products whose manufacturing and usage are more or less worldwide in scope. Cotton is cultivated, including in Ethiopia, in over 70 nations, where many developed and developing nations rely on the import of lint for their spinning/fabric industries. In Ethiopia, as well, there is immense potential for the cultivation of cotton, due to its appropriate agro-ecological zones and the presence of water. Despite its underperformance, the cotton sub-sector still presents a distinctive chance for Ethiopia in terms of serving as a foundation upon which the country can transition to high-value-added technological transformation following its strong backward and forward connections with various sectors, and its provision of employment opportunities for a large number of the rural impoverished.

The nation currently cultivates just 3% of the overall 2.6 million hectares that have the potential for cotton production. Cotton is typically rotated with sesame, sunflower, sorghum and mung beans. Although the values vary among different types, around 2050 heat units (degree-days or day-degrees) are the minimum requirement from cotton planting to 60% boll opening. Cotton prefers full sunlight as it belongs to short-day plants. The light saturation point of cotton is 70,000–80,000 lax. Cotton plants are grown in a wide range of soils, but the crop thrives best in deep arable soils with good drainage, organic matter and a high moisture-holding capacity. There are four cultivated types of cotton, namely, Gossypium arboreum, G. herbaceum, G. hirsutum and G. barbadense. Temperature is the main factor that affects the development and yield of cotton plants. Sowing can begin when the minimum soil temperature at a depth of 10 cm is above 14 °C for at least 3 consecutive days. Seed rate and plant spacing vary depending on the type of cotton, as shown in Table 1. For cotton planted in humid conditions, the sowing depth ranges from 1.5 to 2 cm, while under dry conditions, it is from 3 to 4 cm. Cotton can be planted manually or by using planters. Phosphorus (P) and potassium (K) are applied based on soil content, at the base of the plants. Nitrogen (N) is distributed between the base and top of the plant, with an application rate of up to 200 or 250 units of N, depending on the environmental and crop conditions. Deep application of compost as basal manure makes up for 50–60% of the total amount of fertilizers. Pest and disease control is a significant expense, and repeated applications of insecticides and fungicides may be necessary.

The cultivation of varieties with genetically modified resistance to certain insects has been a significant advancement in managing the crop against major pests. Approximately 150 insect species attack cotton in Africa. The most notable disease affecting cotton is Verticillium wilt, caused by Verticillium dahlia. In Ethiopia's cotton-growing regions, diseases are less significant compared to insects. To make harvesting and ginning (the process of separating fibres from seeds to obtain lint) easier, the plant is defoliated using chemical treatment. This enhances cleanliness and fibre quality.

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