Creating the right ecosystem for better quality and higher productivity in Extra Long Staple Cotton

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• In recent years, climate change has threatened agriculture globally, it is worth noting that cotton production in producing Countries is unlikely to be affected by it.

• Agriculture is both a contributor to and a “victim” of climate change. Up to 18.4% of global greenhouse gas emissions are attributed to agriculture when land clearance is included in the calculation.
Cotton (Gossypium spp.) is used to obtain fiber, oilseeds animal feed, cellulose, and biofuel. It is among the plants that provide employment and income to millions of people for its production, processing, and marketing besides having an important share in the economy. The annual contribution of cotton to the textile industry is 600 billion dollars.
More than 80% of the total cotton production of 25 million tons per year is produced in the top 10 countries, mainly India, China, the United States, Pakistan, Brazil, Pakistan, Uzbekistan, Turkey, Australia, Benin, and Greece “ICAC 2022”. Cotton is grown on almost 2.5% of the world’s arable land by nearly 26 million farmers in 75 countries. It meets 27% of the world’s textile requirements and provides employment and income to almost 100 million families. Two-thirds of the total cotton produced in the world is obtained from 53% of the irrigated lands.
1. World ELS/LS output

- Taken in aggregate, the downward shifts in output for the major long staple producers seem likely to result in a total LS/ELS crop of 303,750 tonnes, down by a third on 2022/23, for which final results were slightly higher than were envisaged earlier in the year at a little over 425,300

<table>
<thead>
<tr>
<th>Country</th>
<th>2020/21</th>
<th>2021/22</th>
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<tr>
<td>Sudan</td>
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<td>-</td>
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<td>Total</td>
<td>356,500</td>
<td>290,200</td>
<td>425,300</td>
<td>303,750</td>
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</table>
The impact of cotton production on climate change

• Agriculture “including livestock” accounts for about 14% of total greenhouse gas (GHG) emissions, contributing to 52% of the world’s methane (CH₄) emissions and 84% of the world’s nitrous oxide (N₂O) emissions.

• Agricultural emissions are predicted to rise by almost 18.4% by 2030 (The world resource Institute, 2020, Figure 1), due to increased demand for food from a growing population and to changing diets favoring meat. In principle, land (and water) may act as a ‘sink’ by absorbing CO₂ from the atmosphere. There is a small net flux of CO₂ between agricultural land and the atmosphere, released from microbial decay and burning of plant litter and organic matter in the soil.
Global greenhouse gas emissions by sector
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.
The impact of cotton production on climate change

- The emissions from fuel and electricity used in agriculture are accounted for in other sectors, including transport and building. Agricultural emissions would rise further if deforestation in developing countries were added. Agriculture is a leading cause of deforestation, but the Intergovernmental Panel on Climate Change (IPCC) does not attribute related emissions to the agricultural sector. The agricultural sector also has the potential to mitigate climate change mainly by increasing the carbon sequestration rate, and to a lesser degree through the reduction of some GHG emissions, principally N₂O and CH₄ (The world resource Institute, 2020).
Where it is grown, cotton is an attractive environment for numerous insects, pests such as aphids, thrips, and spider mites. The only solution that farmers use to fight pests is to use insecticides. About 16% of the pesticides consumed globally are used for cotton growing lands.
• ELS Cotton want special Ecosystem, that needs temperature above freezing, a humid climate, and sunbathing during its growing period. In general, the seed sowing depth (4–5 cm) should be above 15°C for germination to occur. It is desirable that the soil temperature in sowing is at least 18°C. According to the developmental periods, the optimum temperatures are around 21–27, 27–32, and 21–32°C in vegetative, reproductive, and maturity periods, respectively.
Cotton Fiber Quality and Climate Change

• The cultivation of cotton, and in particular the quality characteristics of the fiber, are influenced by the growing conditions of the plants, the cultivation techniques, as well as the climatic changes of the environment. Cotton fiber is mainly composed of cellulose, and any effect on the photosynthetic rate also affects the production of carbohydrates where they will have a similar effect on fiber development.
• Regional climatic characteristics such as temperature, humidity and rainfall also significantly affect to a greater or lesser extent all quality characteristics. For example, high temperatures > 35 °C for a long time combined with dry conditions or water deficit, increase the Micronaire and the strength of the fiber due to falling bolls, however, affect other quality characteristics less.
• Fiber quality parameters are a genetic characteristic; however, these parameters are significantly affected by crop management and environmental conditions. The genotype strongly influences the length of the fibers, while fiber strength and Micronaire are affected by climate and management. There is highly significant impact between the temperature and fiber length.
• Egypt, one of the main producers of Extra Long Staple cotton could be divided into three zones according to the quality and the temperature, Fig. 2. In Egypt, as example, the Extra Long staple cotton “Over 35.0 Millimeter in length should be cultivate in north Egypt, which the temperature ranged from 30.3 to 22.3 °C, as shown in figure 3,4 and 5. Pima “USA and Xinjiang “China” which characterized by high quality could be need the same environmental conditions like Egyptian cotton, Figures 6 and 7, respectively.
Long Staple cotton ≤ 35mm

Figure 3. Egypt and three zones of Temperature

Figure 4. Damietta-Egypt, zone 1 of Temperature
Figure 5. Zagazig-Egypt, zone 2 of Temperature

Figure 6. Beni Suef-Egypt, zone 3 of Temperature
Long Staple cotton ≤ 35mm
• Fiber length distribution, Micronaire (fineness), length, strength are very important parameters for spinning. The cotton lint yield and fiber quality are affected by the quantity and quality of the solar radiation.
• One of the most important environmental factors affecting Micronaire during boll development, due to its impact on secondary wall thickening, is the temperature. Temperature changes during the period of fiber thickening will lead to differences in Micronaire.
Color grade describes the cotton color and it is determined by HVI (RD and +b) and by specialized personnel called classifiers, who compare samples with five categories of color standards (white, lightly spotted, spotted, tinged, and yellow stained). Color has traditionally been related to physical cotton standards. Significant discounts for growers exist for poor grades. Cases of severe staining of cotton generally have no direct bearing on processing ability; however, differences in color can lead to dyeing problems.
Discoloration is due to a range of influences approaching harvest including trash and dust content, rain damage, insect secretions, UV radiation exposure, heat, and microbial decay. Humid conditions or rainfall increase microbial damage thereby potentially reducing color grades.
Conclusion

• Development of management practices for high fiber quality requires an understanding of various mechanisms involved in cotton response to environmental conditions and climate change. Despite the complexity of these mechanisms on fiber development, yield, and quality, a lot of Researchers have been explored, however the literature on critical analysis of the available data on the regional effects on cotton with respect to lint quality is lacking. The regional effect should not only be interpreted as environmental and climatic conditions of the specific region, but also as the crop management practices and technologies adopted by most cotton growers.
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