Sustainability Standard Operating Procedure (SOP)

For Kasturi Cotton Bharat

TEXPROCIL
THE COTTON TEXTILES EXPORT PROMOTION COUNCIL

BEETLE REGEN SOLUTIONS
LET'S REGENERATE TOGETHER

KASTURI COTTON BHARAT

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FOREWORD

Keshav R Kranthi
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India has nurtured one of the world's oldest cotton civilizations, combining centuries of agricultural wisdom with scientific innovation and a globally respected textile industry. As sustainability becomes an increasingly important determinant of market access, competitiveness, and consumer confidence, 'Climate-Smart Kasturi Cotton Bharat'represents a timely national initiative to position India as a global leader in sustainable cotton production and responsible textile manufacturing.

This Standard Operating Procedure (SOP) provides a scientific, transparent, and measurable framework for establishing Climate-Smart Kasturi Cotton Bharat as a globally credible sustainability standard. By integrating regenerative agriculture, climate resilience, environmental stewardship, social responsibility, traceability, and circularity throughout the cotton value chain, the framework seeks to strengthen both farmer livelihoods and India's international leadership in sustainable textiles.
India possesses several natural advantages that uniquely position it for this transformation.

Compared with many major cotton-producing countries, cotton cultivation in India generally involves lower mechanization and consequently lower energy-related emissions. Nearly two-thirds of the cotton area is cultivated under predominantly rainfed conditions, reducing dependence on irrigation across much of the production landscape. India also has the world's largest cattle population, providing abundant farmyard manure, while vast quantities of cotton stalks and other crop residues offer exceptional opportunities to restore soil organic carbon through composting and biochar. Indian farmers have consistently demonstrated their willingness to adopt innovations such as Bt cotton, drip irrigation, drones, diversified cropping systems, biological crop protection, and integrated crop management, providing a strong foundation for regenerative agriculture.

The transition will nevertheless require continued commitment towards reducing reliance on highly hazardous pesticides, improving irrigation efficiency, promoting minimum soil disturbance wherever feasible, enriching soils with recycled biomass, and adopting improved agronomic practices together with early-maturing, high-yielding varieties that reduce losses from pink bollworm, boll rots, cotton leaf curl disease, and other production constraints. India's extensive soil-testing infrastructure provides an important opportunity to guide science-based nutrient management and systematic improvement of soil health.

I earnestly hope that Climate-Smart Kasturi Cotton Bharat will become far more than a certification system. With focused efforts, it could evolve into a globally recognized symbol of quality, sustainability, traceability, and farmer prosperity -one that establishes India as a benchmark for regenerative cotton production and reinforces the country's leadership in building a resilient, low-carbon, and environmentally responsible global cotton economy.

ACKNOWLEDGEMENTS

At the outset, we would like to thank Dr. Keshav R Kranthi, Chief Scientist at the International Cotton Advisory Committee (ICAC), for his guidance and for enriching our understanding of sustainable cotton practices. The contents of this manual have been drawn from several ICAC publications (ICAC Recorders), several lectures of Dr. Kranthi on regenerative practices, steps to high yields, etc. that we had the good fortune to attend. We have also drawn the contents from the Cotton Field Manual of ICAC, authored by both Dr. Sandhya Kranthi and Dr. Keshav Kranthi (2020). Regenerative Agricultural Guide, authored by Dr. Kater Hake (ICAC 2025) & ICAC Recorder September 2025.

Dr MV Venugopalan, Former Principal Scientist (Agronomy) and Head of PME Unit, ICAR-Central Institute for Cotton Research (CICR), Nagpur, played a pivotal role in the development of all facets of HDPS. The time spent with Dr. Venugopalan in the HDPS fields has been vital in our understanding of this concept. The content of this manual has also been drawn from various publications of CICR, especially Technical Bulletin 2023/3 & 2023/2 & 2023/1.

Some facts have been taken from `Healing Soils in India: For Better Crop and Human Nutrition 2026 (Indian Council for Research on International Economic Research (ICRIER).

EXECUTIVE SUMMARY

Leading India's Cotton Towards a Sustainable Future Building a Climate-Smart, Traceable & Premium Cotton Value Chain

Source: Stock Image

India stands at a pivotal moment in its cotton story. As the world's largest cotton-growing nation, it has both an opportunity and a responsibility to prove that quality and sustainability can grow on the same stalk. As global markets increasingly demand traceable, ethically sourced, climate-smart cotton, the Kasturi Cotton Bharat initiative launched by the Ministry of Textiles, Government of India, with TEXPROCIL as the implementing agency, sets out to position Indian cotton as a premium, high-quality, and sustainable fibre for both domestic and international markets.

To bring this vision to life, the Sustainability Standard Operating Procedure (SOP) for Kasturi Cotton Bharat has been developed as a practical, science-backed guide for sustainable cotton cultivation across India. Prepared by Beetle Regen Solutions and drawing on the research and expertise of the International Cotton Advisory Committee (ICAC) and ICAR–Central Institute for Cotton Research (CICR), this document translates complex science into farmer-friendly recommendations, designed to boost productivity, protect natural resources, elevate fibre quality, and strengthen farmer livelihoods. This document weaves together the essential threads of sustainable cotton farming:

- High Density Planting Systems (HDPS) to increase productivity
- Regenerative agricultural practices that rebuild soil organic carbon and long-term farm resilience
- Carbon sequestration for leveraging cotton's natural potential to draw down atmospheric carbon through improved tillage, nutrient efficiency, and biochar integration, opening pathways to recognized carbon credit methodologies
- Water stewardship, with particular focus on blue water -the surface and groundwater on which irrigated cotton depends and strategies to use it more efficiently in the face of climate variability
- Integrated nutrient, weed, and pest management for healthier crops and healthier soils
- Harvest and post-harvest quality management to protect fibre value all the way to the gin
- Social and economic wellbeing of farming communities
- Digital monitoring and traceability, ensuring every step of the journey can be verified

Together, these elements aim to improve soil health, resource efficiency, climate resilience, and fibre quality while making cotton farming more profitable and more resilient for the communities who depend on it.

This document marks only the beginning of the journey. It represents the first phase of the Sustainability SOP for Kasturi Cotton Bharat, laying the technical foundation specifically at the Farm and Ginning Unit level. Subsequent phases will deepen this foundation bringing detailed implementation protocols, certification procedures, and monitoring systems for farms and ginning units, while also extending the SOP framework further downstream, with dedicated supply chain guidelines spanning spinning through to garment manufacturing, ultimately building a complete, verifiable sustainability standard across the entire cotton-to-textile value chain.

By combining rigorous science, real field experience, and India's inherent agricultural strengths, this document offers a practical roadmap for growing cotton that is not just abundant, but genuinely sustainable, supporting India's vision of becoming a global leader in sustainable cotton production, one farm and one fibre at a time.

BACKGROUND

The Kasturi Cotton Bharat programme was launched on World Cotton Day, 15th December 2022 with the objective to brand and promote quality cotton from India. The programme is a joint initiative of the Ministry of Textiles, Government of India, Trade Bodies & Industry. TEXPROCIL is the designated agency to implement the programme. The Kasturi Cotton Bharat programme aims to elevate the value of Indian cotton through an institution of standards that will address every aspect of the cotton handling, sampling, testing and certification. The indigenous Blockchain platform ensures tamper proof end-to-end traceability that establishes the chain of custody.

The objectives of the program are threefold:

1. Elevate Indian cotton by setting specification-based benchmarks for quality and transparency.
2. Deliver an assurance of consistently superior product and its availability.
3. Support lives and livelihood of farmers by enabling them to get better returns for their produce. Here the focus is on

   a. Collaboration with Indian Farmer Producer Organizations (FPO's) and other organizations working with farmers to enhance awareness among farmers about best practices and sustainable farming techniques.

   b. Building the **Kasturi Cotton Sustainability Module** that aims to directly impact the lives of Indian cotton farmers.

INTRODUCTION

Source: Stock Image

This Sustainability Standard Operating Procedure for Kasturi Cotton Bharat sets out clear standards for stakeholders across the cotton value chain to implement, collaborate and continuously improve towards building a resilient, traceable, and globally competitive Indian cotton value chain.

As the first document in the SOP series, it is intended primarily for farmer groups, extension workers and Implementing agencies. It has therefore been written in a simple, accessible style to ensure ease of understanding, while remaining grounded in established scientific research that forms the foundation of sustainable cotton production systems.

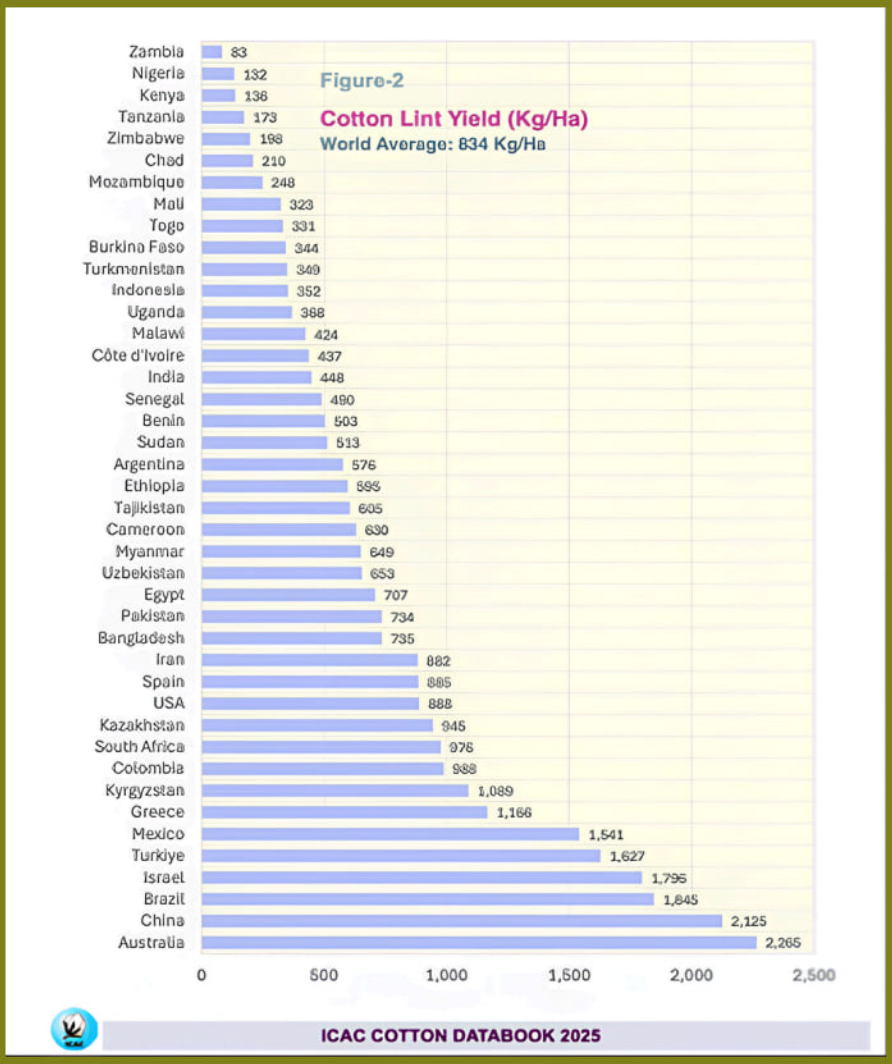
"Science must be simplified for the farmer to make sense out of it. He cannot handle the urban complexities that the technological matrices now manifest." -Dr.KR Kranthi CAI, No.26 27.09.16

It is the understanding of farmers that will play a critical part in the adoption of sustainable practices. We hope that this manual will play an important role in effectively translating research results into action and be able to convince extension personnel and farmers about the benefits of adopting sustainable cotton farming practices.

INDIA PRODUCTIVITY OVERVIEW

As of 2025, India has around 38% of the global area under cotton with around 110.86 lakh hectares and has an average yield of 448 kgs of lint /ha (Cotton Corporation of India). The productivity of Indian cotton is far below the global productivity of 834 lint /ha. About 63% of cotton is rainfed; majority of this area falls in the central and southern zones. Most of the rainfed regions have soils that are shallow to medium depth, have low water-holding capacity, and are poor in fertility. As a result of this, cotton grown in almost 37% of the country's area produces less than 300 kgs of lint/ha. This amounts to around 38 Lakh ha in 20 districts across the states of Maharashtra, Telangana, and Madhya Pradesh. (CICR).

Figure 1: Cotton Lint Yield (Kg/Ha), Global Overview



Source: ICAC Cotton Databook 2025

SUSTAINABLE KASTURI COTTON PRODUCTION

As discussed above, the Sustainable Kasturi Cotton Production section provides details on procedures to be followed during sustainable crop production at the farm level. It draws from principles of regenerative agriculture and is divided into the following sub-sections:

1. The need for High Density Plantation Systems (HDPS) in India
2. Essential components of HDPS/CS (Close Spacing)
3. Regenerative Agricultural Practices in Cotton: Building Soil Organic Carbon
4. Cotton and Carbon Sequestration.
5. Cotton & Water.
6. Biodiversity enhancement
7. Integrated Nutrient Management (INM)
8. Integrated Weed Management (IWM)
9. Integrated Pest Management (IPM)
10. Harvest and Post-Harvest Procedures to Reduce Trash and Contamination
11. Renewable Energy
12. Circularity at farm Level
13. Social Compliance and farmer Wellbeing

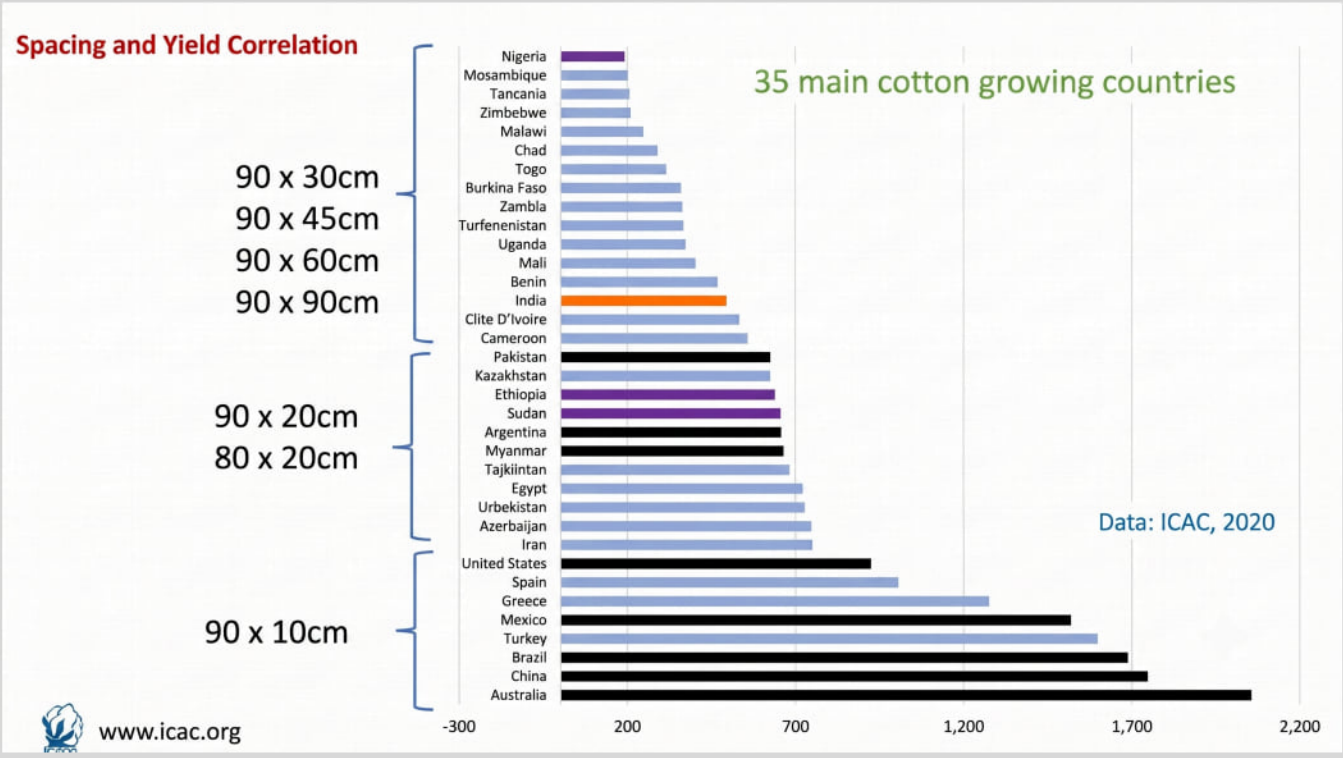
HIGH DENSITY PLANTATION SYSTEM (HDPS)

REASONS FOR LOW YIELD IN INDIA

India follows wide-spacing planting at 90cms or 120cms row to row and about 60cms or 90 CMS. between plants. Due to this, the planting density is less than 10,000 plants per acre. Due to low density, individual plants are required to produce more bolls per plant, which increases the duration of the cotton, and is pushed beyond the monsoon window. Crop thirst and hunger at this stage reduce yields considerably. Further, a long duration of the flowering and boll-formation phase leads to prolonged vulnerability of the crop to insect pests and diseases.

The following graphs shows the corelation between cotton yield and spacing:

Figure 2. Spacing and Yield Correlation



Source: Stock Image

HDPS BASICS

It is imperative to understand the difference between per plant productivity vis-à-vis productivity per unit area.

Source: Stock Image

Seed cotton yield or productivity per plant =
Number of Bolls Harvested x Weight of Boll x Plant population per unit area to obtain productivity per unit area. (sq m or acre or ha etc.)

The following table highlights the difference between hybrids planted at wider spacing and HDPS

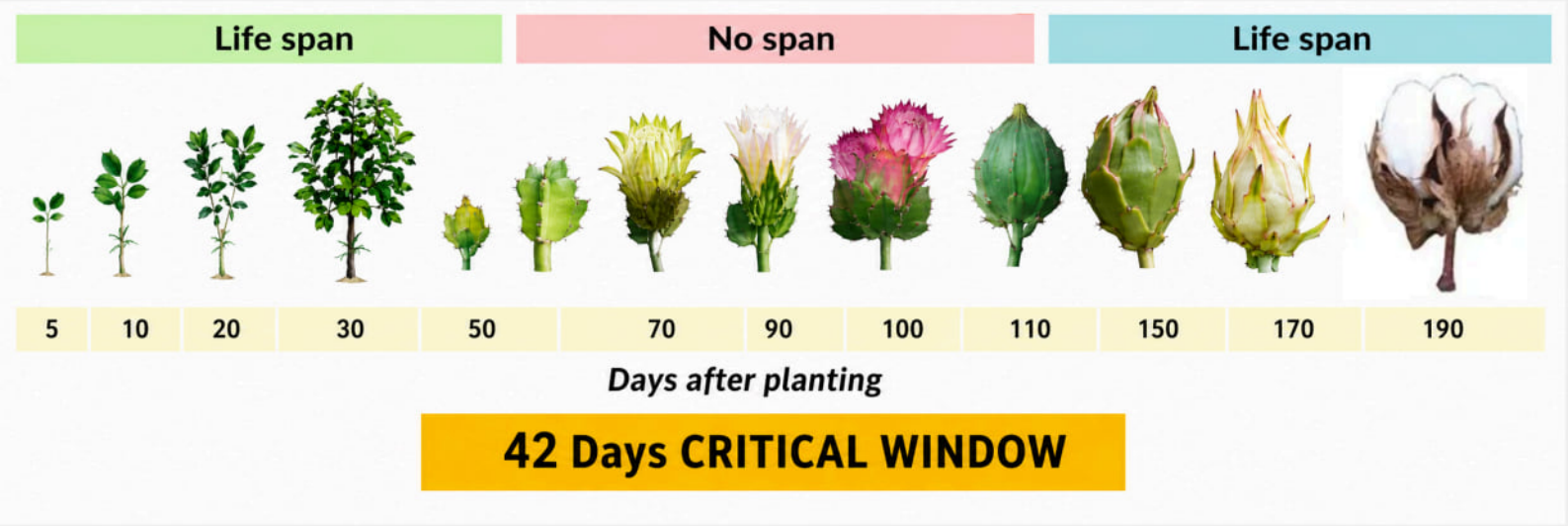
Table 1: Spacing and number of bolls required for achieving desired yields.

Spacing Type	Spacing in (cms)	Plant population per acre	Number of Bolls per plant	Weight of Boll in grams	Productivity per plant in grams	Productivity (seed cotton). Kgs per acre
Conventional Spacing, I	90x60	7407	30	4.0	120	889
	120x45		30		160	1185
Conventional Spacing, II	120x60	5556	30		120	667
			40		160	889
			50		200	1111
HDPS	90x15	29360	10		40	1185
			12		48	1422
			14		52	1540
Close Spacing (CS)	90x30	14000	15		60	8400
			20		80	1120
			25		100	1400

Source: Adapted from CICR Technical Bulletin 2023/2

The above table clearly demonstrates that in comparison to conventional spacing, the bolls per plant are less compared to HDPS/CS and hence the per plant yield is low. However, due to higher plant population per unit area (planting density), the yields are at par or higher than with conventional spacing. What is important to understand is that the fruiting window (flowering to boll bursting) is longer in conventional spacing (since more bolls must be set on each plant, leading to longer duration). Plants need to be nurtured for a longer period, which increases the cost and makes the plant susceptible to biotic and abiotic stress. Due to its short duration, the HDPS/CS system allows for crop rotation and enables a second crop during the `Kharif' season and escapes the dreaded pink bollworm.

Figure 3: Pictorial depiction of critical window



Source: Stock Image

Essential Components of HDPS/Close Spacing (CS)

The architects of HDPS/CS at Central Institute of Cotton Research (CICR) Nagpur coined the term `5G' to describe its main components; without these, the technology will not succeed. It's the implementation of these components that would give the maximum benefits to farmers in terms of yield enhancement. The components are as follows:

1. Genotype: Compact, early maturing
2. Geography: Soil type (Shallow to medium)
3. Geometry: Row to row (90 cm), plant to plant spacing (15 cm)
4. Growth regulation: Canopy management with PGR (Plant Growth Regulators)
5. Gain in yield: Integrate IPM, INM, IWM & Regenerative agricultural practices

1. Genotype/Seeds

Over the past years, both the public sector and private sector have been releasing cultivars that are amenable to both HDPS and CS. The selection criteria laid out by CICR is as follows:

- Compact, short fruiting branches with higher retention of first position bolls.
- Small leaves and short statured plants with column or pyramidal architecture.
- BT cotton cultivars tolerant to sucking pest and diseases
- Big boll size (>4 grams)
- Early maturing, synchronous boll bursting and amenable to machine picking

There are several hybrids from various private companies and open pollinated lines from the public sector as well. The retention of first position bolls is critical to high yields and quality, as almost 60% of plant yield comes from that position.

Early formed bolls and proximal bolls have the best quality. First position bolls contribute to 60% of yield, and second position contributes 30% (Dr. KR Kranthi).

Figure 4: Importance of Proximal & Early formed bolls

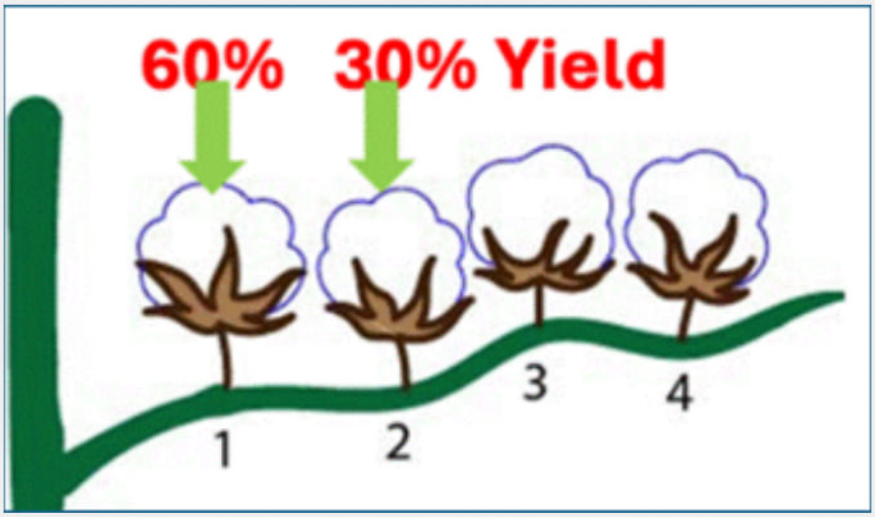


Image Source: Dr. Kranthi

Selection of the right seed type is critical for the success of both HDPS & CS. Farmers are advised not to use illegal seeds and use seeds from reputed seed companies and from the public sector.

2. Geography

HDPS/CS is recommended for light and medium soils and under rain fed conditions. In deep fertile soils where crop duration is extended to give multiple pickings, the yield gains over conventional planting are not consistent. Under deep fertile soil conditions, crop canopy management and crop termination become critical. (CICR Technical Bulletin 2023/3).

There are 157 cotton growing districts in India, these districts have been classified as most efficient, efficient, least efficient, and inefficient. The least efficient has almost 75% of cotton area (75 districts) of the country and has a mean lint yield of 351 kgs per ha. An improvement of yield by 20% using HDPS/CS will add 55kgs of lint per ha to the national average. (Cotton Association of India, issue 46, 15.02.22).

3. Geometry

Spacing cotton is critical to obtaining high yields. HDPS/CS technology, after being extensively evaluated on research farms and in farmers' fields; the recommendations are a result of this research, have come up with the following recommendations:

Table 2: Spacing, seed packets and plant population

Soil Type	Spacing (cms)	Seed Rate (acre)	Plant Population
Light/Shallow	90x15	06 packets	29,629
Medium	90x30	04 packets	14,814

3.1 Sowing Time

Manual sowing to be taken up on the receipt of 70 mm cumulative rainfall in 3 consecutive days, generally between 10th to 30th of June.
Sowing window for pneumatic planters is very narrow, dry sowing may be carried out, where sound rain forecast is there (for next few days) to ensure higher coverage with a single planter.

3.2 Sowing Method

Use of pneumatic planter facilitates precision placement of seeds at the right depth (5-6 cm), with single seeds and ensures good plant stand and makes it possible to apply basal dose of fertilizer along with sowing.

Where pneumatic planters are not available, manual sowing can be carried out (using marked rope, `jugaad' planter, manual seeder etc., to maintain proper distance.

Figure 5. Depiction of different sowing methods

Source: Stock Image


Manual sowing


Pneumatic planter


Manual seeder


`Jugaad' planter

4. Growth Regulation

Canopy management with plant growth regulators (PGR): Canopy management is essential to obtain high yields. Canopy management helps to enhance water-use-efficiency, light-use-efficiency, and nutrient-use-efficiency so that nutrition is channelized to the early formed developing bolls without getting wasted in vegetative branches or to least productive fruits. (Dr. Sandhya & Dr. KR Kranthi August 2020)

To curtail excessive vegetative growth and retain first-formed bolls in HDPS/CS grow regulators (PGR) like Mepiquat Chloride is used 2-3 times, as per the following schedule (CICR):

Table 3: PGR Usage Schedule

Spray	Crop Age (days)	Crop Stage	Crop Height	Dosage of commercial formulation Mepiquat Chloride 5% AS
1st	40-45	Initiation of squares	40-45 cms	1.0 ml/1 litre of water
2nd	55-65	15 to 20 days after 1st spray		1.2 ml/1 litre of water
3rd	Need based only if there is excess vegetative growth due to rain.			

Dos and Don'ts for PGR sprays (CICR/Leaflet/2023/1):

- Before deciding any spray of PGRs, ensure sufficient moisture in soil with no forecast of dry spell in next 10 days and nutrients are also not limiting crop growth.
- Do not go for subsequent sprays of PGR, if there is loss of early formed bolls due to biotic or abiotic stresses.
- Spray volume of 200 litres per acre should be used.
- Stickers and surfactants can be mixed with Mepiquat chloride and do not mix other agrochemicals (pesticides, foliar nutrients, biological preparations etc)
- Undertake PGR spray on a clear rain free day for best results.
- Do not feed or graze cotton foliage to animals up to 30 days of PGR spray.
- Do not undertake any spray of Mepiquat chloride if the crop is 90-100 days old.

Figure 6. Example of excess vegetative growth

Source: Stock Image

REGENERATIVE AGRICULTURAL PRACTICES IN COTTON

While there are several definitions of regenerative agriculture, the backbone of these definitions is to improve soil health (or the ability of soil to indefinitely support profitable crop production). According to Rhodes (2017), regenerative agriculture has at its core the intention to improve the health of the soil or to restore highly degraded soil, which symbiotically enhances the quality of soil, water, vegetation, and land productivity. Soil Carbon is the key indicator of soil health, while it is not a plant nutrient, carbon is present in every living organism and is a dominant component of organic matter.

FROM SUN TO SOIL

The process of building soil carbon starts with the process of photosynthesis, which is essentially the conversion of sunlight energy, water and CO2, into a range of plant materials which are ultimately delivered to the soil.

India is in dire need for adoption of regenerative agricultural practices, due to the following:
Organic carbon crisis: Close to 48.5 per cent of soil samples testing low (<0.5% percent), and only 23% of soil samples testing high (>0.75 percent) (Centre for Science & Environment report analysing samples tested under the Soil Health Scheme (GOI) during 2023-25). Over the decades, the NUE (Nitrogen Use Efficiency) for Nitrogen has steadily declined in India, from about 49% in 1961 to 41% in 2022 (FAOSTAT, 2025). NUE is the measure of plants to absorb and convert applied nutrients to crop yield. Higher NUE implies more nutrient incorporation into plant biomass and less nutrient loss to the environment.

The aftermath of the injudicious application of synthetic fertiliser post green revolution can be explained through overall fertiliser response in terms of crop yield to each unit of added nutrients. The fertiliser response ratio is a measure of kilograms of grain produced per kilogram of NPK fertiliser applied.

Studies show that there has been significant decline in fertiliser response over several decades. (INCRIER 2026). In the irrigated areas of India, a kilogram of NPK fertiliser input could give 13.4 kg of grain yield in 1970, which steadily decreased to around 2.7 kgs in 2015), indicating diminishing returns on fertiliser inputs.

India loses about 5.3 billion tonnes of topsoil each year affecting 12 crore Ha of geographical area, mainly from water and partly from wind. (ICRIER 2026)

The main practices that we will cover here are:

- Growing diverse crops
- Minimizing soil disturbance
- Maintaining permanent soil cover

Additionally, we will cover:

- Integration of Livestock
- Soil Amendments
- Fertiliser Reduction
- Pesticide Reduction

GROWING DIVERSE CROPS is the foundation of resilience in regenerative agriculture. It emulates the success of natural plant diversity where mixed species stands are more resistant to stress.

Benefits

- Disrupts pest and disease cycles.
- Adds fibrous roots and organic matter.
- Enhances soil fertility and nutrient cycling.
- Provides economic stability when weather or markets fluctuate
- Improves environmental quality by reducing excess nitrogen in water and air.

MINIMIZING SOIL DISTURBANCE is one of the most common regenerative agriculture objectives for farmers. Cost saving has been the main incentive for this practice for the farmers.

- Every tillage-pass exposes soil to oxygen, accelerating decomposition of organic matter.
- Each pass disrupts macropores from dead roots and earthworms where water can infiltrate

- Mixing leaves and stems with deeper soil leaves the surface vulnerable to erosion and baking
- The soil microbiome, especially the delicate mycorrhizal fungi networks is disrupted by tillage. (Regenerative Agricultural Guide ICAC 2025)

Benefits

- Reduces fuel, labour, and equipment costs
- Improves soil structure and organic matter retention
- Enhances water infiltration and drought resistance
- Reduces erosion and maintains soil microbiome health

MAINTAINING PERMANENT SOIL COVER is another key regenerative agriculture objective. It protects the soil from rain and wind erosion, adds organic matter, and nourishes soil microorganisms. Keeping soil covered through residues, cover crops, or double cropping helps protect the land, improves fertility, and sustains soil life essential for future cotton/other crop yields.

Benefits

- Protect soil from erosion.
- Fixes nitrogen and add organic matter.
- Loosens compaction, suppress weeds, improve infiltration, and retains nutrients.

INTEGRATION OF LIVESTOCK is supported from the indigenous perspective as well as the scientific perspective. Science supports the benefits of livestock for soil health in cotton farming. Animal manure and urine also return nutrients and organic matter directly to the land, reducing dependence on synthetic fertilizers. It also improves biodiversity and regenerates degraded land. Luckily in India, most farmers have livestock well integrated into their farms (albeit the numbers may be declining).

SOIL AMENDMENTS, such as composts, farmyard manure, vermi-compost, biochar, etc., are bound to have short- and long-term benefits for farming and carbon sequestration. Adding crop residues, especially cotton stalks (shredded) post-harvest, can add 24-35 kgs of nitrogen, 7-8 kgs of phosphorous and 20-25 kgs of potassium per ha. (Dr. Sandhya & Dr. KR Kranthi August 2020). The most ideal way would be to convert cotton stalks to biochar, through controlled pyrolysis. This not only improves soil health but plays a pivotal role in carbon sequestration, removing carbon dioxide from the atmosphere and reducing greenhouse gas (GHG). Biochar enhances soil structure, microbial activity, water retention, and nutrient availability which are essential components for sustainable agriculture.

FERTILISER REDUCTION is a result of regenerative agricultural practices, which lead to healthy soils. Globally, soil health improves nitrogen efficiency by 22% (ICAC 2025).

PESTICIDE REDUCTION is included in many regenerative agricultural frameworks. Reducing the use of broad-spectrum toxic pesticides clearly brings environmental and human benefits. Several broadspectrum insecticides kill insects indiscriminately irrespective of whether these could be pests, predators or parasitoids. In many cases, crop pests develop resistance to insecticides more rapidly compared to predators and parasitoids, resulting in outbreaks.

Chemical pesticides belonging to WHO Class 1a (extremely hazardous) and 1b (highly hazardous) should not be used. Choice of insecticides must be based on selectivity to beneficial insects.

COTTON & CARBON SEQUESTRATION.

Cotton is one of the most drought and heat tolerant crop and soils where cotton is grown are generally low in soil organic matter, offering high sequestration potential. South Asia has the highest potential for agricultural carbon sequestration. Improving nitrogen fertilizer efficiency lowers nitrous oxide emissions, a major greenhouse gas. Agricultural sequestration from no-till is less vulnerable to reversals. Cotton textiles store ~1.5kgs of C02 per kg of fibre grown (Regenerative Agricultural Guide Furthermore, improving nitrogen fertilizer use efficiency reduces emissions of nitrous oxide (N_2O), a greenhouse gas with a global warming potential nearly 273 times greater than carbon dioxide over a 100-year period. Conservation practices such as reduced or no-tillage also enhance soil carbon storage while reducing the risk of reversal compared to some other land-based carbon removal approaches. Cotton textiles themselves act as temporary carbon reservoirs, storing approximately 1.5 kg CO_2e per kilogram of cotton fibre produced (ICAC 2025).

Regenerative agricultural practices, including reduced tillage, cover cropping, crop residue retention, diversified crop rotations, integrated nutrient management, and improved water management—enhance the transfer of atmospheric carbon into soils through increased biomass production and root development. Over time, these practices improve soil organic carbon (SOC), soil structure, water-holding capacity, nutrient cycling, and biodiversity, while increasing resilience to drought and extreme weather events. These outcomes can be quantified and verified under internationally recognized carbon accounting methodologies such as Verra's VM0042 (Improved Agricultural Land Management), which enables the generation of high-integrity carbon credits by measuring net greenhouse gas benefits from changes in soil carbon stocks and reductions in greenhouse gas emissions resulting from improved agricultural management.

An additional opportunity lies in integrating biochar within regenerative cotton production systems. Biochar is produced by converting agricultural residues into a stable form of carbon through pyrolysis under limited oxygen conditions. When applied to agricultural soils, biochar can remain stable for hundreds to thousands of years, effectively removing atmospheric carbon dioxide while simultaneously improving soil fertility, moisture retention, nutrient-use efficiency, and microbial activity. Under carbon methodologies, biochar application can complement regenerative agricultural practices by enhancing soil carbon stocks and improving overall system performance. Dedicated carbon removal methodologies, including Carbon Standards International's (CSI) - Global Artisan C-Sink and Verra's VM0044 (Biochar Utilization in Soil and Non-Soil Applications), also provide pathways for quantifying and verifying durable carbon removal through biochar systems. Integrating regenerative cotton cultivation with biochar application therefore presents a scalable nature-based solution that combines climate mitigation, improved farm productivity, enhanced soil health, and long-term carbon removal.

Standards International's (CSI) - Global Artisan C-Sink and Verra's VM0044 (Biochar Utilization in Soil and Non-Soil Applications), also provide pathways for quantifying and verifying durable carbon removal through biochar systems. Integrating regenerative cotton cultivation with biochar application therefore presents a scalable nature-based solution that combines climate mitigation, improved farm productivity, enhanced soil health, and long-term carbon removal.

COTTON & WATER

It is essential to understand that there are 3 kinds of water that we refer to in agriculture:

- Green Water is essentially rainwater from precipitation and is stored in the rootzone of the soil and evaporated, transpired or incorporated by plants.
- Blue water footprint is water that has been sourced from surface or groundwater resources and is either evaporated or incorporated into a product. Irrigated agriculture will have a blue water footprint.
- Grey water footprint is the amount of fresh water required to assimilate pollutants to meet specific water quality standards.

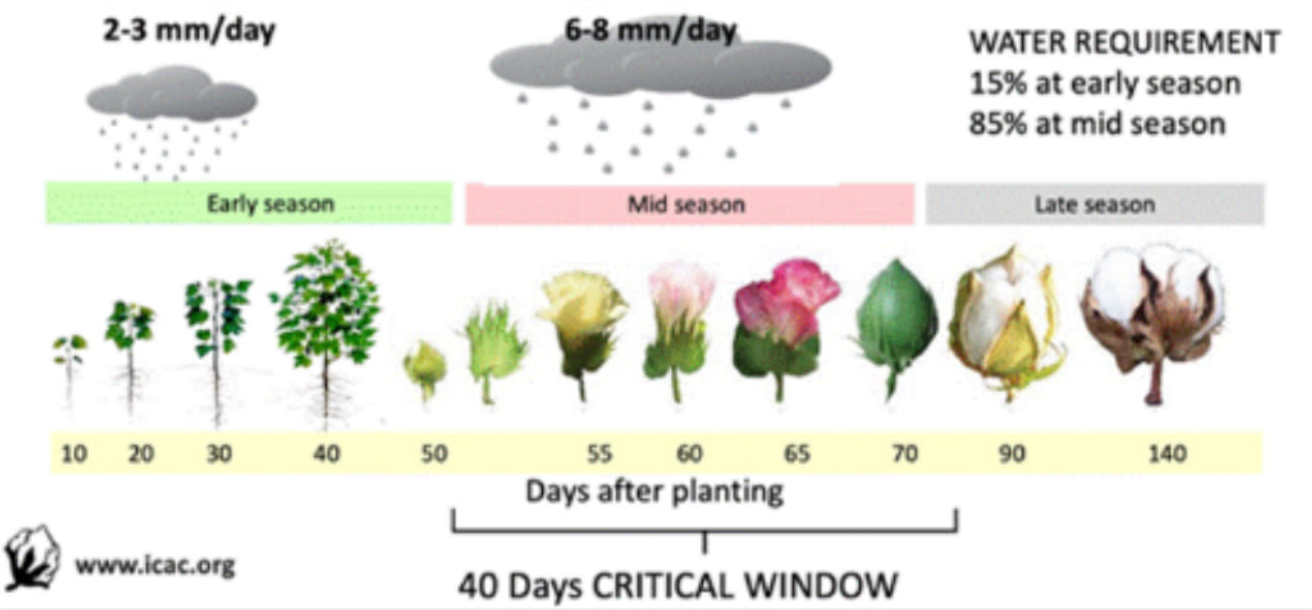
Blue Water

The most critical one as far as cotton is concerned is `blue water'. It should be noted that close to 70% of India's cotton is rain-fed and is sown with the monsoon and generally does not need to be irrigated unless there is a drought or cotton is pushed to the Rabi season. With HDPS/CS cotton the idea is that short duration cultivars cotton would a Kharif crop and with little or no need for irrigation. Water stress needs to be avoided from square formation to the end of the flowering window.

Source: Stock Image

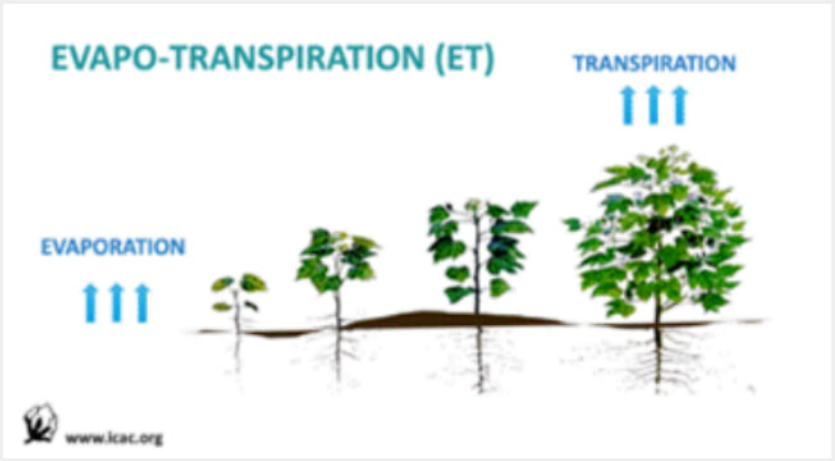
Figure 7: Pictorial depiction of critical window for water needs

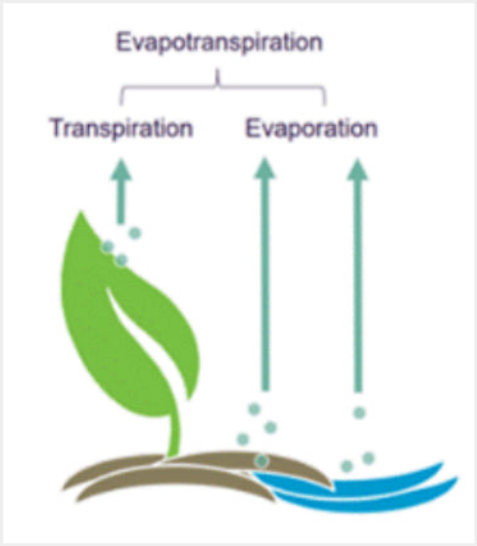
Source: Stock Image



Improving blue water use efficiency remains a central concern especially in times of climate change, droughts and erratic rainfall. The key component in this is the concept of: `Evapotranspiration'

Figure 8: Pictorial depiction of Evapotranspiration





Source: Water Footprint Network

Farmers aim to promote those practices that improve transpiration (getting water into the plant) and minimize evaporation. Regenerative practices (already covered in this manual) such as intercropping, mulching, minimum tillage will help in reducing evaporation and practices such as water harvesting, furrow & alternate furrow irrigation, water harvesting, drip irrigation will improve transpiration.

BIODIVERSITY ENHANCEMENT IN COTTON PRODUCTION

Healthy agricultural ecosystems depend on biodiversity. Biodiversity refers to the variety of plants, animals, insects, microorganisms, and other living organisms that interact within and around a farming system. A biologically diverse cotton ecosystem improves soil health, strengthens natural pest regulation, enhances pollination, increases climate resilience, and contributes to long-term agricultural sustainability.

In conventional farming systems, excessive tillage, monocropping, indiscriminate use of broad-spectrum pesticides, and removal of natural vegetation often reduce biodiversity and disrupt ecological balance. Sustainable cotton production under the Kasturi Cotton programme promotes farming practices that conserve and enhance biodiversity while maintaining productivity and profitability.

Rather than depending solely on chemical interventions, biodiversity enables natural ecological processes to support crop production by encouraging beneficial organisms that regulate pests, recycle nutrients, improve soil structure, and maintain ecosystem stability.

Importance of Biodiversity in Cotton Farming

Biodiversity provides numerous ecological and economic benefits to cotton production systems:

- Improves soil biological activity and nutrient cycling.
- Enhances populations of beneficial insects, pollinators, and natural enemies of crop pests.
- Reduces dependence on chemical pesticides by strengthening biological control.
- Improves resilience to drought, heat stress, and climate variability.
- Supports better water infiltration and soil structure.
- Conserves native flora and fauna within agricultural landscapes.
- Contributes to long-term sustainability and productivity of cotton farming systems.

Biodiversity-Friendly Practices

The Kasturi Cotton Bharat programme encourages farmers to adopt farming practices that protect and enhance biodiversity within and around cotton fields.

1. Crop Diversification

Growing intercrops, cover crops and crop rotations increases plant diversity and creates habitats for beneficial organisms. These practices improve soil fertility, suppress weeds, reduce pest pressure, and increase on-farm biodiversity.

Recommended practices include:

- Intercropping cotton with legumes such as pigeon pea, green gram, black gram, cowpea, or soybean.
- Growing cover crops during the off-season.
- Practising crop rotation wherever feasible.

2. Conservation of Beneficial Insects

Cotton fields naturally support many beneficial insects that prey upon or parasitize crop pests. Common beneficial insects include:

- Ladybird beetles
- Green lacewings
- Hoverflies
- Spiders
- Predatory bugs
- Parasitic wasps
- Dragonflies

These natural enemies help suppress populations of aphids, whiteflies, jassids, mealybugs, and bollworms. To conserve beneficial insects:

- Avoid prophylactic pesticide applications.
- Spray pesticides only after Economic Threshold Levels (ETLs) are reached.
- Prefer selective and biological pesticides wherever possible.
- Avoid WHO Class Ia and Ib pesticides.
- Avoid spraying during peak activity of pollinators.

3. Pollinator Conservation

Although cotton is largely self-pollinated, pollinating insects contribute to improved boll retention, seed development and overall ecosystem health. Farmers should encourage pollinator populations by:

- Conserving flowering vegetation around field boundaries.
- Avoiding pesticide spraying during flowering periods.
- Maintaining flowering intercrops and refuge vegetation.
- Avoiding destruction of natural nesting habitats.

Source: Stock Image

4. Conservation of Natural Habitats

Natural vegetation surrounding farms provides shelter, food, and breeding sites for birds, insects, reptiles and other beneficial organisms. Farmers are encouraged to:

- Retain native trees wherever possible.
- Maintain field bund vegetation.
- Protect village common lands, water bodies, and natural habitats.
- Avoid unnecessary removal of shrubs and grasses that support wildlife.
- Habitat conservation contributes to greater ecological balance and improves natural pest regulation.

Source: Stock Image

5. Soil Biodiversity

Healthy soils contain billions of microorganisms including bacteria, fungi, earthworms, and other soil fauna that play a vital role in nutrient cycling and organic matter decomposition. Practices that improve soil biodiversity include:

- Addition of compost, farmyard manure, vermicompost, and biochar.
- Retention of crop residues.
- Reduced tillage.
- Maintaining permanent soil cover.
- Reduced dependence on synthetic fertilizers and pesticides.

Improving soil biodiversity enhances soil organic carbon, nutrient availability, and water-holding capacity.

Source: Stock Image

6. Responsible Pesticide Use

One of the greatest threats to biodiversity is indiscriminate pesticide use. The Kasturi Cotton Bharat programme promotes Integrated Pest Management (IPM) principles by encouraging:

Source: Stock Image

- Pest monitoring before spraying.
- Economic Threshold Level (ETL)-based decisions.
- Biological control agents.
- Botanical pesticides.
- Selective insecticides with minimal impact on beneficial organisms.
- Elimination of Highly Hazardous Pesticides (HHPs).

Responsible pesticide use helps restore ecological balance while reducing production costs.

Biodiversity Monitoring

Source: Stock Image

The improvement of biodiversity should be considered an important indicator of sustainable cotton production. Implementation agencies and farmer groups may monitor simple biodiversity indicators such as:

- Presence of flowering intercrops.
- Number of beneficial insects observed during field visits.
- Bird activity within cotton fields.
- Presence of earthworms and soil fauna.
- Reduction in pesticide applications.
- Conservation of native trees and vegetation around farms.

Regular monitoring enables farmers to understand the ecological benefits of regenerative agricultural practices and supports continuous improvement.

INTEGRATED NUTRIENT MANAGEMENT (INM)

Imbalanced use of fertilisers, especially nitrogen in excess, has been rendering the soils acidic, due to which uptake of many primary and secondary nutrients has been negatively affected. INM aims to rectify this by integrating chemical fertiliser usage with organic components through the incorporation of crop residues, green manure, farmyard manure, compost, vermi-compost, crop rotations, intercropping etc.

Source: Stock Image

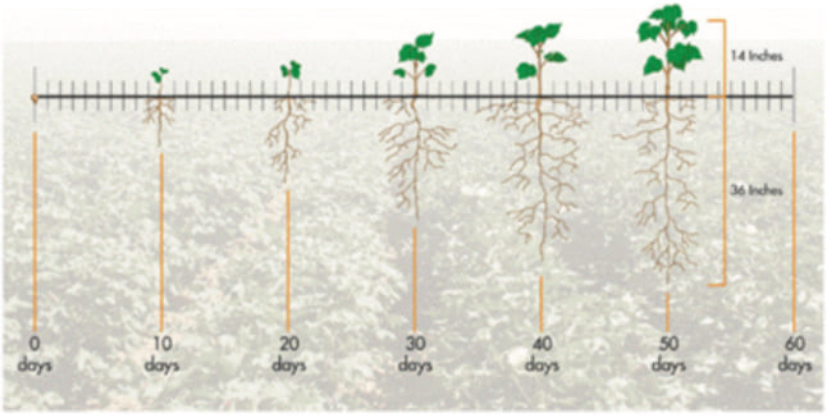
Several aspects have been covered under the regenerative agriculture section. Additionally, we will talk about intercropping of cotton with legumes (red gram, black gram, green gram, soybean, cowpea, etc.), these crops fix nitrogen and also add residues that would assist in moisture retention.

Key Points on Intercropping:

1. Cotton is a long duration, widely spaced crop and grows slowly in the first two months. This space (inter row) is filled with weeds that compete with the crop for resources, and their management adds to the cost of cultivation, which grows slowly during the initial two months.
2. The inter-row spaces remain bare during this period; the soil in the inter-row space is either exposed to lashing rains, causing loss of topsoil due to erosion

The inter-row space can be favourably utilized by growing a variety of intercrops.

Figure 9: Early Season Cotton Development



Source: The First 40 Days: National Cotton Council & Cotton Foundation

Nutrient Management Context in India

The '4R' stewardship framework forms the cornerstone of efficient nutrient management, advocating for the application of fertilisers during the right time, using the right source, at the right rate, and in the right place. This principled approach optimizes nutrient delivery precisely to crop needs and soil conditions, minimizing waste, environmental losses such as leaching or runoff, and unnecessary costs. Nutrient management practices designed based on `4R' concept is proven to be efficient as it promotes optimum nutrient uptake by crops and reduces loss at the same time.

Particularly important for Indian cotton is for farmers to understand that excess nitrogen leads to various issues, such as susceptibility to sap-sucking pests and also delays maturity. The issue of excess N use by farmers is further exacerbated by the distorted fertiliser subsidy. The fertiliser sector in India operates under heavy subsidization, with subsidies reaching INR 1.88 trillion, accounting for nearly 4.5% of the Union Budget in 2024-25. Currently, around 80-85% of urea's production cost in domestic plants is subsidized, compared to 45% for phosphatic fertilisers and a mere 5% for Phosphorous fertiliser. (ICRIER 2026).

Table 4. Nutrient Management Schedule

	36:18:18 kg/acre ($N:P_2O5:K_2O$) is recommended dose for HDPS & CS		
	Timing or Crop Stage	**Nitrogen**	**P &K and others**
1.	Basal Dose at the time of sowing	1/3rd	Full dose of P & ½ dose of K
2.	Squaring Stage (40 to 45 das)	1/3rd	½ dose of K & 5kgs of Zinc Sulphate (Z_nS0_4)
3.	Flowering & Early Boll Formation	1/3rd	2 kgs of Boron

Source: CICR Technical Bulletin 2023/2

Ideally farmers should get the soil tested before sowing and accordingly adjust the recommended dose.

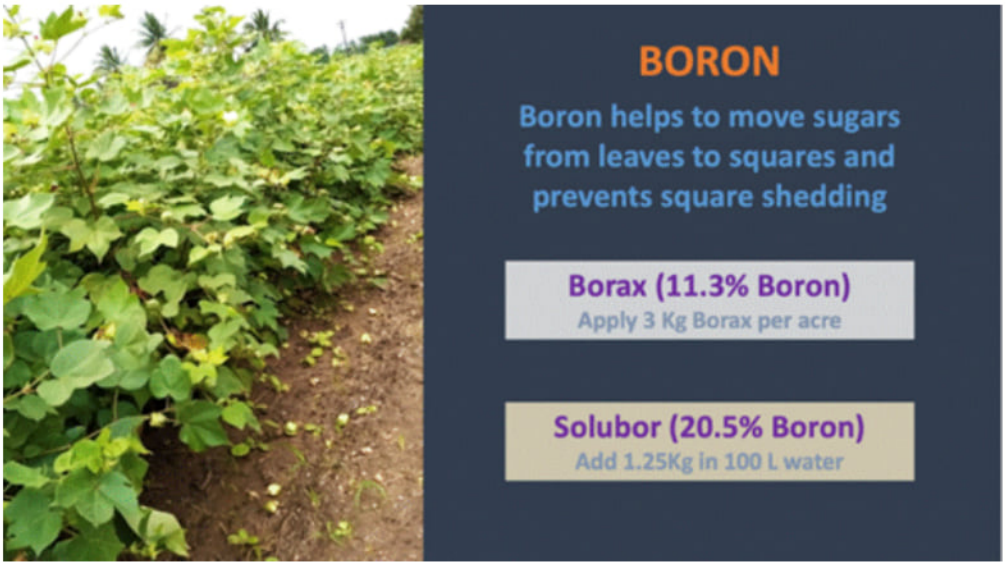
Several cotton growing districts in India are **Boron deficient.**

Figure 10: Signs of Boron Deficiency

Boron helps to move sugars from leaves to squares and prevents square shedding.

Image Source: Dr. KR Kranthi

Figure 11: Importance of Boron



Source: Dr. KR Kranthi, September 2023

Foliar application of plant nutrients helps in correcting nutrient deficiency, if any and provides extra nutrients for healthy boll development, especially **in case of excess rainfall received (responsible for leaching of nutrients) and to meet the higher nutrient demand by plants when boll load is higher.**

Table 5. Foliar Application Schedule

90 to 100 days after sowing	Multi-micronutrient (1 kg in 200 litres of water for an acre)
100 to 110 days after sowing	19:19:19 or 13:00:45 (3-4 kg in 200 litres of water for an acre)

INTEGRATED WEED MANAGEMENT (IWM)


Source: Stock Image

Integrated Weed Management (IWM) is a sustainable approach that combines preventive, cultural, mechanical, biological, and chemical methods to control weeds effectively. It aims to reduce weed competition, minimize herbicide dependence, improve crop productivity, and protect soil health and the environment through an integrated and balanced management strategy.

Key Points:

- Weed competition is toughest with cotton plants mainly during the vegetative phase and early squaring before flowering. This period extends for about 65 to 75 days. It is important to keep the fields-weed free during the vegetative stage of the crop to ensure proper growth of roots and above ground shoots (Dr. Sandhya & Dr. KR Kranthi August 2020)
- Weeds compete with cotton crop for natural resources and thereby reduce yields. They compete for water, nutrients, space and light.

Some of the commonly used methods for weeding are:

- Hand weeding, hoeing and intercultural operations using bullocks and tractors are common amongst farmers in India.
- Growing intercrop covers the soil and helps in control of weeds.
- HDPS/CS ensures quick canopy closure and improves the competitiveness of cotton crop against weeds
- Weed management using herbicides.

Herbicides are applied as pre-emergence and post-emergence in cotton.

Pre-emergence herbicide: Apply Pendimethalin 38.7 % CS @ 700 ml/acre within 24-48 hours of sowing. Pendimethalin application keeps the field weed free for 30 days, with this application, sowing of intercrop is feasible. It is important to ensure that there is enough soil moisture in the field at the time of herbicide application.

One or two hoeings followed by hand weeding at 20 and 40 days after sowing (DAS) keeps the field weed free. If hoeing or hand weeding is not possible due to continuous rains, post-emergence herbicide may be used to check weed growth.

Post-emergence herbicide: Spray Quizalofop ethyl 5% EC @ 2 ml /lit water if the field is infested with grassy weeds. Pyrithiobac sodium 10 % EC @ 1.25 ml/lit water for broad leaved weeds or Quizalofop ethyl 6% EC + Pyrithiobac sodium 4% EC (combination product) @ 2.5 ml /lit of water to control both grassy and broad-leaved weeds.

Post-emergence herbicides are most effective against younger (less than 10-15 days old) weeds or weed plants of less than 4 inches height.

A minimum of 200 litres of spray volume should be used for application of herbicides per acre.

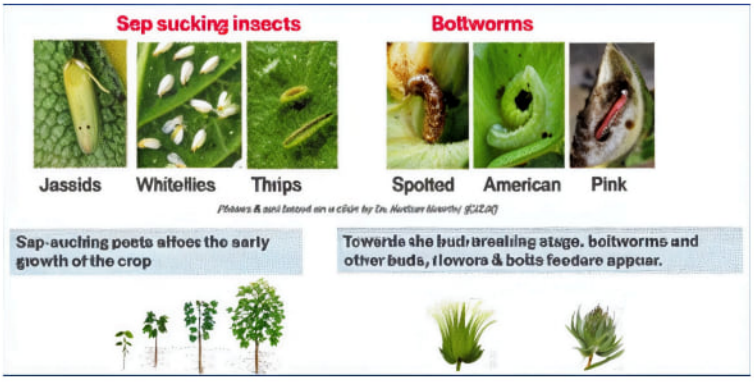
Source: Stock Image

Integrated Pest Management (IPM)

IPM deploys all available methods of pest control to ensure economic and ecological benefits. Cotton crop ecosystem harbours both harmful and beneficial organisms including insects and microbes. Avoiding pesticides early in the season helps beneficial insect population to build in the ecosystem. Some insecticides delaycrop maturity, while others cause pest resurgence (Cotton Field Manual of ICAC 2020). Some aspects have been covered in the regenerative agricultural practice section.

Key IPM Strategies:

- To plant cultivars resistant to sap sucking pests.
- Short duration cultivars under HDPS/CS are less susceptible from bollworms because of the narrow flowering and boll formation window.
- Avoidance of excessive nitrogenous fertilisers to avoid pests and diseases.
- Intercropping with legume crops strengthens biological control and organic matter.
- Trap crop push and pull strategy.
- To use biological pesticides in the initial phase of the crop.
- Avoidance of tank mixtures or cocktails.
- To use Light traps and pheromone traps for monitoring, nano lures reduce the lure replacement frequency in the traps.
- Pheromone based mating disruption technology for management of Pink Bollworm.
- Strict Avoidance of WHO Class 1a (extremely hazardous) and 1b (highly hazardous).



Judicious use of insecticides is enabled via a window based approach called back bone (Table 6). It guides farmers in the adoption of control measures only after the insect population crosses the Economic Threshold Level (ETL) (Table 7). ETL is the insect count in a sample of 20 plants.

Days after Sowing	Target Pest	Intervention
0 to 60 days	Pink Bollworm	45 Das install pheromone traps, 2 per acre (for monitoring), nano lures would be good option as the efficacy lasts a long time.
	Pink Bollworm & Sucking Pests	At 50-60 DAS, spray the crop with Neem oil or neem oil-based formulation (1500 to 3000 ppm) 50 ml + 5% Neem Seed Kernel Extract +10 gm detergent powder in 10 litres of water
60 to 90 days	White Fly	Install yellow sticky traps (8 traps /acre from July to August for monitoring and 40 traps/acre for management). Against whitefly adult population:Diafenthiuron 50% WP @ 12g Or Afidopyropen @ 20ml Or Dinotefuran 20 SG @3gOr Flonicamid 50 WG @4g or Clothianidin 50% WDG 1ml per 10 litres of water. Against the white fly nymphs: Pyriproxyfen 10 EC@ 20ml Or Buprofezin 25 SC @ 20ml or Spiromesifen22.9 SC @ 12ml per 10 litres of water.
	Thrips	Spray Thiamethoxam 25 WG @ 2gm or Spinetoram 11.7 SC @ 8.4 ml per 10 litres of water
	White Fly Thrips or Both	After 70 days old crop, spray Diafenthiuron 50WP @12g Or Spinetoram 11.7 SC 8.4ml Or Profenophos 50EC @ 20 ml per 10 liters of water.
	White Fly & Jassids (leaf hopper) either or both.	Apply Flonicamid 50 WG @4g Or Dinotefuran 20 SG @ 3g per 10 liters of water
	Pink Bollworm & Sucking Pests	Pluck and destroy the rosette flowers. Spray Profenofos 50 EC @ 30 ml or Emamectin benzoate 5 SG @ 5 gm or Indoxacarb14.5SC@10ml or Chlorpyriphos20EC@ 25ml per 10 liters of water
	American	Chlorantranliprole 18.5 SC @ 3 ml or Flubendiamide 39.35 SC
	Bollworm	@ 2.5 ml or Indoxacarb 14.5 SC @ 10 ml per 10 litres of water
90 to 120 days	Jassids	Spray Thiamethoxam 25 WG @ 2 gm per 10 liters of water
90 to 120 days	Thrips	Spray Thiamethoxam 25 WG @ 2gm or Spinetoram 11.7 SC @ 8.4 ml per 10 litres of water
	White Fly	Dinotefuran 20 SG @ 3gms or Spiromesifen22.9 SC @ 12ml per 10 litres of water or Diafenthiuron 50 WP @ 12 gm per 10 litres of water
Crop Growth Stage >120 days	Pink Bollworm	Spray Cypermethrin 10EC @ 10-15 ml or Cypermethrin 25 EC @ 4-6 ml or Lambda Cyhalothrin 5 EC @ 10 ml or Deltamethrin 2.8 EC @ 10 ml or Fenpropathrin 10 EC @ 15.20 ml or Fenvalerate 20 EC @10 ml or Alphacypermethrin 10 EC @ 6 ml per 10 liters of water.

Figure 13. Images of Sucking pests

Jassids or leaf hoppers

Aphids

Thrips

White Fly

All image source: CICR

Sucking Pests	
jassids or leaf hoppers	25% of plants show infestation grade 2,3 &4, or 2 nymphs per leaf.

Source: ICAC Recorder Sept. 2025

Aphids	10% of plants show symptoms of cupping/crumpling of a few leaves on the upper portion of the plant.
Thrips	25% of plants show silvery patches on the underside of leaves above mid canopy or 10 Thrips per plant.
White Flies	6 white flies per leaf.
Bollworms	
American Bollworm	20% of plants having more than one or `flared up' squares or 5-10% infested square or bolls.
Pink Bollworm	More than 8 moths/trap per night for 3 consecutive days and or more than 10% infested flowers or bolls (at least 2 bolls having live pink or white larvae)

HARVEST AND POST-HARVEST PROCEDURES TO REDUCE TRASH AND CONTAMINATION

Issue of Trash and Contamination

Maintaining fibre quality during harvesting and post-harvest handling is critical for improving the value and marketability of Indian cotton under the Kasturi Cotton Bharat programme. Contamination and excess trash reduce spinning efficiency, increase processing costs, and negatively affect the reputation of Indian cotton in domestic and international markets.

Trash is essentially endogenous material; the term endogenous refers to substances that are part of the cotton plant itself, seeds, organic matter abnormal fibre. Machine picked cotton typically contains more trash:17 to 20% on seed cotton basis compared to 1 to 6% found in hand-harvested cotton. Most of the trash can be removed at the ginning level with appropriate machines (centrifugal lint cleaners etc.), removal may lead to lowering of Gin Out Turn (GOT).

Contamination is essentially exogeneous material; the term exogeneous refers to substances that do not originate from the plant, foreign matter, such has human hair polypropylene, etc.

Figure 14. Development of fruiting points on a cotton plant, each number indicates the day the fruiting points were formed

The importance of this image is to understand how cotton bolls mature and how they should be picked by farmers. Only mature and fully open bolls need to be picked and care should be taken to ensure only the cotton is picked and not the dry matter surrounding the same. This will ensure lower trash content.

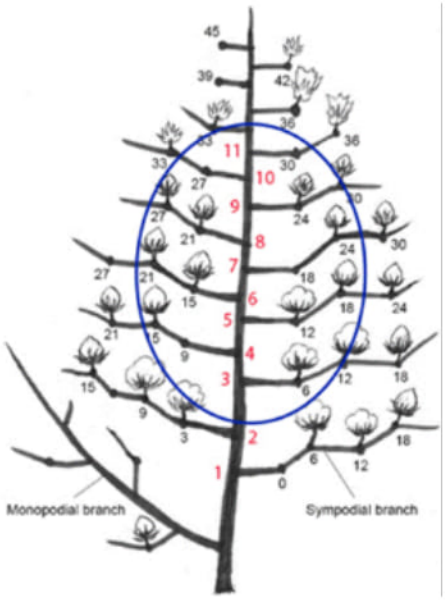
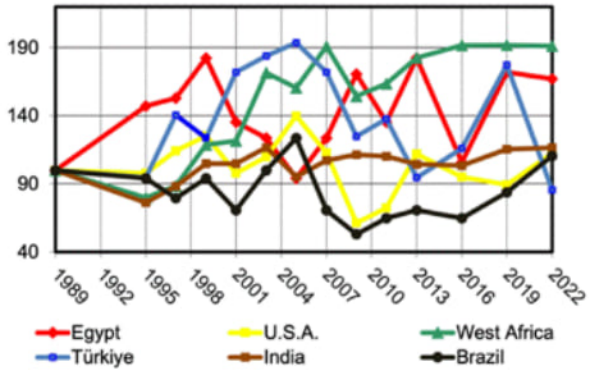


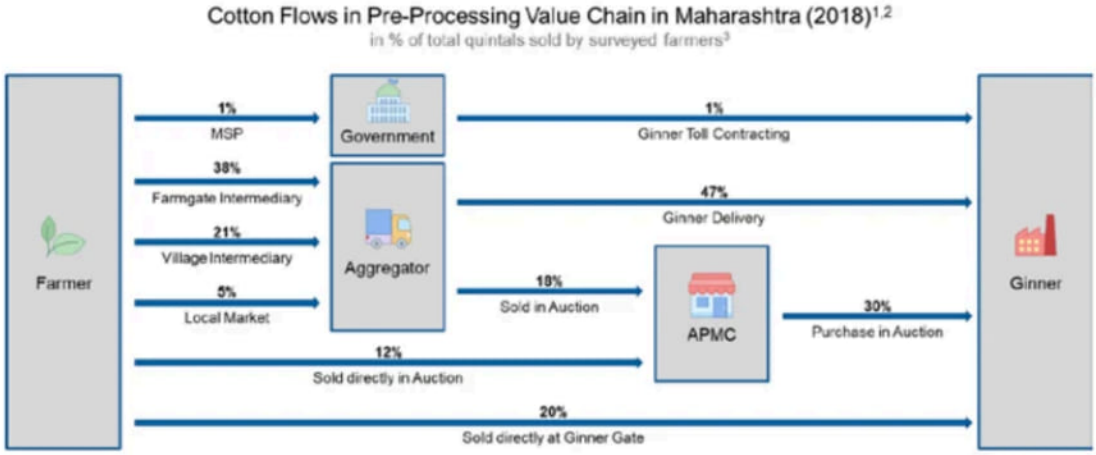
Image drawn by Dr. Keshav Kranti based on Oosterhuis 1990

Figure 15. Foreign Fibre by Country (1989 to 2022)



Source: International Textile Manufacturers Association (ITMF)

Figure 16. Cotton pre-processing value chain Maharashtra 2018: aggregator dominated



Source: Towards Doubling Cotton Farmers Income in Maharashtra (IDH report) 2019

Although this representation is from Maharashtra, with some variations this would be case in several states and districts.

Importance of Fibre Quality in Sustainable Kasturi Cotton

The success of Kasturi Cotton Bharat Programme depends not only on sustainable production practices but also on the delivery of clean, contamination-free, and traceable cotton to the textile value chain. Proper harvest and post-harvest management helps to:

- Improve fibre quality and market value
- Reduce contamination-related losses
- Enhance spinning efficiency
- Strengthen the global reputation of Indian cotton
- Support traceability and sustainability objectives under Kasturi Cotton

Foreign Fibre Contamination is a very serious issue and needs to be addressed at various levels, including at the farmer level, during transportation, intermediate storage etc.

Recommended Practices to Reduce Trash and Contamination

Key Harvesting Practices:

Picking of Mature Cotton:

- Only fully opened and mature bolls should be picked.
- Immature, wet, stained, insect-damaged, or unopened bolls should not be harvested.
- Picking should preferably be undertaken during dry weather conditions and after dew has dried.
- Cotton from rain-affected fields should be dried properly before storage.

Clean Picking Practices:

- Pick only seed cotton and avoid inclusion of dry leaves, burs, stalk pieces, or soil.
- Pickers should keep hands, bags, and collection sheets clean.
- Cotton should never be placed directly on bare soil.
- Separate picking of clean and stained cotton should be practiced wherever possible.

Sequential Picking:

- Early and clean pickings generally provide better fibre quality and reduced contamination.
- Last pickings with poor quality or heavily stained `kapas' should be stored separately.

Moisture Management

High moisture content in harvested cotton can lead to fungal growth, discoloration, and deterioration of fibre quality.

Key precautions:

- Avoid harvesting during rain, heavy dew, or high humidity conditions.
- Harvested `kapas' (seed cotton) should be dried in shade or on clean surfaces before storage.
- Cotton should not be stored in airtight conditions immediately after harvest.
- Wet cotton should never be mixed with dry cotton.

Foreign Fibre Contamination

Foreign fibre contamination is one of the most serious quality concerns in Indian cotton. Contaminants such as polypropylene (PP), plastic threads, jute fibres, cloth pieces, hair, paper, and packaging materials are difficult to remove during spinning and significantly reduce yarn quality.

Contamination can occur at farm level, during aggregation, transportation, storage, or at ginning units. Prevention at source is therefore critical.

Figure 17. Examples of how foreign fibre is entering the cotton fibre

Source: Pictures by Rajeev Baruah

Care at Farmer Level

- As far as possible, avoid the use of polypropylene bags for picking, storage, and transportation. Cotton cloth bags are preferred.
- If polypropylene bags are used, avoid white coloured bags and ensure they are free from loose fibres.
- Do not use fertilizer bags, cement bags, or old plastic sheets for cotton storage.
- Cotton should not be dried on roadsides or directly on plastic tarpaulins that shed fibres.
- Use clean cotton cloth sheets or clean floor surfaces for drying and storage.
- Pickers should avoid carrying food wrappers, tobacco sachets, or plastic materials into fields during harvesting.
- Avoid mixing cotton from different varieties or quality grades.
- Cotton should be protected from contamination by livestock, poultry, dust, and household waste.

Care During Transportation and Storage

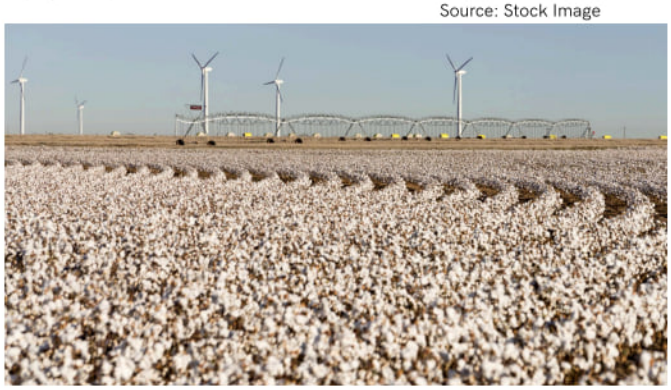
- Cotton should be transported in clean and covered vehicles, tractor trolleys, or bullock carts.
- Storage areas should be clean, dry, and protected from moisture, rodents, birds, and animals.
- Cotton stacks should be placed on raised platforms or pallets and not directly on the floor.
- Minimize repeated handling and intermediate storage to reduce contamination risk.
- As far as possible, farmers should deliver cotton directly to authorized procurement centres, APMC, FPO collection centres or ginning units to minimise handling and storage contamination risk.

Figure 18. Pictures of how polypropylene is entering the fibre, during transportation and intermediate storage

Source: Pictures by Rajeev Baruah

RENEWABLE ENERGY IN COTTON PRODUCTION

Source: Stock Image



The use of renewable energy contributes to climate-resilient and resource-efficient cotton production by reducing dependence on fossil fuels, lowering greenhouse gas emissions, and improving long-term sustainability. Wherever technically and economically feasible, Kasturi Cotton encourages the adoption of clean and renewable energy solutions across farm operations and associated processing facilities. Renewable energy technologies can improve energy efficiency while reducing operational costs and environmental impacts. Their adoption also supports national commitments towards climate change mitigation and sustainable agricultural development.

Recommended Practices

- Promote the use of solar-powered irrigation pumps to reduce dependence on diesel and grid electricity.
- Encourage installation of solar-powered lighting systems in farms, storage facilities, and ginning units.
- Promote the use of energy-efficient irrigation systems and farm machinery to reduce overall energy consumption.
- Encourage periodic maintenance of pumps, motors, and equipment to improve energy efficiency.
- Support adoption of renewable energy technologies through government schemes and financial incentives wherever available

CIRCULARITY AT FARM LEVEL

Circularity in agriculture refers to the efficient use and reuse of natural resources by minimizing waste and returning valuable materials back to the farming system. In cotton production, circular farming practices improve resource-use efficiency, enhance soil health, reduce environmental pollution and contribute to long-term farm sustainability. The Kasturi Cotton Bharat programme encourages farmers to adopt practices that maximize the productive use of on-farm resources while reducing dependence on external inputs and minimizing waste generation.

Recommended Practices

- Recycle crop residues through composting, mulching, biochar production, or incorporation into the soil instead of open field burning.
- Utilize farmyard manure, compost, crop residues and other locally available organic biomass to improve soil fertility and organic carbon.
- Reuse agricultural by-products, where feasible, as livestock feed, for composting or as bio-inputs

- Promote on-farm preparation and use of biological inputs such as compost, vermicompost, Jeevamrut, Beejamrut, botanical extracts, and other locally prepared bio-inputs.
- Segregate and safely dispose-off plastic waste, pesticide containers, seed packets, and other non-biodegradable materials in accordance with local regulations. Burning or indiscriminate disposal of plastic waste should be strictly avoided.
- Integrate crop and livestock systems to facilitate nutrient recycling using farmyard manure and crop residues.
- Reduce food and biomass losses during harvesting, storage, and post-harvest handling through improved management practices.

SOCIAL COMPLIANCE AND FARMER WELLBEING

Overview and Guiding Philosophy

Kasturi Cotton Bharat Programme is committed to building a cotton value chain that is not only environmentally sustainable but also socially responsible. Ethical practices and the well-being of every person involved, from farm to gin, are foundational to the programme's credibility and long-term success.

Sustainable cotton production is not limited to environmental stewardship alone. It also seeks to improve the social and economic well-being of farming communities by promoting decent work, safe workplaces, gender equality, farmer livelihoods, and inclusive growth. Kasturi Cotton encourages farming systems that enhance productivity, strengthen resilience, improve market opportunities, and contribute to better quality of life for farmers and agricultural workers.

This section establishes the Social Compliance Framework applicable to all Kasturi Cotton programme participants, including registered farmers, farmer groups, Farmer Producer Organisations (FPOs), implementing partners, and ginning units. The framework is grounded in:

- Indian labour laws and constitutional rights
- International Labour Organization (ILO) Core Conventions on decent work
- UN Guiding Principles on Business and Human Rights
- Best practices aligned with global sustainability standards (e.g., Better Cotton, GOTS, Fairtrade)

All registered participants in the Kasturi Cotton programme are required to comply with the principles outlined in this section. Compliance is monitored through the Internal Control System (ICS)/ Internal Inspections, periodic field inspections, and third-party audits as applicable.

Key Legal and Regulatory References

The following Indian statutes form the baseline compliance requirements. Sustainability SOP for Kasturi Cotton Bharat meet or exceed these norms:

Table 8: Key Legal and Regulatory References

Requirement	Standard / Reference
Child Labour	Child Labour (Prohibition and Regulation) Amendment Act, 2016
Bonded Labour	onded Labour System (Abolition) Act, 1976
Minimum Wages	Minimum Wages Act, 1948 & applicable State Notifications
Occupational Safety	Occupational Safety, Health and Working Conditions Code, 2020
Factory Standards	Factories Act, 1948 (for ginning units)
Gender Equality	Equal Remuneration Act, 1976; POSH Act, 2013

Social Compliance for farms

Applicable to all registered farmers, farmer groups and FPOs under Kasturi Cotton

1. **Prohibition of Child Labour** - ILO Conventions C138 & C182 | Child Labour Act, 2016

- The protection of children from exploitative labour is non-negotiable under Kasturi Cotton. No economic justification can override a child's right to safety and education.
- No child below the age of 14 years shall be engaged in any farm operations, in line with the Child Labour (Prohibition and Regulation) Amendment Act, 2016.
- Adolescents aged 14–18 years shall not be involved in hazardous activities, including pesticide handling and spraying, operating machinery, or night-shift work.
- Kasturi Cotton actively promotes school attendance and prohibits any labour arrangement that interferes with a child's right to education.
- Family members assisting on their own farm during school holidays are not considered child labour, provided it is non-hazardous and does not displace schooling.
- All farmer group leaders and implementing partners shall maintain awareness of child labour risks during peak seasonal operations (planting, weeding, harvesting).
- Where child labour is identified, a documented remediation protocol shall be followed: immediate withdrawal from work, linkage to education systems, and family support referrals.

Remediation Note: Removal of a child from labour must be paired with education enrolment support. Punitive action without rehabilitation is not an acceptable response.

2. Elimination of Forced and Bonded Labour

- All labour must be voluntary. Any form of bonded, trafficked, or forced labour is strictly prohibited.
- Practices such as advance-based labour tying, debt bondage, retention of identity documents, restriction of movement, or any form of coercion are not permitted.

- Workers shall have the right to leave employment freely, subject to reasonable and mutually agreed notice.
- Migrant and seasonal agricultural workers are entitled to the same protections as permanent workers.
- Labour contractors or intermediaries engaged by farmer groups must be vetted for compliance with these standards.

3. Occupational Health and Safety

- Farmers and workers shall be always provided with safe working conditions.
- Use of appropriate Personal Protective Equipment (PPE), including gloves, masks, protective clothing, and goggles, is mandatory while handling agrochemicals.
- Pesticide use shall follow IPM protocols. WHO Class 1a (extremely hazardous) and Class 1b (highly hazardous) pesticides are strictly prohibited.
- Safe storage, handling, and disposal of all agricultural inputs shall be ensured as per recommended practices.
- Potable drinking water, adequate sanitation facilities, and basic first aid shall be available at the time of need.
- Workers shall not be required to work in extreme heat without adequate shade and rest breaks.
- Pregnant and nursing women shall not be assigned to tasks involving agrochemical exposure, heavy lifting, or other hazardous activities.
- All accidents, near-misses, or occupational illnesses shall be recorded and reported to the concerned authorities.
- Regular awareness and capacity-building sessions on health and safety shall be conducted under the training system.

4. Gender Equality and Non-Discrimination

- Equal opportunity and fair treatment shall be ensured irrespective of gender, caste, religion, ethnicity, disability, or socio-economic background.
- Equal remuneration for equal work must be practised. Female workers shall not receive lower wages than male counterparts for the same tasks.
- Any form of harassment, including sexual harassment, physical or verbal abuse, or discrimination is strictly prohibited.
- Separate and clean sanitation facilities for women shall be available.
- Women's land and resource rights shall be respected. Female farmers shall have equal access to Kasturi Cotton registration, training, and programme benefits.
- Kasturi Cotton actively promotes women's participation in FPOs, farmer groups, training sessions, and leadership and decision-making roles.

5. Fair Wages and Decent Working Conditions

- Wages shall meet or exceed the minimum wage rates as notified under applicable State laws and the Minimum Wages Act, 1948.
- Payments shall be made in a timely and transparent manner. Wage slips or equivalent records shall be provided upon request.
- Working hours shall comply with legal norms, including provision of adequate rest intervals and weekly rest days.

- No unauthorised deductions, exploitative arrangements, or wage withholding as a disciplinary measure are permitted.
- Where food or accommodation is provided to workers as part of remuneration, the arrangement shall be clearly disclosed, voluntary, and not used as a mechanism of control.
- Employment conditions, wage rates, and payment schedules should be communicated clearly to all workers.
- Wage payments should be properly documented through wage registers, receipts, or other appropriate records.
- Wherever applicable, workers should receive statutory benefits in accordance with prevailing labour laws.

6. Freedom of Association

- All workers and farmers shall have the right to join, form, or not join a workers' organisation, union, cooperative, or FPO of their choice, free from interference or coercion.
- No worker or farmer shall be penalised, dismissed, or discriminated against for exercising this right.
- Kasturi Cotton encourages collective platforms such as FPOs as vehicles for farmer empowerment, shared services, and market access.

Farmer Livelihoods and Economic Wellbeing

The objective of sustainable cotton production extends beyond environmental stewardship and social compliance. Kasturi Cotton seeks to improve the economic resilience of cotton farmers by enhancing productivity, improving fibre quality, reducing production costs, and creating opportunities for better market access. Adoption of scientific agronomic practices and regenerative agriculture should contribute to higher profitability while conserving natural resources.

Key Principles

- Promote adoption of sustainable production practices that enhance long-term farm productivity.
- Improve cotton quality through good agronomic, harvesting, and post-harvest practices to increase market value.
- Encourage efficient use of inputs such as fertilizers, pesticides, water, and energy to reduce the cost of cultivation.
- Strengthen farmers' resilience through diversified cropping systems and regenerative agricultural practices.
- Facilitate access to markets that recognize and reward sustainably produced Kasturi Cotton.

Inclusion of Small and Marginal Farmers

India's cotton sector is dominated by small and marginal farmers, who play a critical role in the production of Kasturi Cotton. The programme aims to ensure that these farmers benefit from sustainable production systems through access to knowledge, technology, traceability systems, and market opportunities.

Key Principles

- Encourage participation of small and marginal farmers in the Kasturi Cotton programme.
- Provide regular technical guidance, capacity building, and extension support.
- Promote collective action through Farmer Producer Organizations (FPOs), cooperatives, and farmer groups.
- Facilitate adoption of improved technologies and sustainable farming practices suitable for smallholder production systems.
- Ensure equal access to programme benefits irrespective of farm size

Women's Empowerment

Women contribute significantly to cotton cultivation, including sowing, intercultural operations, harvesting, and post-harvest handling. Kasturi Cotton recognizes the importance of strengthening women's participation in agriculture and promoting equal opportunities across the cotton value chain.

Key Principles

- Encourage active participation of women in technical trainings and capacity-building programmes.
- Promote women's representation in farmer groups, FPOs, and community leadership roles.
- Support women-led enterprises related to bio-input production, seedling nurseries, and value addition where feasible.
- Ensure equal access to information, resources, and programme benefits.
- Promote a safe, respectful, and inclusive working environment for women.

Worker Grievance Redressal

An accessible grievance mechanism enables workers and farmers to raise concerns regarding labour conditions, discrimination, health and safety, wages, or other workplace issues without fear of retaliation. Timely resolution of grievances strengthens trust, accountability, and continuous improvement.

Key Principles

- Establish a simple, transparent, and confidential grievance redressal mechanism.
- Ensure that workers and farmers are informed about the grievance process.Investigate grievances fairly and resolve them within a reasonable timeframe.
- Protect complainants from discrimination or retaliation.
- Maintain records of grievances received, actions taken, and their resolution.

Community Engagement

Sustainable cotton production extends beyond individual farms and requires active participation of farming communities and local institutions. Kasturi Cotton encourages a community-based approach to promote collective learning, environmental stewardship, and inclusive rural development. Community engagement strengthens the adoption of sustainable practices, facilitates knowledge exchange, and enhances the resilience of farming systems.

Community Engagement Initiatives

The following activities are encouraged under the Kasturi Cotton programme:

- Organize regular farmer meetings, field demonstrations, and Farmer Field Schools (FFS) to promote sustainable cotton production practices.
- Establish demonstration plots to showcase improved agronomic, regenerative, and climate-smart farming practices.
- Promote awareness programmes on soil health, water conservation, biodiversity, responsible pesticide use, and fibre quality management.
- Encourage participation of women, youth, and smallholder farmers in training programmes, decision-making, and community-level initiatives.
- Strengthen Farmer Producer Organizations (FPOs), farmer groups, and local institutions to facilitate collective action, input access, knowledge dissemination, and market linkages.
- Promote village-level campaigns on clean harvesting, contamination-free cotton, waste management, and environmental conservation.
- Encourage plantation drives, biodiversity enhancement activities, and conservation of common natural resources within farming landscapes.
- Facilitate collaboration with government departments, research institutions, Krishi Vigyan Kendras (KVKs), civil society organizations, and private sector partners for technical support and capacity building.
- Promote farmer-to-farmer learning and recognition of innovative farmers to encourage wider adoption of sustainable practices.

IMPORTANCE OF DIGITAL MONITORING, REPORTING AND VERIFICATION (D-MRV)

A d-MRV system acts as the digital backbone for traceability, compliance, verification, sustainability reporting, and supply chain transparency, enabling reliable data flow from farm to finished product.

It will serve as critical component of the Kasturi Cotton Programme by supporting traceability, verification, and monitoring across the cotton value chain. The system is intended to strengthen transparency, accountability, quality assurance, and documentation of cotton production and supply chain processes in line with Kasturi Cotton standards and protocols.

Under the programme, d-MRV will be used to capture and maintain:

- farmer profiles,
- landholding details,
- geo-tagged plot information,
- crop practices,
- input usage,
- field observations, and
- harvest-related information through standardized digital tools.

The system will also play a critical role in supporting compliance, digital traceability, and global market readiness under the Kasturi Cotton Programme. The platform will enable systematic collection, verification, and management of farm and supply chain data required to meet emerging global sustainability and traceability requirements, including alignment with the European Union's Digital Product Passport (DPP) framework and evolving regulations related to fibre sourcing and environmental reporting.

Through this monitoring system, verified digital records related to farmer profiles, geo-tagged farms, crop practices, input usage, production volumes, aggregation, and processing stages can be maintained to support end-to-end traceability across the cotton value chain. The system will also facilitate integration of sustainability indicators and Life Cycle Assessment (LCA)-related data, including information on water usage, fertilizer application, energy consumption, emissions-related parameters, and resource-use practices. The system will strengthen compliance readiness, improve transparency, and support the global positioning of Kasturi Cotton in line with emerging regulatory and market expectations.

TRACEABLE LOT MANAGEMENT

Key Practices

Traceable lot management is essential for establishing a transparent, credible, and verifiable Kasturi Cotton supply chain. It ensures that every cotton lot or bale can be traced from its original source through procurement, ginning, pressing, storage, dispatch, transportation, and subsequent movement across the textile value chain. An effective lot management system preserves the identity of Kasturi Bharat Cotton, prevents mixing with non-certified cotton, and strengthens confidence among farmers, aggregators, ginners, spinners, processors, brands, buyers, and certification agencies.

Standard Operating Procedure

1. Each cotton lot shall be assigned a unique lot identification number at the point of aggregation or ginning before any further processing.
2. Lot-level information shall include farmer or source details, procurement date, location, quantity, cotton variety, moisture content, quality grade, ginning unit details, and bale number, wherever applicable.

1. Certified bales shall be tagged with QR code-based identification to enable verification of origin, processing history, and certification status.
2. All lot movement, processing, storage, transfer, transportation, and dispatch records shall be updated in the approved digital traceability system on a real-time or batch-wise basis.
3. Transportation records shall include vehicle type, vehicle registration number, transporter name, driver details, dispatch date and time, route, loading quantity, and delivery location.
4. Certified and non-certified cotton shall be physically segregated at all stages of handling, storage, processing, and transportation to prevent mixing, substitution, or contamination.
5. Any lot split, merge, rejection, reprocessing, stock transfer, or other inventory adjustment shall be documented with the date, responsible person, quantity affected, and reason for the change.
6. Transaction certificates and digital records shall be maintained for every lot movement to establish a complete and auditable chain of custody.
7. Before dispatch, the transporter and vehicle shall be verified against the approved dispatch records to ensure that certified lots or bales are transported only through the designated vehicle and authorised logistics arrangement.

The entire process shall be supported through an approved digital traceability system. Where available, the system should be integrated with blockchain-based traceability to create secure, tamper-resistant, and immutable transaction records across the supply chain. All activities, including lot splitting, merging, rejection, reprocessing, stock transfer, and dispatch, shall be recorded with the corresponding date, quantity, responsible person, and reason for the transaction. The digital records shall remain fully reconciled with physical inventories throughout the supply chain.

Verification Mechanism

Verification shall be conducted through the review of digital traceability records, QR code scans, blockchain transaction logs where applicable, lot registers, bale tagging records, stock registers, warehouse records, dispatch documents, transport records, vehicle verification records, and transaction certificates. Physical verification shall include inspection of lot segregation, bale tags, warehouse inventories, loading records, vehicle registration details, transporter information, and reconciliation of physical stock with digital traceability records to ensure complete chain-of-custody integrity. Any non-conformity shall be documented, investigated, and resolved through appropriate corrective actions before certification approval or onward movement of the lot.

Stakeholder Responsibilities for Traceability

Stakeholder Responsibilities for Traceability Farmer groups and aggregators shall maintain accurate source-level procurement records and ensure the completeness of farmer and lot information before aggregation. Ginning and pressing units shall assign unique lot identification numbers, maintain processing and inventory records, ensure strict physical segregation of Kasturi and non-Kasturi Cotton, and apply QR code-enabled

bale tags to certified bales. Warehouse and logistics teams shall maintain complete records of storage, inventory, transfer, transportation, loading, and dispatch activities, verify transporter identity and vehicle details before movement, and ensure physical traceability and an unbroken chain of custody throughout storage and transportation.

The Certification and Verification Agency shall verify both digital and physical traceability records through audits and field inspections, document any non-conformities, and verify the implementation of corrective actions. The Programme Administrator shall maintain the digital traceability platform, ensure data integrity, user access controls, and system security, monitor compliance across the supply chain, and support audit readiness by maintaining complete, accurate, and up-to-date traceability records.

Table 8: Stakeholder-wise roles and responsibilities

Stakeholders	Roles and Responsibilities
Farmer Groups and Aggregators	• Maintain source-level procurement records. • Ensure the accuracy and completeness of farmer and lot information before aggregation.
Ginning and Pressing Units	• Assign unique lot identification numbers. • Maintain processing and inventory records. • Ensure physical segregation of Kasturi and non-Kasturi Cotton. • Apply QR code-enabled bale tags.
Warehouse and Logistics Teams	• Maintain storage, inventory, transfer, transportation, loading, and dispatch records. • Verify transporter identity, vehicle registration details, and dispatch documentation before movement. • Ensure physical traceability and chain of custody during storage and transportation.
Certification and Verification Agency	• Verify digital and physical traceability records. • Conduct audits and field verification. • Record and report non-conformities and verify implementation of corrective actions.
Programme Administrator	• Maintain the digital traceability platform. Ensure data integrity, user access controls, and system security. • Monitor traceability compliance across the supply chain. • Support audit readiness and maintain complete traceability records.

Records to be Maintained

Comprehensive record-keeping forms the operational foundation of traceable lot management. All stakeholders shall maintain complete, accurate, secure, and reconcilable records in digital, physical, or hybrid formats to demonstrate an auditable chain of custody throughout the supply chain. Records shall include procurement, lot and bale identification, QR code tagging, processing, storage, inventory, transportation, loading, transfer, dispatch, vehicle movement, transaction certificates, and digital traceability system logs, along with supporting documents such as dispatch challans, delivery acknowledgements, and chain-of-custody records.

In addition, all audit reports, verification reports, non-conformity records, corrective action reports, and system transaction histories shall be maintained and made readily available for certification, verification, buyer review, and regulatory inspection. These records shall enable reconciliation between physical inventories and digital traceability data, ensuring the integrity and authenticity of Kasturi Cotton throughout the value chain.

CONCLUSION

The Sustainability Standard Operating Procedures for Kasturi Cotton Bharat represents an important step towards establishing a science-based, farmer-centric, and globally relevant sustainability framework for Indian cotton. By integrating principles of sustainable crop management, regenerative agriculture, resource efficiency, biodiversity conservation, social responsibility, fibre quality, and traceability, the SOP provides practical guidance for strengthening the sustainability and competitiveness of the Indian cotton sector.

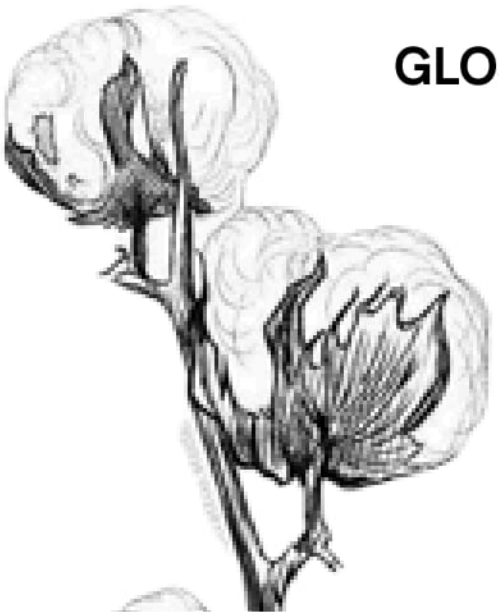
The recommendations presented in this document are intended to support continuous improvement rather than one-time compliance. Successful implementation will depend on the collective efforts of farmers, Farmer Producer Organizations (FPOs), implementing agencies, ginning units, industry stakeholders, research institutions, and government organizations working together towards a shared vision of sustainable cotton production.

This document forms the first phase of the Sustainability Standard Operating Procedures for Kasturi Cotton Bharat and establishes the technical foundation at the Farm and Gin level, for future programme development. Subsequent phases will include details on Spinning to garment protocols, implementation procedures, supply chain and traceability guidelines, monitoring and verification systems, certification procedures, and capacity-building modules to facilitate large-scale adoption across the cotton value chain.

As sustainability challenges continue to evolve, the SOPs will be periodically reviewed and refined based on scientific advancements, field experiences, stakeholder consultations, and emerging national and international sustainability requirements. This approach will ensure that the recommendations remain practical, credible, and relevant while supporting continuous innovation and improvement.

Through collaborative implementation and continuous learning, the Kasturi Cotton Bharat programme aspires to enhance farmer livelihoods, conserve natural resources, improve fibre quality, strengthen responsible supply chains, and position Indian cotton as a globally recognized benchmark for sustainable cotton production

The Sustainability Standard Operating Procedure for Kasturi Cotton Bharat document is envisioned as a living framework that will evolve through research, innovation, stakeholder collaboration, and continuous improvement, contributing towards a resilient, traceable, and globally competitive Indian cotton value chain.

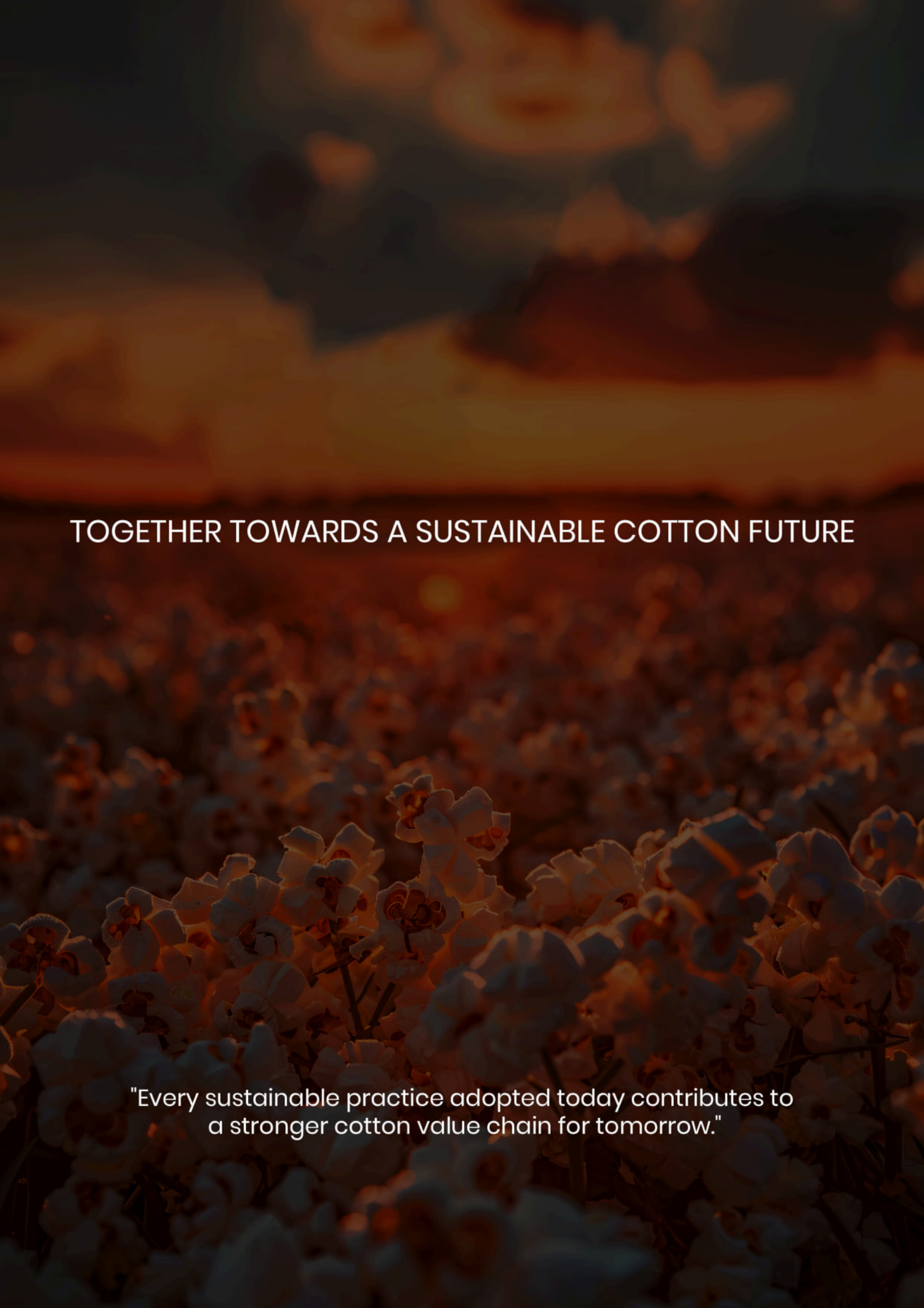


GLOSSARY

Term	Meaning
HDPS	High Density Planting System, refers to planting at 90cmx15 cms achieving a plant population of 29,629
CS	Close Spacing refers to planting at 90cmsx30cms achieving a plant population of 14,814
Seed Cotton	Cotton with the seed inside, commonly known as `Kapas'
Lint Cotton	Cotton with the seed removed, end product of ginning
Genotype	Genetic makeup of an organism, specific set of genes it carries.
Canopy Management	Plant training practices, aimed at re-directing nutrients to fruiting parts. Restricting plant height, removal of vegetative branches etc.
PGR	Plant Growth Regulator for canopy management.
Regenerative Agriculture	Farming practices that improve soil health and the resulting ability of the soil to indefinity support profitable crop production.
Soil Organic Carbon	A key indicator of soil health
Soil Organic Matter	It contains 57% Soil Organic Matter
Nutrient Use Efficiency (NUE)	Measure of plants to absorb and convert applied nutrients to crop yield
Fertiliser Response Ratio	Measure of kilograms of grains produced per kilogram of Nitrogen, Phosphorous, Potash (NPK) fertiliser applied

BIBLIOGRAPHY

- Carbon Standards International. Global Artisan C-Sink Methodology. Zurich: Carbon Standards International. https://www.carbon-standards.com/
- Centre for Science and Environment. Soil Health Scheme (Government of India) — Analysis Report, 2023–25. New Delhi: CSE. https://www.cseindia.org/
- Food and Agriculture Organization of the United Nations. FAOSTAT Statistical Database, 2025. Rome: FAO. https://www.fao.org/faostat/
- ICAR–Central Institute for Cotton Research (CICR). Technical Bulletin 2023/2. Nagpur: CICR. https://cicr.org.in/
- International Cotton Advisory Committee (ICAC). Washington, DC: ICAC. https://icac.org/
- International Textile Manufacturers Association (ITMF). Zurich: ITMF. https://www.itmf.org/
- IDH – The Sustainable Trade Initiative. Towards Doubling Cotton Farmers' Income in Maharashtra. 2019. https://www.idhsustainabletrade.com/
- Kranthi, K.R. and Kranthi, S. Cotton physiology and boll development figures, adapted with reference to Oosterhuis, D.M. (1990), Growth and Development of a Cotton Plant.
- Ministry of Textiles, Government of India. Kasturi Cotton Bharat Programme. Launched World Cotton Day, 7 October 2020. https://kasturicotton.texprocil.org/
- National Cotton Council of America & Cotton Foundation. The First 40 Days. Memphis, TN: NCC. https://www.cotton.org/
- The Cotton Textiles Export Promotion Council (TEXPROCIL). Mumbai: TEXPROCIL. https://www.texprocil.org/
- Verra. VM0044: Methodology for Biochar Utilization in Soil and Non-Soil Applications. Washington, DC: Verra. https://verra.org/methodologies/vm0044-biochar-utilization-in-soil-and-non-soil-applications-v1-2/
- Water Footprint Network. Enschede, Netherlands. https://www.waterfootprint.org/


TOGETHER TOWARDS A SUSTAINABLE COTTON FUTURE
"Every sustainable practice adopted today contributes to
a stronger cotton value chain for tomorrow."