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EDITORIAL ANALYSIS

India's Cotton Needs Better Soil, Not Just New Seeds

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The Indian Express 2 July 2026 GS3

Source: ujiyari.com — researched, fact-checked & UPSC-mapped

INTERVIEW ANGLE

"If Bt cotton once doubled yields and then plateaued, is the answer a newer transgenic seed or a rethink of the soil and agronomy it grows in?"

Source: Original editorial ↗ The Indian Express

Every fact web-verified against primary sources (https://ujiyari.com/how-we-verify/)

WHY THIS MATTERS NOW

Cotton is the fibre of India's textile economy and the livelihood of millions of farmers, yet in village after village its cultivation is turning unviable. The reflex diagnosis is that farmers are stuck with an ageing Bt technology while the world moves to newer transgenic seeds, and that the fix is to approve the next generation of GM cotton. That framing is seductive and incomplete. India's yields have plateaued not mainly because the seed is old, but because the soil it grows in has been exhausted by decades of monoculture (https://ujiyari.com/vocab/monoculture/) and chemical dependence. Fixing cotton means fixing the ground first.

THE CRUX IN 60 WORDS

India grows the most cotton by area but among the least by yield, around 447 kg per hectare against a global 750. Pink bollworm has beaten current Bt seeds, and heavier pesticide use has spawned new pests. The deeper cause is degraded soil from monoculture. Soil regeneration, rotation and integrated pest management will lift yields more durably than a fresh GM-seed push alone.

THE ISSUE, DECODED

CONCEPT	WHAT IT MEANS	WHY IT MATTERS
Yield gap	India's 447 kg/ha versus a global average near 750 kg/ha	Signals management and soil failures, not just seed limits
Bt resistance	Pink bollworm evolving to survive current Bt cotton	Shows a seed-only strategy has biological limits
Secondary pests	Whitefly, jassids and mites triggered by heavy insecticide use	Pesticide dependence creates the next crisis, not a solution
Soil health	Organic carbon, nutrients and structure of the land	Degraded soil caps the yield of even the best seed

THE ANALYSIS

1. **The yield gap points to soil, not genetics.** India cultivates the world's largest cotton area yet produces around 447 kg per hectare against a global average near 750. A gap that large across a whole country reflects agronomy and soil, not the vintage of a single seed.
2. **Bt technology has hit its biological limit.** Pink bollworm has evolved resistance to current Bt cotton across India. The initial gains from the trait have eroded, and no transgenic construct escapes the eventual arms race with a fast-adapting pest.
3. **The pesticide treadmill makes things worse.** As Bt weakened, farmers increased insecticide use, which disrupted natural enemies and unleashed secondary pests like whitefly, jassids and mealybug. More chemistry has meant more problems, not more cotton.
4. **Monoculture mines the soil.** Growing cotton continuously depletes nutrients and organic carbon, compacts the soil and cuts its water-holding capacity. On exhausted land, even an improved seed cannot express its potential.
5. **The economics are turning against farmers.** In many villages, rising input costs and falling yields have made cotton unviable, driving a shift away from the crop, evidence that the current model, not the seed alone, is failing.

DATA AND INSTITUTIONS VAULT

CARRY THESE INTO THE EXAM HALL.

Productivity: India around 447 kg per hectare; global average near 750 kg per hectare; India second-largest producer after China.

Area: India cultivates roughly 13 million hectares of cotton, the largest cotton area in the world.

Bt cotton: the only GM crop commercially approved in India; regulated by the Genetic Engineering Appraisal Committee (GEAC) under the Ministry of Environment, Forest and Climate Change.

Pest status: pink bollworm resistant to current Bt across India; secondary pests include whitefly, jassids, mealybug, aphids.

Soil tools: Soil Health Card scheme; integrated pest management (IPM); crop rotation and intercropping as agronomic levers.

Regulatory anchor: GM approvals fall under the Environment (Protection) Act, 1986 (https://ujiyari.com/legislation/environment-protection-act-1986/) and GEAC clearance.

THE DEBATE

Argument for prioritising soil and agronomy: The yield gap and the failure of Bt against pink bollworm show that the binding constraint is degraded soil and poor management, not seed technology. Restoring organic carbon, rotating crops, and adopting integrated pest management would lift yields durably and cut the costs and ecological harm of the pesticide treadmill.

Argument for new seed technology: Others contend that existing Bt cotton is simply outdated, and that withholding access to newer, more resistant transgenic seeds keeps Indian cotton uncompetitive against countries that have adopted them. On this view, regulatory caution, not soil, is the real bottleneck.

Balanced verdict: The two are not mutually exclusive, but the order matters. New seeds planted in exhausted soil will disappoint and will eventually meet the same resistance treadmill. The durable gains come from regenerating soil, diversifying cropping and controlling pests biologically, with rigorously regulated new technology introduced as a complement. Soil first, seeds second.

HOW TO THINK ABOUT THIS (TRANSFERABLE SKILL)

> *When a system underperforms, resist the most visible or most marketed fix and identify the true limiting factor. Here, the seductive answer is a new seed, but the binding constraint is soil health. In environment and agriculture answers, distinguish symptom (low yield) from cause (degraded land), and prefer regenerative, systemic solutions over silver-bullet technology that leaves the underlying constraint untouched.*

DIAGRAM-IN-WORDS

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Monoculture + heavy pesticides -> soil degraded + pink bollworm resistant + secondary pests -> yields plateau (447 vs 750 kg/ha) -> regenerate soil + crop rotation + integrated pest management + balanced nutrition -> durable yield recovery -> (new GM seeds as complement, not substitute)
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THE WAY FORWARD

1. **Regenerate the soil first:** rebuild organic carbon and nutrients through compost, cover crops and reduced chemical load.
2. **Break the monoculture:** promote crop rotation and intercropping to disrupt pest cycles and restore soil fertility.
3. **Adopt integrated pest management:** cut insecticide dependence, protect natural enemies and slow resistance in pests like pink bollworm.
4. **Use precision agronomy:** soil-health-card-guided nutrition and efficient water use to close the yield gap.
5. **Regulate new technology rigorously:** keep the door open to newer transgenic seeds as a complement, cleared by GEAC on sound biosafety evidence, not as a substitute for soil health.

THE TAKEAWAY BOX

Cotton is a case study in sustainable agriculture, soil degradation and the limits of technological fixes, mapping to GS3 environment and agriculture.

"India's cotton problem is a land problem dressed up as a seed problem."

India yield about 447 kg/ha vs global 750; Bt cotton the only approved GM crop; regulated by GEAC under EPA 1986; pink bollworm resistance; Soil Health Card scheme.

Balance farmers' immediate demand for higher-yielding seeds against the long-term duty to preserve soil for future generations.

Connects to GS3 questions on GM crops, sustainable agriculture and soil conservation.

Soil Health Card scheme; natural and organic farming missions; GEAC and biosafety regulation; farm-income and MSP debates.

Sources: The Indian Express (https://indianexpress.com/section/opinion), Ministry of Agriculture and Farmers Welfare (https://agriwelfare.gov.in)

KEY ARGUMENTS AT A GLANCE

India's falling cotton yields stem largely from degraded soil health, monoculture and poor agronomy rather than the mere absence of newer genetically modified seeds, so soil regeneration and sustainable practices should take priority over a fresh GM push.

✓ SUPPORTING

- India's cotton productivity, around 447 kg per hectare, lags the global average of about 750 kg per hectare despite the world's largest cotton area, pointing to management and soil, not just genetics.
- Pink bollworm has evolved resistance to current Bt cotton, and rising insecticide use has triggered secondary pests, showing that a seed-only strategy hits biological limits.
- Continuous cotton monoculture depletes soil nutrients and organic matter, so without restoring soil health any new seed will underperform on exhausted land.

⚠ COUNTER

Yield gaps also reflect the ageing of existing Bt technology, and denying farmers access to newer, more resistant transgenic seeds could keep Indian cotton uncompetitive against rivals that adopt them.

→ WAY FORWARD

Prioritise soil regeneration, crop rotation, integrated pest management and balanced nutrition, while keeping the door open to rigorously regulated new seed technology as a complement, not a substitute.

MAINS ANSWER FRAMEWORK

QUESTION

India's stagnating cotton yields are as much a soil-health and agronomy problem as a seed-technology problem. Critically examine the case for prioritising soil regeneration over a fresh GM-seed push. (250 words)

INTRODUCTION

India is the world's largest cotton grower by area yet among the lowest by yield. The popular explanation is that Indian farmers lack access to the newest genetically modified seeds.

But the evidence points to a deeper cause: soil that has been mined by monoculture and agronomy that has not kept pace, problems no seed can fix on its own.

BODY

When Bt cotton was introduced it sharply raised yields by controlling bollworms, but that gain has plateaued. Pink bollworm has evolved resistance to current Bt constructs across India, and farmers have responded with more insecticide, which in turn unleashed secondary pests such as whitefly and jassids. India's productivity, around 447 kg per hectare against a global average near 750 kg per hectare, reflects this stagnation. The underlying driver is soil degradation: continuous cotton monoculture strips nutrients and organic carbon, compacts the soil and reduces its water-holding capacity, so even improved seeds meet an exhausted medium.

A pure seed-technology response ignores this and invites the same resistance treadmill. The sustainable path is agronomic: crop rotation and intercropping to break pest cycles, organic matter and balanced nutrition to rebuild soil, integrated pest management to cut chemical dependence, and precise water use. New transgenic seeds may have a role, but only as a complement to healthy soil, not a substitute for it.

CONCLUSION

India's cotton problem is a land problem dressed up as a seed problem. Regenerating soil and modernising agronomy will lift yields more durably than any new transgenic variety planted in degraded ground.

The priority order matters: soil first, seeds second.

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