Pink Bollworm Infestation in Bt Cotton

What is the issue?

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- India is the only Bt cotton-growing country facing the problem of pink bollworm infestation.
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- A look into the various factors that make it a problem unique for India and the consequences therein is essential.
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What is the infestation concern?

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- The pink bollworm infestation is plaguing cotton farmers.
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- Monsanto is an American agro-tech company that released the Bt cotton in India.
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- Bollgard 2 or BG-2 is Monsanto’s second generation insecticidal technology for cotton.
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- BG has a single bacterial gene called CryA1C, and BG-2 has CryA1C and Cry2AB2.
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- Both are designed to protect the crop against pink bollworm.
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- But the pest has grown resistant to the toxins produced by this trait.
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- BG began failing against the pest in 2009, and BG-2 began failing in 2014.
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What is the significance?

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- **Cost** - As a result of this, farmers now spend more on pesticides to control infestations.
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- This, along with the high cost of Bt seeds, is driving farmers to deprivation.
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- **India** - Interestingly, none of the other 14 Bt cotton-growing countries have seen this resistance.
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- China still successfully controls pink bollworm with first-generation Bt cotton.
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- The U.S. and Australia are moving on to third-generation BG-3 without having faced this problem.
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Why is it a problem unique for India?

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- Hybrids are crosses between two crops that often see higher yields than their parents, in a genetic phenomenon called heterosis.
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- All other Bt cotton-growing countries mainly grow open-pollinated cotton varieties rather than hybrids.
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- But India restricted itself to cultivating long-duration hybrids since the introduction of Bt cotton in 2002.
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- This is said to be the reason for the pink bollworm growing resistant to toxins in India.
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What are the factors behind?

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- **Agreement** - Monsanto licensed its BG and BG-2 traits to Indian seed companies.
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- The agreement restricted the introduction of these traits to hybrids only.
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- **Cropping pattern** - When Monsanto introduced Bt cotton in India, the technology was so popular.
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- Many cotton farmers shifted to it in large numbers.
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- However, absence of open-pollinated Bt option forced many farmers to shift en masse to hybrids.
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- From 2002 to 2011, the area under cotton hybrids rose from 2% in north India and 40% elsewhere to 96% across the country.
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- **Seed protection** - India is the only country whose intellectual property laws have never prevented its farmers from either saving or selling seeds.
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- Other countries restrict saving and selling of seeds in various degrees.
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- Some countries allow farmers to reuse seeds from a protected plant variety, but not to sell them.
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- In the U.S., where plant varieties are patented, the patented seeds cannot even be reused.
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- **Seed Companies** - Without seed protection mechanism, several seed companies in India prefer hybrids.
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- This is because unlike open-pollinated varieties, hybrids lose their genetic stability when their seeds are replanted.
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- This compels farmers to repurchase seeds each year and in a way protects corporate revenues.
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What are the consequences?

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- One adverse consequence is resulted from the cost of the hybrids.
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- **Density** - Besides, hybrids are also bigger and bushier.
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- This forces farmers to cultivate them at low densities of 11,000 to 16,000 crops per acre.
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- This is suboptimal, as countries like the U.S. and Brazil plant cotton at 80,000 to 100,000 per acre.
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- The low densities also drive Indian farmers to grow them longer so that they produce enough cotton.
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- **Toxicity** - The introduction of the Bt gene into only one parent of Indian hybrids, as is the practice, is itself a problem.
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- The resulting hybrids are hemizygous, which means that they express only one copy of the Bt gene.
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- They thus produce cotton bolls that have some seeds toxic to the pink bollworm and some that are not.
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- Unlike this, the homozygous seeds of open-pollinated varieties in the U.S., China or Australia have 100% toxic seeds.
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- The problem is hemizygous hybrids allow pink bollworms to survive on toxin-free seeds when they are vulnerable newborns.
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- But this is only a hypothesis, and experiments are needed to confirm this.
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How does pink bollworm affect crops?

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- When all the above factors combine with the pink bollworm’s biology, it creates favourable conditions for resistance.
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- The pest does its most damage in the latter half of the cotton-growing season.
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- It does not consume any other crop that grows then.
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- So, the long duration of Indian cotton crops, between 160 and 300 days, allows this pest to thrive and evolve resistance.
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- Contradictorily, other cotton-growing countries strictly terminate the crop within 160 days, arresting resistance growth if any.
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What is the way out?

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- The National Seed Association of India suggested the government to encourage a move back to Bollgard.
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- Notably, Monsanto has not patented BG in India.
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- Farmers should move swiftly to the short-duration crop varieties.
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- This is where Monsanto’s first-generation Bollgard comes in.
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- Seed companies cannot develop open-pollinated varieties with BG-2, but they can with BG as Monsanto did not patent BG in India.
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What are the challenges?

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- **Moving back** - Some say that when the many countries are moving to BG-3, moving back to BG in India would be a bad idea.
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- This is because the problem was not with the BG trait but with long-duration cotton.
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- **Pests** - Even if BG-2 does not fend off the pink bollworm, it still protects against other pests like tobacco cutworm and American bollworm.
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- The presence of two Bt genes in BG-2 means it will be more effective than BG in delaying resistance against these pests.
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- **Resistance** - Another challenge is that even if government incentivises a return to BG, the seed companies are unlikely to stop making BG-2 seeds.
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- If India cultivates both BG and BG-2, simultaneously, that may accelerate resistance among pests.
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- This could trigger the emergence of new cotton pests.
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- India erred by not clamping down on long-duration crops when Bt cotton was first introduced.

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- At least now it must base its policy on sound science and implement it stringently.
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Source: The Hindu

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