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When Pesticides Stop Working, Crop Rotation May Be the Only Answer

 **DOWN TO EARTH**

13 August 2026 ·

ECONOMY**ENVIRONMENT****GS3**

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When Pesticides Stop Working, Crop Rotation May Be the Only Answer

 Down to Earth

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GS3


INTERVIEW ANGLE

"The piece argues pesticide resistance exposes the limits of intensive single-crop farming. If a farmer's livelihood depends on the immediate yield a familiar cash crop provides, what would actually convince them to accept the short-term income risk of switching to crop rotation?"

 Every fact web-verified against primary sources

THE LIFT LINE

A pesticide that stops working is not solved by using more of it; it is solved by giving the pest nothing familiar left to resist.

WHY THIS EDITORIAL MATTERS FOR YOUR EXAM

This piece grounds a broader agricultural-sustainability concept, pesticide resistance and the case for crop diversification, in a specific, concrete farmer case study, exactly the kind of ground-level illustration that strengthens a GS3 sustainable-agriculture answer beyond abstract policy discussion.

GS Paper 3: Agriculture, cropping patterns, pesticide and input economy, sustainable farming practices.

CONCEPT	MEANING	WHY IT IS TESTABLE
Pesticide resistance	Pest populations evolving reduced susceptibility to repeated chemical exposure	Core agronomic concept the case illustrates
Crop rotation	Alternating crops across seasons to disrupt pest life cycles	The proposed alternative to chemical-input escalation
Selective pressure	Repeated exposure favouring survival of resistant pest strains	The specific biological mechanism driving resistance
Intensive single-crop farming	Continuous cultivation of the same crop, intensifying pest-resistance risk	The structural farming pattern under critique

BACKGROUND AND CONTEXT

Pesticide resistance is a well-documented agronomic phenomenon globally, arising when repeated exposure to the same chemical class exerts selective pressure favouring pest individuals with reduced susceptibility, whose survival and reproduction gradually increase the resistant proportion of the pest population. Intensive single-crop (**monoculture**) farming, common in India's commercial vegetable and cash-crop cultivation, particularly intensifies this risk by providing a consistent host crop and consistent chemical exposure pattern across successive seasons, accelerating the pest population's adaptation.

THE ANALYSIS

- 1. The case study grounds an abstract agronomic concept in a concrete, relatable farmer experience.** Illustrating pesticide resistance through a specific Odisha farmer's failed tomato crop, despite heavy investment, makes the phenomenon's real economic stakes immediately clear, rather than treating it as a purely technical agricultural-science issue.
- 2. The “more pesticide does not solve declining pesticide effectiveness” pattern is the piece's central diagnostic insight.** A farmer's instinctive response to declining effectiveness, applying more of the same chemical, actually accelerates the underlying resistance problem rather than solving it, a counterintuitive but well-established agronomic dynamic worth highlighting precisely.
- 3. Crop rotation works through a specific, testable biological mechanism, not just general “diversification is good” logic.** By removing the pest's adapted host crop periodically, rotation disrupts the pest life cycle and reduces the selective pressure driving resistance, a mechanistic explanation distinct from a vague sustainability argument.
- 4. The economic-risk counter-argument is the piece's most policy-relevant tension.** Smallholder farmers with limited financial buffer face genuine near-term income risk in shifting away from an established cash crop, meaning the agronomically sound solution (rotation) may not be economically accessible without matching market-access and transitional support policies.
- 5. This connects to India's broader sustainable-agriculture policy discourse.** The pesticide-resistance-driven case for crop diversification parallels other sustainability arguments (soil health, water use efficiency) that similarly require pairing technical agronomic guidance with economic support to be practically adoptable by smallholder farmers.

DATA AND INSTITUTIONS VAULT

PRELIMS-GRADE FACTS:

Pesticide resistance: pest populations evolve reduced chemical susceptibility through repeated exposure and selective pressure

Crop rotation: disrupts pest life cycles by removing the adapted host crop periodically

Case study: Odisha vegetable farmer, failed tomato crop despite heavy pesticide/infrastructure investment

WATCH THE TRAP: DO NOT DESCRIBE THE SOLUTION TO PESTICIDE RESISTANCE AS SIMPLY “USING BETTER OR STRONGER PESTICIDES.” THE AGRONOMICALLY SOUND LONG-TERM RESPONSE IS REDUCING RELIANCE ON THE SAME CHEMICAL-CROP COMBINATION THROUGH PRACTICES LIKE ROTATION, NOT CHEMICAL ESCALATION.

THE DEBATE

Argument FOR prioritising crop rotation as the durable solution. Continued pesticide escalation against increasingly resistant pest populations produces diminishing returns and rising costs without restoring yield, while rotation addresses the underlying selective-pressure mechanism directly.

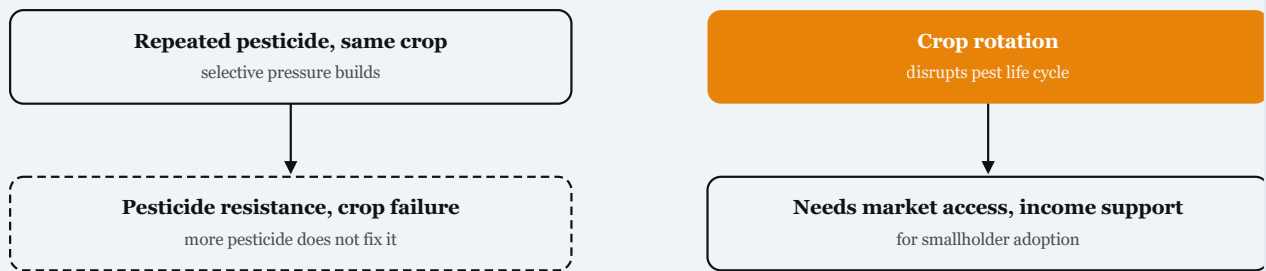
Argument AGAINST expecting rapid farmer adoption. Smallholder farmers face genuine near-term income risk in shifting away from an established, market-familiar cash crop, meaning rotation’s agronomic soundness alone does not guarantee practical, widespread adoption without matching economic support.

Balanced verdict. Crop rotation is the agronomically correct long-term response to pesticide resistance, but its adoption depends on pairing technical guidance with market-access and transitional income support, since asking financially vulnerable farmers to absorb short-term risk for long-term agronomic benefit is unlikely to succeed without such support.

HOW TO THINK ABOUT THIS

The transferable pattern: **when a technical or agronomic solution to a farming problem is sound in principle, check whether smallholder farmers have the financial capacity to absorb the transition risk it requires, and treat economic support as a necessary complement to technical guidance, not an afterthought.** This applies across sustainable-agriculture interventions generally, not pesticide resistance alone.

DIAGRAM-IN-WORDS



Repeated pesticide use builds resistance and crop failure, while crop rotation offers a durable alternative that still requires economic support for smallholder adoption.

TAKEAWAY BOX

A pesticide that stops working is not solved by using more of it; it is solved by giving the pest nothing familiar left to resist.

pesticide resistance, selective-pressure mechanism; **crop rotation**, disrupts pest life cycles; case study: **Odisha** tomato farmer.

does the state have an obligation to provide transitional income support to farmers switching from pesticide-dependent monoculture to rotation-based practices, given the near-term risk falls disproportionately on smallholders least able to absorb it?

UPSC has tested sustainable agriculture and input-use efficiency (GS3); this piece's concrete farmer case study strengthens any answer on pesticide policy or cropping-pattern diversification.

"Pesticide resistance exposes the structural limits of intensive single-crop farming." Examine this claim with reference to crop rotation as an alternative approach.

Sources: Down To Earth, Ministry of Agriculture and Farmers Welfare

Source: When Pesticides Stop Working, Crop Rotation May Be the Only Answer — Ujjyari.com | Free UPSC & State PCS Editorial Analysis

• KEY ARGUMENTS AT A GLANCE

Ajit Panda, writing in *Down To Earth*, uses the case of an Odisha vegetable farmer whose tomato crop failed despite heavy pesticide and infrastructure investment to argue that pesticide resistance is exposing the structural limits of intensive single-crop farming, and that crop rotation and diversified practices may offer a more durable path than continued reliance on chemical inputs alone.



SUPPORTING

- Repeated, intensive pesticide use against the same pest populations on the same crop over successive seasons creates strong selective pressure for pesticide-resistant pest strains, progressively reducing the effectiveness of existing chemical inputs.
- A farmer facing declining pesticide effectiveness typically responds with even heavier chemical application, increasing input costs without restoring yield, a pattern the Odisha case exemplifies directly.
- Crop rotation disrupts pest life cycles by removing the specific host crop pests have adapted to, reducing reliance on chemical intervention and offering a more sustainable long-term approach than escalating pesticide use against increasingly resistant pest populations.



COUNTER

Crop rotation requires farmers to accept short-term income uncertainty by shifting away from an established, market-familiar cash crop toward unfamiliar alternatives, a genuine economic risk for smallholder farmers with limited financial buffer, meaning the transition itself carries real livelihood risk even if the long-term agronomic case is sound.



WAY FORWARD

The piece implies farmers need both agronomic guidance on effective crop-rotation sequences and economic support, market access for rotation crops, transitional income support, to make diversification a financially viable alternative to continued pesticide-dependent single-crop farming, not merely technical advice alone.


MAINS ANSWER FRAMEWORK
QUESTION

Examine how pesticide resistance is exposing the limitations of intensive single-crop farming in India, and assess crop rotation as a more durable alternative to chemical-input-dependent agriculture. (250 words)

INTRODUCTION

Ajit Panda, writing in Down To Earth, uses the case of an Odisha vegetable farmer whose tomato crop failed despite heavy pesticide and infrastructure investment to illustrate how pesticide resistance is exposing the structural limits of intensive single-crop farming.

BODY

The Odisha case follows a well-documented agronomic pattern: repeated, intensive pesticide application against the same pest populations on the same crop across successive seasons creates strong selective pressure favouring pesticide-resistant pest strains, progressively reducing the effectiveness of existing chemical inputs. A farmer facing declining pesticide effectiveness typically responds by increasing application intensity or frequency, raising input costs without restoring yield, precisely the pattern the featured farmer experienced despite substantial investment in both pesticides and supporting infrastructure.

Crop rotation offers a structurally different approach: by periodically removing the specific host crop a pest population has adapted to, rotation disrupts pest life cycles and reduces the selective pressure driving resistance, offering a more durable long-term solution than continued escalation of chemical inputs against an increasingly resistant pest population. However, the transition carries genuine near-term economic risk, since rotating away from an established, market-familiar cash crop toward unfamiliar alternatives exposes smallholder farmers to income uncertainty they may have limited financial capacity to absorb.

CONCLUSION

A complete answer should treat this as requiring both agronomic and economic intervention: technical guidance on effective rotation sequences alone is insufficient without corresponding market access and transitional income support that makes diversification a financially viable choice for smallholder farmers, not merely an agronomically sound one.

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