



4TH CSE-PSCST STATE-LEVEL ORIENTATION WORKSHOP FOR THE GREEN
SCHOOLS PROGRAMME UNDER THE ENVIRONMENT EDUCATION PROGRAMME

ENVIRONMENT EDUCATION IN ACTION

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**Anil Agarwal Environment Training
Institute (AAETI), Nimli, Rajasthan**

PUNJAB'S PADDY PARADOX **One Crop, Many Crises**

*From short-duration seeds and stubble smoke, to floods, migration and mental health —
how one crop's economics shaped Punjab's environment and its people*

Can better seeds stop stubble burning?

- After NGT's 2015 order and Delhi's 2016 smog crisis, Punjab pushed short-duration paddy varieties (PR-126, PR-121) to fight straw burning.
- New varieties mature up to three weeks earlier — PR-126 alone frees a window of over 35 days between paddy harvest and wheat sowing.
- PAU distributed free seeds in six districts (2018-19). The logic: more time to clear fields, less need to burn.

THE ASSUMPTION

More time in hand for farmers would naturally mean less stubble burning.

SHORT-DURATION VARIETIES, SHARE OF PUNJAB'S PADDY AREA

32.6% → 67.7%

2012 2021

Government's short-duration push more than doubled the area under quick-maturing paddy in under a decade.

A clear connection — that reversed in practice

THE EXPECTED CHAIN

- 1 Government promotes short-duration seed (PR-126)
- 2 Crop matures 3 weeks earlier
- 3 Farmer gets a 35-day window before wheat sowing
- 4 Farmer uses the time to clear stubble without fire
- 5 Stubble burning falls

WHAT ACTUALLY HAPPENED

- 1 Short-duration area doubled: 32.6% → 67.7% (2012-2021)
- 2 Same districts saw burning rise, not fall
- 3 Rupnagar (~80% short-duration area): fires up 1,400%
- 4 Freed-up days used to fit in a 3rd cash crop, not to avoid fire
- 5 Straw still burned — just to clear land faster for potato, peas, mustard

Clear connection

Most districts where acreage of short- and medium-duration paddy varieties has risen have also seen an increase in straw-burning incidents

- Increase in straw-burning incidents (2018-2020)
- Names of short- and medium-duration varieties and their percentage share in the total land under paddy in the district in 2020
- Names of long-duration varieties and their percentage share in the total land under paddy in the district in 2020. These varieties are not recommended by the government for cultivation



AMRITSAR (78.8%)

PR 121 (76.5); PR 128 (3.9);
PR 129 (5.7)

BARNALA (91.9%)

PR 122 (2.3); PR 129 (3.3)

PUSA 44 (76.4);
YELLOW PUSA (4.1)

BATHINDA (1.7%)

PR 122 (12.5); PR 126 (16.4)

FAZILKA (100%)

PR 114 (19.3); PR 126 (9.9)

PUSA 44 (13.6);
PEELI PUSA (8.1);
DG PUSA (7.2); CR 212 (11.6)

FARIDKOT (36.1%)

PR 114 (30.2); PR 122 (7.5)

PUSA 44 (5.6);
DG PUSA (10.3); CR 212 (8.3)

FATEHGARH SAHIB (106.1%)

PR 121 (22.5); PR 122 (5.8);
PR 126 (10.4); PR 127 (8.4);
PR 128 (6.5); PR 129 (17.1)

PUSA 44 (16.4)

FEROZEPUR (-8.3%)

PR 114 (46.2); PR 122 (20.9);
PR 126 (17.5); PR 129 (4)

GURDASPUR (123.3%)

PR 121 (60.5); PR 127 (8.7);
PR 129 (7.5)

HOSHIARPUR (286.9%)

PR 121 (43.9); PR 126 (31.8);
PR 127 (9.4)

JALANDHAR (76.9%)

PR 121 (45.7); PR 126 (17.1);
PR 127 (5.6)

PUSA 44 (15)

KAPURTHALA (204.2%)

PR 121 (39.4); PR 126 (24.6);
PR 127 (5.8)

PUSA 44 (6.5)

LUDHIANA (194.1%)

PR 121 (24); PR 122 (7.6);
PR 126 (18.6)

PUSA 44 (34.8)

MANSA (-6.8%)

PR 114 (4.6); PR 122 (6.2);
PR 126 (10.3)

PEELI PUSA (22.6);
CR 212 (16.8)

MOGA (33.9%)

PR 114 (8.6); PR 122 (7.2);
PR 126 (8.5)

PUSA 44 (49.7);
DG PUSA (12.2)

SAHIBZADA AJIT SINGH NAGAR (90.6%)

PR 121 (16.9); PR 126 (54.3);
PR 127 (9.1); PR 128 (4.1);
PR 129 (7.2)

MUKTSAR (-22.2%)

PR 114 (13.6); PR 122 (7.4)
PUSA 44 (19.6); DG PUSA (9);
CR 212 (5.9)

PATHANKOT (100%)

PR 121 (46.3); PR 122 (4.7)

PATIALA (52.5%)

PR 121 (14.4); PR 126 (27.4);
PR 127 (11.1)

PUSA 44 (9)

RUPNAGAR (1,400%)

PR 121 (18.1); PR 122 (5.6);
PR 126 (25.3); PR 127 (13.1);
PR 129 (17.8)

SANGRUR (57.8%)

PR 121 (5.1); PR 122 (5.2);
PR 126 (13); PR 129 (5.2)

PUSA 44 (42.8);
PEELI PUSA (7.1)

NAWANSHAHR (45.2%)

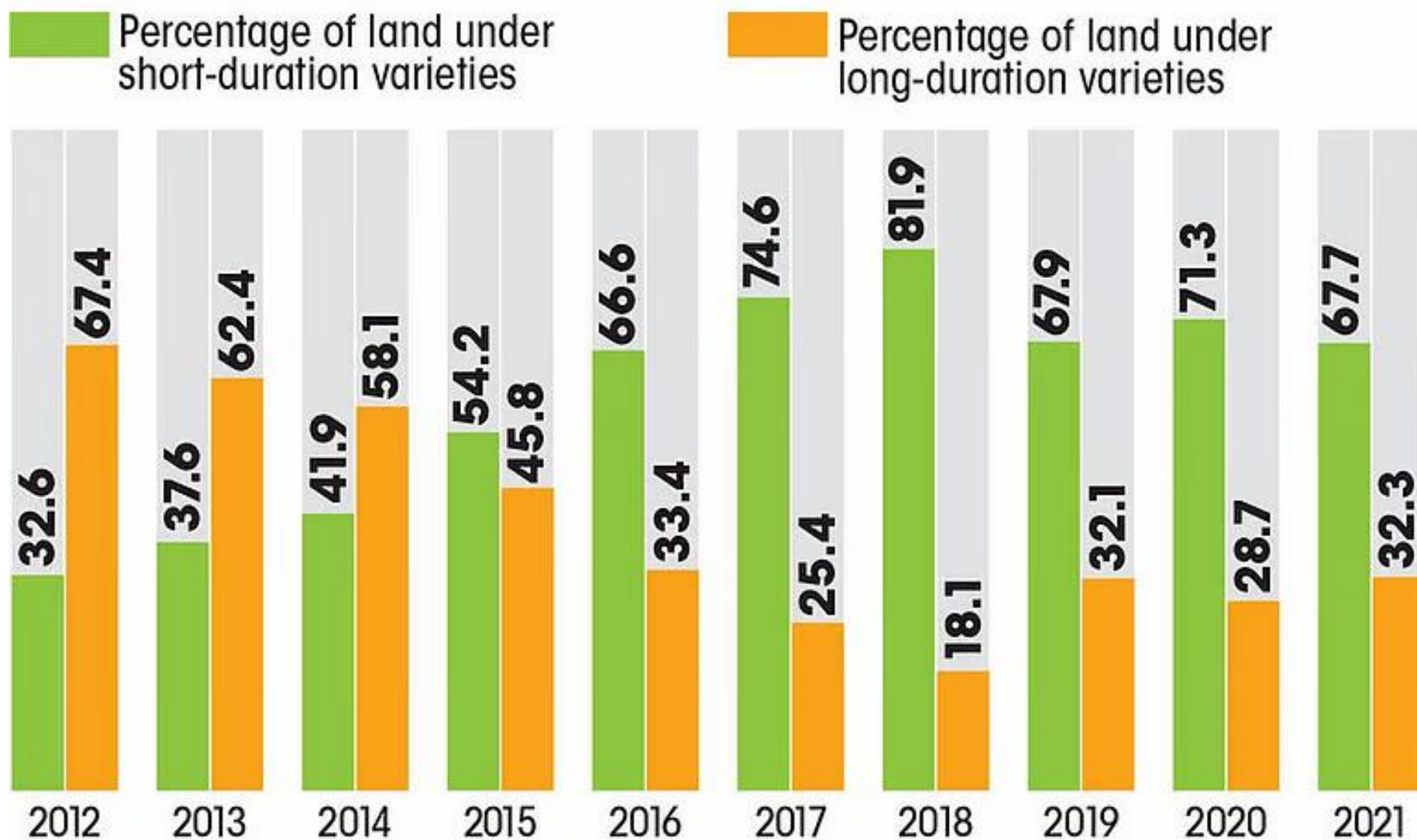
PR 121 (72.3); PR 126 (15);
PR 127 (6.5)

TARN TARAN (88.1%)

PR 114 (9.4); PR 121 (7.5);
PR 122 (8.1); PR 129 (2.7)

Preference reversal

Acreage of short-duration varieties has seen a major rise in Punjab in the past decade, while land under long-duration varieties has reduced



Source : Punjab Agricultural University

False hopes

The government has released six short- (up to 140 days) and medium-duration (140 to 160 days) varieties since 2013 to provide farmers time between kharif and rabi to clear fields without straw burning



Major short-, medium- and long-duration paddy varieties

PR 121 (Short duration)

2013	May 20-25	110
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PR 122 (Medium duration)

2013	June 20-25	117
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PR 124 (Short duration)

2015	May 25-June 15	--
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PR 126 (Short duration)

2017	May 25-June 5	93
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PR 128 (Medium duration)

2020	May 20-25	111
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PR 129 (Short duration)

2020	May 20-30	108
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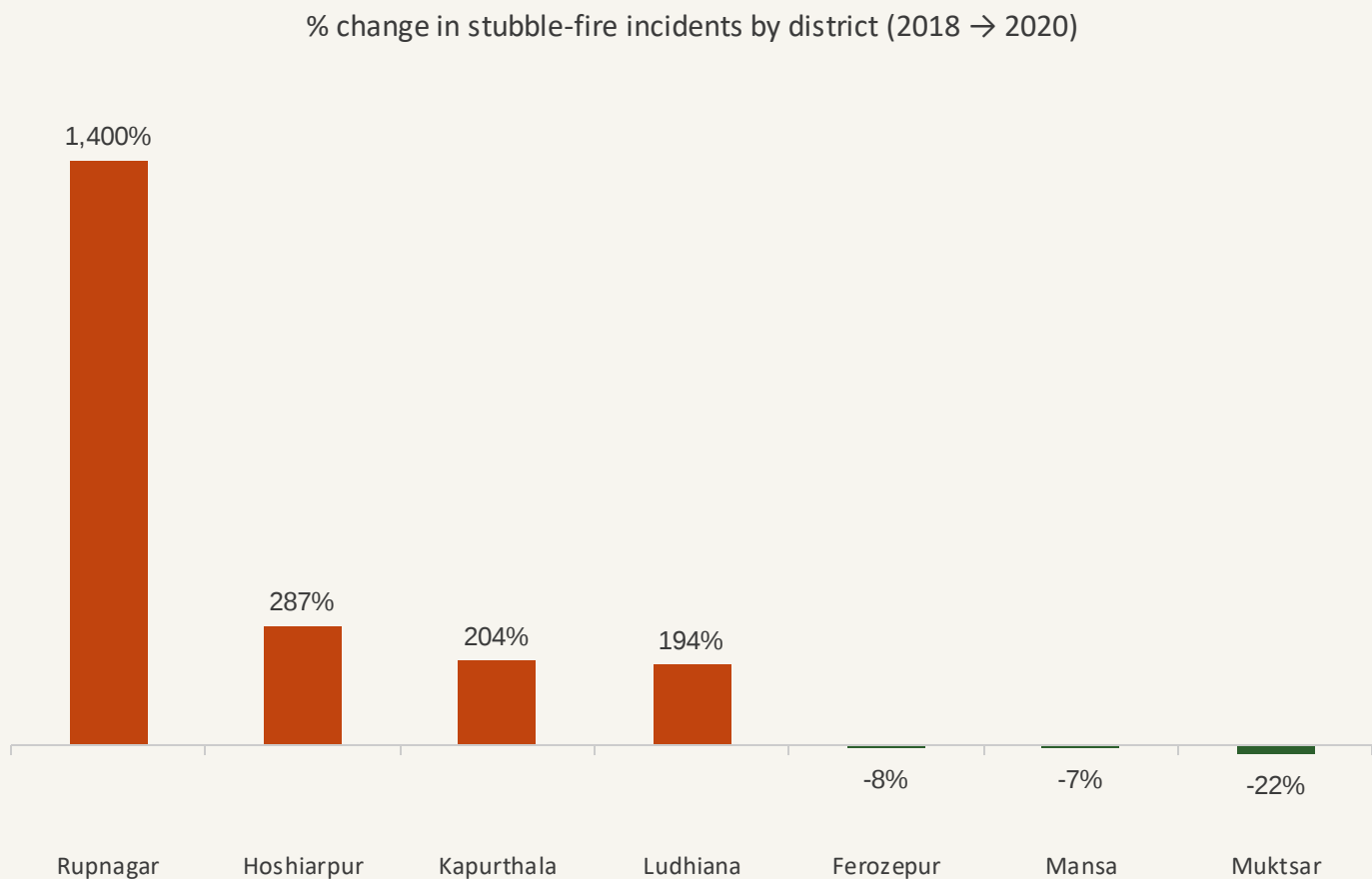
Pusa 44 (Long duration)

1994	May 20-30	130
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Source : Punjab Agricultural University

Burning rose exactly where short-duration varieties boomed



RUPNAGAR

+1,400%

rise in fires — despite ~80% of its paddy area already under short-duration varieties by 2020.

ONLY 3 DISTRICTS IMPROVED

Muktsar, Ferozepur and Mansa — mostly districts where long-duration varieties still dominate, not short-duration ones.

Adoption of the 'right' seed did not reliably predict less burning.

Farmers were weighing economics — not ignoring science

1

Lower yield

PR-126 gave ~7 t/ha versus ~8.8 t/ha from long-duration Pusa-44 — farmers felt the income gap.

2

A rush for a 3rd crop

The extra window was often used to sow potato, peas or mustard for cash — so straw still had to go, fast.

3

Rice mills push back

Punjab's 3,600 rice mills initially discouraged PR-126; MSP gaps (Rs 1,960/qtl for PR-126 vs Rs 4,000-5,000 for PB-1121) shaped what farmers grew.

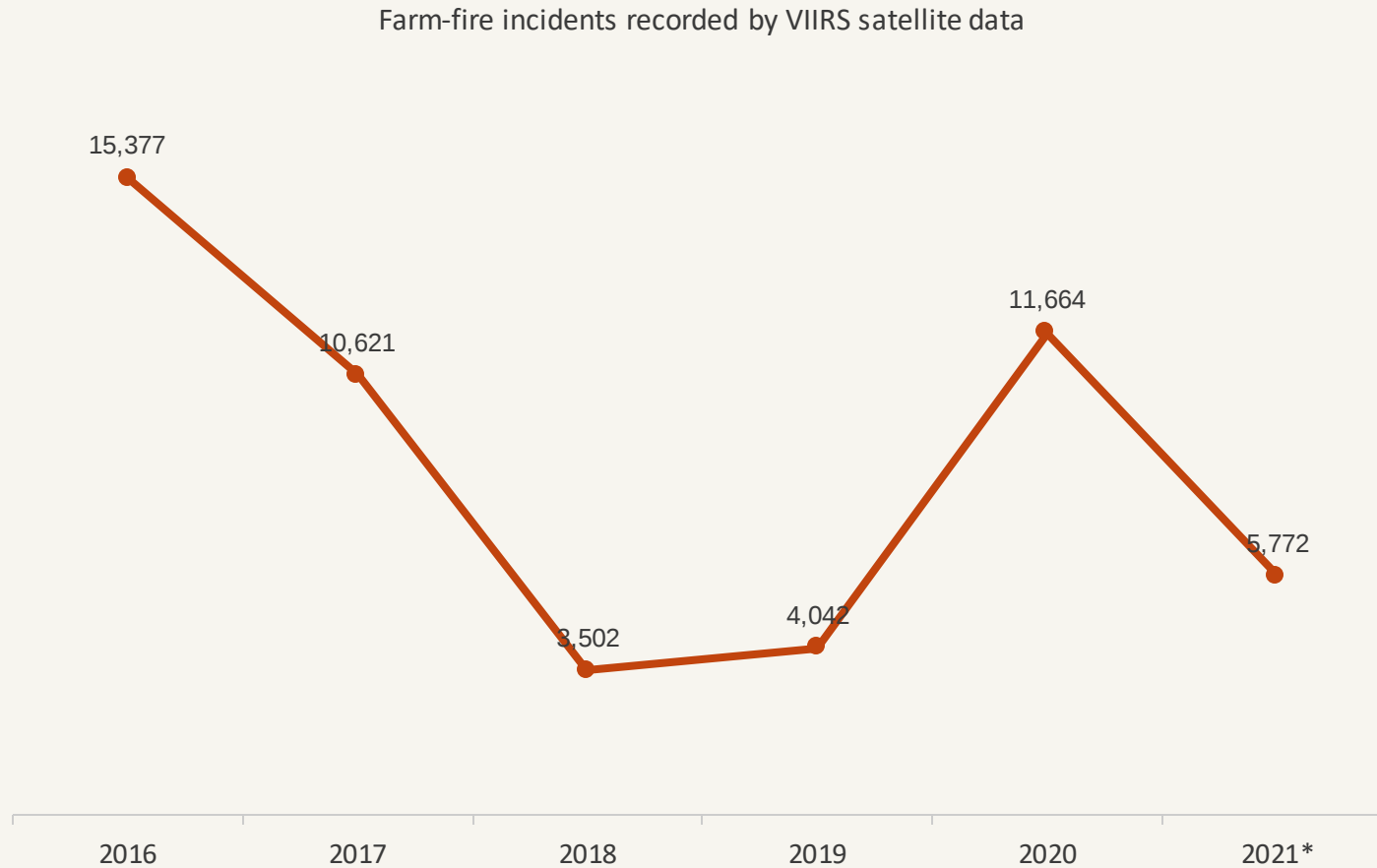
4

Cost of the alternative

Diesel over Rs 100/litre and costly residue machinery made burning the cheapest, fastest option.

"What do we do if not set the stubble on fire? Paddy cannot be bundled or sold anywhere. About 24-25 quintals of stubble is released in one acre; farmers cannot keep it in the house." — **Balendra Singh, farmer, Tarn Taran district**

A decade of interventions, a stubborn trend line



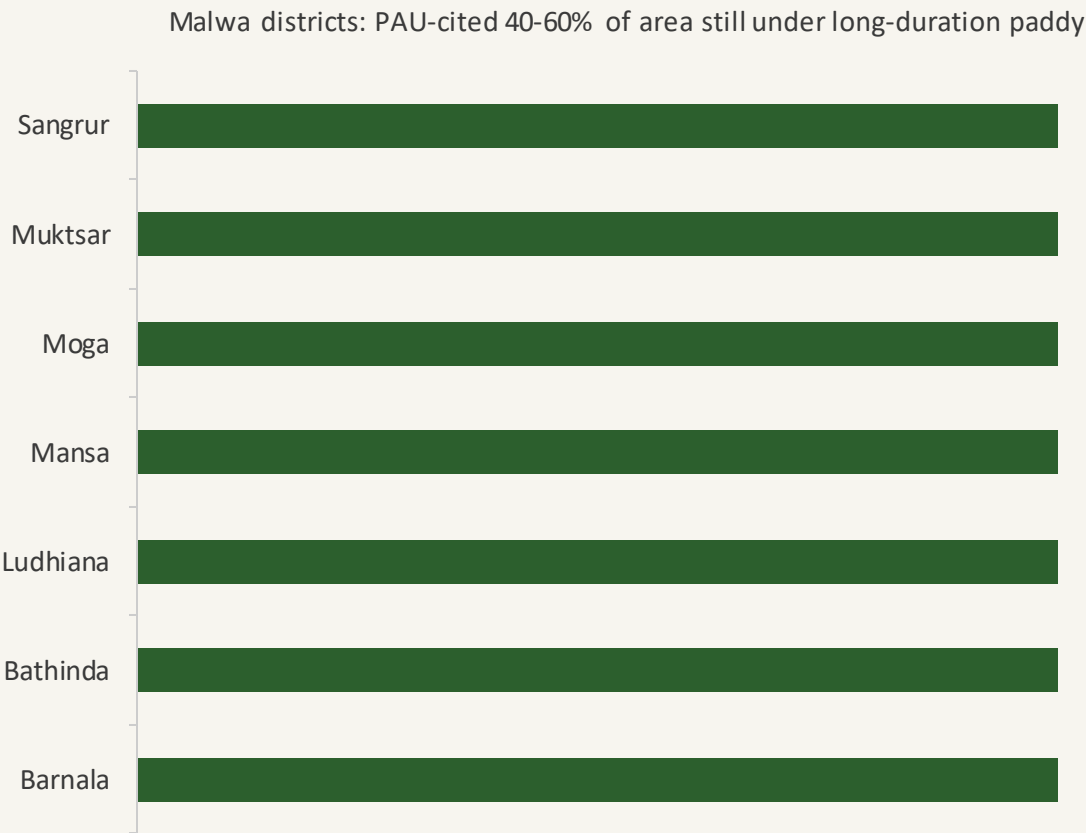
*2021 figure counted only till 22 October — season was still underway.

THE LESSON FOR PUNJAB

*A better seed changes what's biologically possible.
It doesn't change what's economically rational.*

- Science alone cannot fix a system problem.
- Farmers grow what is profitable, procured, and accepted by mills.
- Real change needs seed + market + procurement policy + affordable machinery, together.

In Malwa, farmers still won't let go of Pusa-44



Original chart built from PAU / DTE-reported district data — not a reproduction of any published map.

WHY PUSA-44 SURVIVES THE BAN

- Yield gap: Pusa-44 gives up to 40 quintals/acre vs PR-126's 35 — a 5-quintal loss farmers can't yet absorb.
- Nov 2023: Supreme Court rebuked Punjab, Haryana, UP & Rajasthan for not curbing the variety driving stubble burning.
- Oct 2023: CM Bhagwant Mann announced a ban on Pusa-44 sale from the next Kharif season.
- PAU data (2019-24): area under non-recommended varieties (mostly Pusa-44) still ~42% of Punjab's paddy.
- Rice mills still prefer it — its grains don't break during milling, unlike short-duration varieties.



WHEN THE RIVERS PUSHED BACK

2025: Punjab's worst floods since 1988

Breaches on the Ravi, Beas and Sutlej left the 'breadbasket' underwater

2,520

villages submerged

~4,00,000

farmers directly hit

7,00,000 ha

under floodwater

2,02,095 ha

standing crop destroyed

58

lives lost

~10,000

houses damaged

"For days, we saw the waters in the canals swell, but the government did not do anything." — Gurpreet Singh, farmer, Kapurthala district



WHY PUNJAB FLOODED

Heavy rains over the last two weeks of August in Punjab, combined with torrential downpours in upstream Jammu and Kashmir, Ladakh and Himachal Pradesh that swelled the rivers, triggered the state's worst floods since 1988

Pulaha Roy

● Flooded areas (each dot equals 10 sq m)
— Rivers Dams

TWO WEEKS OF FURY

Between August 21 and September 3, Punjab was battered by back-to-back deluges, with rainfall surpluses of 388% in the first week and 454% in the next

Weekly rainfall departures from normal

■ Large Excessive (surplus rainfall of 60% or more)
■ Excessive (20 to 59%) ■ Normal (-19 to 19%)
■ Deficient (-59 to -20%) ■ Large deficient (-99 to -60%)

-80% (Jun 11)	3% (Jun 18)	-25% (Jun 25)	80% (Jul 2)	-19% (Jul 9)
11% (Jul 16)	-34% (Jul 23)	-24% (Jul 30)	5% (Aug 6)	-59% (Aug 13)
20% (Aug 20)	388% (Aug 27)	454% (Sep 3)		

Note: Flood extent derived using the Otsu method. The map is indicative and should be verified with ground observations
Source: India Meteorological Department and ground reports, Sentinel 1 SAR via Google Earth Engine

Jammu and Kashmir

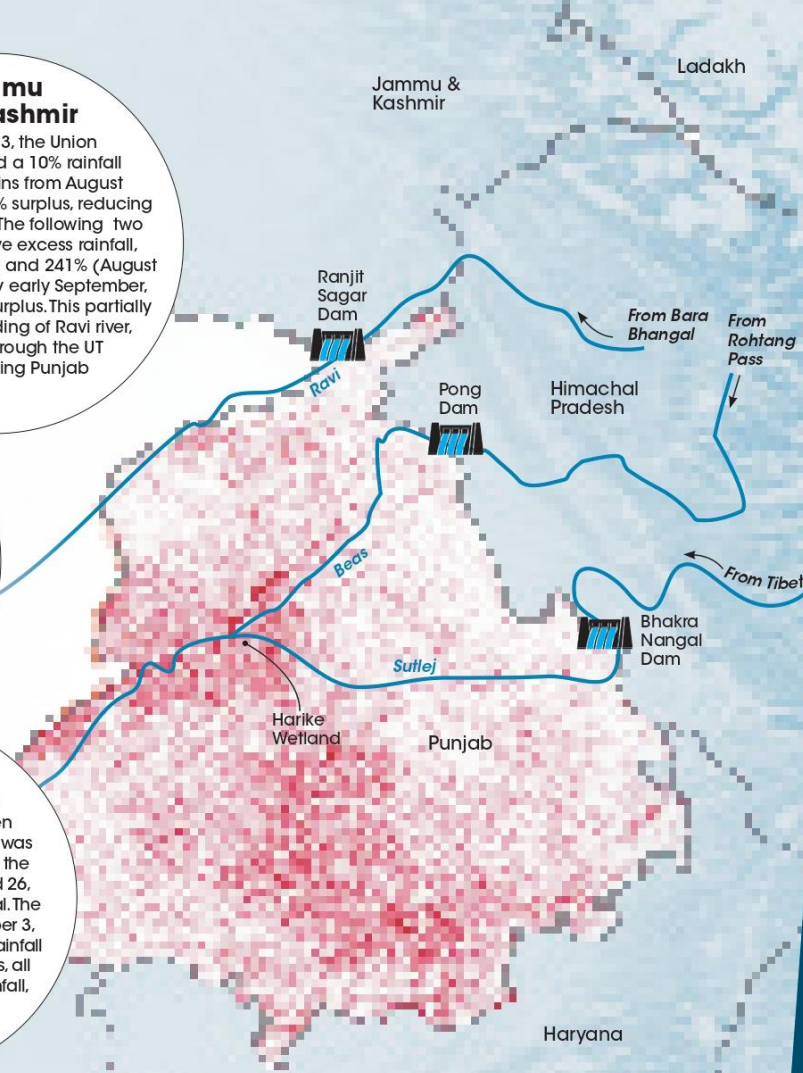
Until August 13, the Union Territory (UT) had a 10% rainfall deficit. Heavy rains from August 14-20 brought a 42% surplus, reducing the shortfall to 5%. The following two weeks saw massive excess rainfall, 260% (August 21-24) and 241% (August 28-September 3). By early September, the UT had a 43% surplus. This partially explains the flooding of Ravi river, which flows through the UT before entering Punjab

Himachal Pradesh

The Himalayan state faced three extreme rain spells this monsoon. From June 26 to July 2, rainfall surged 195%, with Mandi and Shimla districts recording 482% and 433% surpluses, triggering floods, landslides and cloudbursts. Next, flash floods hit Dharali from July 31 to August 6. A third, ongoing spell since August 14 has swelled Punjab's Ravi, Beas and Sutlej rivers

Punjab

Heavy rains in Himachal Pradesh and Jammu and Kashmir had already swollen Punjab's rivers when the state was struck by record downpour. In the week between August 21 and 26, rainfall was 388% above normal. The next week, August 27-September 3, the state received 454% more rainfall than normal. Within two weeks, all districts saw large excess rainfall, unleashing devastating floods



FLOOD TRAIL PUNJAB HAS EXPERIENCED MULTIPLE FLOODS IN THE PAST DUE TO POOR DRAINAGE SYSTEM, HEAVY RAINS AND UPSTREAM SURGES

1955

This was one of the earliest recorded floods in independent Punjab. Heavy monsoon rains caused the Ghaggar and Sutlej rivers to overflow, leading to extensive damage in the Malwa region

1988

Until 2025, this was considered to be Punjab's worst flood. The state had received 634 mm of rain in four days, which along with dam discharges, submerged 9,000 villages, killed 600 people affected 3.4 million during paddy harvest

2008

Water released from dams on the Sutlej and Beas triggered flash floods that destroyed thousands of hectares of crops and severely damaged rural infrastructure

2019

Incessant rain and Bhakra Dam discharge inundated 300 villages and thousands of hectares of crops. Losses were pegged at around ₹1,200 crore, prompting the state government to declare the event a natural calamity

2023

Punjab's worst flood in a decade was triggered by exceptionally heavy rain in upstream Himachal Pradesh, combined with poor drainage in Punjab. It submerged 1,432 villages and destroyed thousands of hectares of cropland

Source: Media reports

RAIN AND RUIN HOW DEVASTATING WERE THE 2025 PUNJAB FLOODS

The spread

By September 5, Punjab had recorded a staggering 54% surplus rainfall for the season. Of its 22 districts for which IMD has released rainfall data, 10 recorded large excess rain, with surpluses above 60%, while another five had excess rainfall overall (20-59% surplus). The situation turned catastrophic in the last two weeks of August, when every single district was deluged with large excess rainfall, pushing the state into its worst flood crisis in decades.

The damage

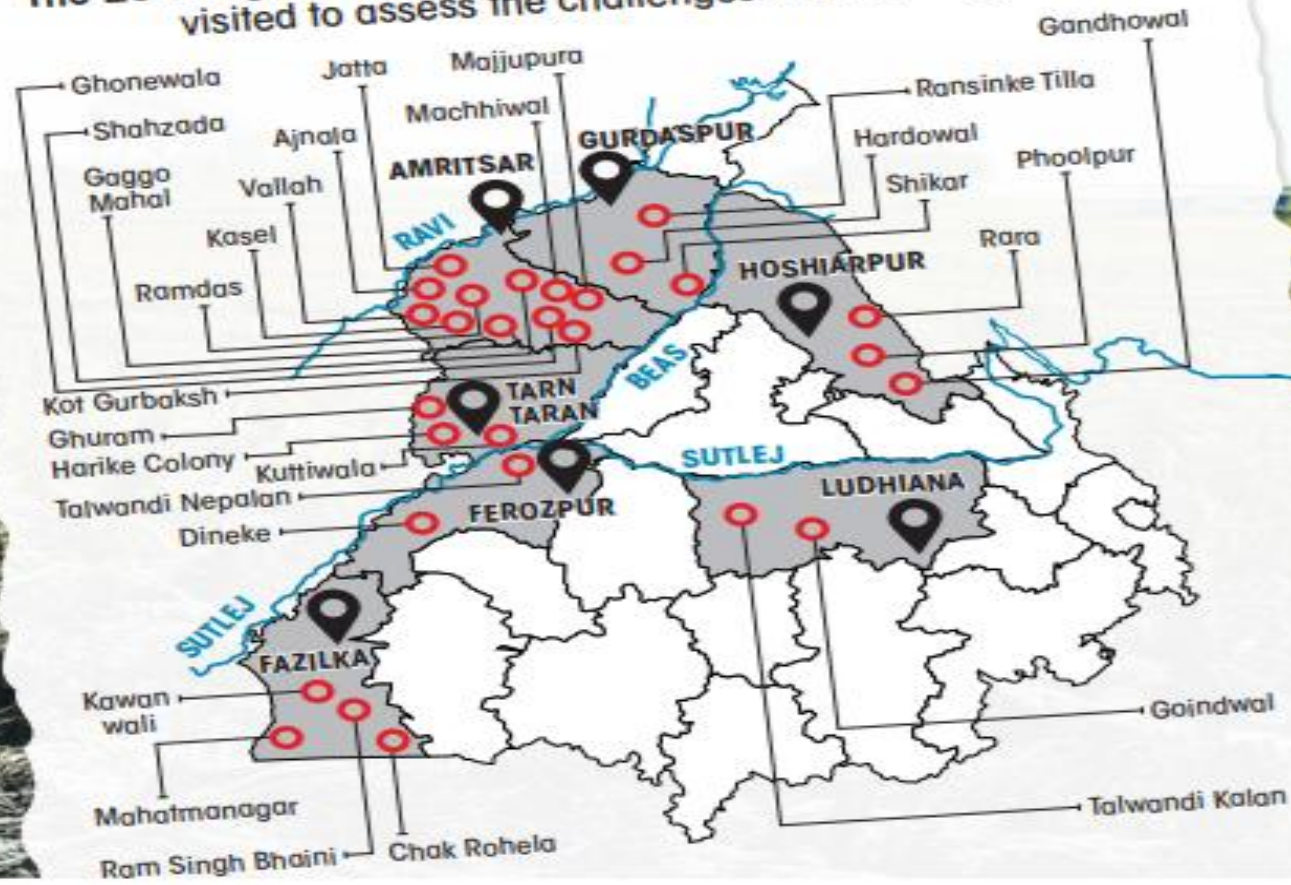
Between June and August 2025, Punjab faced monsoon-related extreme weather on nearly 42 per cent of days, leaving a trail of devastation. The floods since August 27 claimed 48 lives, damaged at least 1.39 million hectares of crops, and affected 261,426 people. Authorities evacuated 16,568 residents, while a total of 1,247 villages have been impacted

Source: India's Disaster Atlas, CSE-DTE data centre, India Meteorological Department and Disaster Management Division, Union Ministry of Home Affairs

Amrik Singh, a farmer, surveys his ruined paddy field in Hardowal village, Dera Baba Nanak tehsil, in Punjab's Gurdaspur district

WIDESPREAD DAMAGE

The 28 villages across seven flood-stricken districts of Punjab visited to assess the challenges of rebuilding



When the land stops paying, families borrow to leave

74%

of Punjab's foreign migration over the last 30 years happened after 2016 alone

13.34%

of rural Punjab households now have at least one member living abroad

Rs 3.13 lakh

average loan taken per family to send a member abroad

56%

of migrant families had to borrow money for the move

Rs 14,342 cr

total borrowed statewide for migration

READING THE PATTERN

- Same crisis, new symptom: farm debt from paddy-wheat economics now finances exit from the very land it came from.
- Even loss-making land is mortgaged or sold to fund a child's migration.
- Villages report an ageing, shrinking workforce left to farm.

Behind the debt, a quieter health crisis

PUNJAB, IN NATIONAL DATA (NCRB)

~45%

of Punjab's suicides (2021) were linked to illness — roughly 2.5x the national average

Nationally in 2024: 30,617 illness-linked suicide deaths vs 10,546 farmer/farm-worker suicides — illness is the more frequent, less discussed toll.

WHAT EXPERTS SAY

"Suicide prevention is not solely a mental health issue — it is a public health, social and developmental issue. If Punjab wants to reduce illness-related suicides, we must treat the person, not just the disease."

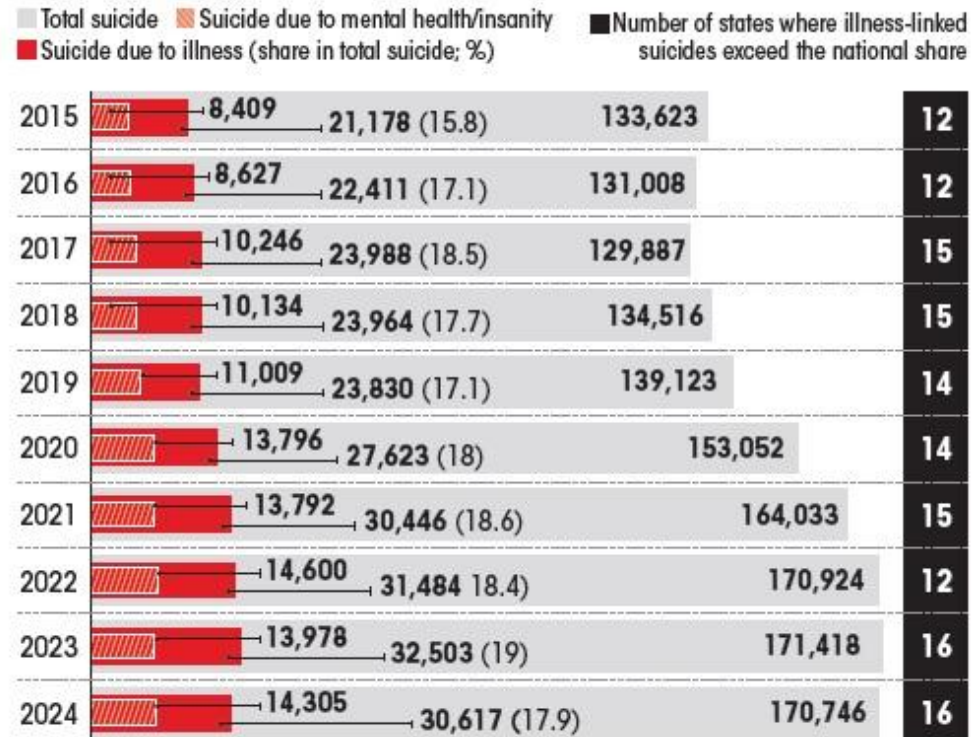
— Zimi Angad Singh, psychologist, Mental Health First India, in conversation with Down To Earth

Debt, migration-related family separation and agrarian stress are recurring threads behind these numbers — not any single cause.

A sensitive subject for the classroom — approach with care. This is population-level data, not a portrait of any individual or family.

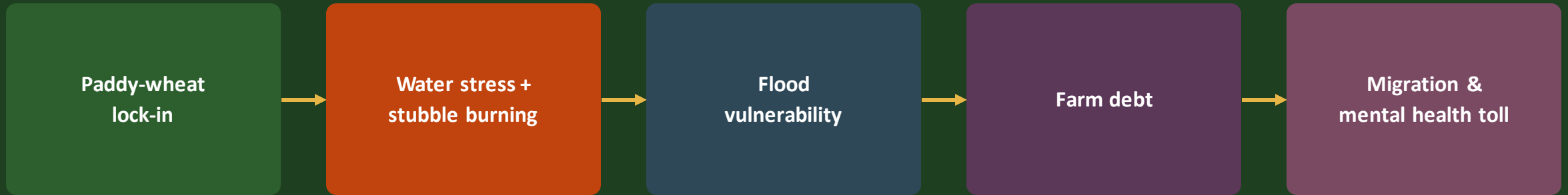
The burden of illness

Illness-related suicides have increased over the past decade, and now make up a fifth of all suicides in India



Source: "Accidental Deaths and Suicides in India 2024" report by the National Crime Records Bureau

One crop, many crises



Each box is its own Down To Earth story. Together, they trace one system: a crop whose economics were fixed for food security in the 1960s-70s now shapes water tables, air quality, disaster exposure, household debt and public health — decades later.

This is why a single fix — a seed, a subsidy, a ban — rarely resolves a problem this deeply interconnected.

FOR DISCUSSION

If the science was right, why didn't the outcome follow?

Q1

What other environmental problems in our own villages/districts follow this same pattern — a good idea that failed for economic reasons?

Q2

How do stubble burning, floods, debt and migration connect in the lives of families you know?

Q3

How can teachers help students see environmental issues as social and economic questions, not just technical ones?

WATCH

Farmers unite in Punjab and Haryana during the 2023 floods

A short Down To Earth video on farmers helping each other through recurring floods — useful to open or close the classroom discussion.



Thank you
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