Stubble Burning in India

For Prelims: Environment Protection Act, 1986 (EPA), Commission for Air Quality Management (CAQM) Act, 2021, Southwest Monsoon, Volatile Organic Compounds, Greenhouse Gas Emissions, MSP, Biofuel, Sub-Mission on Agricultural Mechanization, Biochar.

For Mains: Impacts of stubble burning, reasons behind it, methods for recycling and reuse, and potential solutions for mitigation.

Source: TH

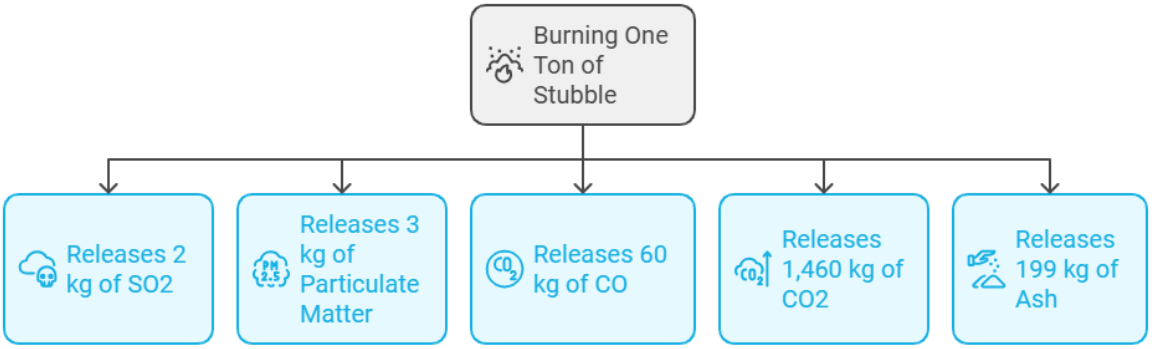
Why in News?

To address the **Delhi pollution crisis**, the Supreme Court directed **Punjab, Haryana, and Uttar Pradesh** to fill **State Pollution Control Board vacancies** within **three months** and urged the **Union Government** to impose **penal measures** against stubble burning.

What is Stubble Burning?

- **About:** It refers to the practice of **setting fire** to the **leftover straw after harvesting crops like paddy and wheat**.
  - It is commonly used **to clear paddy crop residues** from fields **before sowing wheat,** typically between late September and early November.
  - This practice is most prevalent in the states of Punjab, Haryana, and Uttar Pradesh during this period.
- **Reason for Stubble Burning:**
  - **Mono-Cropping Patterns:** The minimum support price (MSP) **system** primarily favors **wheat and rice**, encouraging **mono-cropping patterns**.
    - As a result, farmers often resort to burning crop residues to quickly prepare their fields for the next planting season.
  - **Cost-Effectiveness**: It is **much cheaper compared to other methods** of residue disposal, such as incorporating the stubble into the soil or using machinery like**balers or shredders**, which require significant investment and labor.
  - **Weed Management**: Fire helps in **eliminating weeds** and their seeds present in the crop residues, reducing the **need for additional herbicides**. It is a simple way to control weed growth before sowing the next crop.
  - **Limited Residue Management Options:** There is **inadequate infrastructure or awareness** about alternative residue management practices, such as **composting or using crop residue for bioenergy**. This makes stubble burning a default practice.
  - **Impact of Climate Variability: Erratic monsoons** and **rising temperatures** delay harvesting, pushing farmers to burn stubble to meet **sowing deadlines**.
- **Impacts:**
  - **Air Pollution:** Stubble burning releases **major air pollutants** like **PM10, PM2.5, NOx,** methane (CH4), **carbon monoxide (CO), and** volatile organic compounds

(VOCs).
    - These pollutants create **smog** that spreads in the air and raises the risk of **asthma, COPD, bronchitis, and lung cancer**.
  - **Greenhouse Gas Emissions:** The practice contributes to greenhouse gas emissions, thereby **accelerating global warming.**
  - **Soil Fertility Loss: Burning crop residue destroys nutrients in the soil, reducing fertility. The heat penetration also leads to loss of soil moisture and kills beneficial microbes, further degrading soil health.**



What are the Challenges in Controlling Stubble Burning in India?

- **Technology and Infrastructure Gaps**: **Standard combine harvesters** leave behind **10–15 cm of stubble**, which is difficult to manage without specialized equipment.
  - **Custom Hiring Centres (CHCs)** often **lack sufficient machinery**, and many farmers face **logistical challenges** in accessing these resources.
  - The **high silica content** in paddy straw can damage machinery when used as feedstock, and the **absence of an efficient supply chain** for biomass collection and processing exacerbates the problem.
- **Policy Hurdles:** Unclear definitions of **stubble burning** and **environmental compensation**, along with confusing **Red Entry** compliance markings, create challenges that further burden farmers.
  - Current policies often emphasize penalties over incentives, discouraging farmers from adopting eco-friendly practices.
- **Economic and Funding Limitations:** Limited subsidies for **machinery adoption** and weak frameworks for utilizing the **environmental compensation fund** hinder effective implementation.
- **Other Barriers:** There is a significant gap in **training programs on sustainable alternatives** to stubble burning, leading to a reliance on traditional practices.

India's Initiatives to Tackle Stubble Burning

- **Framework by the Commission for Air Quality Management (CAQM):**
  - **In-Situ Crop Residue Management: Focuses on managing crop residues** on the field using **farm machinery**, **Custom Hiring Centers (CHCs)**, **faster-growing paddy varieties**, **staggered harvesting**, and **bio-decomposers**.
  - **Ex-Situ Crop Residue Utilization:** Encourages alternative uses of paddy straw, such as **biomass power**, **co-firing in thermal plants**, **2G ethanol and compressed biogas production**, and **making packaging materials.**
  - **Ban and Enforcement:** Imposes **prohibition on stubble burning** through **monitoring, enforcement, and environmental compensation** to reduce air pollution from crop residue.
- **Financial Support:** Under the Sub-Mission on Agricultural Mechanization (SMAM), farmers receive **financial assistance** for procuring **agricultural machinery and equipment**, especially small and marginal farmers.
- **Technological Interventions:**

    - **Happy Seeder:** Tractor-mounted device, **sows wheat**, **paddy fields**, **cutting straw**, **avoiding burning**, **saving time**, **improving soil health**.
    - **Pusa Decomposer: Microbial formulation**, **converts stubble**, **compost**, **enhancing soil fertility**.
    - **Pelletization: Crop residues**, **biomass pellets**, **energy**, **reducing burning**, **generating income**.
    - **Biochar Production: Stubble converted**, **biochar**, **improving soil fertility**, **water retention**, **microbial activity**, **carbon sequestration.**
- **Local Initiatives:**
    - **Chhattisgarh: Gauthans**-village plots where collected stubble is converted into **organic fertilizer** using cow dung and natural enzymes, creating **employment for rural youth.**
    - **Punjab: Mobile apps i-Khet and Cooperative Machinery Tracker** facilitate farmers' access to **crop residue management machinery**

What Strategies can India Adopt to Curb Stubble Burning?

- **Legal Reforms:** A **parliamentary standing committee** has proposed setting a **MSP** for **paddy residue** to reduce **stubble burning**, a major contributor to **air pollution in Delhi**.
    - The recommendation came from the **Committee on Subordinate Legislation**, which reviewed the **Commission for Air Quality Management (CAQM) Rules, 2023**.
- **Infrastructure and Logistics:** Implement **real-time crop mapping**, **forecast crop maturity**, build **temporary storage facilities**, and support **local supply chains and aggregators.**
- **Innovative Farming Technologies: Use tools like Microbe Pusa to turn stubble into compost within 25 days and the Happy Seeder to sow wheat without burning residue.**
    - Encourage **short-duration paddy varieties**, standardize **procurement processes**, and enforce **seed certification** to reduce residue.
    - Convert wheat stubble into **cattle fodder** and recycle it for **manure, paper, cardboard, biofuel, and power generation.**
- **Economic Support and Pricing:** Provide **guaranteed prices** for stubble, set **benchmark prices annually**, and ensure returns cover **collection and labor costs**.
- **Post-Harvest Solutions: Introduce programs similar to** MGNREGA **for harvesting and composting stubble, regulate residue management, and reward farmers who adopt eco-friendly practices.**

Conclusion

Stubble burning remains a significant **environmental** and **health challenge** in **North India**, driven by **crop patterns**, **limited alternatives**, and **climate variability**. Combating it requires a **multi-pronged approach**, combining **technological interventions**, **financial incentives**, **regulatory measures**, and **local innovations** to ensure **sustainable residue management**, reduce **air pollution**, and protect **soil fertility.**

Drishti Mains Question:

Q. Analyze the various factors that perpetuate the practice of stubble burning in North-West India despite the availability of technological solutions and government interventions.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Consider the following agricultural practices: (2012)

1. Contour bunding
2. Relay cropping
3. Zero tillage

In the context of global climate change, which of the above helps/help in carbon sequestration/storage in the soil?

(a) 1 and 2 only

(b) 3 only

(c) 1, 2 and 3

(d) None of them

Ans: (b)

Mains

Q. What are the major factors responsible for making the rice-wheat system a success? In spite of this success, how has this system become bane in India? (2020)

Q. Mumbai, Delhi and Kolkata are the three mega cities of the country but the air pollution is much more serious problem in Delhi as compared to the other two. Why is this so? (2015)