

Straight head Disease in Paddy

Prelims: Current events of national and international importance | Agriculture

Why in news?

Research published in Proceedings of the National Academy of Sciences recently has warned the microbial link between arsenic in soil, lower rice yield.

- It is a ***physiological disorder in rice*** that causes empty, sterile florets and distorted husks, giving the panicle an erect, "straight" appearance.
- **Causes** - It is caused by ***arsenic toxicity***, often from arsenic-based herbicides on crops like cotton or naturally occurring high-arsenic soils, soil microbes, etc.

***Arsenic (As)** is a naturally occurring, semi-metallic element, known for its high toxicity, especially in its **inorganic form**.*

- **1st reported** - In 1912 in USA, subsequently reported in Europe, China, India (West Bengal) and Bangladesh, etc. (Now - recognised as a **global threat**).
- **Symptoms** -
 - **Sterile florets and distorted palea** and lemma (husk) which looks like crescent or "parrot breaking".
 - The **panicles remain upright** at maturity because there is no seeds with no weight, (that is why the disease is called "straighthead").
 - During the vegetative stage, plants may appear darker green and unusually vigorous, but the symptoms are **not visible until heading time**.
- **Impact** - The condition can reduce grain yield by ***up to 70%*** in severely affected areas.
- It occurs even when the total arsenic level in the soil is relatively low because the real problem is ***arsenic speciation***, (i.e.) the chemical form arsenic takes in the soil and plant.

- **Control measures** - Through water management (like draining fields), using arsenic-resistant rice varieties, silicon fertilization (to reduce the plant's uptake of arsenic), crop rotation strategies can help mitigate the risk.

India's status

- World's **2nd largest** producer and consumer of rice, with 45 million hectares under cultivation.
- **High-risk states** - West Bengal, Bihar, Assam, and Uttar Pradesh, where groundwater **arsenic exceeds 05 mg/L** (WHO limit - 0.01 mg/L).
- At present, the Food Safety and Standards Authority of India (FSSAI) does not have a specific standard for arsenic in rice; thus, Indian rice is governed by more generic food safety rules.

Quick Fact

Link between arsenic in soil & lower rice yield

- The study was led by a research team in **China**.
- It has revealed that the **balance between** arsenic-methylating and arsenic-demethylating microbes in rice paddies determines rice yield and safety, not just the total amount of arsenic in the soil.
- **Arsenic-methylating bacteria** convert inorganic arsenic to more toxic, organic forms, while **demethylating archaea** help neutralize it.
- **Geographic differences** - Younger paddy soils (under 700 years old), common in places like the US, Europe & China have more methylating bacteria and higher arsenic levels in rice, compared to older paddies (South & Southeast Asia).

References

1. [The Hindu | Microbial link between arsenic in soil](#)
2. [National Library of Medicine | Straighthead Disease](#)