

CONFINED FIELD TRIALS ON GM MAIZE - ENVIRONMENT

NEWS: The Genetic Engineering Appraisal Committee (GEAC) has approved confined field trials of two varieties of genetically modified (GM) maize at the Punjab Agricultural University (PAU) for the 2025 Kharif season.

WHAT'S IN THE NEWS?

Traits Being Tested in GM Maize in India

- **Herbicide Tolerance (HT):**

GM maize is engineered to tolerate **glyphosate**, a **broad-spectrum herbicide** that typically kills weeds and non-resistant crops.

The field trials aim to **evaluate the effectiveness of weed control** when glyphosate is applied and to assess any **impact on plant health and yield**.

- **Insect Resistance (IR):**

GM maize has been modified to resist **lepidopteran pests**, especially **stem borers**, which are known to significantly reduce crop productivity.

The trials focus on determining the **level of pest protection**, associated **reduction in pesticide usage**, and **potential yield improvement**.

What Are Genetically Modified (GM) Crops?

- **Definition and Purpose:**

GM crops are those whose **genetic material (DNA)** has been altered using **biotechnology** to incorporate **specific desirable traits**, such as **pest resistance**, **herbicide tolerance**, **drought resistance**, **enhanced nutrition**, or **higher yield**.

- **Steps in GM Crop Development:**

The process involves the **identification of a desirable trait**, **isolation of the relevant gene**, **insertion into the crop's genome**, and **confirmation of gene expression and trait stability**.

- **Techniques Used:**

Various biotechnological methods are applied, such as:

- **Gene gun** (biolistic particle delivery)
- **Electroporation** (electric pulses to insert DNA)
- **Microinjection**
- **Agrobacterium tumefaciens-mediated gene transfer**

- **Types of Genetic Modifications:**

- **Transgenic:** Insertion of genes from unrelated species.
- **Cis-genic:** Gene insertion from the same or closely related species.
- **Sub-genic:** Editing or silencing genes within the same species (e.g., using CRISPR).
- **Stacked Traits:** Incorporation of **multiple traits** such as both IR and HT.

- **Common Traits in GM Crops:**
 - **Herbicide Tolerance (HT)**
 - **Insect Resistance (IR)**
 - **Stacked Traits** for combining multiple benefits.

Indian Scenario in GM Crops

- **Bt Cotton (Approved in 2002):**
India's only commercially approved GM crop so far is **Bt cotton**, which contains genes from the bacterium **Bacillus thuringiensis (Bt)**.
These genes enable the cotton plant to **produce proteins toxic to pink bollworm**, reducing pest infestation and pesticide usage.
- **Other GM Crops Under Development:**
 - **Bt Brinjal:** Developed for resistance to the **fruit and shoot borer**, but commercial release is stalled.
 - **DMH-11 Mustard:** A hybrid mustard developed using **barnase-barstar gene system** to improve yield potential, awaiting final approvals.

Regulatory Framework Governing GM Crops in India

- **Genetic Engineering Appraisal Committee (GEAC):**
Functions under the **Ministry of Environment, Forest and Climate Change (MoEF&CC)** and is the **apex body for approving large-scale research and commercial release of GM crops**.
- **Key Acts and Rules Applicable:**
 - **Environment (Protection) Act, 1986**
 - **Biological Diversity Act, 2002**
 - **Plant Quarantine Order, 2003**
 - **Foreign Trade Policy – GM Policy**
 - **Food Safety and Standards Act, 2006**
 - **Drugs and Cosmetics Rule (8th Amendment), 1988**

Concerns Related to GM Crops and GM Maize Trials

- **Use of Glyphosate and Health Risks:**
 - GM maize trials involve glyphosate use, even though it is **banned in some states like Punjab** due to environmental and health concerns.

- Studies have linked glyphosate exposure to **serious health issues**, including **non-Hodgkin lymphoma**, and **disruption of soil microbiota** affecting long-term soil fertility.
- **Biodiversity Threats:**
 - GM crops can potentially lead to **monocultures**, reducing **agro-biodiversity**.
 - **Gene flow from GM crops to traditional/native varieties** through cross-pollination may threaten indigenous gene pools.
- **Public Health and Antibiotic Resistance:**
 - Some GM crops use **antibiotic resistance marker genes** for identification.
 - Critics argue that this may contribute to the **rise of antibiotic-resistant pathogens**, posing risks to **public health**.
- **Lack of Transparency and Public Oversight:**
 - Civil society groups like the **Coalition for a GM-Free India** have criticized the **non-transparent process of granting NOCs (No Objection Certificates)** for field trials.
 - There is **insufficient public consultation**, **lack of parliamentary debate**, and **absence of independent scientific peer review**.

Way Ahead – Strengthening Governance and Public Trust

- **Scientific Transparency and Credibility:**
 - Ensure **all biosafety assessments** and **field trial results** are **peer-reviewed and publicly accessible** to build trust in scientific findings and regulatory decisions.
- **Public Engagement and Literacy:**
 - Conduct **open consultations** with key stakeholders, including **farmers, scientists, state governments, and civil society**, to create consensus and awareness.
 - Launch **educational campaigns** to explain **GM technologies, associated risks, and potential benefits** in a balanced, fact-based manner.
- **Protect Agro-Biodiversity:**
 - Establish **buffer zones and containment measures** around field trial sites to **prevent gene escape into native crop varieties**.
 - Promote **in-situ conservation of indigenous crops** alongside GM trials.
- **Strengthen Oversight Mechanisms:**
 - Make **biosafety and ethics committees more autonomous**, with **independent funding, accountability structures, and diverse representation**.

- Involve **State Agricultural Universities (SAUs)** only in **neutral research roles**, avoiding promotional responsibilities that could create conflict of interest.

Source: <https://www.thehindu.com/news/national/punjab/confined-field-trials-on-gm-maize-to-begin-soon-at-punjab-agricultural-university/article69814457.ece#:~:text=The%2>