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DAILY EDITORIAL ANALYSIS

TOPIC

INDIAN AGRICULTURE & GENETIC INNOVATION

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Context

- As the **trade deadline approaches**, the USA is ramping up pressure on India to open its agriculture market to **genetically modified (GM) crops.**
  - However, India has drawn **firm red lines,** citing **farmers' livelihoods and food safety** as non-negotiable.

India's Red Lines in Trade Talks With USA

- **Dairy Sector:** India is unwilling to open its dairy market to U.S. imports, citing the need to protect millions of small-scale dairy farmers.
- **Genetically Modified (GM) Crops:** India restricts the import of GM maize and soyabean, which dominate US agriculture. The US push for access to these markets has met resistance.
- **Ethanol Imports:** Proposals to allow GM maize imports for ethanol production have sparked concern among domestic sugar mills and maize producers.
- **Tariff Protections:** India maintains high tariffs on sensitive farm products and is resisting US pressure to reduce them, especially on corn, soyabean, and dairy items.

India's Agriculture & Genetic Innovation

- Genetic innovation in agriculture refers to the use of tools like CRISPR gene editing, genomic selection, and transgenic technologies to improve crop traits. These include:
  - Enhancing crop yields and nutritional content;
  - Increasing resistance to pests, diseases, drought and heat;
  - Reducing dependency on chemical pesticides and fertilizers;
  - Shortening crop cycles and making agriculture more climate-resilient;

Global Expansion of GM Crops

- GM crops have seen massive adoption, since their global debut in 1996.
- By **2023**, over **200 million hectares** of GM soy, maize, canola, and others were cultivated across **76 countries**.
- Many of India's trading partners — including the US, Brazil, and China — have fully embraced GM agriculture.

Bt Cotton: India's Only GM Crop

- **Bt cotton** was approved in **2002 by India**.
- Its production had grown by **193%**, and productivity rose by **87%**, by 2013–14.
- India became the **second-largest producer and exporter** of cotton globally, with net exports touching **$4.1 billion** in 2011–12.
- Bt cotton seeds are **now used across 90%+** of India's cotton area.
  - Cottonseed oil, a by-product, enters the human food chain, while the cotton cake feeds cattle.

Related Efforts Made By India

- **From the Lab to the Field:** CRISPR-edited rice lines with improved nitrogen use efficiency and yield, developed by ICAR scientists in Delhi.
  - Genome-edited **chickpea variety 'Saatvik (NC9)'**, which performs better under drought stress.
  - RNA-based antivirals to protect crops like banana and cucumber from devastating viruses, offering a pesticide-free solution.
  - **Miniature genome editors like TnpB**, developed by ICAR, are small enough to work efficiently in plant cells—especially useful for crops like rice.
- **From Gene Banks to Global Partnerships: India's first National Gene Bank**, established by ICAR-NBPGR, safeguards genetic diversity for future breeding.

- A regional center of the **International Potato Center (CIP)** is being **set up in Agra** to develop climate-resilient, high-yield potato varieties.
- The **Amaranth Genomic Resource Database** helps identify varieties that combat obesity and malnutrition.

Concerns & Challenges

- **Stagnation and Policy Failure**: India's cotton yields fell from **566 kg/ha** in 2013–14 to **436 kg/ha** in 2023–24—far below the global average (**770 kg/ha**) and significantly lower than **China (1,945 kg/ha)** and **Brazil (1,839 kg/ha)**.
  - Annual cotton production has declined by about **2%**, driven by pest outbreaks and policy barriers.
- **Illegal HT-Bt Cotton: Herbicide-Tolerant (HT) Bt cotton**, which allows **glyphosate spraying**, has not been cleared for official use.
  - However, these seeds have **illegally spread across states** like Gujarat, Maharashtra, and Telangana.
  - Estimates suggest **15–25%** of cotton acreage now uses **unauthorised HT-Bt seeds**.
- **Regulatory Bottlenecks:** Government interventions since 2015 have **disincentivized R&D**:
  - The **Seed Price Control Order (SPCO)** capped royalties and trait fees, reducing them to **Rs 39 per seed packet by 2018**.
    - By 2020, stricter caps and forced technology transfers drove away **global biotech investors**.
    - It turns India into a **net cotton importer** worth **$0.4 billion in 2024–25**.
  - India's regulatory paralysis also affects other GM innovations:
    - **Bt Brinjal**, cleared by the **GEAC**, has faced a moratorium since 2009.
    - **GM Mustard (DMH-11)** received environmental clearance in 2022, but **commercialization is stalled** pending more studies and possible court rulings.
    - **GM soy and corn**, widely used elsewhere, remain off the table despite earlier imports for poultry feed
- **Policy Paralysis:** India's regulatory framework has discouraged biotech innovation:
  - **Seed Price Control Order (2015)** drastically cut royalties on GM traits;
  - **2016 regulations** mandated forced technology transfers and royalty caps;
  - By **2020**, even tighter restrictions were imposed.

Other Concerns

- **Loss of Crop Diversity:** As farmers adopt high-performing genetically modified (GM) varieties, traditional and locally adapted crops may be abandoned, reducing biodiversity.
- **Seed Dependency:** Some GM seeds are patented, meaning farmers may need to purchase new seeds each season, increasing reliance on biotech companies.
- **Access Inequality:** Smallholder and marginal farmers may face barriers to accessing advanced genetic technologies due to cost, awareness, or infrastructure gaps.
- **Regulatory and Ethical Issues:** Concerns around biosafety, labeling, and long-term ecological effects can create uncertainty and resistance among farming communities.

India's Balancing Act

- The **Genetic Engineering Appraisal Committee (GEAC)** plays a pivotal role in **approving and regulating** genetically engineered organisms.
  - It has cleared some crops for field trials — like GM mustard — however, wider commercial adoption remains sluggish.
- The government's regulatory framework, including the **Review Committee on Genetic Manipulation (RCGM)**, plays a key role in ensuring biosafety and ethical deployment.
- **Public and Private Collaboration:** Public sector research institutions like the Indian Council of Agricultural Research (ICAR);
  - Private sector biotech firms bringing in cutting-edge tech;
  - Farmers, who must be educated and empowered to adopt new practices;

Way Forward: Need for Science-Led Agricultural Reform

- India's Prime Minister's 'Jai Anusandhan' **(Hail Innovation)** and a **Rs 1 lakh crore RDI fund** are welcome steps — but **innovation must move from lab to land.**
- As Former PM Atal Bihari Vajpayee envisioned, 'What IT is for India, BT can be for Bharat'. The potential for biotechnology to transform **rural prosperity** is immense.
- Key steps include:
  - **Approval and regulation** of HT-Bt cotton, Bt brinjal, and GM mustard;
  - **Reform of seed pricing and licensing policies** to incentivise innovation;
  - **Public engagement** to build trust in GM safety and benefits.

Source: IE

Mains Practice Question

[Q] To what extent can the integration of genetic technology transform the future of Indian agriculture, and what socio-economic concerns might arise from its widespread adoption?

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