



## Genetically Engineered Insects

**For Prelims:** Genetically Engineered Insects, [GDP \(Gross Domestic Product\)](#), [United Nations Food and Agriculture Organisation \(FAO\)](#), Biotechnology Industry Research Assistance Council (BIRAC).

**For Mains:** Genetically Engineered Insects, Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology.

[Source: TH](#)

### Why in News?

India aims to increase the Bioeconomy's contribution to [GDP \(Gross Domestic Product\)](#) from **2.6% to 5% by 2030**, as outlined in the '[Bioeconomy Report 2022](#)' by the Department of Biotechnology (DBT).

- **Biotechnology funding in India remains stagnant, with only a 0.0001% allocation of the GDP. Despite a temporary increase during [Covid-19](#), funding levels haven't returned to pre-pandemic standards.**
- The 'Guidelines for Genetically Engineered (GE) Insects', issued by the DBT in April 2023, provide procedural roadmaps for those interested in creating GE insects but have issues.

### What is Bioeconomy?

- According to the [United Nations Food and Agriculture Organisation \(FAO\)](#), the bioeconomy is "**the production, use and conservation of biological resources**, including related knowledge, science, technology, and innovation to provide information, products, processes and services to all economic sectors with the aim of moving towards a sustainable economy".
- The term bioeconomy became popular in the first decade of the 21st century following its adoption by the [European Union \(EU\)](#) and the [Organisation for Economic Co-operation and Development \(OECD\)](#) as a framework for promoting the use of **biotechnology to develop new products and markets**. Since then, both the EU and the OECD have implemented specific bioeconomy policies.

### What are the Key Highlights of the Bioeconomy Report 2022?

- India's bioeconomy is on a robust growth trajectory, projected to reach USD 150 billion by 2025 and surpass USD 300 billion by 2030.
- The sector experienced a remarkable 14.1% increase, reaching USD 80 billion in 2021 compared to USD 70.2 billion in 2020.
  - Daily, the bioeconomy generated USD 219 million, reflecting its significant economic impact.
- In 2021, the sector witnessed the **establishment of three biotech startups daily**, totaling

1,128 for the year.

- With over USD 1 billion invested in research and development, the industry is demonstrating a commitment to innovation and advancement.
- Amidst the global pandemic, India administered **4 million Covid-19 vaccine doses** and conducted 3 million tests daily, showcasing its resilience and capacity.
- Over the past decade, the number of **biotech startups has soared from 50 to over 5,300**, with expectations of doubling by 2025.
- The **Biotechnology Industry Research Assistance Council (BIRAC)** has played a pivotal role by establishing 74 bio-incubation centers across 21 states/UTs, fostering a supportive environment for bio-entrepreneurs.
- Notably, India boasts the second-highest number of USFDA (United States Food and Drug Administration)-approved manufacturing plants outside the US, underscoring its global standing in the biotech industry.

## What are Genetically Engineered (GE) Insects?

### ▪ About:

- GE insects are organisms **whose genetic material has been altered through genetic engineering** techniques to introduce specific desired traits or characteristics.
- This involves **manipulating the insect's DNA** in a way that is not naturally occurring, often with the aim of conferring certain benefits or addressing specific issues.

### ▪ Application:

- The development and release of GE insects offers applications in various fields such as,
  - **Vector management in human and livestock health**
  - Management of major crop insect pests
  - Maintenance and improvement of human health and the environment through a reduction in the use of chemicals
  - Production of proteins for healthcare purposes
  - Genetic improvement of beneficial insects like predators, parasitoids, pollinators (e.g. honey bee) or productive insects (e.g. silkworm, lac insect).

### ▪ Issues with Genetically Engineered (GE) Insects Guidelines:

- The guidelines **lack specificity on the purposes for which GE insects** may be approved in India. While they emphasize **applications in health, agriculture, and environment**, there is a **misalignment with the broader commitment** to contributing to the bioeconomy.
  - **Uncertainty for Researchers:** The guidelines are limited to research and don't address confined trials or deployment. Lack of clarity on government approval for deployment raises concerns about community exposure without individual choice.
  - **Uncertainty of Ambit:** Ambiguity surrounds the definition of 'beneficial' in the context of GE insects, hindering funders and scientists from investing. Similar ambiguities exist in other gene-editing guidelines, affecting progress.

## What are the Challenges Related to Genetically Engineered (GE) Insects?

### ▪ Ecological Impact:

- One major **concern is the potential ecological impact** of releasing genetically modified insects into the environment. There is a risk that these insects could disrupt ecosystems by affecting non-target species or by altering the balance of existing populations.

### ▪ Unintended Consequences:

- Genetic engineering is a complex process, and **unintended consequences can arise**. Changes in the targeted genes might have unexpected effects on the insect's behavior, lifespan, or interactions with other organisms.
- There is the risk of the modified genes **spreading beyond the intended population**. If the modified insects can breed with wild populations, the engineered genes may enter the wild gene pool, leading to unintended consequences.

### ▪ Ethical Concerns:

- Some people are concerned about the morality of altering the genetics of living organisms, particularly when it involves their release into the environment.

### ▪ Regulatory Challenges:

- Developing regulatory frameworks for genetically engineered **insects can be challenging**. Determining the appropriate level of testing, monitoring, and oversight is crucial to ensure both safety and effectiveness.
- **Long-Term Stability:**
  - Ensuring the **stability of the engineered traits over generations** is crucial. Genetic modifications must remain effective and not degrade or become subject to natural selection pressures that could compromise their intended purpose.
- **Costs and Scalability:**
  - Developing and implementing genetically engineered **insect technologies can be expensive**. Ensuring cost-effectiveness and scalability for large-scale applications, such as disease vector control, is an ongoing challenge.

## Way Forward

- Comprehensive and clear policies are crucial for achieving the ambitious goals set for the bioeconomy, and addressing these issues is vital for the sector's growth and contribution to the national economy.
- Addressing the challenges related to GM Insects requires a multidisciplinary approach involving scientists, policymakers, ethicists, and the public to ensure that the benefits of genetically engineered insects are realized while minimizing potential risks.
- Ongoing research and open dialogue are essential to navigating these complexities responsibly.

## UPSC Civil Services Examination, Previous Year Questions (PYQs)

**Q. Other than resistance to pests, what are the prospects for which genetically engineered plants have been created? (2012)**

1. To enable them to withstand drought
2. To increase the nutritive value of the produce
3. To enable them to grow and do photosynthesis in spaceships and space stations
4. To increase their shelf life

**Select the correct answer using the codes given below:**

- (a) 1 and 2 only
- (b) 3 and 4 only
- (c) 1, 2 and 4 only
- (d) 1, 2, 3 and 4

**Ans: (c)**