

## RNA-based antiviral for Plant Virus

**Prelims (GS I) - General Science| Current events of national and international importance.**

**Mains (GS III) - Science and Technology- developments and their applications and effects in everyday life.**

### Why in news?

Researchers recently reported developing an RNA-based antiviral agent that confers strong protection against cucumber mosaic virus (CMV).

- **Plant virus** - It is a **microscopic, infectious agent** that causes diseases in plants.
- It destroys a significant portion of annual crops worldwide.
- Unlike bacteria or fungi, viruses **cannot be controlled** with pesticides or fungicides.
- **Cucumber Mosaic Virus (CMV)**
- CMV is a plant virus that infects more than 1,200 plant species, including critical food crops like cucumbers, squash, and cereals, and medicinal plants.
- **Spread through** - sap-sucking insects called aphids.
- **Effects** - Infected plants develop mosaic discoloration, stunted growth, and commercially unviable fruits.
- **Severity** - Nearly 90 aphid species are capable of transmitting CMV, making outbreaks difficult to contain.

*In India, CMV causes 25-30% yield losses in banana plantations.*

### Current RNA-based Crop Protection Techniques

- **RNA Silencing** - It is a **natural defense mechanism** in plants.
- When a virus infects a plant, it introduces double-stranded RNA (dsRNA).
- The plant responds by activating Dicer-like enzymes (DCLs), which slice the dsRNA into small fragments called small interfering RNAs (siRNAs).
- These siRNAs guide the plant's defense system to recognize and destroy viral RNA.
  - **Limitations** - Not all siRNAs are effective, and some plant viruses can mutate rapidly.
- **Host-induced gene silencing (HIGS)** - It works by genetically modifying plants to produce virus-fighting dsRNA in their cells.
  - **Limitations** - High production costs.
- **Spray-induced gene silencing (SIGS)** - More flexible alternative to HIGS where plants are treated with RNA sprays instead of being genetically modified.
  - **Limitations** - Traditional dsRNA Spray formulations produce a random mix of siRNAs, and many are ineffective.

### Key Findings of the Research

- Researchers first screened and identified the most potent siRNAs against CMV.
- These specially selected siRNA bind to the virus's genetic material to trigger a stronger antiviral response.
- Then they designed effective dsRNA (e-siRNAs) enriched with highly functional siRNA.
- These e-siRNAs were assembled into dsRNA constructs for more targeted protection.
- CMV infected plants treated with the enhanced siRNA had almost 80% lower viral load.
- The new dsRNA formulation outperformed traditional dsRNA and it is effective against multiple CMV strains.

### Advantages of the New Approach

- More precise targeting of viral particles of the most vulnerable genetic regions.
- Stronger defense by targeting multiple regions of viral genome simultaneously.
- The effective dsRNA can be redesigned in about a month to target new viral strains.

### Reference

[The Hindu| RNA-based antiviral](#)

