

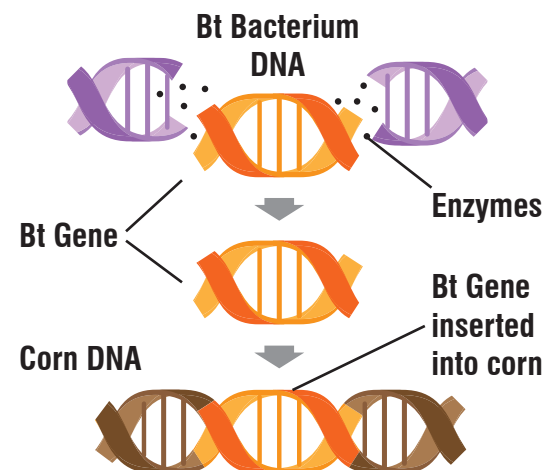
Detection Tools for GMOs



WHAT IS A GMO?

A genetically modified organism (GMO) or living modified organism (LMO), hereinafter referred to as GMO, is any organism whose genetic material has been modified using laboratory-based transfer of genetic material from another organism.

- Major global GM crops: Soybean, maize (corn), canola and cotton
- Major global GM traits: Insect resistance and herbicide tolerance
- In India, bollworm resistant cotton is the only GM crop approved for cultivation in farmers' fields, while several other crops are under experimentation.



WHY DETECT GMOs?

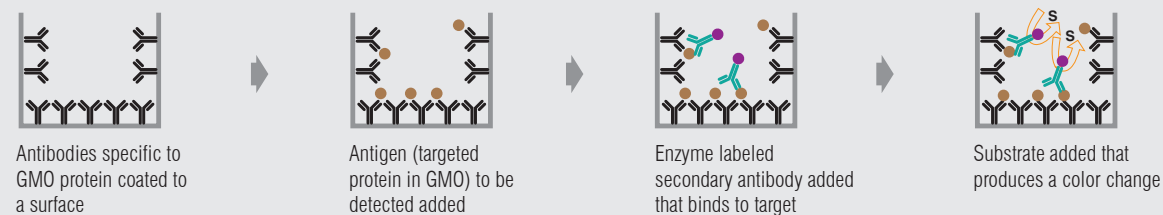
- Assure compliance with legislation:
Research, cultivation, import and export of GMOs is regulated under:
 - The Environment Protection Act (1986)
 - The Destructive Insects and Pests Act (1914)
 - The Foreign Trade (Regulation and Development) Act (1992)
- Ensure that a product meets market requirements
- Solve GM related ownership and other legal issues
- Assure purity and segregation of seeds and production thereof
- Trace genetic modification in breeding experiments

HOW ARE GMOs DETECTED?

Most often GM plants and their seeds do not bear visible traits to distinguish them from their non-GM counterparts. Biochemical tests are used to detect the modified gene (transgene) introduced into a GMO or its protein product. The tests differ with the type of material and the level of information required (mere presence of group of introduced genes or a particular gene and its frequency in the sample).

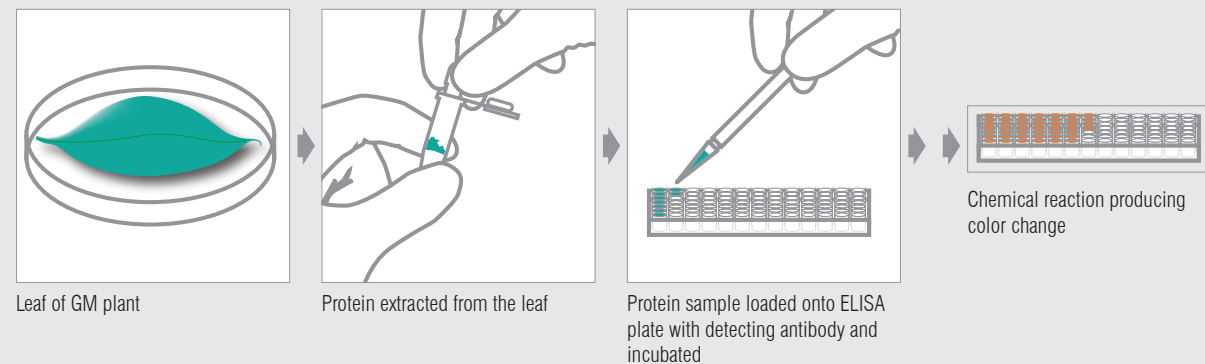
PROTEIN BASED METHOD

Use of antibodies that react with specific proteins produced by the GMO and produce a detectable signal.



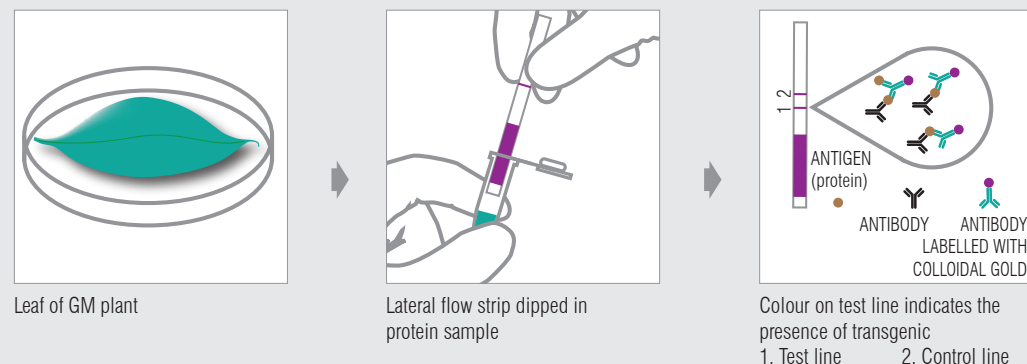
Enzyme Linked Immunosorbent Assay (ELISA)

A quick method of detection used widely for qualitative analysis of presence of transgene.



Lateral flow strip method

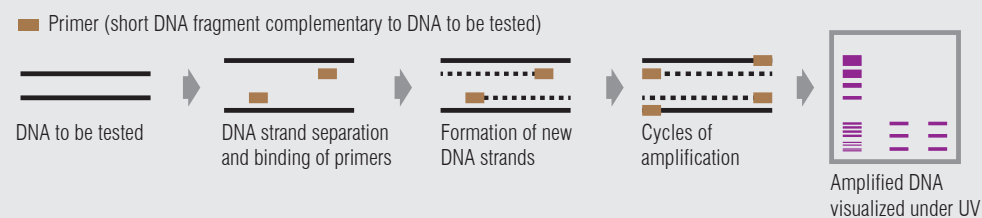
This is a field based method performed using a dip-stick (lateral flowstrip) and gives result in 2-5 minutes. Two specific antibodies are immobilized onto the strip in specific zones.



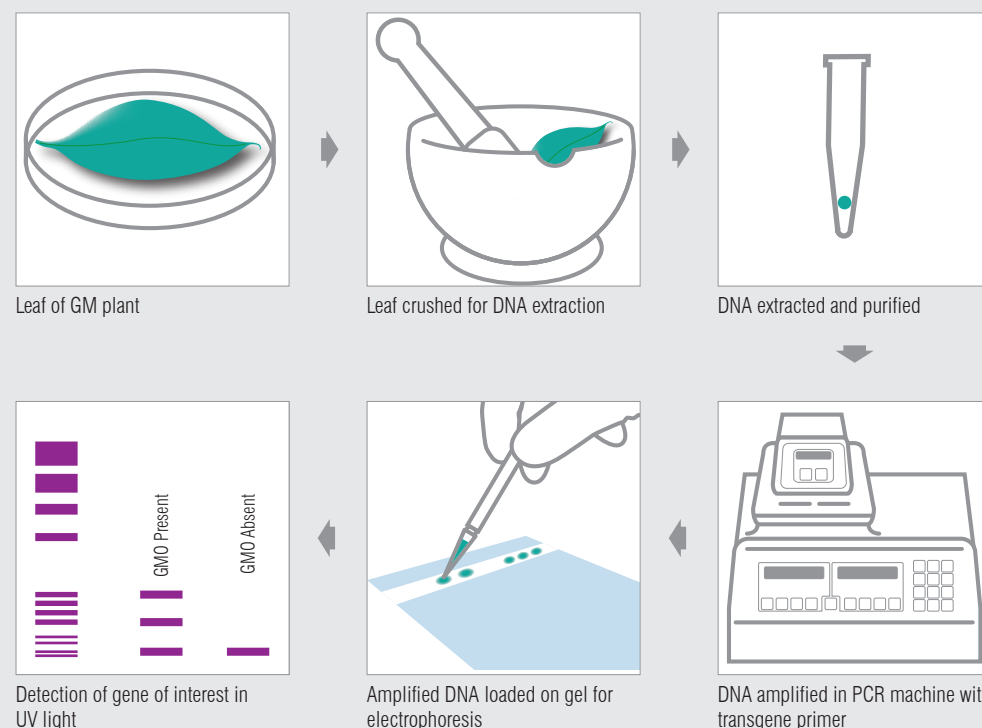
GENE BASED METHOD

Polymerase Chain Reaction (PCR)

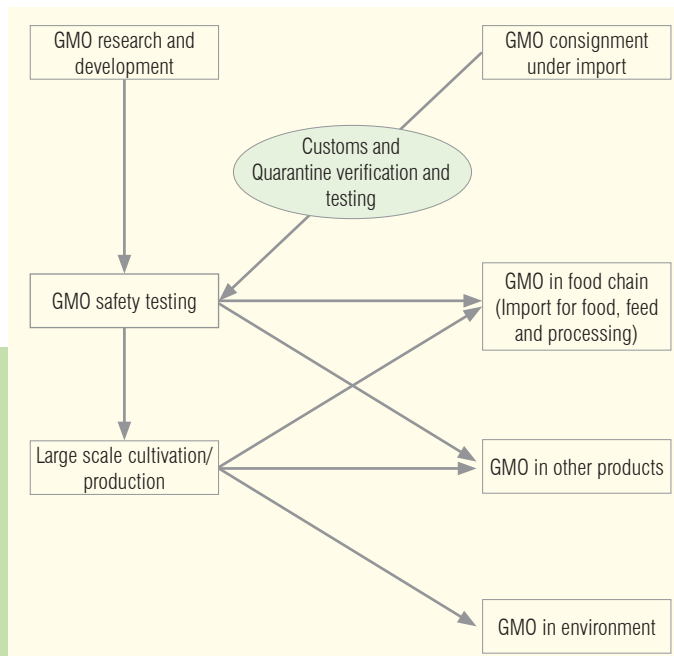
The technique involves exponential multiplication of specific DNA segments of the transgene resulting in its millions of copies and their subsequent visualization. It is a microlevel technique with high specificity and sensitivity.



Procedure



GMO DEVELOPMENT AND DISTRIBUTION PATHWAYS



DOCUMENTS VERIFIED BY CUSTOMS AND QUARANTINE FOR GMOs UNDER IMPORT

- ✓ Declaration that the product is GM
- ✓ Description of the content of GMOs and point of contact for emergency
- ✓ Import permit
- ✓ Phytosanitary certificate
- ✓ Invoice
- ✓ Memorandum of understanding, if applicable

NEW TECHNIQUES FOR GMO DETECTION

- Real time PCR: Monitors amplification reaction in real time; eliminates gel electrophoresis step
- LAMP (Loop mediated isothermal amplification): 2-3 sets of primers used simultaneously.
- Microarray (DNA chip): Based on DNA hybridization method. Can perform multiple tests at one go.

REFERRAL LABS

1. Mohali, Punjab Biotechnology Incubator
2. Delhi, National Bureau of Plant Genetic Resources
3. Hyderabad, DNA Fingerprinting and Transgenic Crops Monitoring Lab
4. Kochi, Export Inspection Council of India

