



ATOMIC ENERGY CENTRAL SCHOOL 4

MUMBAI

UNIT IX

CHAPTER 12

BIOTEHNOLOGY AND ITS APPLICATION

SYNOPSIS

MODULE – 1/3

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TOPICS TO BE COVERED

❖ Biotechnological Applications in Agriculture

Applications of Biotechnology in

- Therapeutics
- Diagnostics
- Genetically modified crops for agriculture
- Processed food
- Bioremediation
- Waste treatment
- Energy production

Research Areas in Biotechnology:

- Catalyst in the form of improved organism
- Optimum conditions are created through engineering for a catalyst to act

➤ Downstream processing technologies to purify the protein/ organic compound

Options to increase food production:

➤ **Agrochemical based agriculture**

The Green Revolution succeeded in increasing the yield of the crops due to: use of improved variety of crops and use of agrochemicals.

Which proved to be insufficient for the growing population.

➤ **Organic agriculture or Organic farming:**

Use of manure, bio – fertilizers, bio – pesticides, bio – controls. To switch on to

eco friendly farming to increase the crop productivity.

➤ **Genetically Engineered Crop based Agriculture.**

As organic farming cannot increase the crop productivity to appreciable degree, then these GM crops were the solution to this problem.

Transgenic Plants

The plants in which foreign genes are introduced through genetic engineering are called **Transgenic plants**.

There are two techniques for introducing foreign genes into the plant genome.

i) through vector

ii) through direct introduction of DNA

Some examples of GMOs

- ❖ Golden Rice
- ❖ Flavr Savr tomato
- ❖ Bt cotton
- ❖ Bt rice
- ❖ Bt brinjal
- ❖ Bt potato

PEST RESISTANT PLANTS

Bacillus thuringiensis is a rod shaped soil bacterium.

- Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans, coleopterans and dipterans.

- *Bacillus thuringiensis* form protein crystals which contain a toxic insecticidal protein.
- This protein is present in its inactive form once it is ingested by the insect in its gut due to alkaline medium it is converted to active protein which cause binding of active toxin to the surface of mid gut epithelial cells and create pores that cause cell swelling and lysis and eventually death of the insect.
- Bt toxins are insect group specific.
- Toxin is coded by a gene cryIAC named cry.
- Proteins encoded by the gene cryIAC and cryIIAb control the cotton boll worms and cryIAb controls corn borer.

PEST RESISTANT PLANT (RNAi)

- Many plants and animals are parasitized by nematodes.
- If nematode parasitizes a crop ultimately productivity is reduced.
- Tobacco plant often is parasitized by *Meloidegyne incognitia*, a nematode.
- A novel strategy was recognized by Fire and Mello in 1998 to prevent this infestation that was based on the process of RNA interference (RNAi).
- RNAi takes place in all eukaryotic organisms as a method of cellular defense.
- This method involves **silencing of a specific mRNA.**

- *Agrobacterium* vectors are used; nematode specific genes are introduced into the host plant.
- The introduction of the DNA produces both sense and anti-sense RNA in the host cell.

ACKNOWLEDGEMENT

The following text books were referred to complete the synopsis:

1. Text book of NCERT Class – XII
2. Truman's Elementary Biology Part – 2
3. MT Biology Today
4. MTG at your fingertips
5. Wikipedia