

# 12. BIOTECHNOLOGY AND ITS APPLICATIONS

(1 x 2) + (1 x 4) = 6 Marks

## ROOT POINTS

1. **Biotechnology** deals with Industrial scale production of biopharmaceuticals, genetically modified crops for agriculture etc.,
2. Biotechnology has given **several useful products** to humans by using microbes, plants, animals and their metabolic machinery.
3. Genetically modified organisms are created by **recombinant DNA technology**(Gene cloning)
4. Genetically modified plants are useful in **increasing crop yields**, reduce post harvesting losses and make crops more tolerant to stress.
5. rDNA technology has an impact on **health care** by mass production of safe and more effective therapeutics.
6. **Gene therapy** is the **insertion of genes into cells** to treat hereditary diseases.
7. Gene therapy has **replaced a defective mutant allele** with functional gene.
8. **Benefits of Transgenic Plants (TP):** [IPE]
  - a) TP have resistance to pathogens and pests.
  - b) TP are suitable for food processing technology.
  - c) TP have improved nutritional value.
  - d) TP are used for hybrid seed production.
  - e) TP are tolerant to abiotic stresses caused by chemicals, cold, drought, salt, heat etc.,
9. **Bt cotton** is a Genetically Modified Organism (GMO) cotton variety, which produces an insecticide to bollworm.
10. **Bt cotton** is created by using some strains of a bacterium, **Bacillus thuringiensis (Bt)**

## FRUITY Qs OF IPE

(1 x 2) + (1 x 4) = 6 Marks

1. Can a disease be detected before its symptoms appear? Explain the principle involved.
2. What is GEAC and what are its objectives?
3. Name the nematode that infects the roots of tobacco plants. Name the strategy adopted to prevent this infestation.
4. For which variety of Indian rice, has a patent been filed by a USA company.
5. What is green revolution? Who is regarded as Father of green revolution?
6. List out the beneficial aspects of transgenic plants.
7. What are some bio-safety issues concerned with genetically modified crops?
8. Give a brief account of (a) Bt cotton, (b) pest resistant plants.

## SCENT BOXES- MEMORY HINTS

### FOR SELECTIVE QUESTIONS

47. Give a brief account of Bt cotton.

[AP 15,20][TS 16,17,18,20,22,23]

- A:**
- 1) Bt cotton is a genetically modified organism (GMO) cotton variety, which produces an insecticide bollworm.
  - 2) Bt cotton is created by using some strains of a bacterium, *Bacillus thuringiensis* (Bt in short form)
  - 3) This bacterium produces proteins that kill certain insects such as lepidopterans (tobacco bud worm), coleopterans(beetles) and dipterans (flies, mosquitoes)
  - 4) Bt forms protein crystals during a particular phase of growth. These crystals contain a toxic insecticidal protein.
  - 5) Bt toxin protein exist as **inactive protoxins**, but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to **alkaline pH** of the gut which solublises the crystals.
  - 6) The activated toxin binds to the surface of mid gut epithelial cells and create pores that cause cell swelling and lysis leading to death of an insect.
  - 7) Specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into several crop plants.
  - 8) Most Bt toxins are insect group specific. Hence, the toxin is coded by a gene named 'Cry'. For example, the protein encoded by the **genes *Cry IAc* and *Cry IIAb* control the cotton bollworms and *Cry I Ab* controls corn borer.**

#### SCENT BOX

Bt GMO Kills LCD &  
Cries in AC & AB  
sitting on cot eating corn

#### Tick Boxes

  

48. Give a brief account of pest resistant plants.

[TS 19]

- A:**
- 1) Pest resistant plants are developed by using biotechnology processes.
  - 2) A **nematode parasite** called '**Meloidegyne incognitia**' infects the **roots of tobacco plant** which reduces the production of tobacco.
  - 3) To prevent the infestation, a process called **RNA interference (RNAi)** was adopted .
  - 4) RNAi is a method of **cellular defence**, which prevents a specific mRNA to translate (silencing)
  - 5) Using *Agrobacterium* vectors, nematode specific genes were introduced into the host (Tobacco) plant.
  - 6) Now this host plant is a transgenic plant.
  - 7) With the introduction of DNA, both sense and anti sense RNAs were produced in the host cells.
  - 8) These two RNAs are complementary to each other and formed a double stranded RNA
  - 9) It initiated RNAi and silenced the specific m RNA to translate.
  - 10) Under these circumstances the parasite could not survive in a transgenic plant.
  - 11) Therefore the transgenic plant got protected from the parasite.

#### SCENT BOX

Melody Chocolate of Nepal  
was prepared from  
roots of tobacco plants

**118. Give different types of cry genes and pests which are controlled by the proteins encoded by these genes.** [AP 23][TS 16]

- A:** 1)The proteins of Cry I Ac and Cry II Ab control the cotton boll worms.  
2) The proteins of Cry I Ab controls corn borer.

😊 SCENT BOX 😊

AcI and Ab II sat on cot & playing with ball then Ab I came & started eating corn

**120. What is GEAC and what are its objectives?** [TS 22][AP 15,17,18]

- A:** 1)GEAC stands for Genetic Engineering Approval Committee.  
2) **Objectives:** To make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

😊 SCENT BOX 😊

GEAC is the head of the two families GMR and GMO

**121. Name the nematode that infects the roots of tobacco plants. Name the strategy adopted to prevent this infestation.** [TS 18,20][AP 16, 19]

- A:** 1)The nematode is Meloidegyne incognitia .  
2)RNA interference (RNAi) is adopted to prevent the infestation.

😊 SCENT BOX 😊

Melinco works in RNAi company Nepal.

**124. What is green revolution? Who is regarded as Father of green revolution?**

[TS 15,17,20,23]

- A.** 1)The creation and utilisation of high yielding varieties in the field of agriculture, substantial and dramatic increase in agricultural production is called green revolution.  
2)**Norman Borlaug** is regarded as Father of green revolution.

😊 SCENT BOX 😊

If there is no Green revolution then no hybrid seeds no increased production . But only increased deaths due to Hunger.