DEPARTMENT OF BIOTECHNOLOGY

TRANSGENIC AND ITS IMPORTANCE IN CROP IMPROVEMENT

By-
Ms. Payal Talekar

WHAT ARE TRANGENIC PLANTS?

- The Plants whose genome is altered by adding one or more foreign gene are known as transgenic plants.
- Also Known as genetically modified plants
- The foreign gene/inserted sequence is also known as transgene.
- The purpose is to make it as useful and productive.

TRANSGENIC PLANTS

- Genetically engineered plants
- Transgenic plants
- Recombinant DNA plants
- Gene-spliced plants
- Bioengineered or Biotech plants


HYBRID DEVELOPMENT FOR HIGHER YIELD
NUTRITIONAL QUALITY
BIOTIC STRESS TOLERANCE
TRANSGENIC PLANTS
ENHANCED SHELF LIFE
ABIOTIC STRESS TOLERANCE
INDUSTRIAL PRODUCTS
PHARMACEUTICALS & EDIBLE VACCINE

HOW TO MAKE A TRANSGENIC PLANT

- PREPARE TISSIUE FOR TRANSFORMATION

➢Tissue must be capable of developing into formal plants

➢Leaf, germinating seed, immature embryos

- INTRODUCE DNA

➢ locate the genes for plant traits

➢Introduction into cell

- CULTURE PLANT TISSUE

➢Develop shoots

➢Develop roots

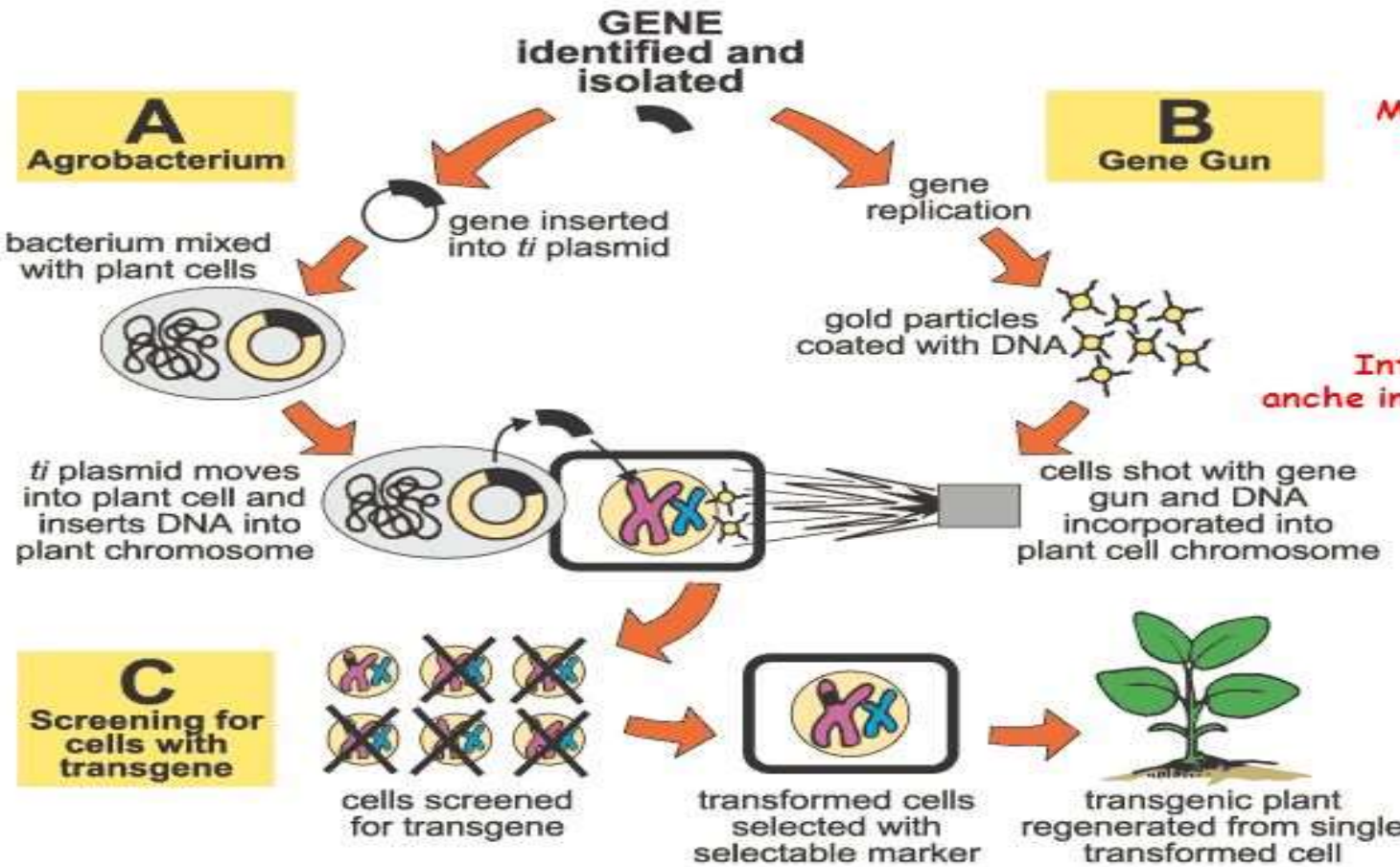
- FIELD TEST THE PLANTS

➢Multiple sites, multiple years

Agrobacterium and Gene gun

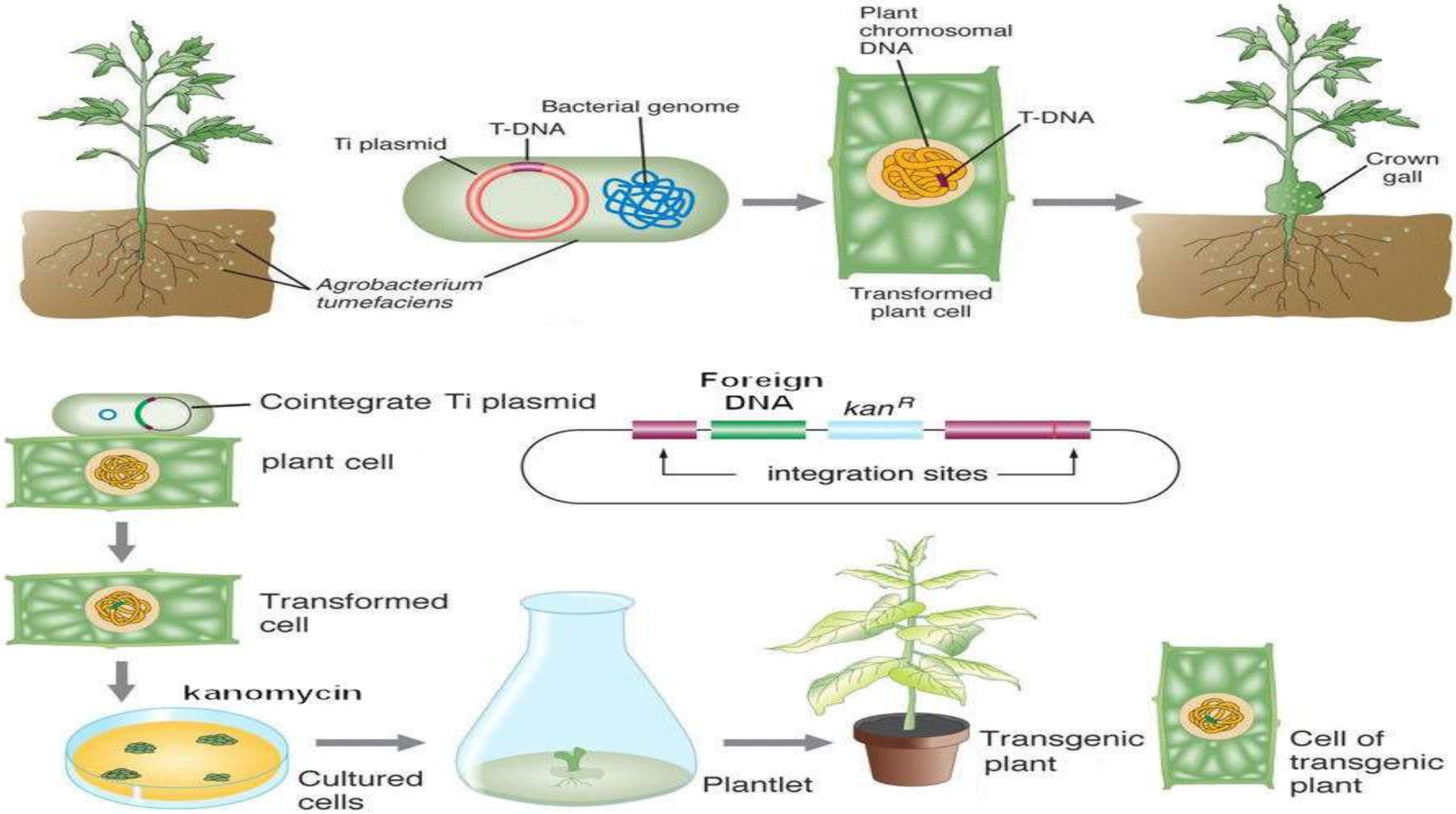
Infetta solo DICOTILEDONI

Introduzione del DNA solo nel NUCLEO



Infetta MONOCOTILEDONI DICOTILEDONI EMBRIONI etc

Introduzione del DNA anche in cloroplasto/mitocondrio


Plant chromosomal DNA
Bacterial genome
T-DNA
Ti plasmid
T-DNA
Crown gall
Agrobacterium tumefaciens
Transformed plant cell
Cointegrate Ti plasmid
plant cell
Foreign DNA
kanR
integration sites
Transformed cell
kanomycin
Cultured cells
Plantlet
Transgenic plant
Cell of transgenic plant

ADVANTAGES OF TRANSGENIC PLANT

- Improvement in Yield
- Improvement in Insect and Disease Resistance
- Improvement in Quality
- Herbicide Resistance
- Resistance to Abiotic Stresses
- Industrial Products
- Rapid and Accurate Technique

TYPES OF TRANSGENIC CROPS

- Transgenic Crops for resistance to biotic stress.
- Transgenic Crops for resistance against abiotic stress
- Transgenic crops for increased productivity & nutritional Quality
- Transgenic Crops for floriculture or ornamentals.

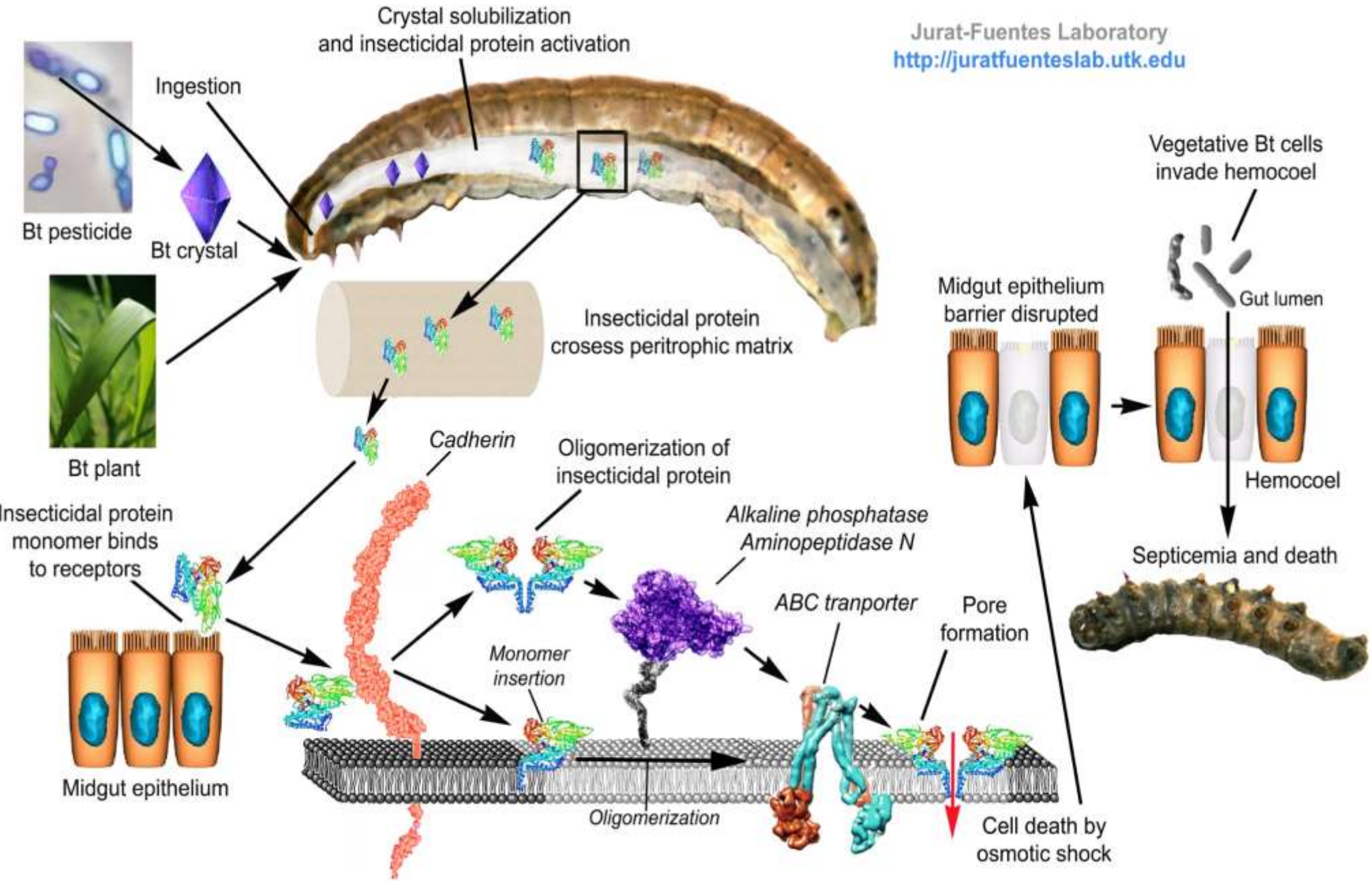
- **Example**

Disease-Insect-Resistant Varieties:

BT Cotton:

- The transgenic technology provides alternative and innovative method to improve pest control management which are ecofriendly, effective, sustainable and beneficial in terms of yield.
- The first genes available for genetic engineering of crop plants for pest resistance were cry genes (popularly known as Bt genes) from bacterium Bacillus thuringiensis.
- These genes are specific to particular group of insect pests and are not harmful to other useful insects such as butterfly, silk worms and honeybee.

- The insect disease causing organism Bacillus thuringenesis is naturally occuring soil borne bacterium found world wide.
- A unique feature is that it produce crystal like protein that selectively kill specific group of insects & other organisms.
- When the insect eat these cryo proteins, its own digestive enzyme activate the toxic form of the protein.
- Cryoprotein bind to specific receptors on the intestinal wall& rupture the midgut cells.
- Susceptible insects stop feeding within a few hours after taking the first bite, & if they have eaten enough toxin, die within 2 or 3 days


Jurat-Fuentes Laboratory
http://juratfuenteslab.utk.edu
Crystal solubilization
and insecticidal protein activation
Ingestion
Bt pesticide
Bt crystal
Bt plant
Insecticidal protein
crosess peritrophic matrix
Vegetative Bt cells
invade hemocoel
Midgut epithelium
barrier disrupted
Gut lumen
Hemocoel
Septicemia and death
Cadherin
Oligomerization of
insecticidal protein
Insecticidal protein
monomer binds
to receptors
Alkaline phosphatase
Aminopeptidase N
ABC tranporter
Pore
formation
Monomer
insertion
Midgut epithelium
Oligomerization
Cell death by
osmotic shock

Flavr Savr Tomato

- The Flavr savr Tomato was the first commercially grown genetically engineered food to be granted a license for human consumption.

- The gene responsible for softening ripe of tomatoes was reduced to allow tomatoes to ripen slowly& have a longer shelf life.

- The Polygalactouronase enzyme was silenced, as it causes ripening in tomatoes.

GOLDEN RICE

- Transgenic Technology produces a new variety of rice that accumulate beta Carotene in rice.
- Golden rice is genetically modified rice that contains large amount of Vit A
- When it is consumed Beta carotene is converted to vit A

TEARLESS ONION

Fig: Produced by Gene Silencing

COLOURFUL CAULIFLOWER

COLOURFUL CORNS