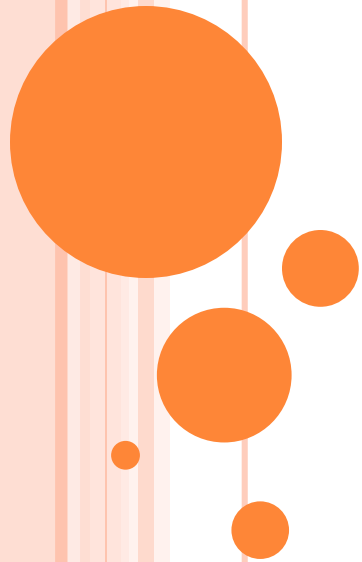


# FLAVR SAVR TOMATO



# IN TRADITIONAL CROPS

- A major problem in agriculture is perish ability of its products.
- Various methods have been initiated and developed to increase the shelf life of crops especially for fruits and vegetables.
- One such successful technique is delaying the ripening of fruits and vegetables by manipulating the genes through genetic engineering.



# FRUIT RIPENING PROCESS

- Fruit ripening is an active process characterized by increased respiration accompanied by a rapid increase in ethylene synthesis.
- As the chlorophyll gets degraded, the green color of fruit disappears and a red pigment, lycopene is synthesized.
- The fruit gets softened as a result of the activity of cell wall degrading enzymes namely polygalacturonase (PG) and methyl esterase.
- The phyto hormone ethylene production is linked to fruit ripening as the same is known to trigger the ripening effect.
- The breakdown of starch to sugars and accumulation of large number of secondary products improves the flavor, taste and smell of the fruits.

# GENES INVOLVED

IN CASE OF TOMATOES:

- i) **pTOM5** encodes for phytoene synthase which promote lycopene synthesis that gives red coloration
- ii) **pTOM6** gene encodes for polygalacturonase. This enzyme degrades the cell wall, resulting in fruit softening.
- iii) **pTOM** gene encodes for ACC oxidase. This enzyme catalyzes the ethylene formation that triggers the fruit ripening.



# GENETICALLY MODIFIED TOMATO

- A **genetically modified tomato**, or transgenic tomato is a **tomato** that has had its genes **modified**, using **genetic engineering**. The first commercially available **genetically modified** food was a **tomato engineered** to have a longer shelf life (**FLAVR SAVR**).



# FLAVR SAVR TOMATO

- First genetically engineered crop granted license for human consumption.
- Produced by Californian company Calgene 1992.
- Calgene introduced a gene in plant which synthesizes a complementary mRNA to PG gene and inhibiting the synthesis of PG enzyme.
- On May 21, 1994, the genetically engineered **Flavr Savr** tomato was introduced.



# DEVELOPMENT OF FLAVR SAVR TOMATO

- Softening of fruits is largely due to degradation of cell wall (pectin) by enzyme polygalacturonase (PG). The gene encoding PG has been isolated and cloned (pTOM6).

## **Procedure involves: -**

- 1) Isolation of DNA from tomato plant that encodes the enzyme polygalacturonase (PG).
- 2) Transfer of PG gene to a vector bacteria and production of complementary DNA (cDNA) molecules.
- 3) Introduction of cDNA into a fresh tomato plant to produce transgenic plant.



# MECHANISM OF PG ANTISENSE RNA APPROACH

In normal plants, PG gene encodes a normal or sense mRNA that produce the enzyme PG and it is actively involved in fruit ripening.

- The cDNA of PG encodes for antisense mRNA, which is complementary to sense mRNA.
- The hybridization between sense and antisense mRNA render the sense mRNA ineffective.
- Consequently, no polygalacturonase is produced hence fruit ripening is delayed.

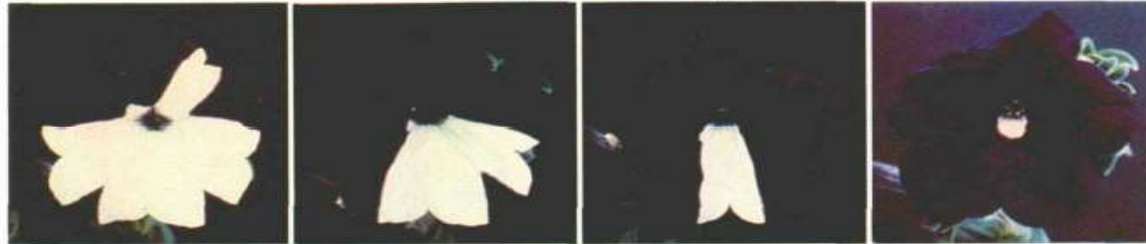




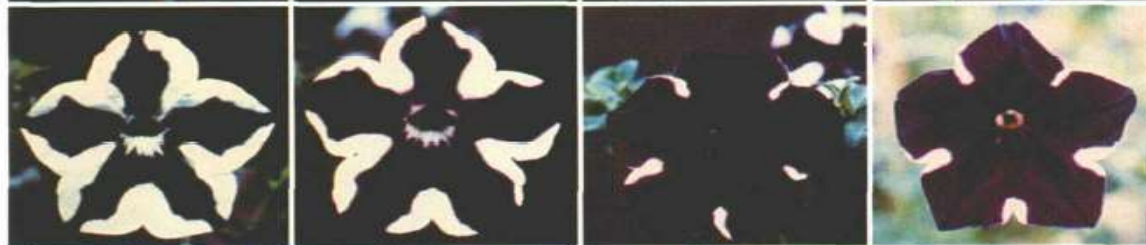
PARENTAL



Transgenic line 1



Transgenic line 2

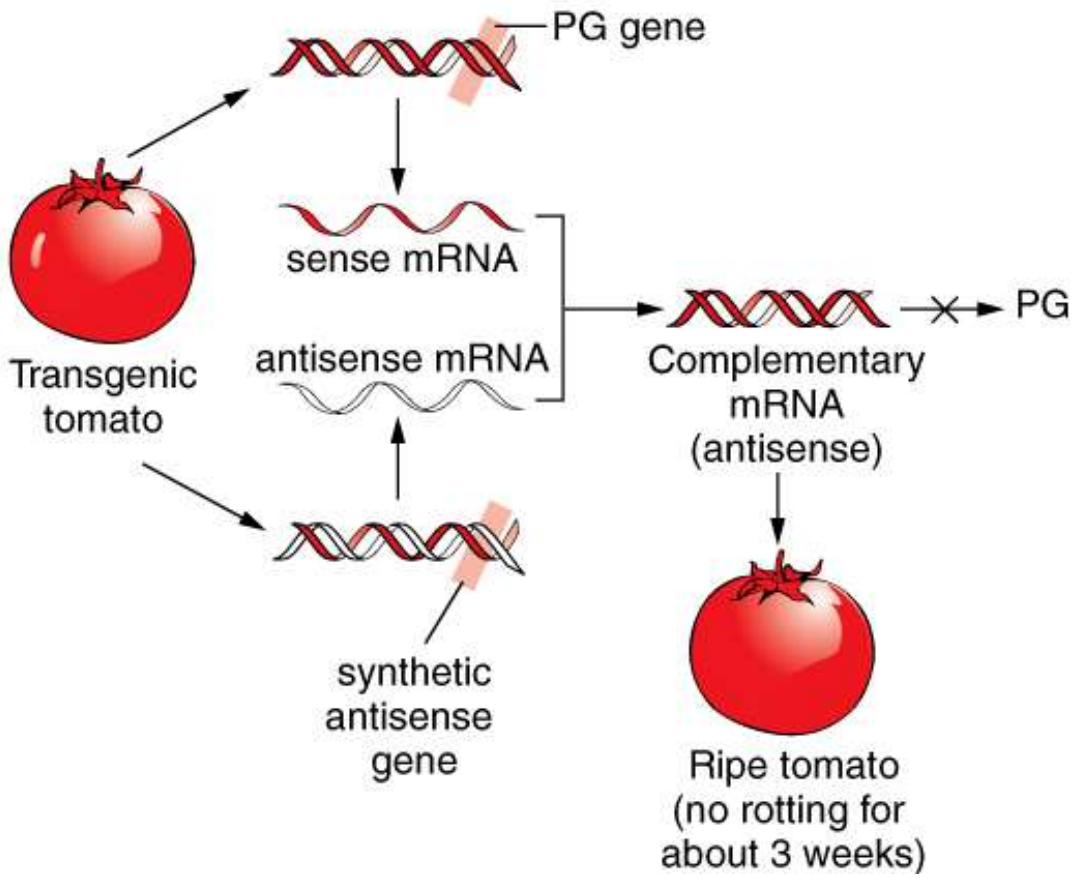
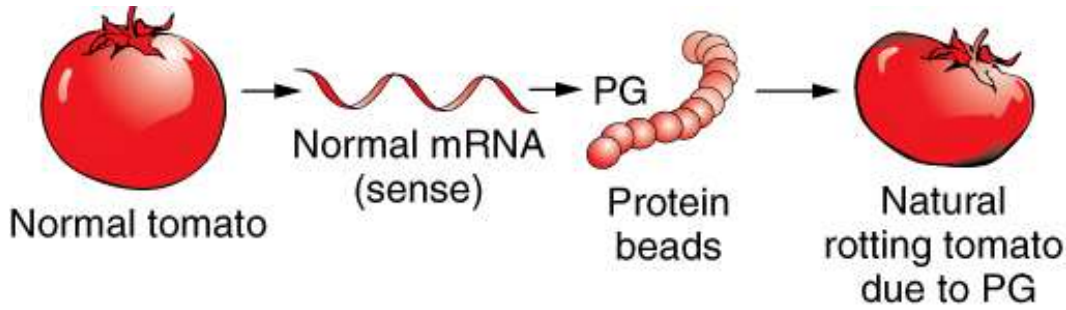


Transgenic line 3



Transgenic line 4





## ADVANTAGES:

- Slower ripen rate
- Ripen longer on vine
- Fully developed flavors
- Increase the shelf life.





**THANK YOU**

