CONVENTIONAL VERSES NON CONVENTIONAL METHODS OF CROP IMPROVEMENT

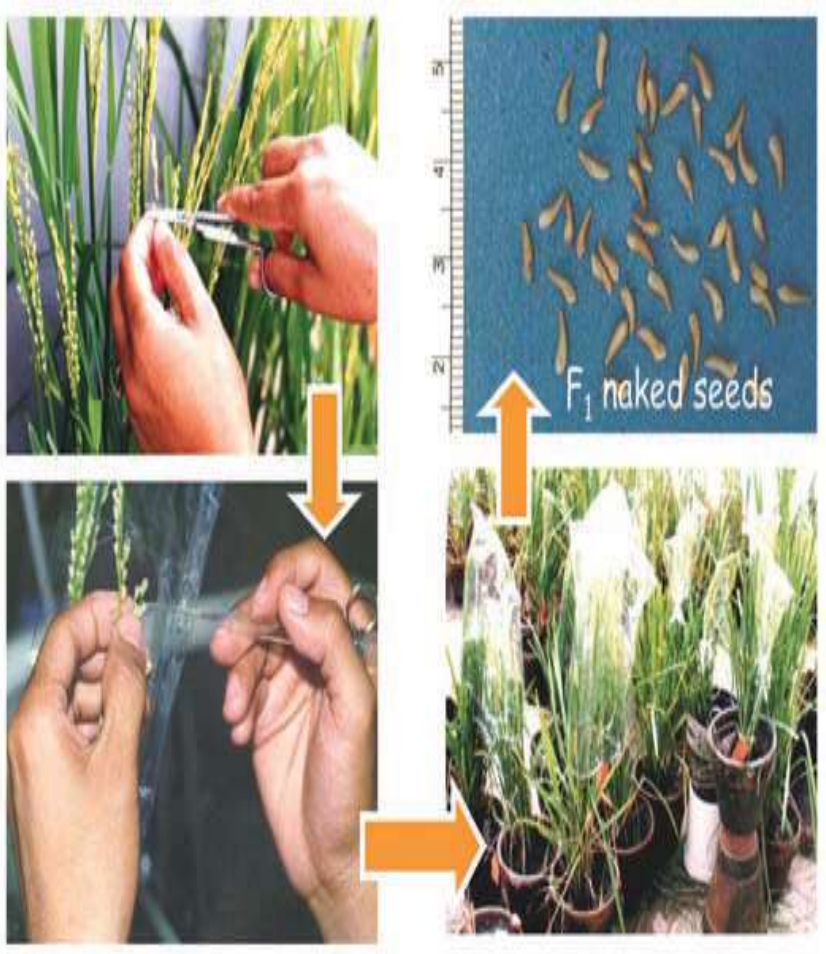
- Eight to ten thousand years ago, farmers have been altering the genetic makeup of the crops they grow
- Early farmers selected the best looking plants and seeds and saved them to plant for the next season
- By using science of genetics breeders use that knowledge to develop the improved varieties with the desired traits

- The selection for features such as
  - faster growth,
  - higher yields,
  - pest and disease resistance,
  - larger seeds,
  - sweeter fruits
- Has dramatically changed domesticated plant species compared to their wild relatives
- For example
- Initially thousands of years ago corn was found like finger of a hand
- Today, there are hundreds of corn varieties which having various size are available

Conventional Methods Of Crop Improvements

- Conventional plant breeding has been the method used to develop new varieties of crops for hundreds of years

- However, conventional plant breeding can no longer sustain the global demand with the
  - Increasing population,
  - Decline in agricultural resources such as land and water,
  - and the
  - Decreasing of the yield curve of the staple crops
- Thus, new crop improvement technologies should be developed and utilized



MUTATION BREEDING

- Recognizing desirable traits and use them into future generations is very important in plant breeding
- A few superior traits occasionally arise spontaneously through a process called mutation
- But the natural rate of mutation is very slow
- In 1920s, researchers discovered that they could greatly increase the number of these variations or mutations by exposing plants to X-rays and mutation-inducing chemicals

MUTATION BREEDING CONT…

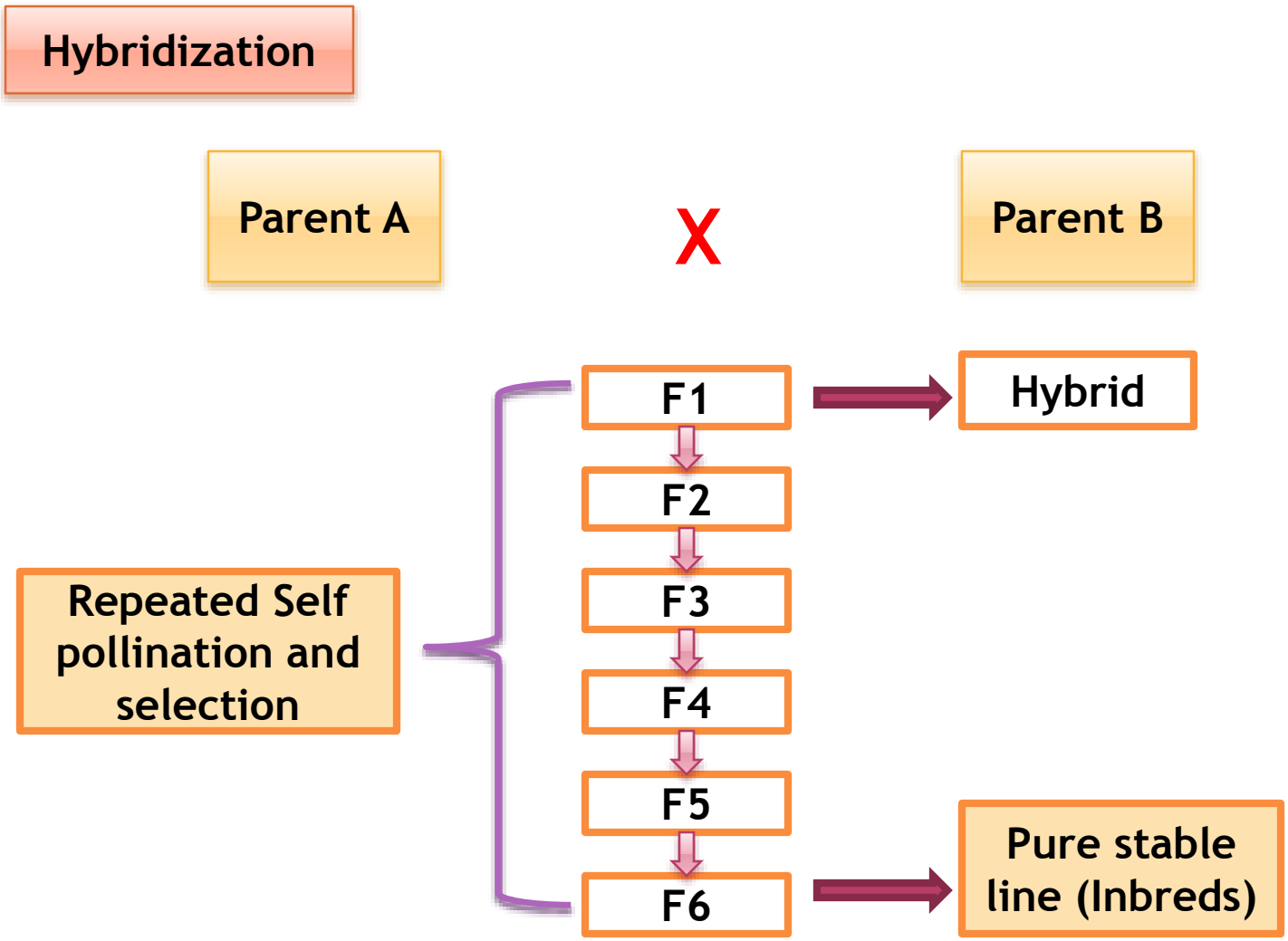
- Mutation breeding" accelerated after World War II, when the techniques of the nuclear age became widely available
- Plants were exposed to gamma rays, protons, neutrons, alpha particles, and beta particles to see if these would induce useful mutations
- Chemicals such as sodium azide and ethyl methanesulphonate, were also used to cause mutations
- Mutation breeding efforts continue around the world today.

MUTATION BREEDING CONT…

- In the 73 years of mutation breeding (1939-2013), a total of 3,218 varieties obtained through mutation breeding
- As well as other important crops that were improved to possess agronomically-desirable characteristics.

Crop	Number
Rice	824
Barley	312
Wheat	274
Maize	96
Common bean	57
Potato	20
Sugarcane	13
Soybean	2

PURE LINE AND HYBRID SEED TECHNOLOGY



HYBRID SEED TECHNOLOGY

- In hybrid seed technology, two pure lines with complementing traits and are derived from diversely related parents are bred together by hand
- F1 hybrids are tested for hybrid vigor in all agronomic and yield parameters and compared to both parents
- The resulting offspring's will usually perform more vigorously than either parents.

HYBRID SEED TECHNOLOGY CONT…

- In China increased production from **140** million tons in 1978 to **188** million tons in 1990 using the hybrid seed technology
- With the proven impact of hybrid seed technology, new tools for hybrid breeding were discovered
- Utilized for self-pollinating crops including development of CMS lines

LIMITATIONS OF CONVENTIONAL METHODS

- In this methods of crop improvement hybrid varieties has had a tremendous impact on agricultural productivity over the last decades

- While an extremely important tool, conventional plant breeding also has its limitations

  - 1. Breeding can only be done between two plants that can sexually mate with each other

  - This limits the new traits that can be added to those that already exist in that species

  - 2. when plants are crossed, many traits are transferred along with the trait of interest including traits with undesirable effects on yield potential

NON CONVENTIONAL METHODS OF CROP IMPROVEMENTS

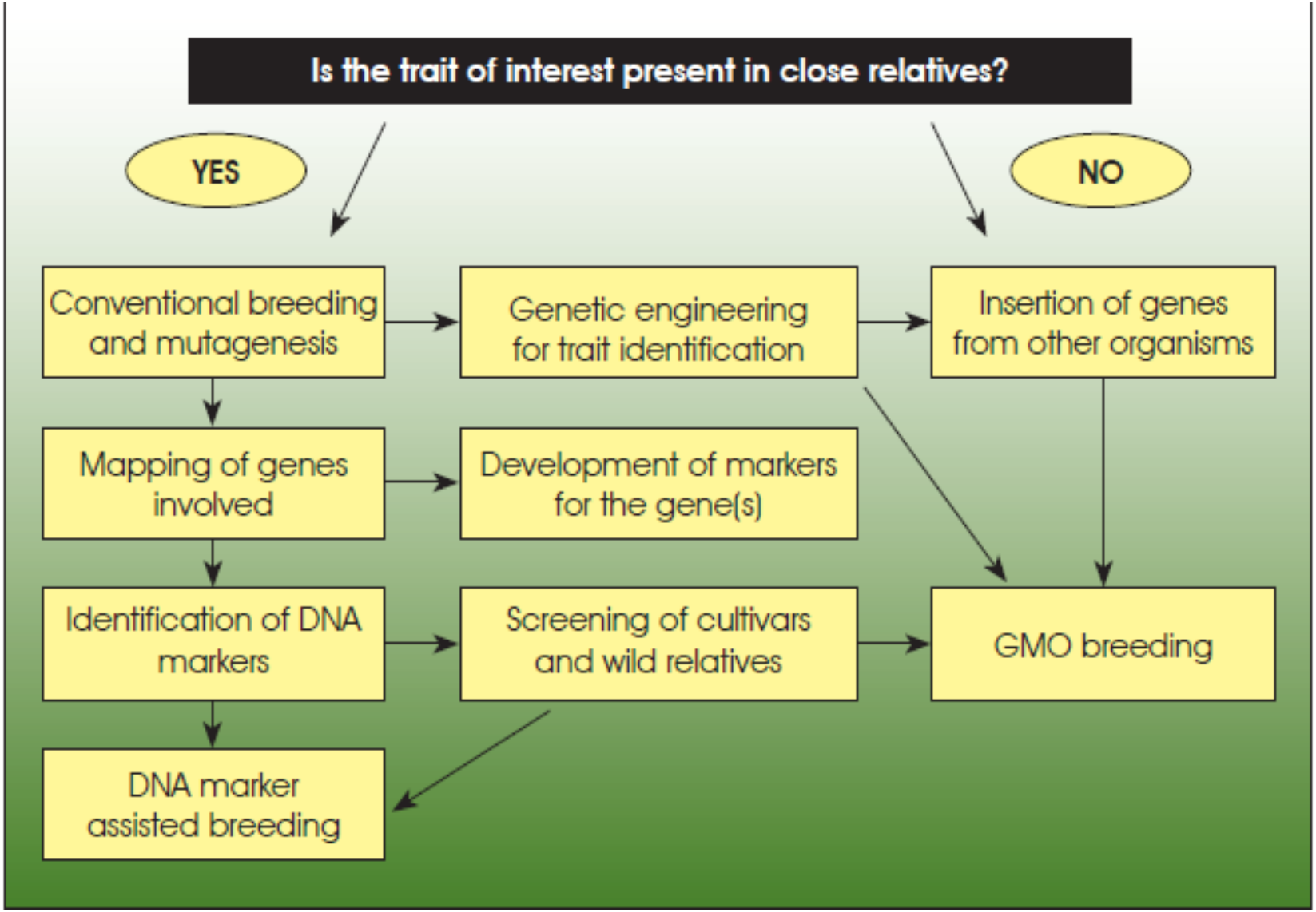
NON CONVENTIONAL METHODS OF CROP IMPROVEMENTS

- Over the last 50 years, the field of genetic engineering has developed rapidly due to the greater understanding of DNA
- DNA having code from which genes are made
- The term genetic engineering is used to describe the process by which the genetic makeup of an organism can be altered using “recombinant DNA technology

DIFFERENCE BETWEEN CONVENTIONAL AND NON CONVENTIONAL METHODS

Conventional Methods	Non conventional Methods
1. Limited to exchanges between the same or very closely related species 2. Little or no guarantee of any particular gene combination from the million of crosses generated 3. Undesirable genes can be transferred along with desirable genes 4. Takes a long time to achieve desired results	1. Allows the direct transfer of one or just a few genes, between either closely or distantly related organisms 2. Crop improvement can be achieved in a shorter time compared to conventional Breeding 3. Allows plants to be modified by removing or switching off particular Genes

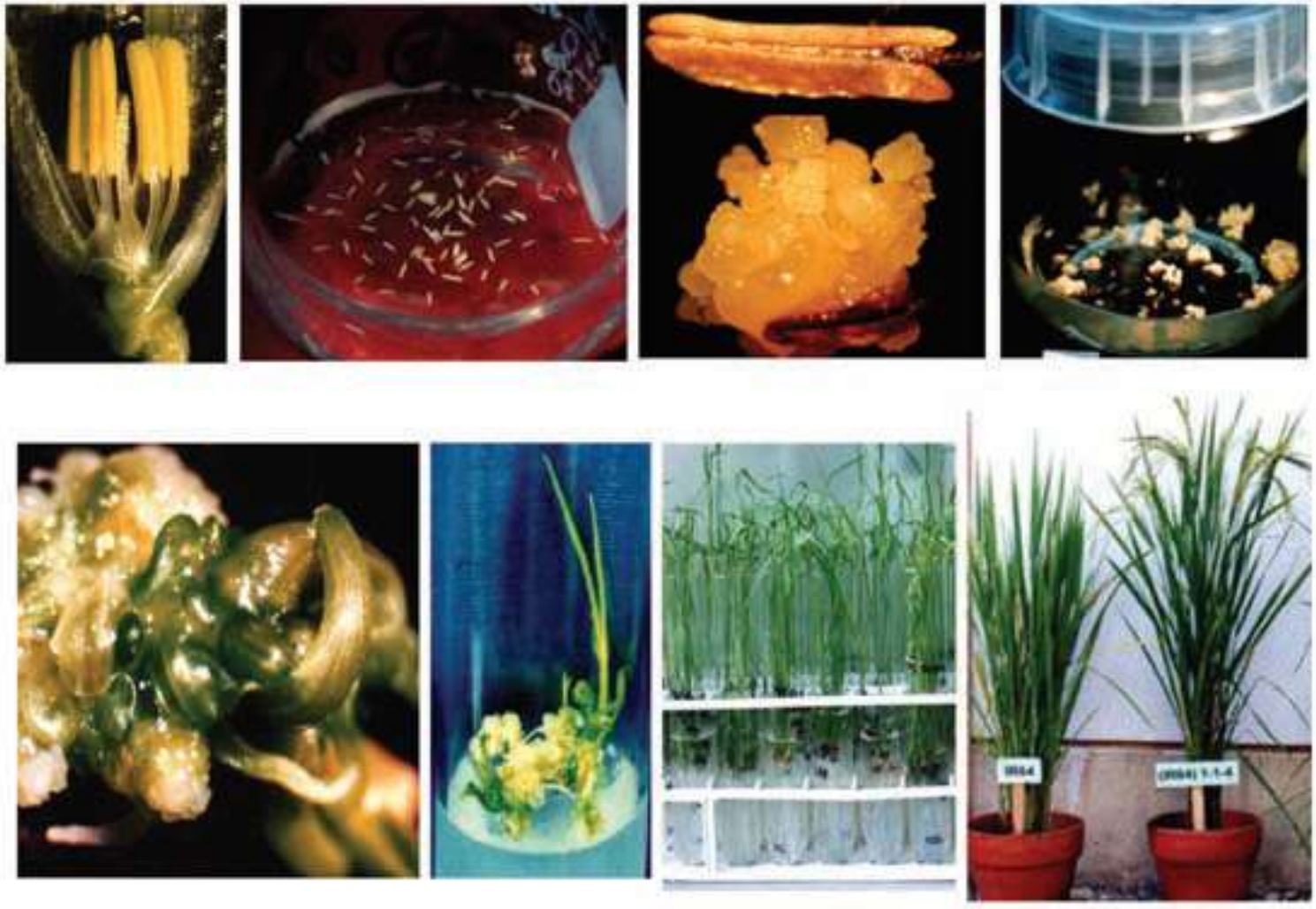
MODERN CONCEPT OF CROP BREEDING



PLANT TISSUE CULTURE

- Tissue culture is the cultivation of plant cells, tissues, or organs on specially formulated nutrient media
- Under the right conditions, an entire plant can be regenerated from a single cell
- Plant tissue culture is a technique that has been around for more than 30 years
- There are several types of tissue culture depending on the part of the plant (explant) used.

ANTHER CULTURE OF RICE



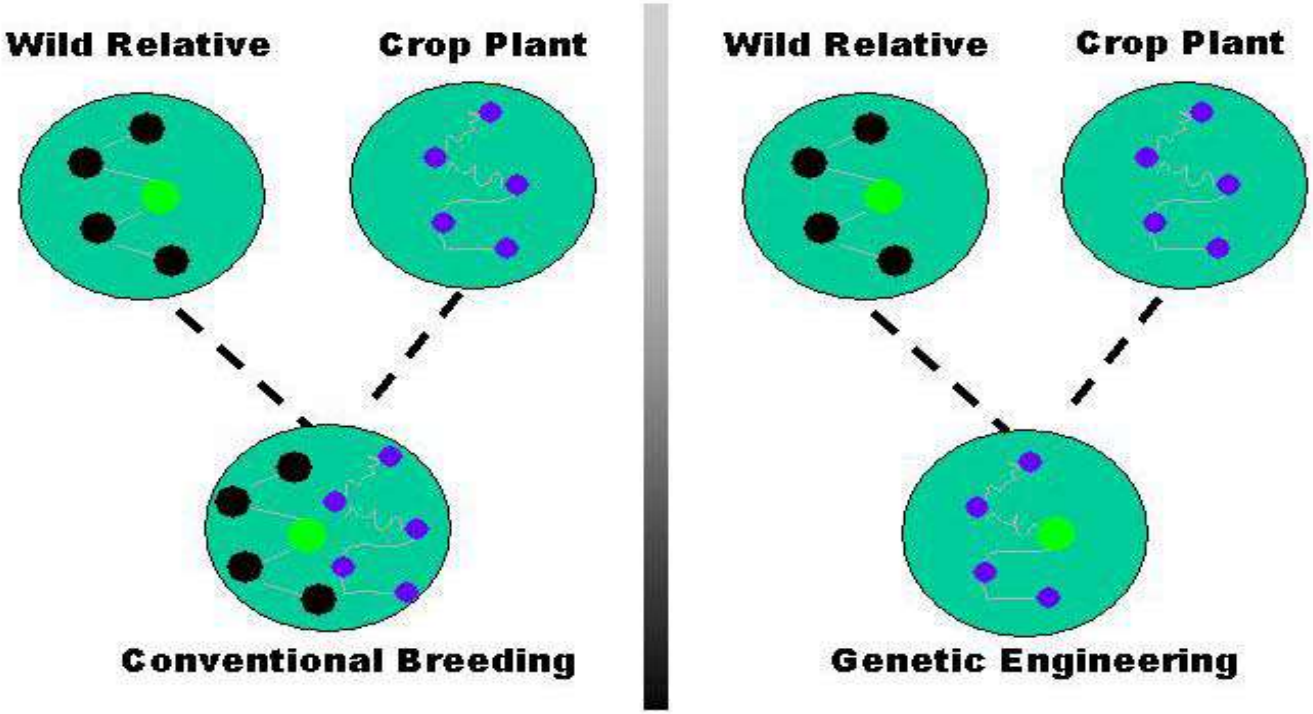
OTHER METHODS USED IN THE PTC

- Micro propagation
- Embryo Rescue
- Somaclonal Variation
- Pollen culture
- Ovary culture..etc..

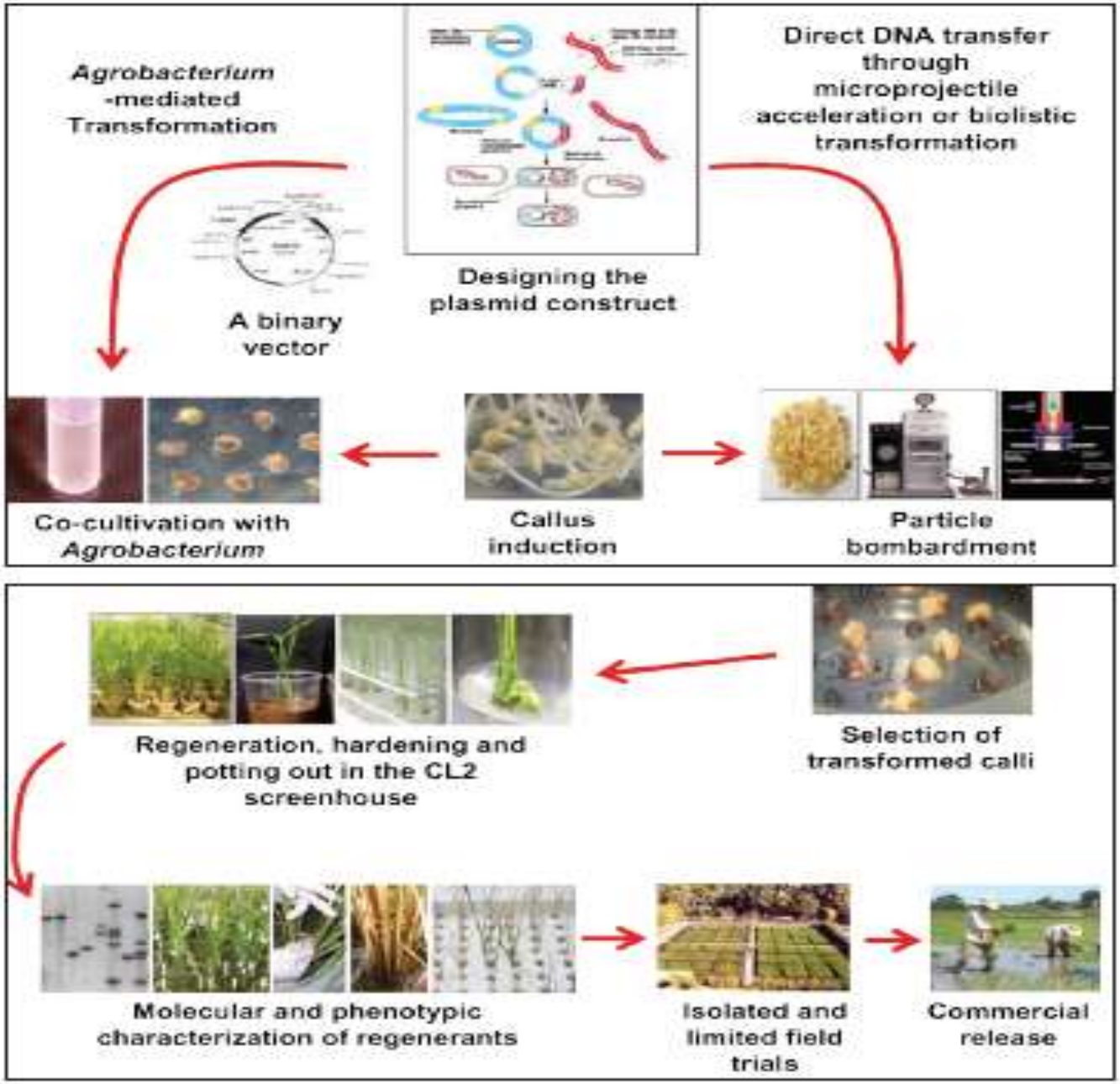
MOLECULAR BREEDING AND MARKER-ASSISTED SELECTION

- plant breeders now use molecular marker-assisted selection
- To help identify specific genes, scientist use what are called molecular markers
- Which are short strings or sequence of nucleic acid which makes up a segment of DNA.
- The markers are located near the DNA sequence of the desired gene
- Since the markers and the genes are close together on the same chromosome, they tend to stay together as each generation of plants is produced
- This is called genetic linkage
- This linkage helps to predict whether a plant will have the desired gene

GENETIC ENGINEERING AND GM CROPS



DEVELOPMENT OF TRANSGENIC PLANTS



LIST OF PLANT PRODUCTS OF BIOTECHNOLOGY

Product	Trait
Alfalfa	Herbicide tolerance, altered lignin production
Apple	Non-browning
Bean	Virus disease resistance
Canola	Herbicide tolerance, modified oil/fatty acid, pollination control system, phytase production
Cotton	Herbicide tolerance, insect resistance
Maize	Abiotic stress tolerance, altered growth/yield, herbicide tolerance, insect resistance, modified product quality (modified alpha amylase, lysine boost, phytase production), pollination control system
Melon	Delayed ripening
Papaya	Disease resistance
Plum	Disease resistance
Potato	Disease resistance, herbicide tolerance, insect resistance, modified product quality (modified starch, reduced acrylamide potential, non-bruising), fungal disease resistance
Rice	Herbicide tolerance, insect resistance, anti-allergy
Soybean	Herbicide tolerance, insect resistance, modified product quality, altered growth/yield, abiotic stress tolerance, modified oil/fatty acid
Squash	Disease resistance
Sugar beet	Herbicide tolerance
Tomato	Disease resistance, insect resistance, delayed ripening, delayed fruit softening
Wheat	Herbicide tolerance


Thank You