Principles of seed production

- Seed production requires improved cultural practices, efficient control of weeds, diseases and pests, optimum irrigation and fertilizer input, and some other specific operations.
- Seed production must be carried out under standardized and well organized conditions.

Genetic principles

Genetic purity:

Trueness to type of a variety can deteriorate due to various factors such as :

- Mechanical mixtures.
- Developmental variation.
- Natural crossing.
- Selective influence of diseases.
- Techniques of plant breeders.
- Mutations.

Steps suggested for maintaining genetic purity

- Adequate isolation to prevent contamination by natural crossing or mechanical mixtures.
- Rouging of seed fields at vegetative stage.
- Periodic testing for genetic purity.
- Certification of seed crops to maintain genetic purity and quality of seed.
- Adopting the generation system.
- Grow out tests.

Agronomic principles

- Selection of a agro-climatic region.
- Selection of seed plot.
- Isolation of seed crops.
- Preparation of land
- Selection of variety.
- Seed treatment.
- Time of planting.
- Seed Rate.
- Method of sowing.

Cont.....

Agronomic principles

- Depth of sowing.
- Rouging.
- Supplementary pollination.
- Weed control.
- Disease and insect control.
- Nutrition.
- Irrigation.
- Harvesting of seed crops.
- Drying and storage of seeds.

Steps necessary for maintaining varietal purity

- Use of only approved seed in seed multiplication
- Inspection & approval of field prior to planting.
- Field inspection and approval of growing crops at critical stages for verification of genetic purity
- Sampling and sealing of cleaned lots.
- Growing of samples of potentially approved stocks for comparison with authentic stocks.

Seed Production System in India

- It adheres to the limited generation's system for seed multiplication in a phased manner.
- The system recognizes three generations:
  - Breeder seed
  - Foundation seed
  - Certified seed
- To maintain purity of the variety adequate safeguards for quality assurance is provided.

Breeder seed

- Breeder seed is the progeny of nucleus seed of a variety and is produced by the originating breeder or by sponsored breeder.
- Breeder seed production is the mandate of the Indian Council of Agricultural Research (ICAR) with the help of:
- ICAR Research Institutions, National Research Centers and All India Coordinated Research Project of different crops.

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Breeder seed

- State Agricultural Universities with 14 centers established in different states.
- Sponsored breeders recognized by selected State Seed Corporations.
- Non-governmental Organizations.

Breeder seed

ICAR also promotes sponsored breeder seed production program through:

- National Seed Corporation. (NSC)
- State Farms Corporation of India. (SFCI)
- State Seeds Corporation (SSCs)
- Krishi Vigyan Kendras (KVKs)

Foundation seed

- Foundation seed is the progeny of breeder seed and is required to be produced from breeder seed or from foundation seed which can be clearly traced to breeder seed.
- The responsibility of its production has been entrusted to the NSC, SFCI, SSC and State Departments of Agriculture and private seed producers having the necessary infrastructure.

Certified seed

- Certified seed is the progeny of foundation seed and must meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standard s, 1988.
- In case of self pollinated crops, certified seeds can also be produced from certified seeds provided it does not go beyond three generations from foundation seed stage-I

Requirements of Certified seed

- Seed has to meet certain rigid requirements before it can be certified for distribution.
- Seed must be of an improved variety released by either Central or State Variety Release Committee for general cultivation and notified by the Ministry of Agriculture, Govt. of India.

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Requirements of Certified seed

- Genetic purity.
- Physical purity.
- Germination.
- Freedom from Weed seeds.
- Freedom from Diseases.
- Optimum Moisture Content.

Role of Biotechnology in seed production

- Progress in Agricultural Biotechnology has occurred at a rapid pace in the last three decades.
- Not only ability to genetically transform a wide variety of crop species has been enhanced but also the capacity to generate variability for a range of economically important traits in crop plants through biotechnology has been established.
- There is a prospect for agriculture to use the biological tools to produce all desired needs through plant biotechnology.

Use of plant tissue culture technology in seed production

- Plant tissue culture is a collective term for protoplast, cell, tissue and organ culture raised under controlled environment.
- Micro-propagation or tissue culture multiplication has developed into a preferred method for cloning and bulking of elite planting materials.
- Tissue culture techniques are being exploited to enhance crop production and improvement.

Micro-propagation, Artificial Seeds and Somatic Embryogenesis

- Micro-propagation techniques can be especially useful in increasing propagates of a new sexual or somatic hybrid or a plant freed from pathogens or even in a case of genetically engineered plant.
- If the embryos formed by this means are enclosed in a skin like conventional seeds called encapsulation in a suitable matrix would lead development of artificial seeds.

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Micro-propagation, Artificial Seeds and Somatic Embryogenesis

- Special delivery systems like fluid drilling will also need to be developed and perfected.
- Somatic embryogenesis or using vegetative plant part for plant propagation is useful in annual field crops and perennial trees.
- Micro-propagation technology on a commercial basis is available, and banana is the most successful crop in commercial micro-propagation.

Application of Biotechnology tools in crop improvement and their impact

- Seed is the carrier of new technology.
- Tissue culture techniques are being exploited to enhance crop production and improvement, and are used for conservation of those species whose seeds are recalcitrant or ones which do not produce seeds at all.
- Plants developed by using genetic engineering technology are known as transgenic plants.

Application of Biotechnology tools in crop improvement and their impact

- Recombinant DNA technology can be used for insertion of genes in plants not only from related plant species but also from unrelated species such as microorganisms.
- The process of creation of transgenic plants is for more precise and selective than traditional breeding.
- Application of recombinant Technology is primarily for the production of transgenic plants with higher yield and nutritional content, increased resistance to stress and pests.

Insect resistance

- Biotechnology has opened up new avenues for natural protection for plants by providing new pesticides, such as microorganisms, toxic to crop pests but do not harm humans, animals, fish, birds or beneficial insects.
- The classic example is the use of Bt gene from a soil living bacteria Bacillus Thuringiensis to impart pet resistance to cotton plants.

Herbicide tolerance

- Imparting selective tolerance to herbicides into the crop plants would facilitate chemical weed control.
- Other benefits are mechanization of herbicide application and reduced tillage of soil resulting in cost reduction and prevention of loss of fertile top soil.

Disease resistance

- Plants are susceptible to viral, bacterial and fungal diseases.
- Much progress has been made in evolving transgenic plants resistant to viruses.
- A number of other viral resistant plants species have been developed including squash and potatoes.

Produce quality improvement

- One of the most successful research efforts to change the characteristics of a plant produce was carried out with tomatoes.
- Tomatoes need to be picked while still green so that they are firm enough to withstand mechanical handling and transport.

Issues related to GM crops

- Many Indian seed companies are taking trials for transferring genes from bacteria into the cells of vegetables and oilseeds such as mustard, tomato, cabbage etc.
- The objective is to create insect resistant vegetable crops and oilseed crops that are at least 20% more productive than regular varieties.

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Issues related to GM crops

- Today, Genetically Modified (GM) products are available in US, Spain, France, Canada, Australia.
- In the US, which allowed transgenic products just five years ago, they already accounted for 50% of all soyabean, corn and cotton acreage.
- The genetic engineering technique is commonly used in the western countries but there is controversy about it in India.

Genetically Modified (GM) Crops in India

- The first and as yet the only GM crop approved for cultivation in India is the “Bt-cotton” which confer resistance to boll worm which is a menace in cotton crop.
- The other transgenic crops such as Pigeon pea, Brinjal, Potato, Tomato etc are under experimental and evaluation stage.
- Bio-safety issues need to be looked at critically before the release of GM crops.

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Genetically Modified (GM) Crops in India

- In India, the debate on GM crops in the past few years has been lively with views and counter-views.
- Because of worldwide concerns on the use and implications of this technology, and civil society groups and farmers expressing reservations regarding use of this technology within India, the Government has been treading carefully in this area.