

Hybrid Seed Technology



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Definition

Hybrid seed technology is based upon the cross pollination of diversely related two pure lines showing desire traits, produces the hybrid seed that show the inferior traits then parents.



Requisites of hybrid seed production

Breeders responsibilities

- Develop inbred lines
- Identification of specific parental lines
- Develop system for pollen control

Major problems for breeders & producers

- Maintenance of parental lines
- Separation of male and female reproductive organs
- Pollination

Characteristics of parental lines

- Female Parent Male Parent
- High seed yield Good pollen production
- Good seed characteristics Long shedding period
- Male sterility Plant height

Basic procedures for hybrid seed production

- Development and identification for parental lines
- Multiplication of parental lines
- Crossing between parental lines and production of F1
- Commercial hybrid seed production demands crossing technique which is easy and also economic to maintain parental lines. Only few crossing mechanisms have been adopted for commercial hybrid seed production they are;
- Hand emasculation and pollination
- Self-incompatibility
- Dicliny : monoecious and dioecious
- Male sterility

Why we prefer hybrid seed technology on open pollinated

- Distinct yield advantage compared to open pollinated varieties
- Ability to produce hybrid seed on commercial scale at economic level

Hybrid seed production in allogamous plants

- In nature to create genetic variability and for its wider adaptation in different environmental conditions, flowering plants has adopted many mechanisms for cross pollination.
- Cross-pollination results in genetic heterogeneity and show wider adaptations. In cross pollinated plants it is easy to produce hybrids as there are many mechanism that promote cross pollination in nature i.e..
Dicliny(Unisexuality), Dichogamy, Herkogamy, Self Incompatibility, Male Sterility.

Hybrid seed production in Autogamous plants

- For self-pollinating plants, the plant must be male sterilized during the crossing process in order to avoid self-fertilization.
- There are various mechanism / contrivances that promote / facilitate self-pollination.

Cont....

- With the proven impact of hybrid seed technology, new tools for hybrid breeding were discovered and utilized for self-pollinating crops including cytoplasmic male sterility (cms).
- Cytoplasmic male sterility is a condition where the plant is unable to produce functional pollen and would rely on other pollen source to produce seeds. This greatly facilitates large scale hybrid seed production, by-passing hand pollination

How male sterility manifests in plants?

- The absence or mal formation of male organs (stamens) in bisexual plants or no male flowers in dioecious plants.
- Failure to develop normal anther.
- Abnormal micro sporogenesis leading to inviable pollen.
- Abnormal pollen maturation inability to germinate on compatible stigma.
- No dehiscent anthers but viable pollen sporophytic control.
- **Barriers preventing pollen from reaching ovule.**

classification of male sterility

- There are basically, two types of classification of male sterility.
- Phenotypic classification
- Penotypic Classification

phenotypic classification

Phenotypic classification includes

- Structural male sterility (anomalies in male sex organs)
- Sporogenous male sterility (stamens form, but pollen absent)
- Functional male sterility (viable pollen form, but barrier prevents fertilization, inability of pollen to migrate to stigma or other factors that affect fertilization).

Genotypic classification

Cytoplasmic Male Sterility (CMS)

The pollen sterility which is controlled by cytoplasmic genes is known as cytoplasmic male sterility (CMS).

Usually the cytoplasm of zygote comes primarily from the egg cell and due to this progeny of such male sterile plants would always be male sterile.

Utilization in Plant Breeding:

CMS has limited application. It cannot be used for development of hybrid, where seed is the economic product. But it can be used for producing hybrid seed in certain ornamental species or asexually propagated species like sugarcane, potato, and forage crops.

Genetic Male Sterility

- Male sterility is controlled by mutations in nuclear genes in the single recessive genes affect stamen and pollen development, but it can be regulated also by dominant genes E.g Safflower
- The maintenance of the male sterile line. Normally, a GMS line (A-line) is maintained by backcrossing with the heterozygote B-lines (Maintainer lines), but the progeny produced are 50% fertile and 50% male sterile.

Utilization in plant breeding

- Male fertile plant from the female is costly operation and due to this cost of hybrid seed is higher. Therefore, GMS has been exploited commercially only in few crops by few countries. E.g. In USA used in castor while in India used for hybrid seed production of Arhar (*cajanus cajan*).

Environment-sensitive genic male sterility (EGMS)

- ▶ Male sterility system is controlled by nuclear gene expression, which is influenced by environmental factors.
- TGMS(Temperature sensitive genic male sterility)
PGMS(Photoperiod sensitive genic male sterility)
TPGM(Photo-thermo sensitive genic male sterility)

Chemical induce male sterility

- This non-genetic method of inducing male sterility involves the use of chemical called hybridizing agents (CHA's) or Gametocides.

Tree lines hybrid seed technology

- Since this system involves three lines (A, B and R line) it is called as three line system.
- The hybrids developed by utilizing this system are called as three line hybrids.

Requirements for 3 Lines in CMS System

➤ **A-line**

1. Stable Sterility
2. Well developed floral traits for outcrossing
3. Easily, wide spectrum, & strongly to be restored

➤ **B-line**

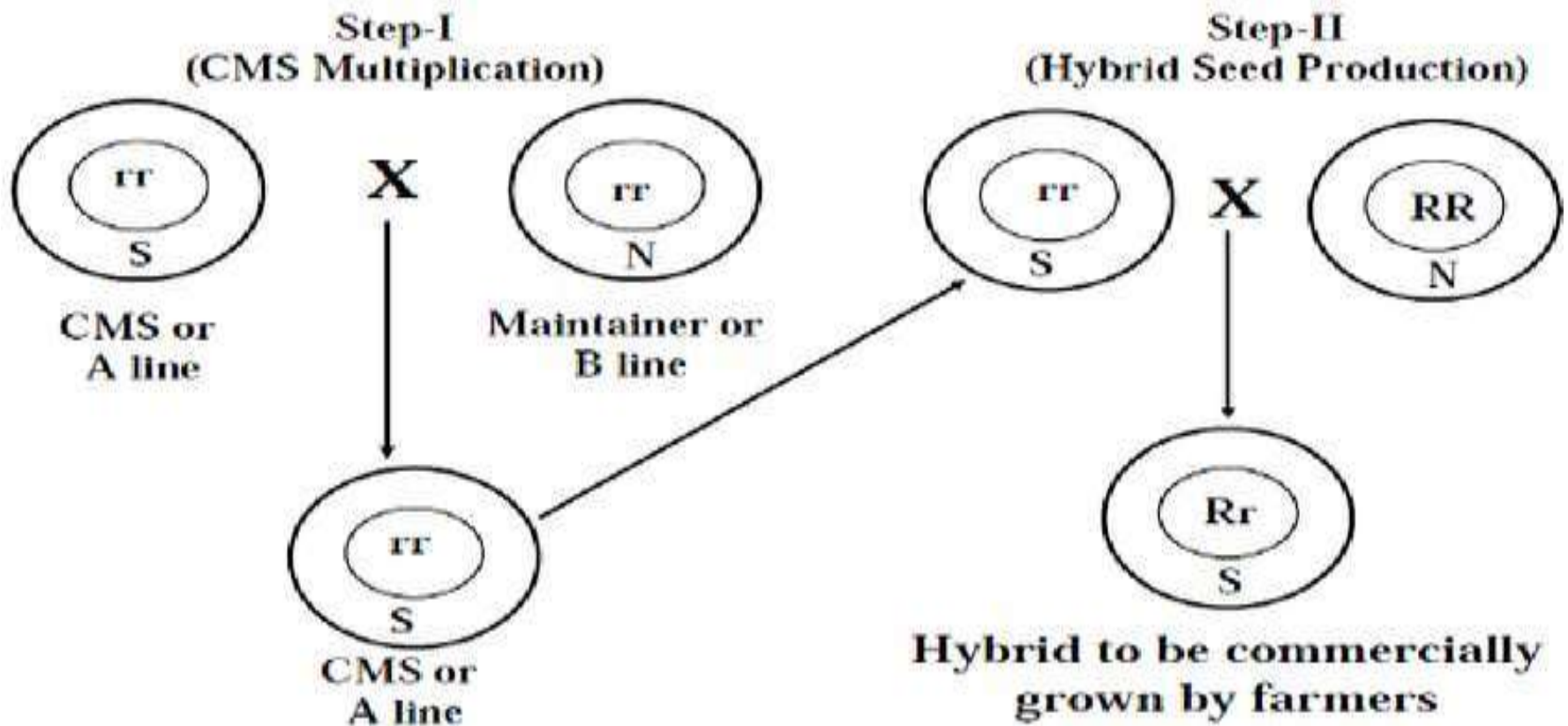
1. Well developed floral traits with large pollen load
2. Good combining ability

➤ **R-line**

1. Strong restore ability
2. Good combining ability
3. Large pollen load, normal flowering traits and timing

Steps:-

- CMS multiplication (A x B)
- Commercial hybrid seed production (A x R)

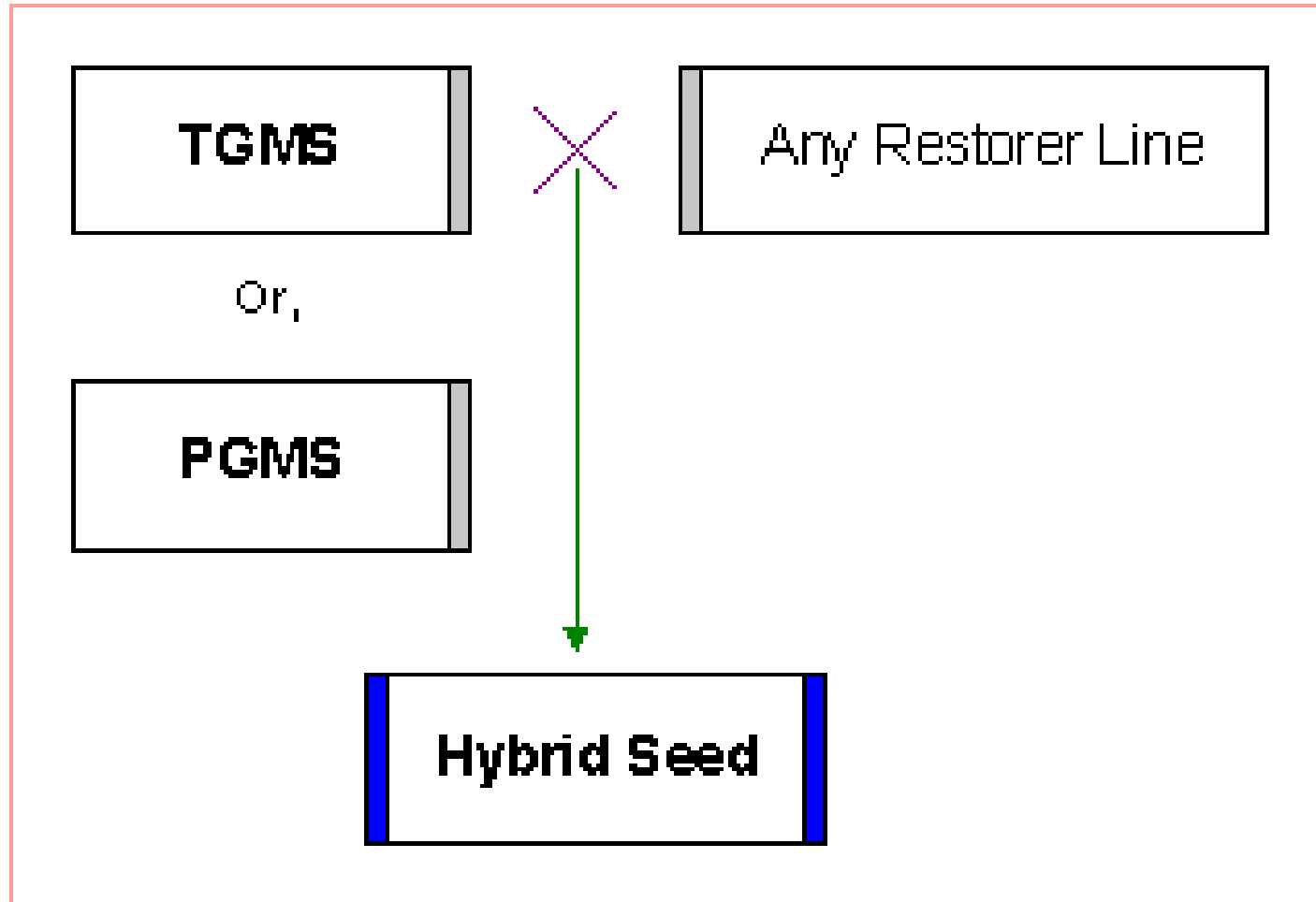


TWO LINE SYSTEM

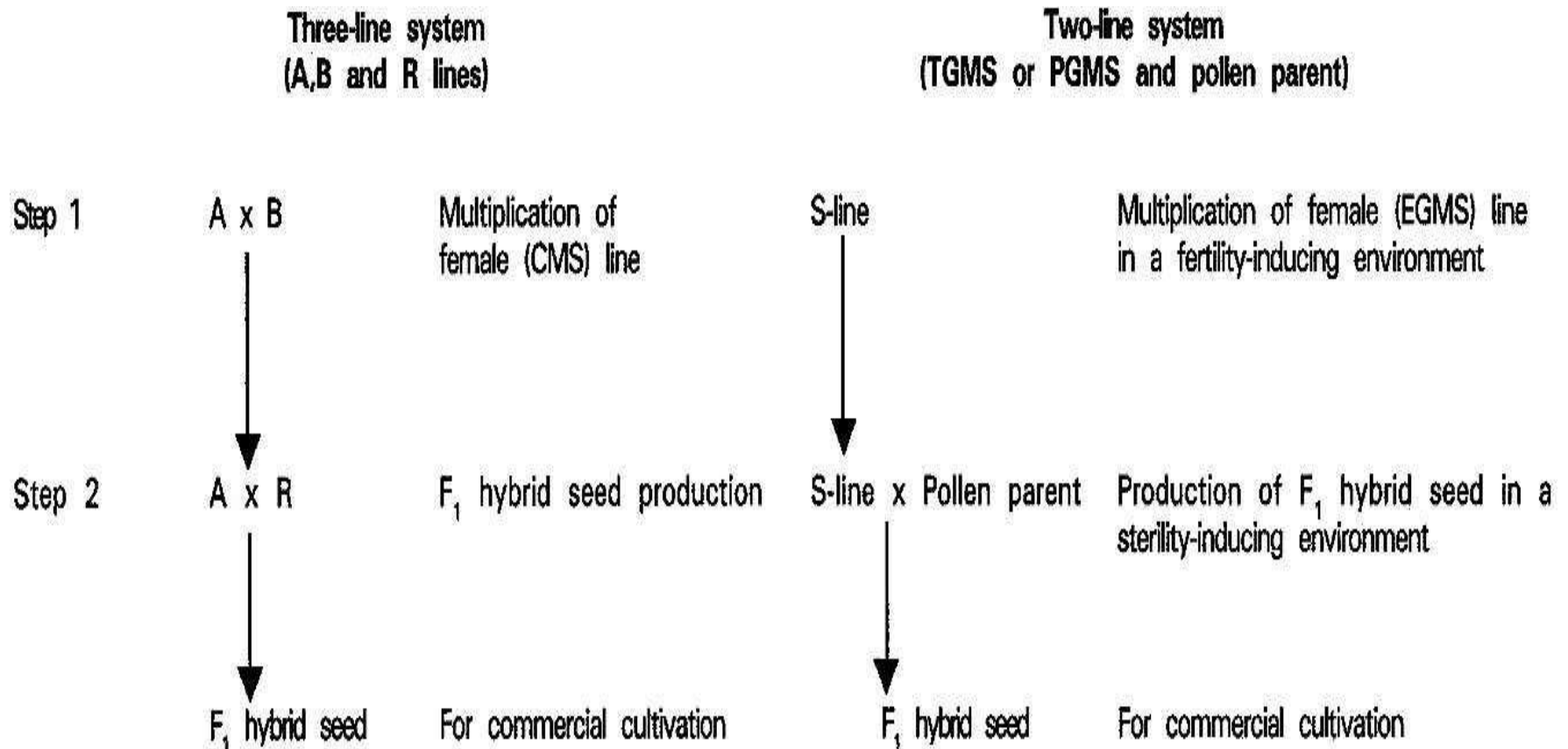
Hybrids produced by chemically induced male sterility are also called two line hybrids.

- Multiplication of EGMS lines
- Hybrid rice seed production

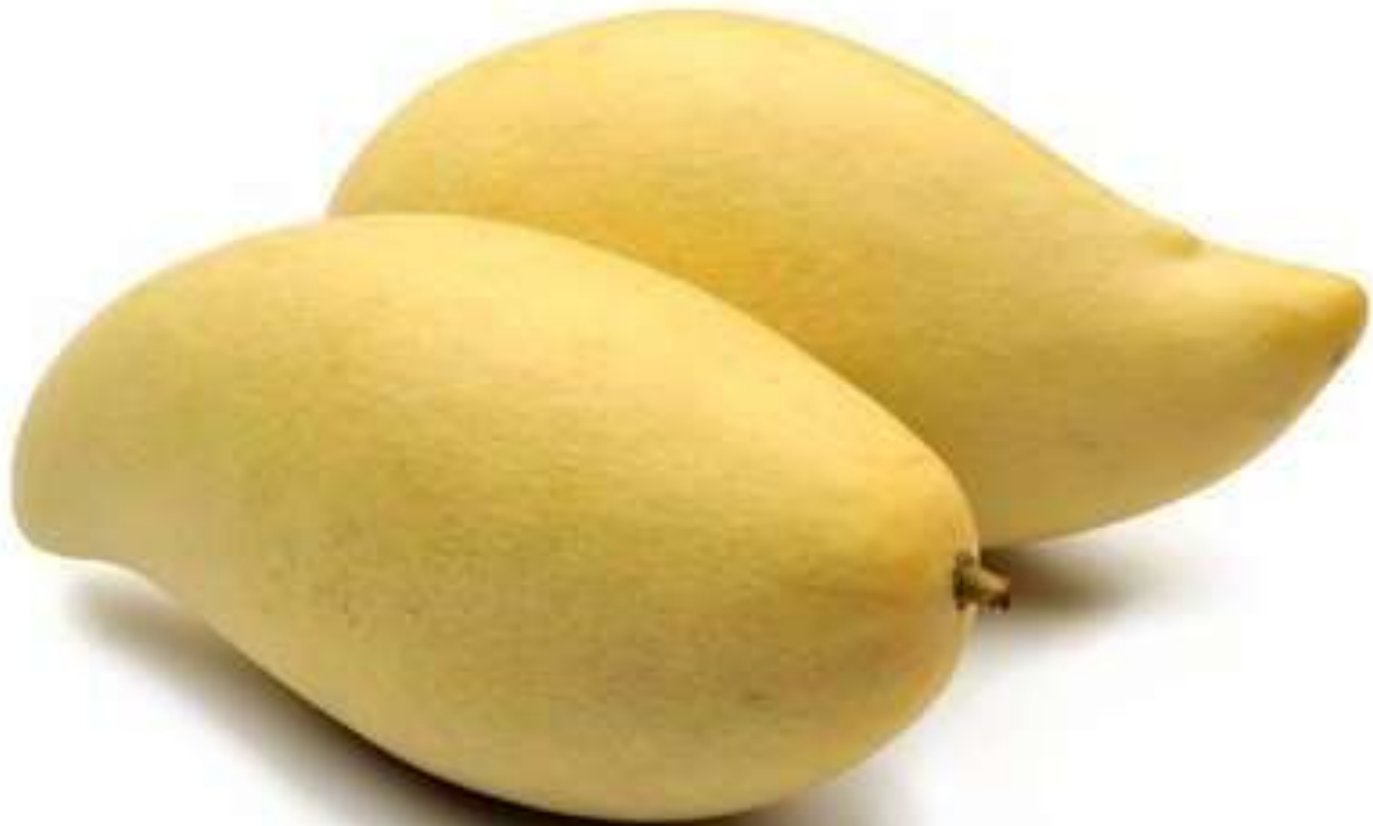
TWO – LINE SYSTEM



Advantages of Two-line v/s Three-line System



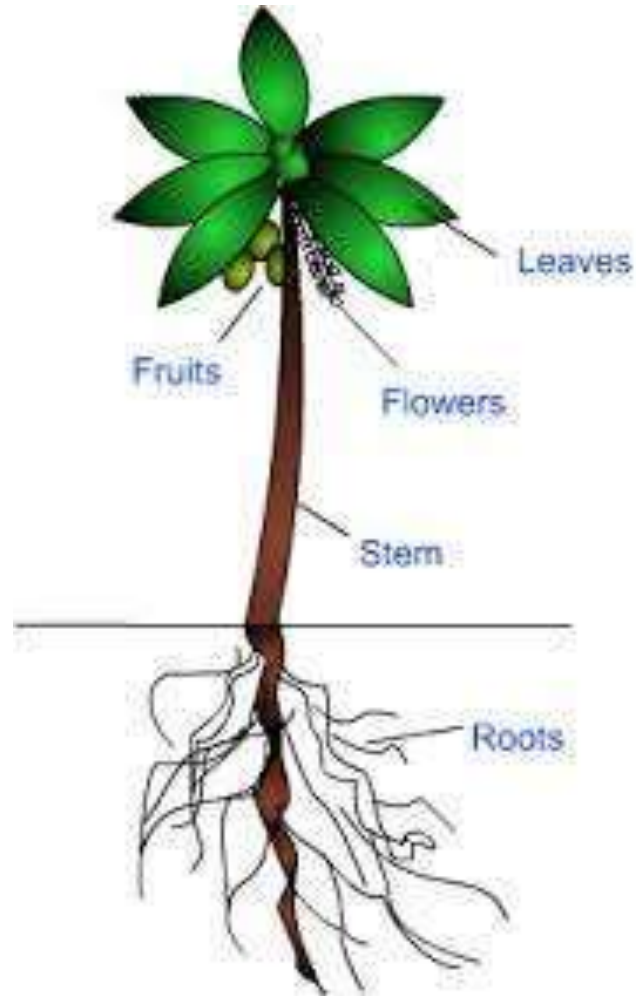
Mango



Classification

➤ Domain	Eukarya
➤ Kingdom	Plantae
➤ Class	Magnoliopsida
➤ Order	Sapindales
➤ Family	Anacardiaceae
➤ Genus	Mangifera
➤ Species	M. indica

Structure



objectives

- An ideal mango variety should possess tree dwarfness.
- Attractive (golden apricot) color on ripening.
- medium size (5 in a kg)
- Good quality fruit (high pulp: stone ratio, firm and fibreless flesh);
- Highly tolerant to various diseases including malformation and pests; and high keeping quality.

It would be futile to take up all these objectives at a time in any mango breeding program. Therefore, these characters are to be incorporated at stages and the variety is to be built up gradually.

Agronomy



Climate

The mango is adapted to both tropical and subtropical conditions. Temperature range is 21-25°C. Rainfall of at least 600 mm/year and an altitude of 1,500-2,000 m are ideal for the crop. The crop is intolerant to saline conditions.



Soil

Mangoes require deep soils with good drainage not necessarily fertile but mangoes can thrive in a wide range of soil types.



Planting

Medium fine field is adequate. Dig holes 60 cm deep and 60 cm ,Mix well decomposed manure with top soil at 1:1 ratio and put back into the hole to cover the first 30 cm.



watering

When planting is done during low rainfall season, the young plants should be watered at least once a week to avoid drying.



Fertiliser Requirements

Apply manure once a year at the beginning of the rainy season. Put at least 2 tins per tree, applied around one metre from the tree. Avoid putting too much nitrogen fertilizers to your mango plants during productive stage. Smoking in the field and cutting the bark of the tree encourages flowering.



Harvesting

Harvest mature fruits and with smooth, undamaged skin. Use a long stick with a knife and basket at the tip or just long stick with knife and clothes or polythehe spread below, Avoid picking fruits from the ground.



Production

Depending on the variety, the time from flowering to maturity is 100-150 days. Under good management 400-600 fruits per tree per year can be produced. Yield range is 10-16 ton/ha .



Medicinal Value

- Prevents Cancer
- Lowers Cholesterol
- Clears the Skin
- Improves Eye Health
- May Help with Diabetes
- Promotes Healthy Sex
- Improves Digestion
- Helps Fight Heat Stroke
- Boosts the Immune System

Tobacco



Classification

Domain:	Eukarya
Kingdom:	Plantae
Phylum:	Magnoliophyta
Class:	Magnoliopsida
Order:	Solanales
Family:	Solanaceae
Genus:	<i>Nicotiana</i>
Species:	<i>Nicotiana tabacum</i>

Structure



objectives

- Examine crop substitution and the profitability of tobacco and alternative agricultural crops.
- Analysis the relative costs and profitability of agricultural crops with the existing data analysis the relative costs and profitability of agricultural crops with the existing data
- Discuss and outline the main issues that need to be considered as part of a crop diversification program.

Seed germination

Tobacco seed require warm temperatures for germination of about 75-80 degrees. Seed should be started indoors 4-6 weeks before your last frost date. **DO NOT** cover the seed with any soil as they need light for germination and covering can slow down germination time or if covered too deeply the seed won't germinate at all, watering in lightly is all that is needed.



Soil

The soil should be kept moist but not soggy and should never be allowed to dry completely out.



Watering

- Care should be taken when watering freshly emerging tobacco seedlings because the force of the water can uproot the tiny seedlings causing them to die. The best way to water seedlings is from the bottom, the way this is accomplished (if you are using a pot with holes in the bottom) sitting the container with the seedlings into a pan of water for only a few seconds or a bit longer, the potting mix will wick the water up into the seedling container allowing your seedlings to be water without getting the leaves wet.

Transplanting into trays or Pots

The next step is to transplant the tobacco seedlings into a larger container such as a pot or transplant cell tray. so that they can develop a good root system. Under 'normal' conditions the tobacco seedlings will be large enough and ready for moving into pots or cells after 3 weeks from the beginning of germination.



Fertilizers

- The initial fertilizing you gave at the potting stage should be sufficient food for the plants until they reach transplanting stage, which normally takes approximately 3-4 weeks. If your plants begin to yellow or look stunted another dose of fertilizer may be needed but do so sparingly, over fertilization while in pots or trays may burn the plant's roots and may also lead to overgrown spindly plants.

Transplanting into garden

Tobacco is a heavy feeder and if grown continuously in the same spot will deplete the nutrients in the soil. So to counteract this it is wise to employ a 2 year rotation in your growing space by planting 2 years in a specific location and waiting a year or more before you plant your tobacco back into that location again. Tobacco also requires good amounts of nitrogen and potash.



Space the tobacco plants 2-3 feet apart in the row and space rows 3 1/2 - 4 feet apart when it is practical.



Thank You

