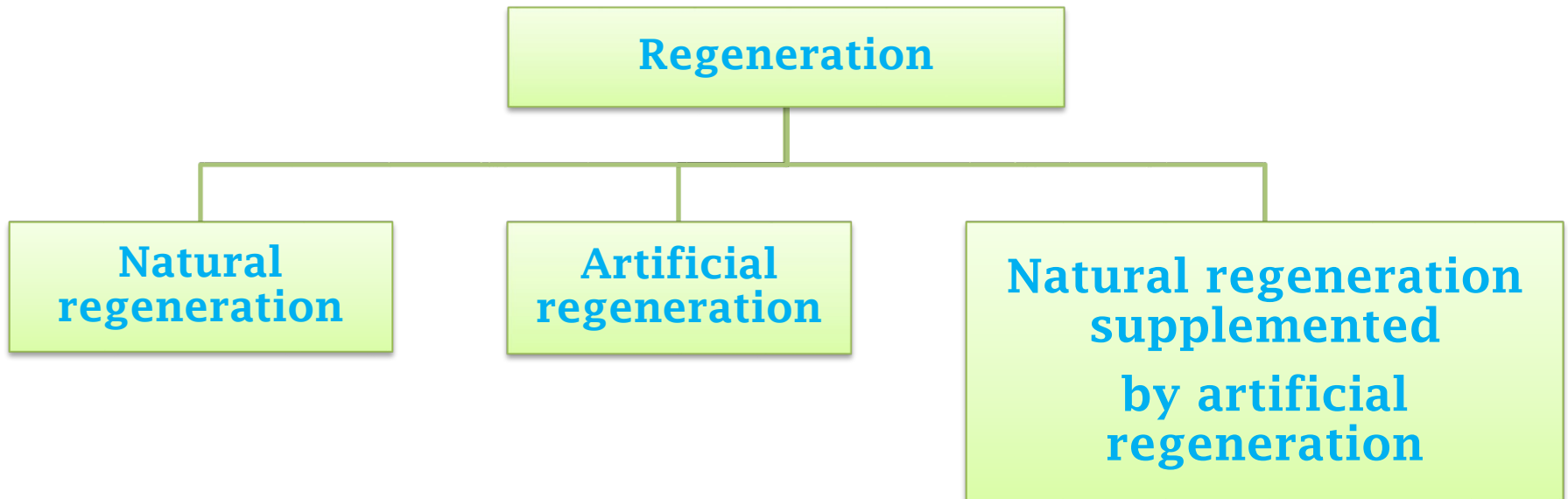


**NATURAL REGENERATION
&
ARTIFICIAL REGENERATION**



REGENERATION

Regeneration is ‘the renewal of a forest crop by natural or artificial means’



A photograph of a forest showing natural regeneration. In the foreground, a large, textured tree trunk stands on the left. The ground is covered in dense, vibrant green undergrowth, including various shrubs and small plants. In the background, numerous tall, slender trees with green foliage rise up, creating a dense canopy. The overall scene is lush and green, indicating a healthy and regenerating forest.

Natural regeneration

WHAT IS NATURAL REGENERATION?

Natural regeneration refers to the ‘ **natural process by which plants replace or re-establish themselves** ’

TWO MAIN SOURCES:

- 1.From seed**
- 2.From vegetative part**



NATURAL REGENERATION FROM SEED DEPENDS UPON:



Seed production



Seed dispersal



Germination



Establishment

SEED PRODUCTION

- ✓ Natural regeneration from seed is the production of adequate quantities of fertile seed by the trees of the area.

THE PRODUCTION OF SEED DEPENDS UPON

1. Seed year
2. Age of trees
3. Size of crown
4. Climate
5. External factors

CLIMATE

- ✓ In the hill the trees growing towards the lower limit of the altitudinal zone of their species produce more seeds than those growing towards the upper limit.
- ✓ Hot dry years are generally followed by heavy seed year on account of increase in photosynthesis.
- ✓ Heavy storms at the time of pollen dissemination reduced changes of good seed production

EXTERNAL FACTORS

- ✓ Injury by fire
- ✓ Insect attack

SEED DISPERSAL

✓ The seed produced by the trees is dispersed by many agency.

1. **By wind**-Conifers, Casuarina, Dalbergia,etc.
2. **Water** -Teak, most mangrove species,etc
3. **Gravity** -Oaks,Aesculus,Juglans regia,etc
4. **Birds** -Mulberry,Trema,prunus,etc
5. **Animals** -Acacia arabica, prosopis juliflora,etc.

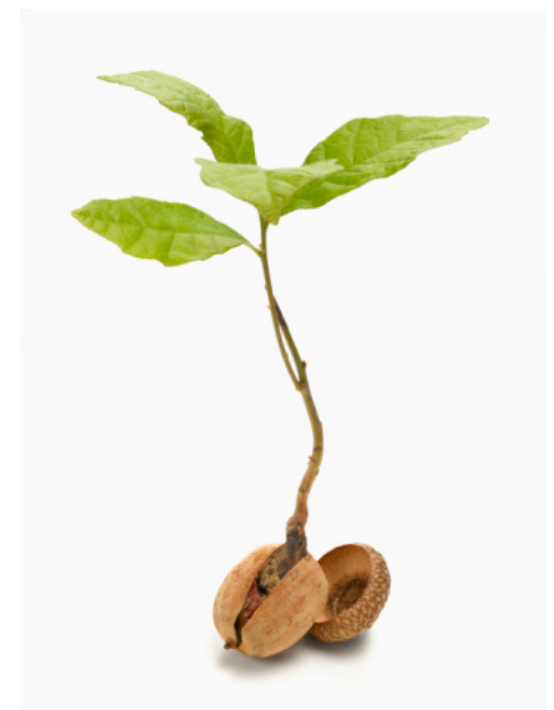


GERMINATION

- ✓ After dispersal, a lot of seed is destroyed by insects, birds and rodents. They deposited in soil.

GERMINATION OF SEED DEPENDS UPON

1. Internal factors
2. External factors



INTERNAL FACTORS

1. *Permeability to water*
2. *Permeability to oxygen*
3. *Development of embryo*
4. *After-ripening*
5. *Viability*
6. *Size of seed*
7. *Germination capacity*
8. *Germination energy*
9. *plant percent*

PERMEABILITY TO WATER

Moisture is very essential for germination. If the seed has hard seed coat, it prevent moisture reaching the seed embryo and therefore prevents germination.

PERMEABILITY TO OXYGEN

Oxygen is necessary for germination. Factors which inhibits moisture reaching the seed, also prevent oxygen reaching it.

DEVELOPMENT OF EMBRYO

The embryo should be fully developed at the time of seed fall eg. *Fraxinus floribunda*

AFTER-RIPENING

If the embryo is fully developed, seed, sometimes do not germinate because the embryo is not chemically ready for germination. Such seeds germinate after ripening

E.g. *Juniperus macropoda*

VIABILITY

Potential capacity of a seed to germinate

E.g. Under natural condition sal seeds remain viable for about a week. If monsoon is delayed most of the seeds that fall on dry ground and die

SIZE OF SEED

The Size of seed, affect natural regeneration because while very minute seeds are washed away with the rain water, very big seeds do not get properly covered by soil or humus and so do not germinate.

EXTERNAL FACTORS

1. Moisture
2. Air
3. Temperature
4. Light
5. Seed bed



SEEDLING ESTABLISHMENT

- ✓ Establishment is defined as the development of a new crop, to a stage when young regeneration is considered safe from normal adverse influences such as frost, drought and weeds.

FACTORS AFFECTING ESTABLISHMENT

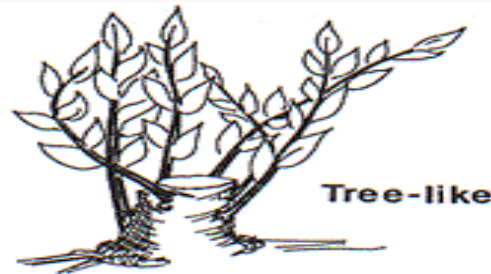
1. Development of roots
2. Soil condition
3. Light
4. Climatic factors
5. Competing weed growth
6. Grazing, browsing and burning
7. Drip
8. Composition of the crop

NATURAL REGENERATION FROM VEGETATIVE PART

- ✓ Vegetative reproduction is defined as a sexual reproduction in plants from some part of the plant body.
- ✓ e.g., Of trees by coppice or root sucker or from root.

METHODS OF VEGETATIVE REPRODUCTION

1. Coppice
2. Root sucker



NATURAL REGENERATION BY COPPICE

Coppice shoot

A shoot arising from an adventitious bud at the base of a woody plant that has been cut near the ground or burnt back

Obtained by



Seedling Coppice

- Shoot coppice arising from the base of seedling that have been cut or burnt back
- Cutting back woody shoots



Stool Coppice

- Shoot coppice arising from the stool or a living stump
- Shoot arising from the adventitious buds of a stump of felled trees



FACTORS AFFECTING NATURAL REGENERATION BY COPPICE

- ✓ Species
- ✓ Age of trees
- ✓ Season of coppicing
- ✓ Height of stump and method of cutting it
- ✓ Rotation
- ✓ Silvicultural system

The Controlling Factors



SEED SUPPLY



SOIL CONDITION



COMPETITION



PREDATION OF YOUNG PLANTS



**NATURAL HAZARDS AND
CONTROLS**

SEED SUPPLY

- ✓ No seed, or seed of poor viability.
- ✓ Absence of fertile plants with viable seed
- ✓ Seed harvesting by ants and predation by other insects, birds and mammals
- ✓ Lack of fire
- ✓ Lack of pollinators
- ✓ Seasonal variations



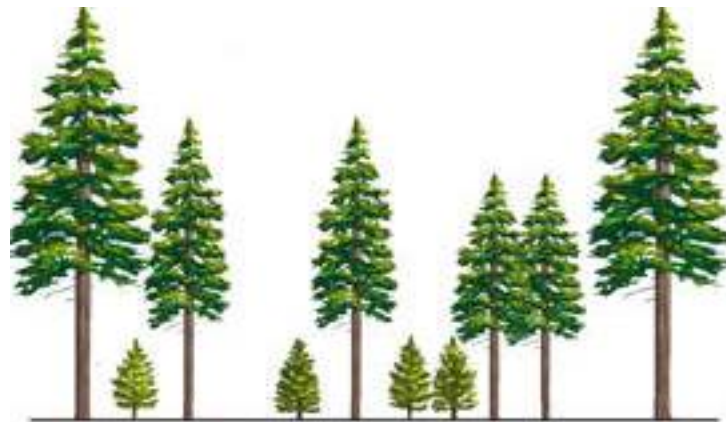
SOIL CONDITION

- ✓ Soil compaction
- ✓ Loss of topsoil
- ✓ Unstable site
- ✓ Salinity
- ✓ Lack of water holding capacity
- ✓ Poor aeration



COMPETITION

- ✓ Competition from other trees species
- ✓ Competition from weeds: eg. *Strobilanthes* and *Petalidium* in Teak
- ✓ Parent plant allelopathy : eg *Eucalyptus*
- ✓ Fungal attack



PREDATION OF YOUNG PLANTS

- ✓ Insects or other invertebrates: Caterpillars, crickets, beetles, mites, nematodes, and other invertebrates eat seeds and seedlings
- ✓ Stock: cattle, sheep, horses and goats
- ✓ Native wildlife: Deer, hares, Elephant and Bison



NATURAL HAZARDS AND CONTROLS

- ✓ Fire,
- ✓ Flood,
- ✓ Wind,
- ✓ Drought,
- ✓ Temperature extremes (eg frosts)



Natural Regeneration

Advantages

- ✓ Preservation of locally adapted populations
- ✓ Preservation of high genetic variability
- ✓ Good adaptation to micro-sites
- ✓ Undisturbed root development
- ✓ Mostly low cost
- ✓ Low investment risk

Natural Regeneration

Disadvantages

- ✓ Inability to change genetic stock
- ✓ Irregular regeneration density and tree species composition
- ✓ Dependence on fructification and seed production
- ✓ Low flexibility
- ✓ High management intensity and complexity
- ✓ Long risk period

Artificial regeneration



WHAT IS ARTIFICIAL REGENERATION?

Artificial regeneration is defined as ‘ **the renewal of a forest crop by sowing, planting or other artificial methods** ’



Objects

✓ Reforestation:

Restocking of a felled or otherwise cleared woodland by Artificial means

✓ Afforestation:

Establishment of a forest by Artificial means on an area from which forest vegetation has always long been absent



ESSENTIAL PRELIMINARY CONSIDERATION



Selection of site



Choice of species



Choice of method of artificial regeneration



Spacing



Arrangement of staff and labour



Vegetative propagation

SITE SELECTION

- ✓ Spp. to be raised are already known
- ✓ Spp. With particular use
- ✓ Local vegetation is the best indicator



CHOICE OF SPECIES

- ✓ Climate and micro - climate
- ✓ Soil conditions
- ✓ Stages of succession
- ✓ Object of management
- ✓ Consumers requirement
- ✓ Growth rate
- ✓ Availability of suitable exotic
- ✓ Ease of establishment
- ✓ Cost
- ✓ Effect on site



NURSERY PRACTICES USED TO INFLUENCE SEEDLING QUALITY

- ✓ Seed source
- ✓ Seedbed density
- ✓ Control insects and disease
- ✓ Control competition
- ✓ Irrigate and fertilize
- ✓ Inoculate with mycorrhizae
- ✓ Top prune





Casuarina equisetifolia

Casuarina junghuniana





Clonal origin

seed origin

PRODUCTION OF QUALITY SEEDLINGS

Preparation of soil mixture(1:1) ratio

Mist chamber sprayed with 10 ml/lit of formalin for sterilization

Closed air tight for 24 hr and opened for next 24 hr

Filled poly bags staked inside the chamber

Cuttings collected from CMA
Both nodal and leafy cuttings are used

Soaked in bavistin for 10-15 min

Dipped in IBA

Casuarina 4000 ppm; *Eucalyptus*-5000 ppm

Planted in poly bags inside the chamber

Same day evening sprayed with bavistin(1g/lit H₂O)
& dithane M 45 (1g/lit H₂O) to avoid fungal infection
For 500 bags

Watering (intermittent mist) done once
in a day
Temp-35 to36 c & RH- 85 to 90%

7th day sprayed with bavistin & Dithane
M 45 (1g in 1 lit H₂O each) for 1000 bags

Repeated for 14th day also

PRODUCTION OF QUALITY SEEDLINGS

21st day sprayed with cytozyme(1ml in 1lit) + multiplex growth tonic (2 ml in 1 lit water) for 1000 bags

30th day the chamber is opened to kill the unrooted seedlings

31st day evening the seedlings are shifted to the shade house

Maintained the seedling in 20-30 days and sprayed with same growth promoting substance in 4th / 5th day

Shifted to open hardening area and hardened for 30 days

PLACE	DURATION
Mist chamber	30 days
Shade house	20-30 days
Open hardening area	30 days
Total	80-90 days

CHOICE OF METHOD OF ARTIFICIAL REGENERATION

- ✓ Sowing seeds (Broad-cast sowing, Line sowing, Stripe sowing, Patch sowing, Dibbling)
- ✓ Seedlings
- ✓ Cutting

TYPE OF PLANTING	ADVANTAGE	DISADVANTAGE
SOWING	Less cost, easy work	Large quantity of seed is required, Seedling mortality is high
PLANTING	Less material is required, less damage by animals	Planting is costlier, requires more labour

Spacing

- ✓ Spacing is varies with sp to sp

Factors governing spacing

- ✓Rate of growth
- ✓Habit of branching
- ✓No of annual rings/centimeter
- ✓Height of planting material
- ✓Site factors
- ✓Inter-cultivation
- ✓Market for small-sized timber
- ✓Fruit production as objective
- ✓Cost



Arrangement of staff and labour

Mechanization

- ✓ Soil preparation (Ploughing, Harrowing, Ridging)
- ✓ Digging pits for fence posts
- ✓ Transport
- ✓ Fire protection



Vegetative propagation

- **CUTTINGS**

Any portion removed from the parent plant

- **GRAFTING**

An art of joining parts of plants together in such a way that they will readily unite and continue to grow as one plant

- **BUDDING**

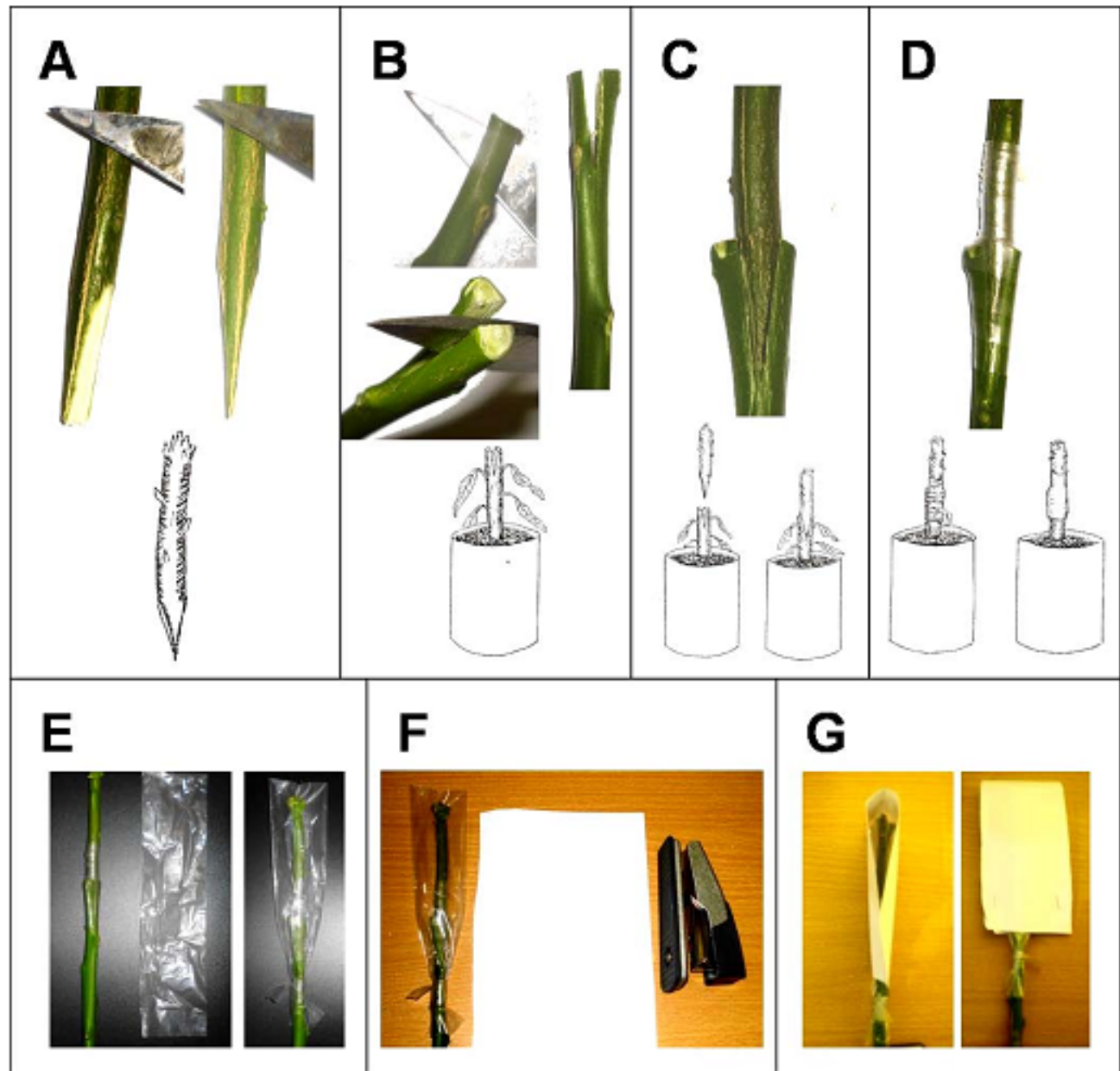
Budding is a variation of grafting in which the scion is a dormant bud with a small patch of attached bark

- **LAYERING**

Formation of roots on branches while they are still attached to the tree

Schematic 24: Green Cleft Grafting

Grafting in oil seed tree species



Source: Photo by Ferenc Sandor. Graphic design by Forestry Commission, Harare, Zimbabwe

Schematic 12: Chip-budding

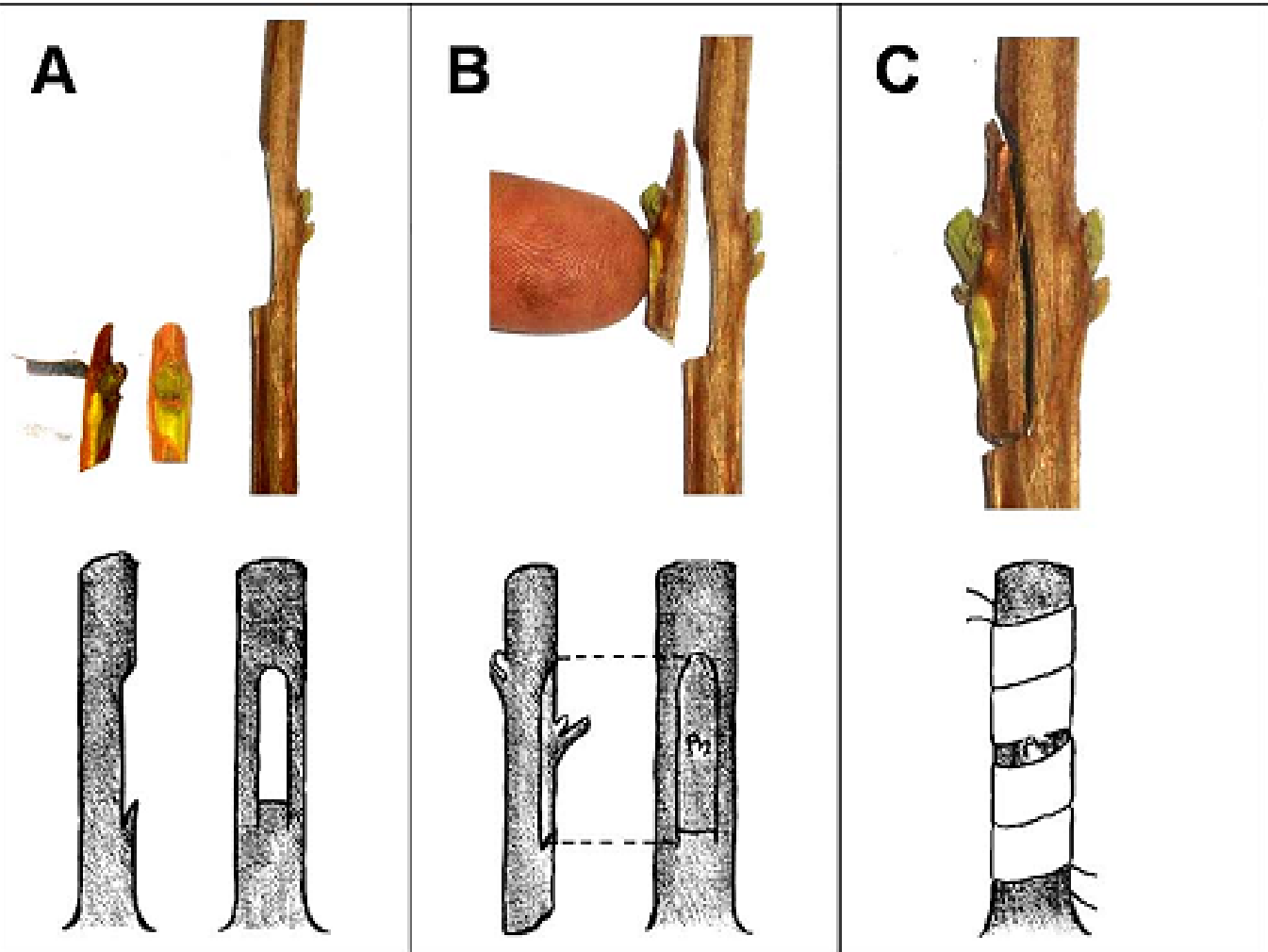
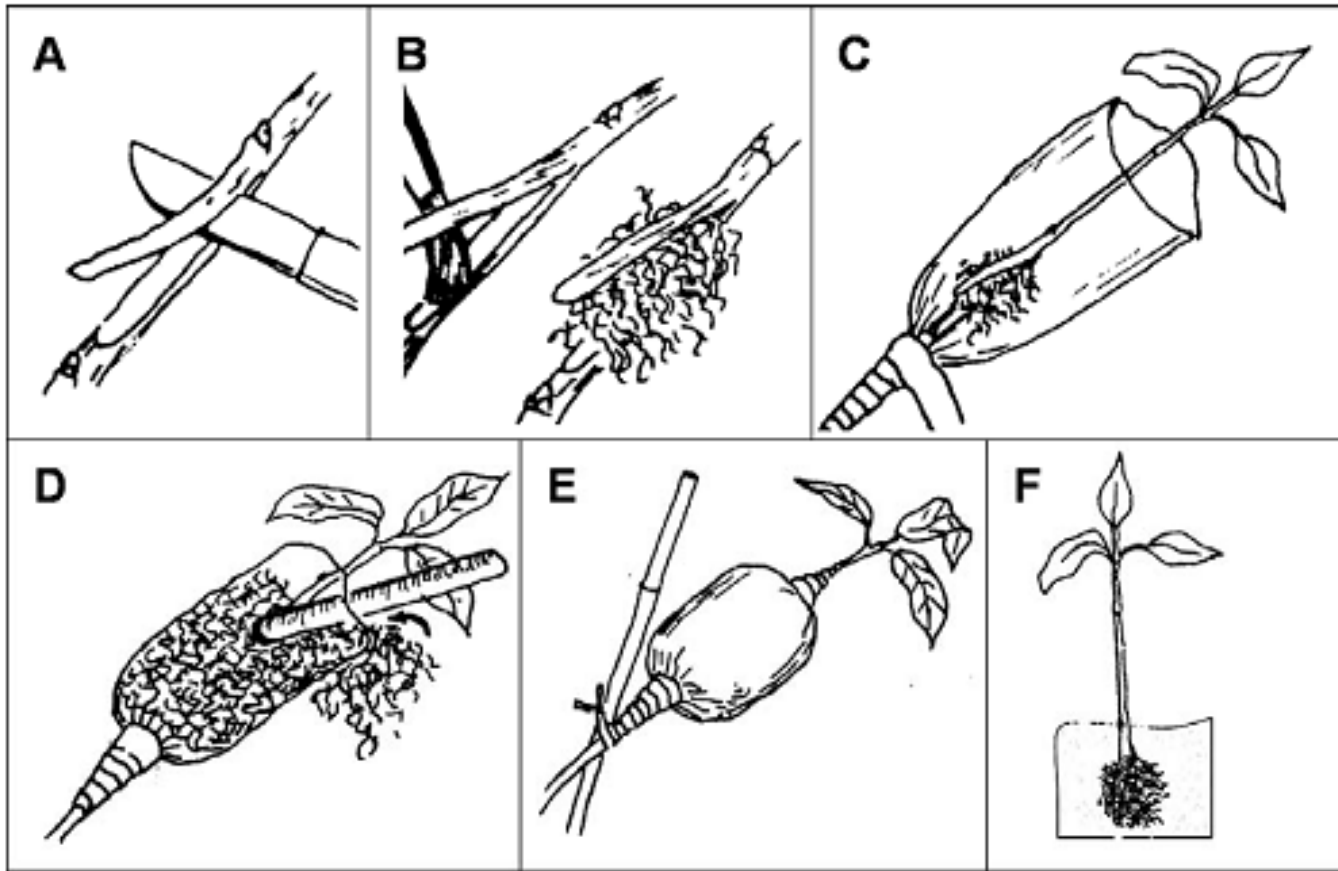


Photo by Ferenc Sandor. Graphic design by Dr. Cselotei-Dr. Nyujto-Csaki, Horticulture, Mezogazdasagi Kiado, Budapest, Hungary (1985)



Source: Growing fruit trees. Forestry Commission, Harare, Zimbabwe

Factors affecting the choice between AR & NR

- ✓ Risk of loss and determination of soil
- ✓ Crop composition
- ✓ Genetic consideration
- ✓ Risk of damage by pests
- ✓ Flexibility of operation
- ✓ Density of stocking
- ✓ Yield
- ✓ Time factor
- ✓ Cost

Artificial Regeneration

Advantages

- ✓ Controlled plant density
- ✓ Predictable seedling production
- ✓ High flexibility
- ✓ Low management intensity
- ✓ Option of introducing improved seed or plant material
- ✓ Changing species and/or varieties

Artificial Regeneration

Disadvantages

- ✓ Labors-intensive
- ✓ Temporarily disturbed root development
- ✓ Less adapted to micro-sites
- ✓ Cost-intensive

WHY WE GO TO NATURAL REGENERATION INTO ARTIFICIAL REGENERATION

- ✓ **Quality planting stock**
- ✓ More production
- ✓ Meet the industrial demand
- ✓ Assumed planting stock
- ✓ Resistant varieties
- ✓ Reduced rotation age
- ✓ Multiply suitable spp
- ✓ Clonal propagation
- ✓ Timing silvicultural operation





Quality planting stock



A vibrant, sun-drenched forest scene. Tall, slender trees with dense green foliage form a canopy. Sunlight filters through the leaves, creating bright rays and a warm, golden glow. The foreground is a field of green grass and numerous small white flowers, possibly daisies, scattered across the ground.

THANK U...!