



# PLANTATION OPERATIONS & TECHNIQUES

# STEPS IN PLANTATION OPERATIONS

- 1) Planning
- 2) Survey & Site Selection
- 3) Site Preparation
- 4) Fencing
- 5) Alignment and Staking
- 6) Earth working – digging pits
- 7) Transportation of seedlings / plants
- 8) Sowing / Planting
- 9) Manuring & Fertilization
- 10) Irrigation
- 11) Maintenance & Tending

# Step 1. Planning

- Prepare Plantation time table
- <https://www.youtube.com/watch?v=zeag3Bs7F7M>

## Land

- Analyse information of nursery stocks
- Arrange for labour
  - Daily wagers
  - Labour contract
  - Regular Mazdoors



District Plantation and Environment Committee meeting at Raebarely

# Step 2. Survey

Detailed information is gathered during survey regarding

- ***Boundary***
- ***Terrain, Soil and geology***
- ***Vegetation cover***
- ***Drainage conditions***
- ***Communication approach***
- ***Rights and privileges of local people***

The Best site that matches objectives of planting programme is finally selected well in advance

# *Treatment Map*

- Map of the plantation site on a suitable scale
- Earlier plane table survey, but now handheld GPS survey should be done.
- Clearly mention boundaries and other natural features
- Clearly mark the treatment and choice of species to be planted
  - Ploughing
  - Fertilization
  - Irrigation facilities, if any
  - Blocks / Strips / lines w.r.t. Species
  - Special interventions like gully plugging, check dams, trenches, inspection paths
- To be placed in PLANTATION JOURNAL

# PREPLANTING SURVEY AND TREATMENT MAP *contd...*

- ❖ Soil map is prepared to demarcate different zones of soil depth viz.

*Zone I* - shallow soil depth < 10 cm.

*Zone II* - Medium soil depth - 10 – 30 cm and

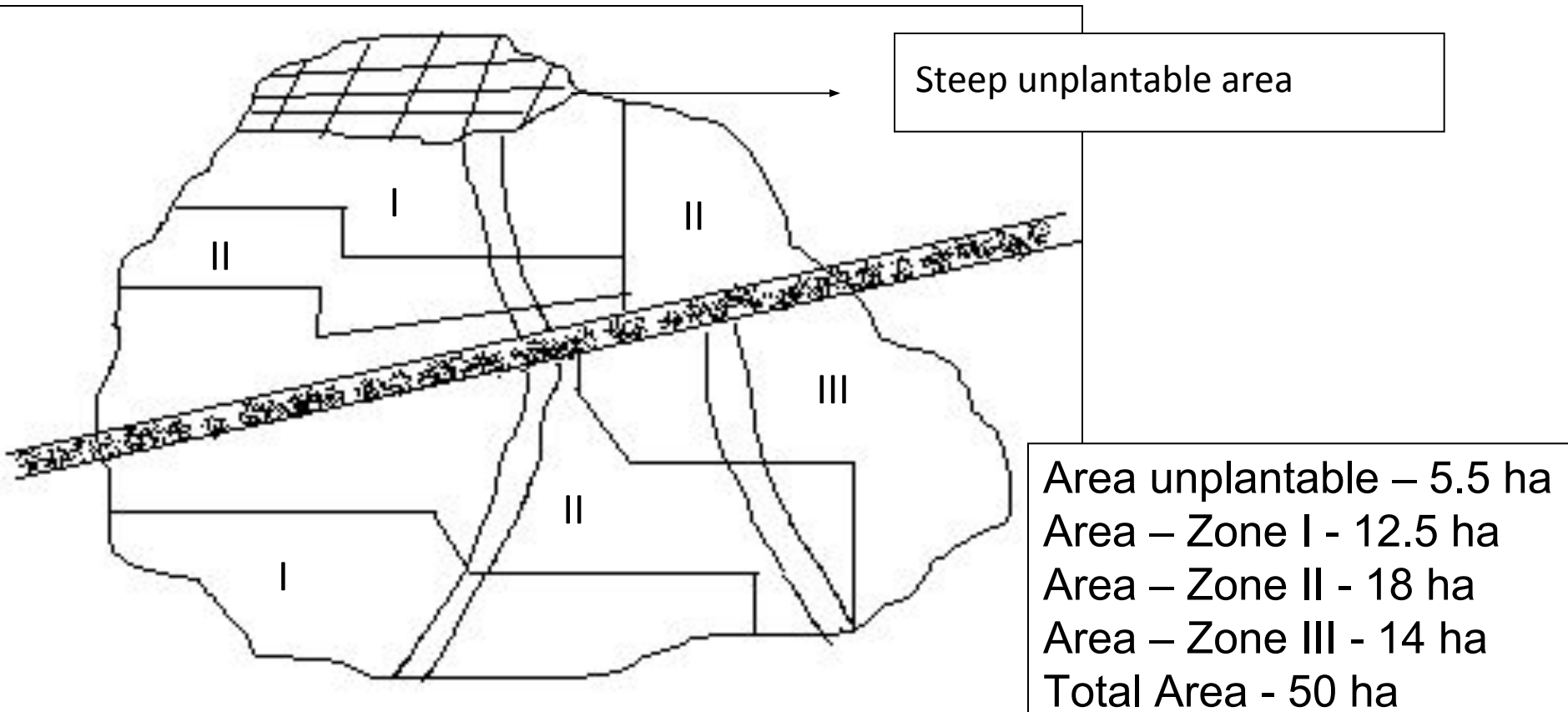
*Zone III* - Deep soils - > 30 cm.

# TREATMENT MAP

- Treatment map is then drawn on a suitable scale (say 20 cm=1.6 km) or 1:15000 scale indicating the type of treatment to be given to each zone, categorized as below:
  - Zone I - Extremely refractory area, where considerable research and experimentation would be necessary to evolve suitable soil conservation and afforestation techniques.
  - Zone II - Suitable for pasture development coupled with tree planting.
  - Zone III - Suitable for tree planting.



# THE MANAGEMENT MAP AND APPRAISAL REPORT



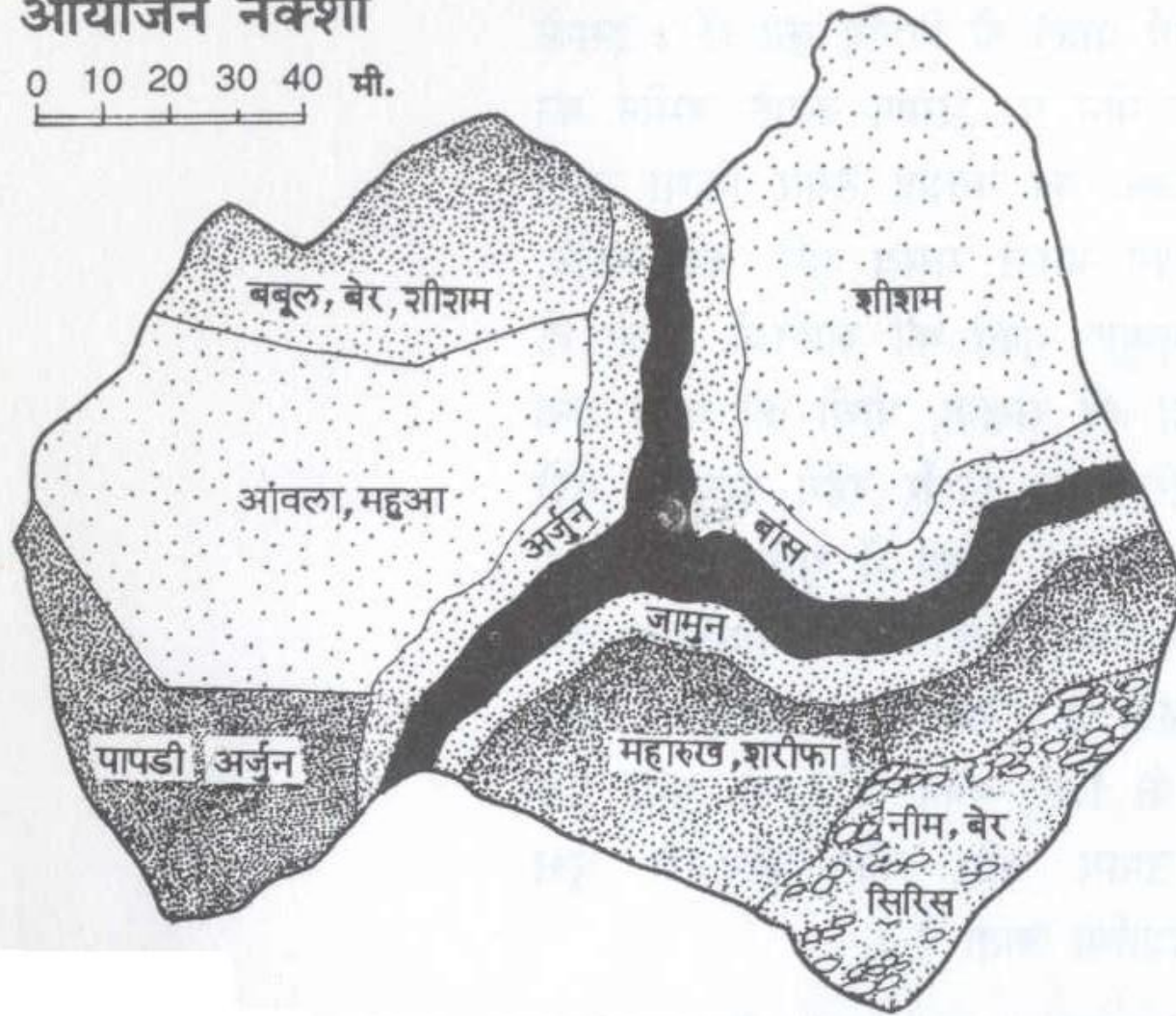
TREATMENT MAP OF DEGRADED AREA

## TREATMENT MAP *contd...*

- Treatment map shows details of river & water courses flowing through the area, water points, layout of roads & inspection paths, slope of different parts of area, soil depth, soil texture, nature of erosion, quality class or nutrient status and area allotted to each species and other such details as may be helpful for plantation or afforestation works.

आयोजन नक्शा

0 10 20 30 40 मी.



Treatment Map

# Step 3. Site Preparation

- Clearing the land
  - *Slash disposal (fire and pest / disease hazard)*
  - *Remove stumps of harvested trees (pest / disease hazard like rots)*
  - *Removal of weeds and unwanted shrubs (in strips / patches / complete)*
  - *Inferior trees that may affect growth of seedlings*
- Ploughing on hard soils (practiced in plains)
- Improve drainage
- Moisture conservation activities



# Step 4. Fencing

- Keep out domestic cattle, wild animals, human beings
- Kinds of fencing
  - Cattle proof barbed wire fence
  - Game proof fence
  - Pig and porcupine proof fencing
  - Stone fencing
  - Trenching

# Cattle proof barbed wire fence

- Fence post either wooden or RCC Post or angle iron
- Wooden is cheapest
- 3-5 strands of B-wire stretched, height of more than 1.5m
- Wooden posts
  - Cheapest, easily available
  - Preference to species like *Erythrina*, *Lannea* etc that sprout easily
- RCC and angle iron fence post costs Rs. 200-300 per post
- Interlacing of B-wire strands with thorny bushes and live hedges.
- Reinforce with live fencing like *Agave*, *Vitex*, *Ipomea*



# Game proof fencing

- Interwoven barbed wire at the bottom
- 5-6 strands of B-wire
- Porcupine and wild boar proofing by burrying bottom b-wire mesh





# Stone fencing

- Possible as per availability of flat / rectangular stones and cheap labour
- Costly
- Common in Lahaul-Spiti of H.P.
- Not penetrable by domestic cattle, wild boars and porcupines
- Trenches dug around plantation to keep out elephants, cattle etc.
  - Very costly, not common

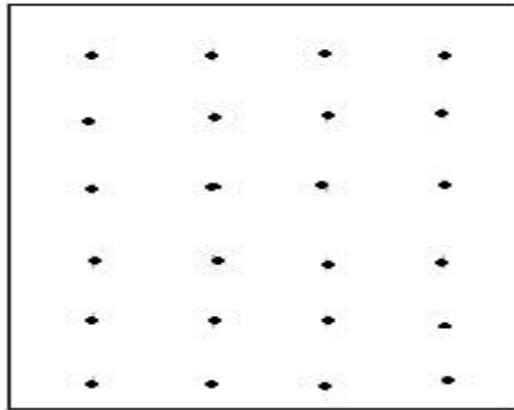


## Step 5. Alignment & Staking

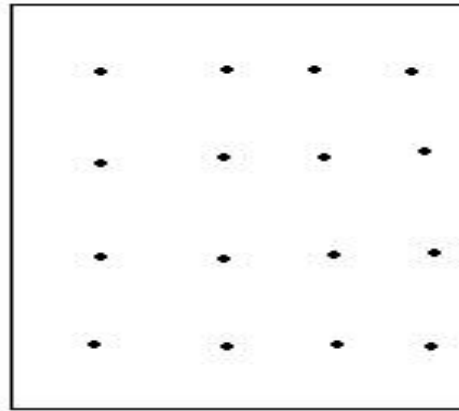
- Staking out: Marking position of lines, rows and pits to be dug using small wooden or bamboo pegs is known as *Staking out*.
- Use ropes, lime and measuring tapes for alignment and staking out at required spacing.
- The Planting pattern should be pre-decided for staking out.

# *Planting pattern*

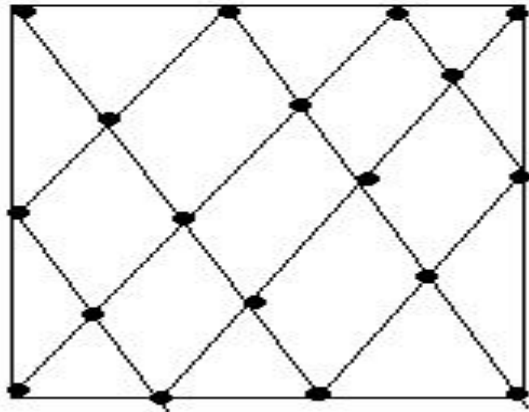
- Line Planting: Planting in line, with each line separated by a particular distance (eg 3m x 2m). Plants occupy four corners of rectangle
- Square planting: Plants occupy four corners of a square (eg: 3m x 3m)
- Triangular planting: Plants occupy three corners of equilateral triangle
- Quincunx planting: An extra plant is placed in the centre of each square



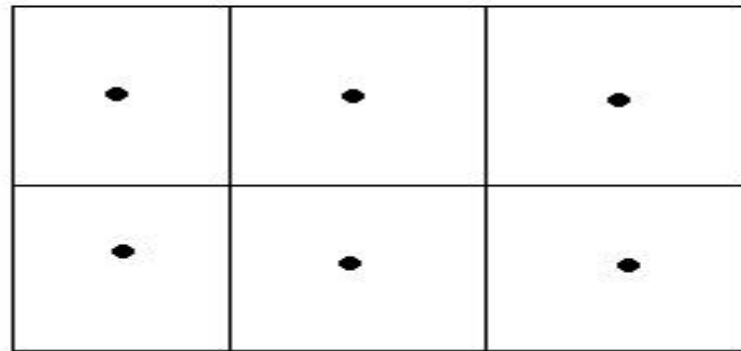
**LINE PLANTING**



**SQUARE PLANTING**



**TRIANGULAR PLANTING**



**QUINCUNX PLANTING**

# Calculation of plants required (Per Ha):

- Line planting

$$N = 100 \times 100 / (\text{dist. of plants in lines}) \times (\text{dist btw lines})$$

- Square planting

$$N = 100 \times 100 / (\text{Square of planting distance})$$

- Triangular planting

$$N = 100 \times 100 \times 1.155 / (\text{Sq. of planting dist})$$

- Quincunx planting

$$N = 2 \times 100 \times 100 / (\text{Sq. Of the side of planting sq.})$$

# Step 6. Earth work

- Earth / Soil working is done for:
  - Enabling the establishment of tap root of seedlings
  - Improve aeration in root zone and infiltration of water, moisture conservation
  - To accommodate root system of plants during planting
  - To provide better nutrients to plants

# Activities in Earth working

- Ploughing and turning the soil
  - Disc harrows
- Soil working depends upon
  - Method of AR – Sowing or planting
  - Locality factors – plain, hill slope, water logging, dry area etc

- Patches dug out for patch sowing
- For planting
  - Pits
  - Trenches

[https://www.youtube.com/watch?v=n\\_RI8OZOXwU](https://www.youtube.com/watch?v=n_RI8OZOXwU)

<https://www.youtube.com/watch?v=aoQfA6MaADo>



# SOIL WORKING (MANUAL)

## PITS

ORDINARY PITS

SAUCER PITS

RING PITS

## RIDGE DITCHES

SMALL RIDGE DITCH

LARGE RIDGE DITCH

SLOPED RIDGE DITCH

## TRENCHES

SHELFED TRENCH

DOUBLE TRENCH

TRENCH RIDGE

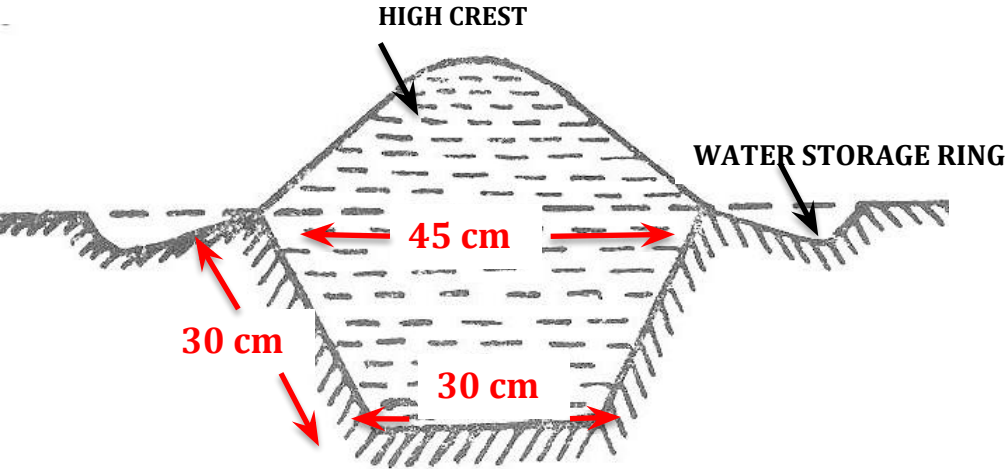
TRENCH MOUND

WURLI



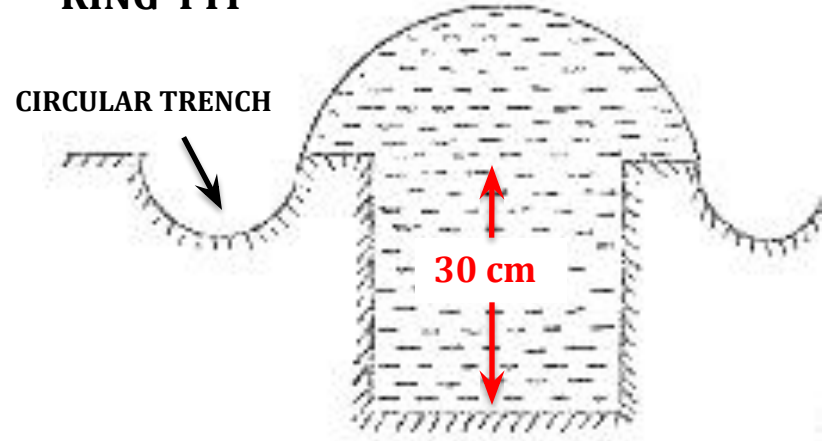
# PITS

## ORDINARY PIT



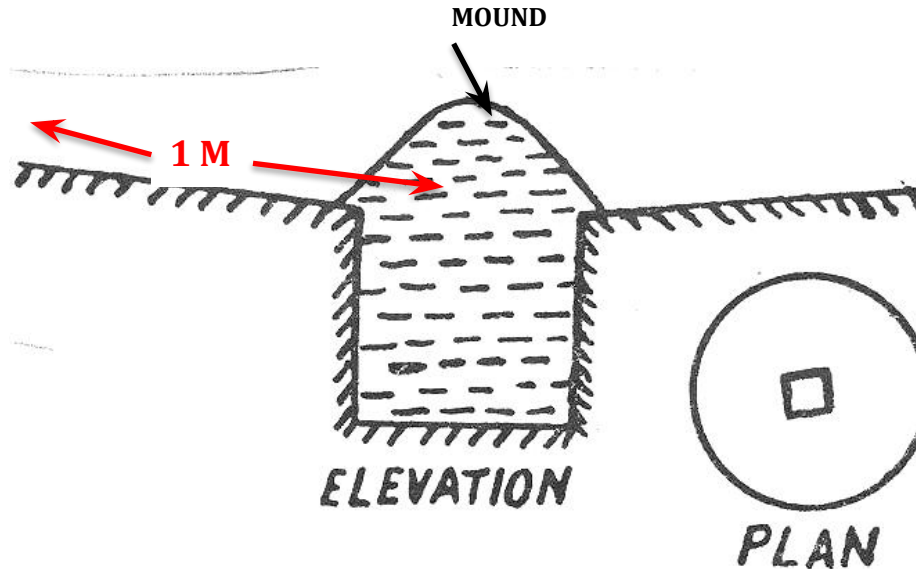
Minimizes water logging and collection of salts near the seedlings. Suitable for clayey and saline alkaline soils

## RING PIT



Circular pit collects rain water for supply to moisture. Suitable for sandy soils

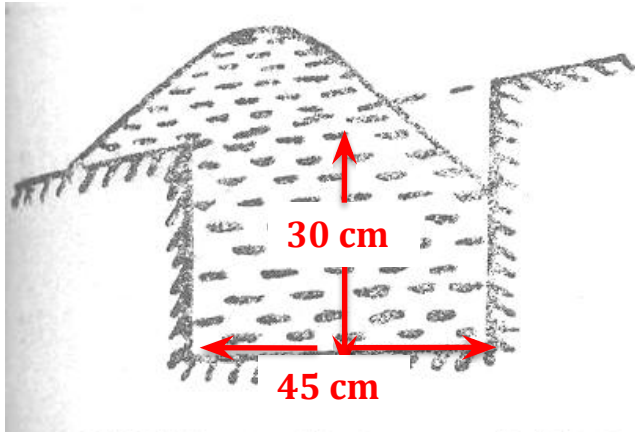
## SAUCER PIT



Suitable for loamy soil in dry areas

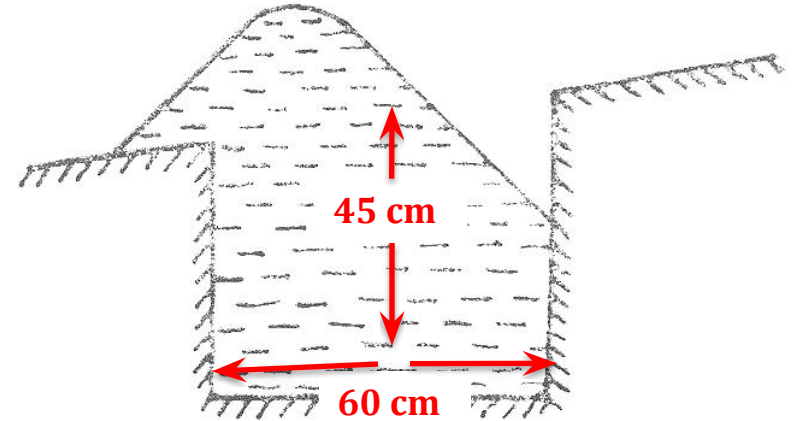
# RIDGE DITCH (TRENCH WITH VERTICAL SIDES)

## SMALL RIDGE DITCH



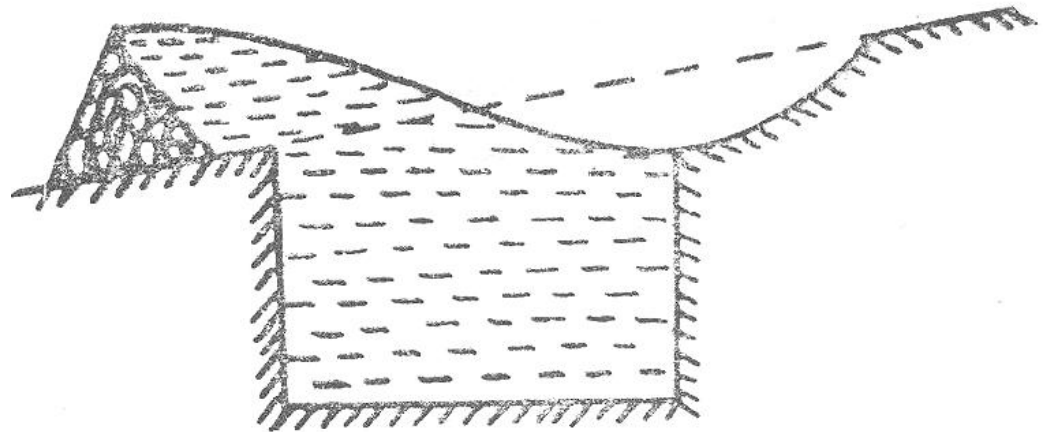
Suitable for areas towards moister part of dry areas and loamy soils

## LARGE RIDGE DITCH



Suitable for low rainfall and deep soil conditions

## SLOPED RIDGE DITCH

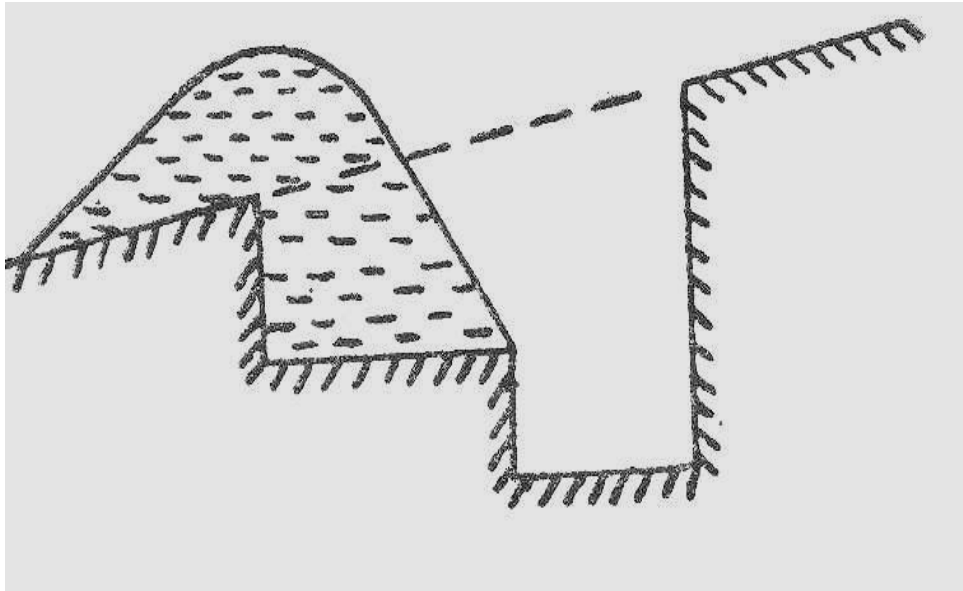


Suitable for shallow soils with large number of rainy days

# SHELFED TRENCH

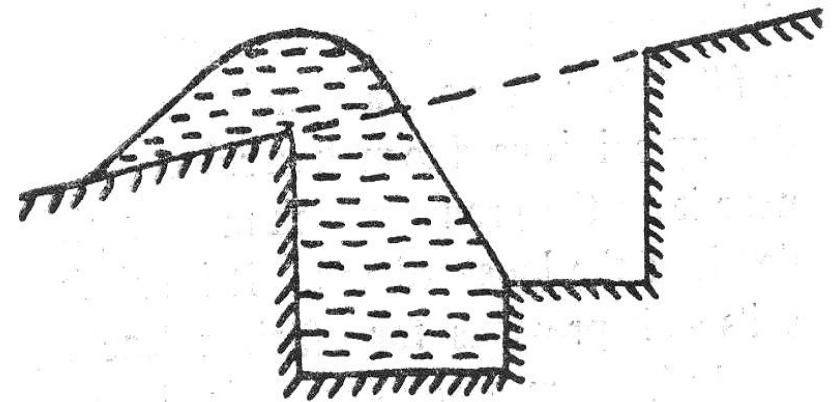
Shelf is made on one side of the trench. Suitable for peninsular soils which contain very fine tenacious clay dispersed in a matrix of fine to coarse grain laterite. The clay forms an impermeable crust on wetting and drying and also binds the granular laterite into hard clods.

## **SHALLOW FILLED SHELFED TRENCH**



Rainwater is stored in the deeper part of the trench and does not come in direct contact with the major worked up soil . But it infiltrates into and below it.

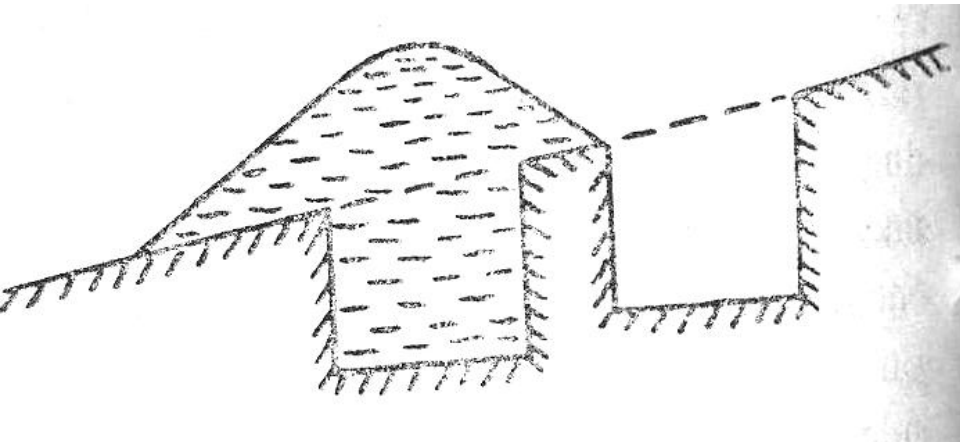
## **DEEP FILLED SHELFED TRENCH**



Suitable for peninsular sandy soils in areas with low to high rainfall received in small number of rainy days as heavy showers thus requiring large storage capacity

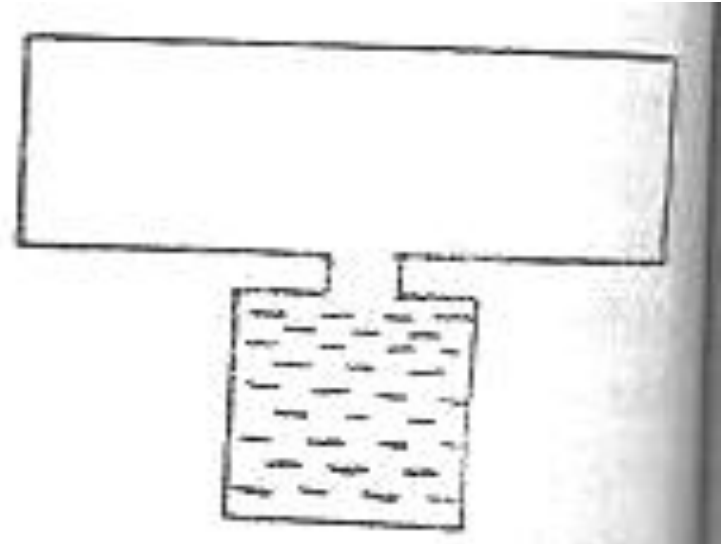
# DOUBLE TRENCH

## TRENCH PIT



Here there are two trenches one filled with soil and the other for storing water

## DOUBLE TRENCH

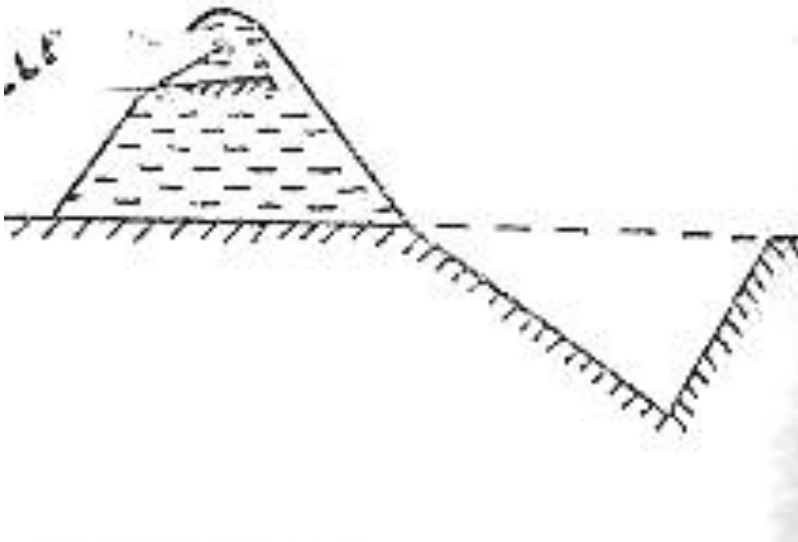


The pit is filled and used for planting while the trench remains unfilled and used for water storage

# TRENCH RIDGE

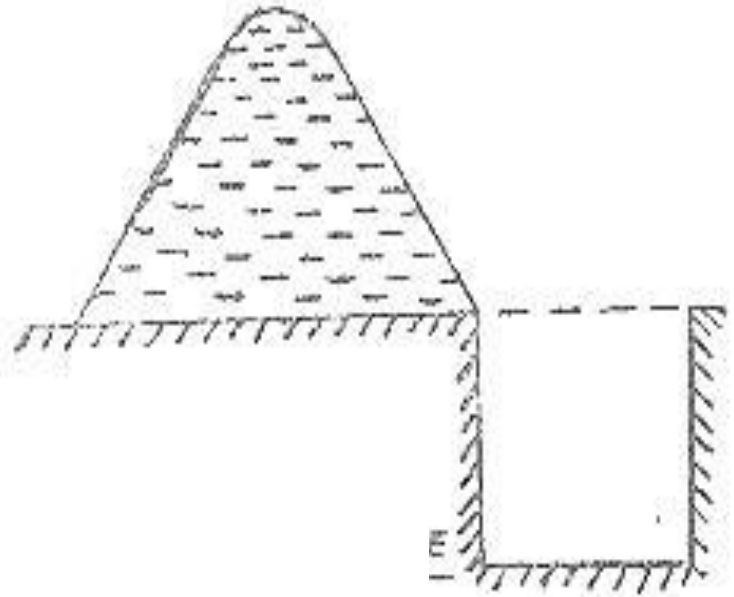
Here trench is dug and kept unfilled for water storage and the dug up soil is used to make a ridge near it on the ground. Suitable for salt -impregnated soils as it provides for efficient leaching of salts from the seedbed

## SHALLOW TRENCH RIDGE



Suitable for saline alkaline soils with rainfall spread over a large number of rainy days

## DEEP RIDGE TRENCH

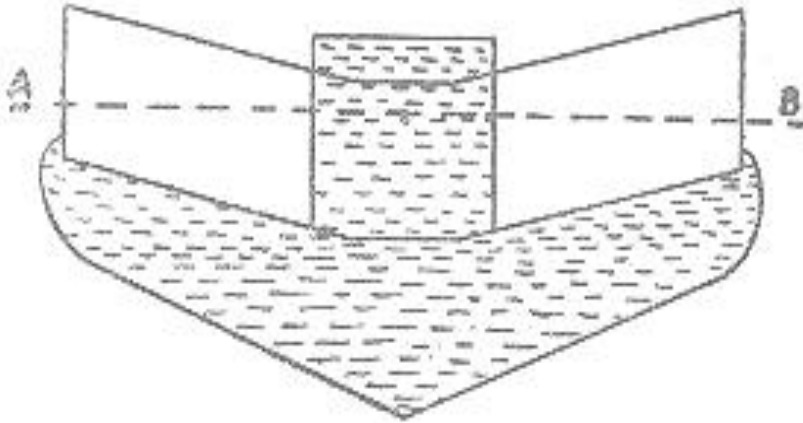


Suitable for areas with high salt content in soil and scanty rainfall received in heavy showers

# TRENCH MOUND

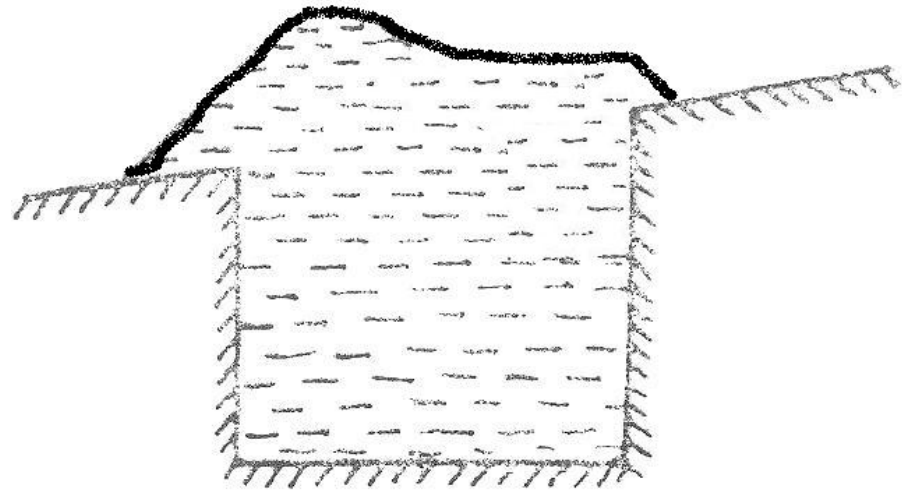
In areas with low, erratic and badly distributed rainfall, a mound is made at the middle of the trench and surplus soil is made into a sloping ridge at the lower side of the trench

## INCLINED TRENCH MOUND



Suitable for areas with a gentle slope

## STRAIGHT TRENCH MOUND

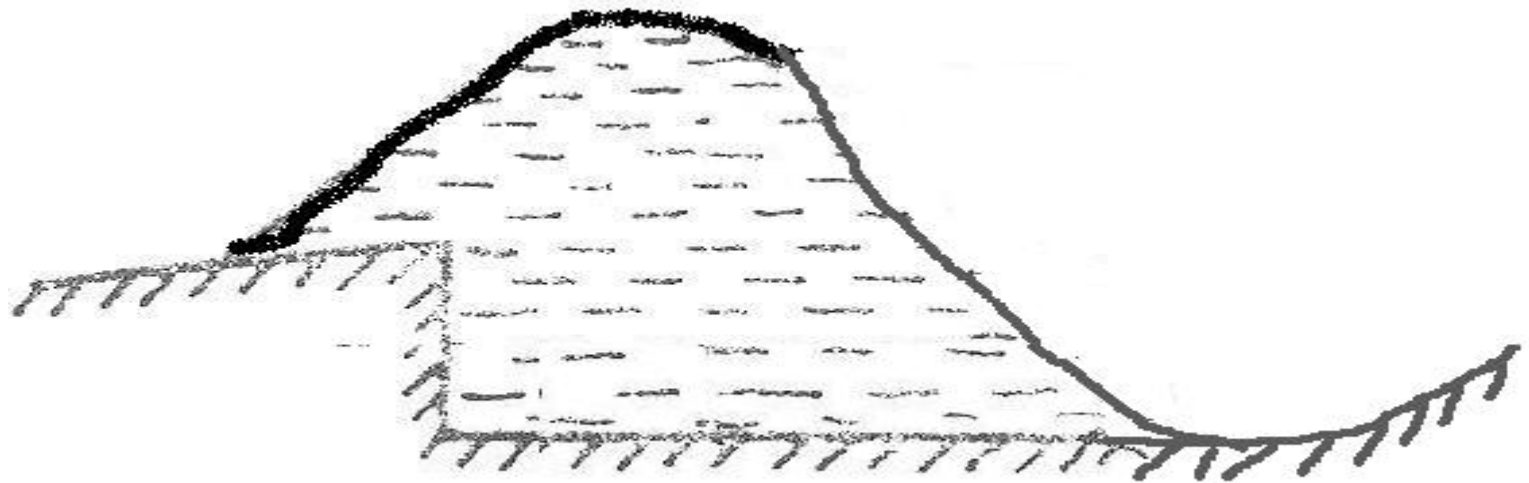


Suitable for flatter areas



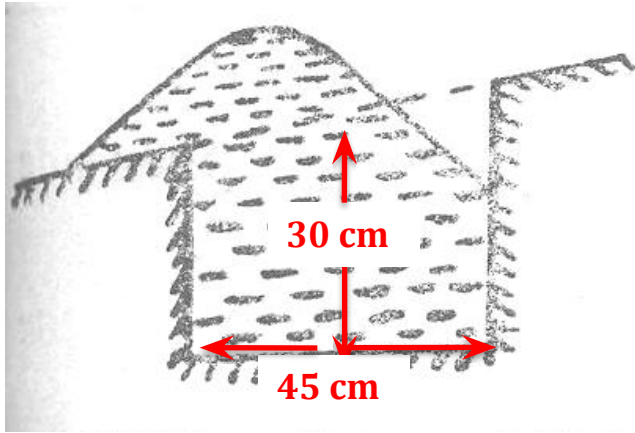
# WURLI

**It is a kind of shallow trench ridge and suitable for gentle slopes with loamy granular soil in areas with rather high and well distributed rainfall**



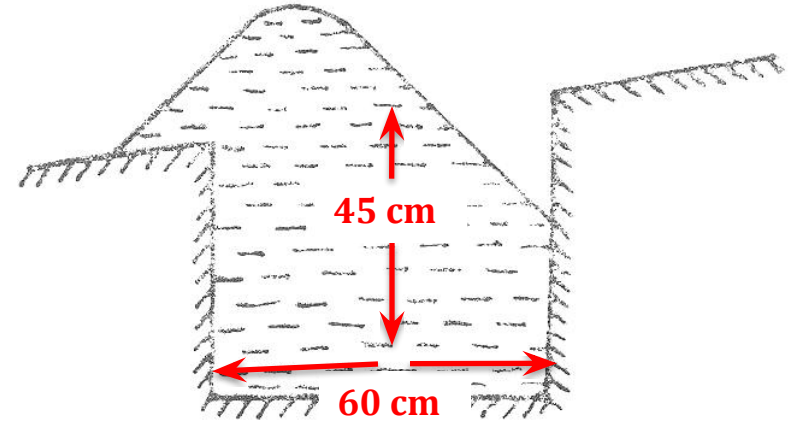
# RIDGE DITCH (TRENCH WITH VERTICAL SIDES)

## SMALL RIDGE DITCH



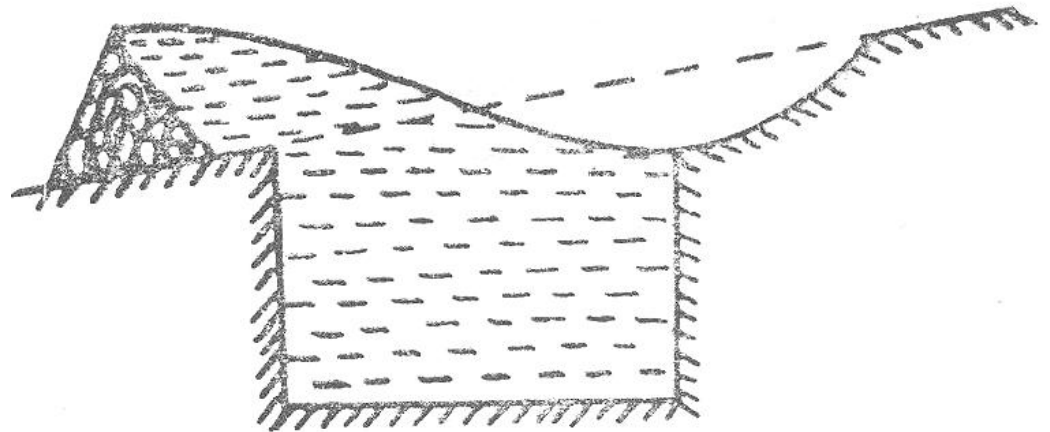
Suitable for areas towards moister part of dry areas and loamy soils

## LARGE RIDGE DITCH



Suitable for low rainfall and deep soil conditions

## SLOPED RIDGE DITCH



Suitable for shallow soils with large number of rainy days

# Contour trenches











# PIT digging







## Step 7. Transportation of seedlings

- Screen out poor performing seedlings in nursery using yardstick
  - Height of seedling
  - Collar girth of seedling
- Cause minimum disturbance to seedlings while loading
  - ball of earth should not be disturbed
- Load the seedlings in such a way that they don't shake and bounce in the vehicle – keep seedlings in baskets or crates in the vehicle
- Plan sourcing in such a way that long distance journey is avoided
- Keep seedlings in shady and moist area at the plantation site, if need arises.



Mahindra 265DI

Sukhmitra

जय मा





# Step 8. Sowing / Planting

- **Direct Sowing**

- **Methods:** Hand broadcasting, Aerial broadcasting, Dibbling, Line sowing, Strip sowing, Patch sowing

## **Advantages**

Cheaper

Trees are not disturbed after germination

Species like *Acacia* and *Prosopis* give equally good results on direct sowing

## **Disadvantages**

Large quantities of seed are required

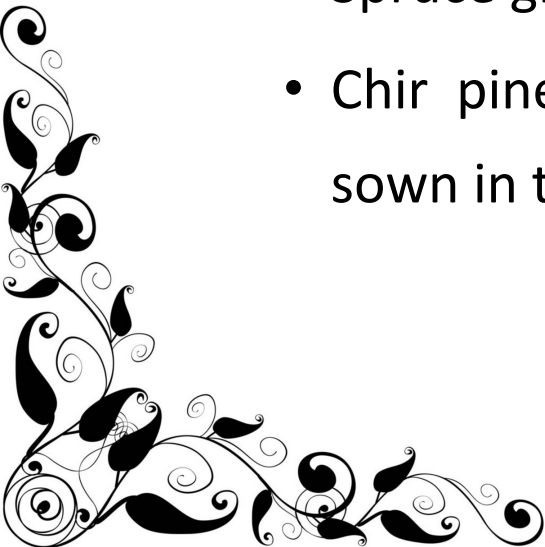
Irregular stocking is achieved

Greater amount of soil working and weeding operations are required

Seedlings have to survive greater biotic and abiotic stresses

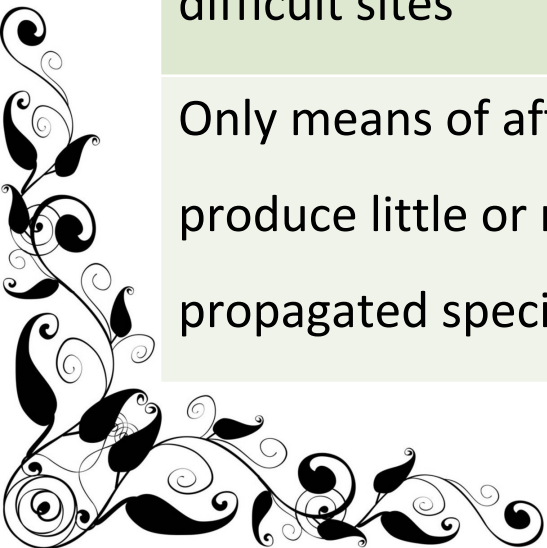
# *Time of sowing*

- Generally seeds should be sown just before the time it germinates in nature
- As a rule all temperate species in early spring as the snow melts but for all practical purposes sowing is done before the snow falls. Eg Deodar, silver fir, walnut, ash
- Spruce gives better results with rain sowings
- Chir pine and most tropical deciduous species should be sown in the beginning of the rainy season



# *Planting*

ADVANTAGES	DISADVANTAGES
Proper utilization of site and facilitates cultural operations	Costly
Fast growth and establishment of stock	Requires more skill
Plantation is the only means of afforestation for difficult sites	Labour intensive
Only means of afforestation for species that produce little or no seed and for vegetatively propagated species	





# Season of planting

<b>SEASON</b>	<b>DETAILS</b>
<b>Monsoon</b>	<i>Common. Planting is done immediately after a good shower when the ground has been moistened to the depth of planting. Deodar, silver and spruce in Uttarakhand and Himachal Pradesh and almost all the tropical deciduous species</i>
<b>Premonsoon</b>	<i>If irrigation is available or summers are accompanied by fairly good showers. It lengthens the period of growth .eg. Morus alba</i>
<b>Winter</b>	<i>Most temperate species are best planted before winter. In Bengal Toona ciliata, Chukrassia, Cinamommum, Dalbergia latifolia and Bombax ceiba in North India . Deodar in Himachal Pradesh.</i>
<b>Spring</b>	<i>In parts of Kashmir the SW monsoon does not reach hence spring planting of conifers is resorted to</i>

# CHOICE OF SPACING

- ***RATE OF GROWTH***
- ***WEED GROWTH***
- ***SOIL MOISTURE AND NUTRITION***
- ***OBJECT OF MANAGEMENT***
- ***COST***
- ***ORGANIC MATTER DEPOSITION***
- ***VOLUME OF TIMBER***

## COMMON SPACINGS

2m x 2m	<i>Teak, Eucalyptus, Dalbergia sissoo, Casuarina, Prosopis, Cedrus deodara, Abies pindrow</i>
3m x 1m	<i>Prospis spp, Acacia spp etc, Cedrus deodara, Casuarina equisetifolia, Cryptomeria japonica etc.</i>
2m x 4m 3m x 3m	<i>Albizzia lebbek, Adina cordifolia, Gmelina arborea, Santalum, album, Acer spp., Terminalia spp., Acacia catechu, Cedrus deodara, Pinus roxburghii, Spruce etc.</i>
4m x 6m 5m x 5m 6m x 6m	<i>Bombax ceiba, Populus spp., Dendrocalamus strictus, Azadirachta indica</i>
6m x 8m 8m x 8m 10m x 10m	<i>Anacardium occidentale, Artocarpus spp, Mangifera indica, Bambusa arundinacea and other fruit trees</i>

# *Planting process*

- Place plants in pits without damaging roots, carefully remove the polythene bag.
- DO NOT DISTURB BALL OF EARTH
- **IMPORTANT: Only good top soil should be filled back into the pit mixed with Farm Yard Manure / Compost.**
- Soil should be firmed around the plant by moderate foot pressure
- Plastic bags should be removed before planting







**कृषकाल-रघुनाथ गांधी**  
 कृषकाल-रघुनाथ गांधी  
 कृषकाल-रघुनाथ गांधी  
 कृषकाल-रघुनाथ गांधी  
**रक्षा-सलिल**  
 पाठ्यक्रम के अंतर्गत प्रथम वर्ष के छात्रों के लिए









**विश्व पर्यावरण दिवस**  
5 जून, 2019  
22 करोड़ वृक्षारोपण महाभियान  
जागरूकता एवं प्रशिक्षण कार्यक्रम  
स्थान : बायन बुजुर्ग बल्ला पौधशाला  
रेंज - रायबरेली  
पर्यावरण वन तथा जलवायु परिवर्तन प्र



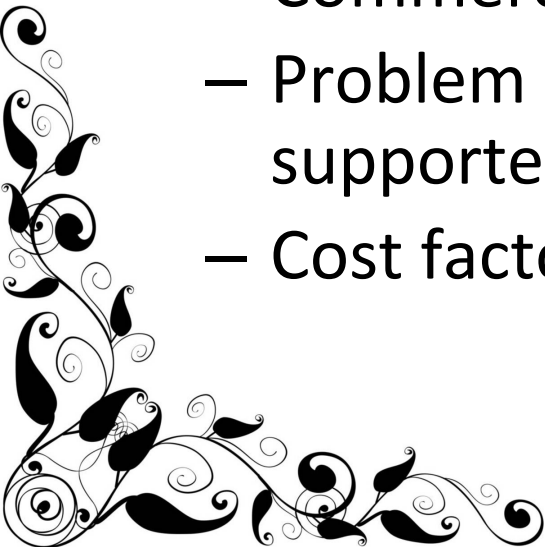
# Step 9. Manuring & Fertilization

- Generally done in wastelands, problem soils
- Short rotation crops for commercial purposes
- Initially mix FYM / Compost in the pits at the time of planting if soil is deficient in nutrients



# Step 10. Irrigation

- To be carried out only if needed
  - Nearby water source is available
  - The ground is flat
  - Roadside Avenue plantations
  - Agroforestry systems
  - Commercial short rotation plantations
  - Problem areas where reclamation is to be supported
  - Cost factor



- NURSE CROP: Tree crop raised to protect the main plantation species from sunlight, frost, winds etc.
  - Nurse crop is usually fast growing as compared to main species or planted previously
  - Eg: *Gmelina arborea* for *Dipterocarpus turbinatus*, *Acacia auriculiformis* for *Vateria indica*
- Cover crop: Herbs / shrubs / creepers grown for providing immediate ground cover in plantation
  - improve nutrient status of soil – nitrogen fixing
  - Suppress weed growth
  - Eg: *Cajanus cajan* (pigeon pea, tur), *Crotolaria juncea*,



# Team

