PRACTICAL MANUAL

ON

Introductory Agroforestry

HNR 333 2(1+1)

For B.Sc. Horticulture V Semester students

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2019

College of Horticulture & Forestry

RANI LAKSHMI BAI CENTRAL AGRICULTURAL UNIVERSITY, JHANSI - 284003

Introductory Agroforestry HNR 333 2(1+1)

Practical: Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, Grewia optiva, Morus alba, Acacia catechu, *Dalbergia sissoo*, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

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Roll No. .....

Batch .....

Session .....

Semester .....

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Course No. : ..... Credit .....

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Practical Excercise-1

Objective: Identification of seeds of different multipurpose tree species

- Agroforestry involves raising trees in combination with other agricultural enterprises, including livestock.
- Different species of trees can be planted with many types of crops in a variety of patterns. For example, fast-growing trees can be planted when the land is fallow or they can be grown at the same time as agricultural crops.
- In addition to providing fodder, fuel, wood, and other products, trees in agroforestry systems promote soil and water conservation, enhance soil fertility and act as windbreaks for nearby crops.

Purpose: It is important to identify size, shape, colour and characteristics of seeds of different MPTs as they play a very vital role for successfully growing of plants in the nursery.

Field Exercise: Seeds of some important MPTs

S. No.	Tree species		Image
1.	Common name		
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21.	Common name		
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	Description	……..… ……..…… ……..……	
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Practical Excercise-2

Objective: Identification of seedlings of different multipurpose tree species

- Agroforestry as a complete farming system has recently received attention and MPTs are considered as its integral component.
- They occupy prime importance for having potential and vital role in sustainable agricultural development.
- The importance of MPTS in meeting human needs for wood and its products and sustaining soil productivity is becoming increasingly recognized. Hundreds of species have been considered to have multiple uses.
- MPTS extremely vary for their natural distribution and variation, methods of exploration, collection and evaluation of their germplasm.

Purpose: It is important to select the most suitable trees since it is not easy to replace them once they have been planted. The following factors should be kept in mind when selecting tree species

- Environmental adaptation
- Needs of farmers
- Ease of maintenance
- Availability of genetic materials

Field Exercise: Seedlings of some important MPTs

S. No.	Tree species		Image
1.	Common name		
	Scientific name		
	Family		
	Description	…… …… ……	
	Uses	…… ……	
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	Scientific name		
	Family		
	Description	…… …… ……	
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19.	Common name		
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	Description	…… …… ……	
	Uses	…… ……	
20.	Common name		
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	Uses	…… ……	

Practical Excercise-3

Objective: Nursery practices for *Populus deltoides*

Common name: Poplar, Pharipipal
Scientific Name: *Populus deltoides*
Family: Salicaceae

Phenology:

- Deciduous tree
- Flowering- April
- Fruit ripe- June
- Leaf fall- March – April
- Leaf renewal- October-March

Distribution: West Punjab in Pakistan, Middle East, New South Wales in South Australia, Parana Delta and north eastern continent part of the Argentina

In India, it has been successfully cultivated as a forest crop or agroforestry crop in the Punjab plains and in the Tarai region of Uttar Pradesh.
Soil: Sandy loam to fairly stiff clay, but it makes its best growth on moist, well-drained, deep, medium-textured, alluvial soils that are fertile and well-aerated.

General Description:

- Poplars are amongst the fastest growing tree species under appropriate agro climatic conditions.
- Poplars can be harvested at short rotations of 8 to 10 years.
- Poplars with straight and cylindrical bole, moderate conical crowns mostly deciduous during winter months,
- Combine well with inter-cultivation of agriculture crops.
- Six indigenous species viz *Populus ciliata*, *P. laurifolia*, *P. gamblei*, *P. alba*, *P. glauca*, are found along water courses in Himalayan region

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: Cuttings, Sets, Bag plants, Root-shoot cuttings, Entire transplants

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Selection of cuttings: ……

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4. Preparation of cuttings: ……

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5. Treatment of cuttings: ……..

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6. Planting of cuttings: ……..

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7. Irrigation: ……

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8. Fertilizer application: ……

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9. Plant protection measures: ……

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10. Utilization: ……..

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Practical Excercise-4

Objective: Nursery practices for *Grewia optiva*

Common name: Beul, Dhaman
Scientific name: *Grewia optiva*
Family: Tiliaceae

Phenology:

- Leaf-fall - March-April
- Leaf renewal - April-May
- Flowering - April-May
- Fruiting - June-July
- Fruit ripe - October-November

Distribution: It is a tree of sub-tropical climate. It is distributed from the foothills of the Western Himalayas from Jammu and Kashmir to Nepal up to 2000 m elevation.

Soil: Tree is hardy and grows on a variety of soils. Sandy loam soil with adequate moisture supply supports good growth.

General Description:

- It is a very popular tree of the farmers of the sub-Himalayan tract for its fodder and fibers.
- Strong light demander, require complete overhead light, It is frost hardy tree but young seedling dieback due to severe frost
- It coppice very well, Susceptible to fire and browsing

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: By cutting or planting stumps, transplanting of nursery raised seedings

Nursery techniques:

1. Site selection: ……
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2. Site preparation: ……
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3. Preparation of nursery bed: ……
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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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Practical Excercise-5

Objective: Nursery practices for *Morus alba*

Common name: Shahtut, tut, tutri, chinni
Scientific name: *Morus alba L.*
Family: Moraceae

Phenology:

Leaf-fall: November- December
Leaf renewal: March- April
Flowering: March- April
Fruit ripe: April- June

Distribution: Northern India from Jammu and Kashmir to Assam. In the Himalayas, it ascends up to an elevation of about 1200 m.

Soil: Tree grows on a variety of soils ranging from sandy loam to clayey loam, alluvial, deep, loamy soil with sufficient moisture supply supports its best growth. Grows best with soil pH ranging between 6.0 and 7.5.

General Description:

- A full grown *M. alba* is a moderate sized tree with short clean bole and spreading crown
- *M. alba* is a shade bearing tree and it can with advantage be grown as an under-story with other light demanding species.
  It coppices and pollards very well. It can withstand light frost.
- Its water requirement is high. It suffers from droughts as may be expected from its being a surface feeder.
- It is susceptible to fire and browsing.

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: planting out nursery raised seedlings or through rooted branch cuttings

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Preparation of nursery bed: ……

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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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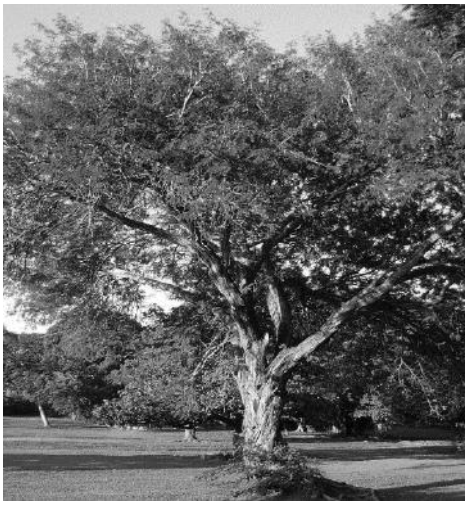
Practical Excercise-6

Objective: Nursery practices for *Acacia catechu*



Common name: Khair, kath tree, cutch tree
Scientific name: *Acacia catechu* Wild.
Family: Leguminosae
Sub Family: Mimosoideae

Phenology:

Leaf-fall: January- February
Leaf renewal: April- May
Flowering: April to August
Fruiting: September- October
Seed collection: October- November, December

Distribution: It is found throughout India except in humid and temperate region. It is widely distributed between 900-1200 m from Jammu to Assam. Variety catechu is found in Sikkim, Tarai region, West Bengal, Assam.

Temperature: Maximum 40°C -50°C, Minimum 1°C, **Rainfall**: 500 mm to 2000 mm, **Altitude:** 1200 m.

Soil: Acacia catechu grows on wide variety of soils such as sandy, gravelly alluvial, loam with varying proportions of sand and clay and black cotton soils. It is capable of growing on shallow soils with murram or kankar on which few other species can grow.

General Description:

- A moderate sized deciduous tree with light feathery crown with crooked brown bole, Bark dark brown and red inside. Branches are glabrous armed with recurved thorns.
- The species is distinguished into three distinct varieties viz. Acacia catechu, variety catechuoides, sundra and catechu.
- Strong light demander, frost and fire hardy, wind firm, browsed by animals

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: Acacia catechu can be propagated by planting out nursery raised seedlings and stump planting

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Preparation of nursery bed: ……

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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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Practical Excercise-7

Objective: Nursery practices for *Dalbergia sissoo*

Common name: Khair, kath tree, cutch tree
Scientific name: *Acacia catechu* Wild.
Family: Leguminosae
Sub Family: Mimosoideae

Phenology:

Leaf-fall: January- February
Leaf renewal: April- May
Flowering: April to August
Fruiting: September- October
Seed collection: October- November, December

Distribution: It is found throughout India except in humid and temperate region. It is widely distributed between 900-1200 m from Jammu to Assam. Variety catechu is found in Sikkim, Tarai region, West Bengal, Assam.

Temperature: Maximum 40°C -50°C, Minimum 1°C, **Rainfall**: 500 mm to 2000 mm, **Altitude:** 1200 m.

Soil: Acacia catechu grows on wide variety of soils such as sandy, gravelly alluvial, loam with varying proportions of sand and clay and black cotton soils. It is capable of growing on shallow soils with murram or kankar on which few other species can grow.

General Description:

- A moderate sized deciduous tree with light feathery crown with crooked brown bole, Bark dark brown and red inside. Branches are glabrous armed with recurved thorns.
- The species is distinguished into three distinct varieties viz. Acacia catechu, variety catechuoides, sundra and catechu.
- Strong light demander, frost and fire hardy, wind firm, browsed by animals

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: Acacia catechu can be propagated by planting out nursery raised seedlings and stump planting

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Preparation of nursery bed: ……

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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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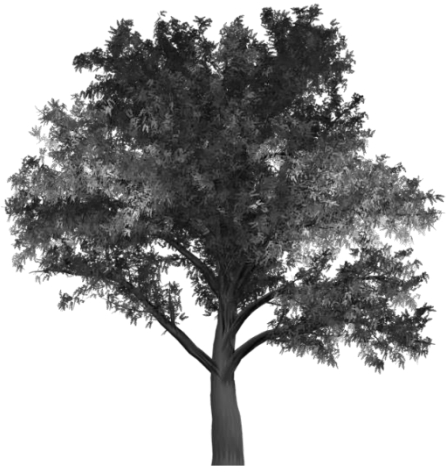
Practical Excercise-8

Objective: Nursery practices for *Robinia pseudoacacia*



Common name: Black Locust
Scientific name: *Robinia pseudoacacia* Linn.
Family: Leguminosae
Sub Family: Papillinioideae

Phenology:

Leaf fall - September-November
Leaf renewal - March-April
Flowering - April-May
Fruiting - June-July
Fruit ripening - September-October

Distribution: It is native to North America, from where it has been introduced to France, Hungary, Belgium, Southern Russia, Italy and Balkan states. **In India** it was first introduced in Himachal Pradesh in 1890 and later to Jammu and Kashmir in 1919. It has performed well in outer Himalayas between 1800-3000m and in the inner Himalayas at elevations as low as 1050 m in Himachal Pradesh

Temperature: Maximum- 29.4°C Minimum- 3.8°C**, Rainfall:** 700-1750 mm**, Altitude:** 1500-2000 m.

Soil: It grows on wide variety of soils. Favours lime-derived soils having pH between 4.6 and 8.2**.** It is a versatile colonizer**.** For best growth it requires deep, rich gravelly, well drained loamy soils and avoids wet, heavy and stiff soils**.** Eexcessively dry soils and soils with slow drainage are not suitable for its growth

General Description:

- It is a medium sized thorny, deciduous tree**.** Full grown trees have rough brown dark grey longitudinally furrowed bark.
- It is strong light demander**.** It is intolerant of competition**.** It is frost hardy, Mature trees are drought hardy
- The tree is wind firm under ordinary wind velocity. It coppices freely

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: The species can be propagated by planting out nursery raised seedlings.

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Preparation of nursery bed: ……

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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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Practical Excercise-9

Objective: Nursery practices for *Leucaena leucocephala*

Scientific name: *Leucaena leucocephala* Lam.
Common name: Subabul, Ipil-ipil
Family: Leguminosae

Phenology:

Evergreen tree
Flowering – Throughout the year
Fruiting - Throughout the year
Seeding - Throughout the year

Distribution: It is native to Mexico, Gauntemala, Honduras and El Salvador. Grown in many Oceanic countries Philippines, India, Indonesia, Srilanka, Papua New Guinea, Malaysia, Hawaii, Fiji, Northern America, East and West Africa and the Caribbean Islands for various purpose soil conservation, fuel and fodder etc**. In India**, planted in Andhra Pradesh, Karnataka, Tamil Nadu, Himachal Pradesh etc.

Temperature: Maximum 45°C**, Rainfall:** 600-1700mm**, Altitude**: up to 1000 m

Soil: It is found to grow on diverse type of soils. It grows only on neutral to alkaline soils but low tolerance for acidic soils. Soils with low pH level give lower increments and yields. Exhibit good growth on coral and limestone outcroppings**.** Best growth is obtained on deep fertile soils with adequate moisture and abundant supply of nutrients.

General Description:

- It is a large evergreen shrub or a small tree
- More than 800 species and these are broadly classified in four types: The Hawaiian type, The Salvador type**,** The peru type & Cunningham type.
- It produces a long tap-root and hence utilizes deep soil water and fairly drought resistant
- It is fire retardant and fire tolerant plant. It It is frost tender & good coppice ability.

Artificial regeneration:

- By sexual reproduction
- By Vegetative propagation: Planting out seedlings raised in the nursery and by stem cuttings

Nursery techniques:

1. Site selection: ……

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2. Site preparation: ……

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3. Preparation of nursery bed: ……

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4. Pre-treatment of seeds: ……

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5. Sowing of seeds: ……..

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6. Irrigation: ……..

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7. Fertilizer application: ……

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8. Plant protection measures: ……

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9. Planting out: ……

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10. Utilization: ……..

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Practical Excercise-10

Objective: Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops

- **Agroforestry** is unique in many respects, both as a science and as a practice. One such aspect is its inseparable mixture of **biophysical principles and social objectives**.
- Amongst the inseparable components of agroforestry viz., land, tree, crop, animals and management, crop part is most important as it affects the owner's life most.
- Since the performance of the agroforestry, particularly the intercrop depends largely on the type and magnitude of tree crop interaction, management of tree and crop is very important aspect in agroforestry for its success.
- Management of tree crop interaction means enhancing the complementary effect and minimizing the competitive effect by selection of species, proper density, spacing and geometry, tree canopy management (training and pruning) and input management (water , nutrients, etc).

Field Exercise:

1. **Name of the visiting sites:** ……
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Area (m^2):** ……....
5. **Geographical location:** ……
6. **Altitude:** ……..
7. **Slope:** ……..
8. **Presence of agroforestry tree species in the sites**

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							

12.							
13.							
14.							
15.							

9. Criteria for selection of tree species: ……

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10. Identification of agroforestry systems (On the basis of structure and function):

S. No.	Name of agroforestry system	Components		
		Trees	Crops	Pasture
1.	Agri-silvi			
2.	Silvi-pasture			
3.	Agri-silvi-pasture			
4.	Others			

11. Significance of important agroforestry practices:

S. No.	Name of agroforestry practices	Components	Significance
1.	Alley cropping		
2.	Fuel and fodder blocks		

12. Diagrammatic representation:

13. Net amount of money gains by adapting particular agroforestry system: ……..

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14. Suggestion: ……

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15. Conclusion:……

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Practical Excercise-11

Objective: Visit to social forestry- railway line plantations

- A trend toward rail-side planting for the provision of greenery, protection from dust and winds and creation of additional tree resources has developed in recent years in many countries.
- This trend is likely to spread to other countries due to the favorable results already achieved in certain countries.
- Three to six rows of trees on either side of the track are considered useful. The planting techniques are similar to those for roadside planting.
- Species vary and depend on the prevailing climatic conditions, mainly temperature, soil and rainfall.

Field Exercise:

1. **Name of the visiting sites:** ……
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Area (m^2):** ……...
5. **Geographical location:** ……
6. **Altitude:** ……..
7. **Slope:** ……..
8. **Presence of multipurpose tree species in railway line plantation area**

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							

10.							
11.							
12.							
13.							
14.							
15.							

9. **Criteria for selection of species to railway line plantation:** ……..

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10. **Achievements of plantation area:** ……

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11. **Diagrammatic representation:**

12. **Conclusion:** ……

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Practical Excercise-12

Objective: Visit to social forestry- canal plantations

- Several thousands of kilometers of irrigation canals have been laid in many countries. The banks of such canals are available for planting purposes and constitute a considerable area for production of timber and firewood for the rural population. Full advantage is being taken of this in many countries like China, Egypt, India and Pakistan.
- A few rows of trees, varying from 4 to 6, are generally planted on each bank of the canal with an espacement depending on the characteristics of the species and the type of produce desired
- When designing a canal plantation, the requirement may be the same as for the design of irrigated plantations with respect to climatic and soil conditions and to supply and quality of water.
- Choice of species for canal side plantations should take into account both the particular character of the plantation and its purpose. The roots of the trees should strengthen the banks of the canal and the trees should keep the canal and its banks well shaded in order to suppress weed growth and reduce evaporation.
- Species that tend to increase water seepage through the sides and bottom of the canal should be avoided. Where canals have an intermittent flow, such as flood discharge canals, only trees able to adjust to varying water levels in the soil can be used.

Field Exercise:

1. **Name of the visiting canal bank plantation sites:** ……
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Area (m^2):** ……...
5. **Geographical location:** ……
6. **Altitude:** ……..
7. **Slope:** ……..
8. **Presence of tree species in canal bank plantation area**

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							

7.							
8.							
9.							
10.							

9. Criteria for selection of species to canal bank plantation: ……..

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10. Achievements of plantation area: ……

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11. Diagrammatic representation:

12. Conclusion: ……

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Practical Excercise-13

Objective: Visit to social forestry- roadside plantations

Transportation enhancement plantings along our state and federal highways and our country roads are critical elements of a complete road system.

Aims:

- Trees increase the comfort of travellers by providing shade and attractive surroundings.
- Trees may protect the road itself against moving dunes or act as a windbreak for adjacent fields.
- Trees may become an important factor by alleviating timber and fuelwood shortage. In fact, roadside trees are frequently considered a part of the national forest planting programme. Such trees may produce edible fruit, yield pods for feeding animals, furnish food and shelter for birds or, when in bloom, be valuable in beekeeping.
- Location of the trees in relation to road formation. Firstly consideration should be given to the existing road formation so that trees ar not planted close to the inside of curves or near road junctions where they could obscure vision and so create a driving hazard. Secondly, consideration should be given to the possibility of the future widening of roads, including the development of double traffic lanes.

Field Exercise:

1. **Name of the visiting road side plantation sites:** ……
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Area (m^2):** ……
5. **Geographical location:** ……
6. **Altitude:** ……..
7. **Slope:** ……..
8. **Presence of tree species in canal bank plantation area**

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							

8.							
9.							
10.							

9. Criteria for selection of species to road side plantation: ……..

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10. Achievements of plantation area: ……

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11. Diagrammatic representation:

12. Conclusion: ……

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Practical Excercise-14

Objective: Visit to social forestry- industrial plantations

It is the specific land use system where in the industrial utility tree species are planted in an agro-forestry system which include both agro and farm forestry.

Aim:

- To meet the requirement of timber, pulp and paper industries
- Raw material supplies of plywood and vencer, match splints, boxes, pencil, packing and dendro-powder industries.
- To ensure the requirement of huge volume of wood to the bio-fuel and construction industries.

Policy directions:

National forest policy, 1988: Directed all the wood based industrial in the country to generate their own raw material needs without depending on the forest depart supply. It also facilitating quality seedling supply technological support, credit and insurance facility and promote agro-forestry plantations.

The national agro-forestry policy, 2014: Intensified the promotion of industrial agro-forestry plantations. It directed the government to liberalize the timber transit rules and attract farmers towards agro-forestry. It also directed to extend credit and insurance facilities to agro-forestry plantations besides establishing necessary market mechanism.

Field Exercise:

1. **Name of the visiting industrial sites:** …….
2. **Date of visit:** ……..
3. **Locality:** …….
4. **Area (m^2):** ……
5. **Presence of prioritized tree species to the specific industrial plantation sites:**

S. No.	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							

8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

6. Achievements of industrial plantation area: ……..

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7. Major Wood based industries and prioritized species:

Major industry	**Species promoted and deployed**
Timber and construction	……
industry	……
	……
Paper and pulp	……
	……
	…….
Plywood	……
	……
	…….
Match wood	……
	……
	……...
Dendro biomass	……
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Bio-fuel ……

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Others ……

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8. List of successful industrial plantations: ……

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9. Important schemes being implemented for industrial forestry: ……

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10. Conclusion: ……

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Practical Excercise-15

Objective: Visit to social forestry- shelterbelt plantations

- Shelterbelt is a wide belt of trees, shrubs and grasses, planted in rows which goes right across the land at right-angle to the direction of the prevailing winds to deflect air current, to reduce wind velocity and to give general protection to cultivated areas against wind erosion and desiccating effect of the hot winds in lee-ward side.
- A typical shelterbelt has a triangular cross-section which can be achieved by planting tall trees in the centre, flanked on both sides successively by shorter trees, tall shrubs and then low spreading shrubs and grasses.
- A certain amount of penetrability is desirable in shelterbelts as a result of which the zone of influence is very much greater and the velocity curve shows a smooth, slowly declining trend.
- The width of shelterbelt depends upon local climatic conditions, wind velocity, and the soil type.
- Shelterbelt should be oriented as nearly as possible, at right angles to the prevailing wind In case, where winds blow from different directions, shelterbelt should be raised in quadrangles

Field Exercise:

1. **Name of the visiting shelterbelt plantation sites:** ……
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Area (m^2):** ……....
5. **Geographical location:** ……
6. **Altitude:** ……..
7. **Slope:** ……..
8. **Presence of tree species in shelterbelt plantation area**

S. No.	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

9.							
10.							

9. Criteria for selection of species to shelterbelt plantation: ……..

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10. Achievements of plantation area: ……

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11. Diagrammatic representation:

12. Conclusion: ……

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Practical Excercise-16

Objective: Rapid assessment of farmers needs for green manure and fodder in selected village

- The ensured availability of green manure and fodder as a source of sustainable livelihood and alternative source of income remained integral part of socio-economic fabric of farmers in India.
- Green manures, also referred to as fertility building crops, may be broadly defined as crops grown for the benefit of the soil. They have been used in traditional agriculture for thousands of years but conventional farming systems largely rejected them as the use of fertilizers and pesticides became more common. Although they have many roles they are still often under-utilized by today's organic farmers. However, recent emphasis on reducing the environmental impact of all farming systems (stimulated by new legislation) has led to a growing interest from the conventional sector.
- Adequate supply of quality feed, particularly fodder is essential for sustainable development of livestock as well as farming system.

Field Exercise:

1. **Name of the selected village:** ……..…
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Geographical location:** ……
5. **Total no. of farmers to be sampled:……..**
6. **Estimates of fodders fed to the animals and mention their proportions to total seasonal fodder requirements (quantity per day in quintals/kgs)**

S. No.	Particulars	Winter season	Summer season	Rainy season
1	**Farmers own land**			
a)	Leaf fodder			
b)	Straw			
c)	Hay			
d)	Green fodder			
i)	From cultivated land			
ii)	From uncultivated land			
2	**Govt. forests**			
a)	Green grasses			
b)	Leaf fodder			
c)	Hay			
3	**Community lands**			
a)	Green grasses			
b)	Leaf fodder			
c)	Hay			
4	**Markets**			
a)	Green grasses			
b)	Leaf fodder			

c)	Green fodder			
d)	Straw			
e)	Hay			

7. Estimates of green manures their proportions to total seasonal requirements (quantity per day in quintals/kgs)

S. No.	Particulars of green manures	Winter season	Summer season	Rainy season
1.	**Farmers own land**			
a)				
b)				
c)				
d)				
e)				
f)				
g)				
2.	**Community lands**			
a)				
b)				
c)				
d)				
e)				
f)				
g)				
3.	**Markets**			
a)				
b)				
c)				
d)				
e)				
f)				
g)				

8. Conclusion:

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Practical Excercise-17

Objective: Rapid assessment of farmers needs for fuel wood in selected village

- Mastering the economic and social impact of fuel wood is of paramount importance in the bid to mitigate forest degradation and fight against poverty.
- In particular, due to continued fuel wood scarcity, rural households are developing strategies to cope with the added stress, such as increasing labor for fuel wood collection, collecting fuel wood from non-forest areas, or using crop residues.
- Adequate supply of fuel energy, particularly fuel wood is essential for farming community.

Field Exercise:

1. **Name of the selected village:** ……..…
2. **Date of visit:** …… **Day:** ……
3. **Locality:** ……
4. **Geographical location:** ……
5. **Total no. of farmers to be sampled……**
6. **Consumption of fuel energy (Per family per month)**

Fuel	Winter		Summer		Rainy	
	Quantity	Value	Quantity	Value	Quantity	Value
LPG						
Coke/coal						
Agri. waste						
Firewood						
Dung cakes						
Kerosene						
Electricity						
Biogas						
Solar energy						
Others						

7. **Presence of fuel wood tree species in selected village**

S. No.	Tree Species		No.
	Common Name	Scientific Name	
1.			
2.			
3.			
4.			

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6.			
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8.			
9.			
10.			

11. Conclusion:

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Practical Excercise-18

Objective: Economics and marketing of products raised in agro-forestry systems

- Agroforestry trees play a key role in the economy of rural population and they add to diversification and contribute to nutrition and energy security of the people
- Agroforestry system have proven their financial viability and attractiveness as important land use alternatives in various setting throughout the world

- Economic analysis of agriculture and agroforestry developments is similar with a difference that agroforestry system has more than one component with complementary and supplementary roles.
- Agroforestry market is a place where buyers and sellers transact forest products, agricultural and livestock products at a particular place and time.
- The importance of marketing include optimization of resource use and output management in agroforestry, increase in farm income, widening of markets, growth of forest based industries, price signal to all stakeholders, adoption and spread of new technologies, generating employment and income at regional and national level, enhancing better living of the people and creating a form, place, time and possession utilities.

General costs of forestry enterprises

- Land value or rent
- Capital value or costs
- Costs of nursery
- Costs of raising plantation
- Costs of silvicultural practices

Measures to assess

(1) Simple rate of return (SRR)…….....

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(2) Payback Period (PBP)……..……

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(3) Benefit Cost Ratio (BCR)……..

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(4) Net present Value (NVP) or Net Present Worth (NPW)……..……

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(5) Internal Rate of Return (IRR)……..……

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Field exercise

1. Economic analysis of Agroforestry systems

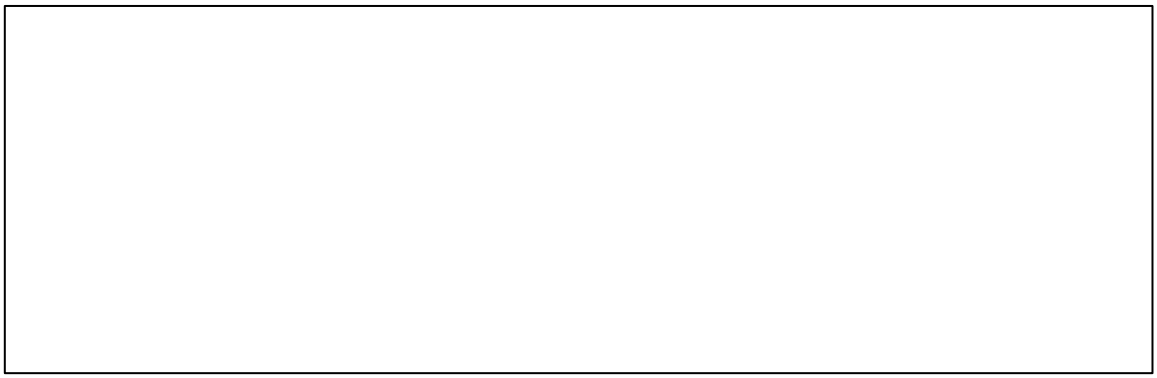
S. No	Treatment	Components	Cost of cultivation	Gross return	Net return	BC ratio
1	Agri-silvi system					
2	Agri-horti system					
3	Agri-silvi-horti systems					

2. Major markets for forest, farm and agroforestry products in India

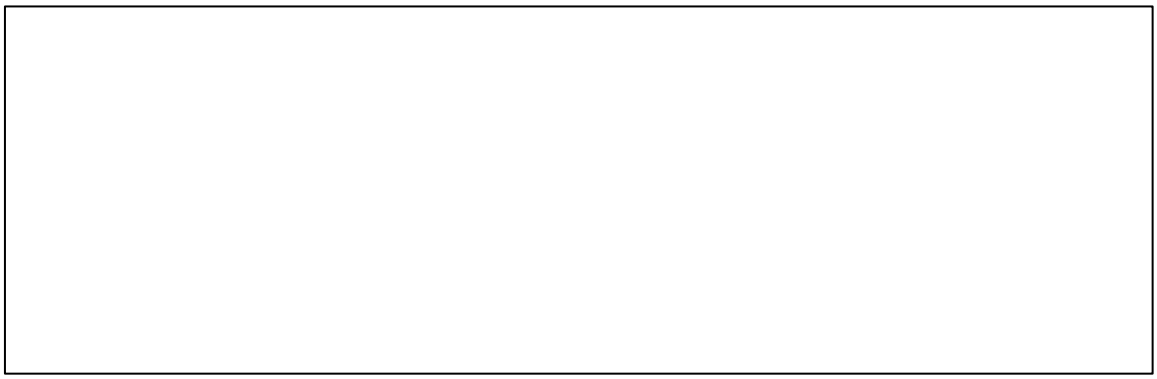
State	Market

3. **Existing marketing channel of any fast-growing agroforestry tree in Uttar Pradesh**

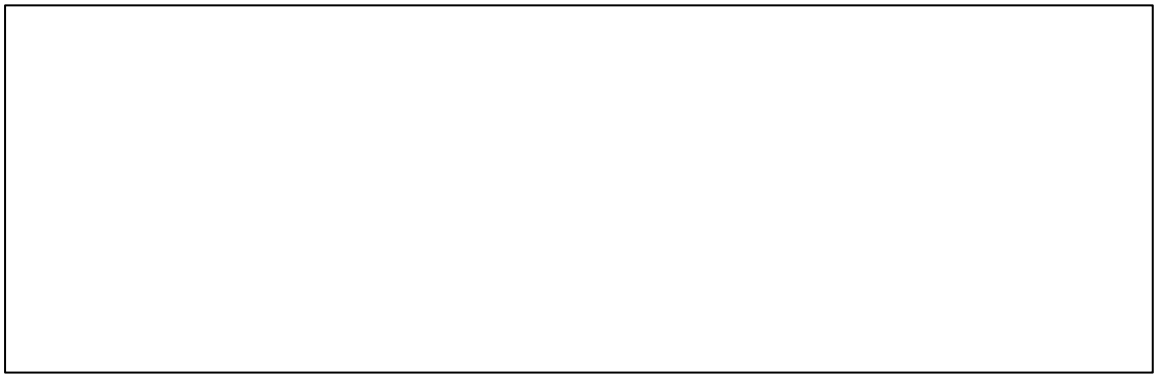
Channel- I



Channel- II



Channel- III



4. **Conclusion:**

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