

PRACTICAL MANUAL

FUNDAMENTALS OF HORTICULTURE

Course No. APH 176 Credit Hrs. 2(1+1)

For Undergraduate Agriculture Students

Dr. Ranjit Pal
Dr. Anjana Kholia



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College of Agriculture
Rani Lakshmi Bai Central Agricultural University
Jhansi - 284003

Syllabus

Practical: Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Name of Student:

.....

Roll No. **Batch**

Session **Semester**

Course Name:

Course No:

Credit:

CERTIFICATE

This is to certify that Shri/Km

ID No has completed the practical course
..... Course No as per the syllabus of
B. Sc (Hons) Agriculture/Horticulture
semester in the year in the respective lab/field of college.

Date:

Course Teacher

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Exercise No. 1

Objective: Identification of Garden Tools, Implements, and Plant Protection items

| S. No | Tools | Use |
|-------|----------------------------|-----|
| 1. | Secateur | |
| 2. | Budding cum Grafting Knife | |
| 3. | Pruning Saw | |
| 4. | Bill Hook | |
| 5. | Lopper | |
| 6. | Tree Pruner | |
| 7. | Hedge Shear | |
| 8. | Axe | |
| 9. | Lawn Mower | |
| 10. | Crow-bar | |
| 11. | Shovel | |
| 12. | Planting Board | |
| 13. | Wheel Barrow | |
| 14. | Hand Trowel | |
| 15. | V-Hoe or Drill hoe | |
| 16. | Flat Spade (Khurpi) | |
| 17. | Hand Hoe | |
| 18. | Spade | |
| 19. | Pickaxie | |
| 20. | Mattock | |
| 21. | Hand weeder | |
| 22. | Hand Cultivator | |
| 23. | Sickle | |

| | | |
|-----|--------------------------|--|
| | | |
| 24. | Garden Rake or Hand Rake | |
| 25. | Garden Rake | |
| 26. | Garden fork | |
| 27. | Wheel Hoe | |
| 28. | Watering can or Rose Can | |
| 29. | Hand sprayer | |
| 30. | Sprayer | |
| 31. | Manual Foot Sprayer | |
| 32. | Hand rotary Duster | |
| 33. | Battery Sprayer | |
| 34. | Ladder | |
| 35. | Dibber: | |
| 36. | Bulb planter | |
| 37. | Grass Sword | |
| 38. | Magnifier Glass | |
| 39. | Measureing Tape | |
| 40. | Rope | |
| 41. | Thorn remover | |
| 42. | Brush cutter | |
| 43. | Rubber garden gloves | |
| 44. | Gumboot | |
| 45. | Hose pipe | |
| 46. | Digger | |
| 47. | Root Trainer | |

Exercise No. 2

Objective: Identification of Fruits and Plantation Crops (Tropical, Sub tropical & Temperate fruits)

| S. No | Common name | Botanical name | Family |
|-------|-------------|----------------|--------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
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| 30. | | | |
| 31. | | | |
| 32. | | | |
| 33. | | | |
| 34. | | | |
| 35. | | | |

Plantation crops

| S. No | Common name | Botanical name | Family |
|--------------|--------------------|-----------------------|---------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |

Exercise No. 3

Objective: Identification of Vegetables and Spices Crop

Important vegetables and spices crops and their identification

| S. No. | Common Name | Botanical Name | Family |
|------------|-------------|----------------|--------|
| 1. | | | |
| 2. | | | |
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| 25. | | | |
| 26. | | | |
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| 29. | | | |
| 30. | | | |
| 31. | | | |
| 32. | | | |

Exercise No. 4

Objective: Identification of Annuals and Ornamental Plants

Summer and Rainy Season Annuals

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |

Winter Annuals

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
| 6. | | | | | | | |
| 7. | | | | | | | |
| 8. | | | | | | | |

All Season Annuals

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |

Ornamental Biennials

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |

HERBACEOUS PERENNIALS

Bulbous plants

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |

Orchids

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |

House plants

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |

Cacti & succulents

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |

ORNAMENTAL SHRUBS:

Flowering shrubs

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
| 6. | | | | | | | |

Foliage shrubs

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
| 6. | | | | | | | |

ORNAMENTAL TREES:

Common foliage & flowering trees:

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
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| 10. | | | | | | | |
| 11. | | | | | | | |
| 12. | | | | | | | |
| 13. | | | | | | | |
| 14. | | | | | | | |
| 15. | | | | | | | |

Ornamental palms

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |

| | | | | | | | |
|----|--|--|--|--|--|--|--|
| 2. | | | | | | | |
|----|--|--|--|--|--|--|--|

Ornamental cycads

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |

Ornamental conifers

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |

Ornamental climbers

| S. No | Common Name | Botanical Name | Plant Family | Method of propagation | Time of sowing/planting | Time of flowering | Colour of flower |
|-------|-------------|----------------|--------------|-----------------------|-------------------------|-------------------|------------------|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
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| 7. | | | | | | | |
| 8. | | | | | | | |
| 9. | | | | | | | |

Exercise No. 5

Objective: Media Preparation for plant propagation in Nursery beds and Root trainer

Materials required:

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Soil:.....

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Sand:.....

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Compost:

.....

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Saw dust:.....

.....

Coco peat:

.....

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Sphagnum moss:

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Vermiculite:

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Perlite:

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Procedure:

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Precaution:

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Exercise No. 6

Objective: Plant Propagation Methods on Horticultural Crops

Materials required:

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Sexual propagation methods:.....

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Description of seed and seed items

| S. No | Name of the crops | Monocot/Dicot | No of seeds / fruit | No of embryos |
|--------------|--------------------------|----------------------|----------------------------|----------------------|
| 1. | | | | |
| 2. | | | | |
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| 20. | | | | |
| 21. | | | | |
| 22. | | | | |

Asexual propagation methods:.....

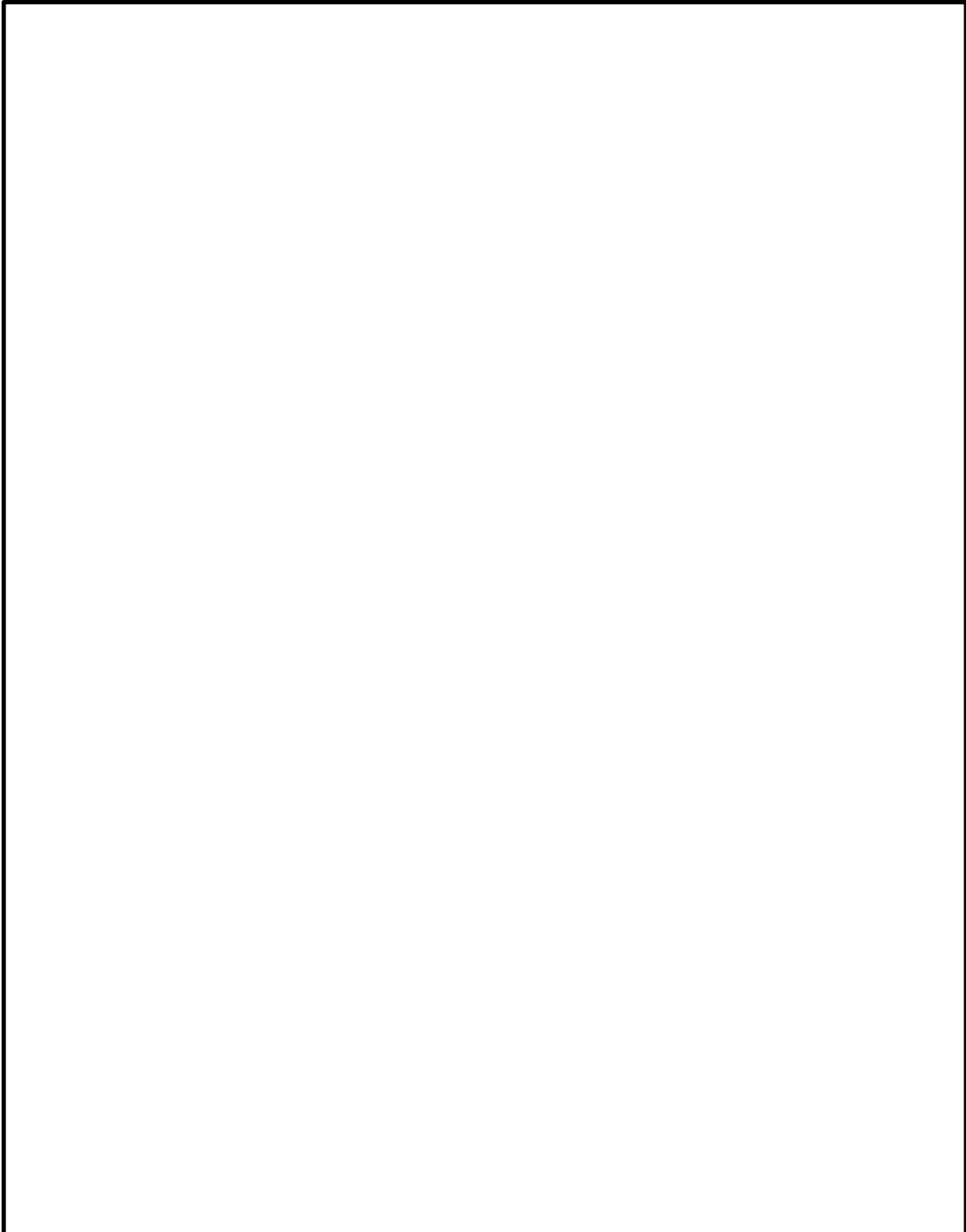
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Plant Propagation by Cuttings:

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Draw sketches



Plant Propagation by layering:

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Draw sketches



Plant Propagation by grafting:

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.....

Draw sketches



Plant Propagation by budding:.....

.....

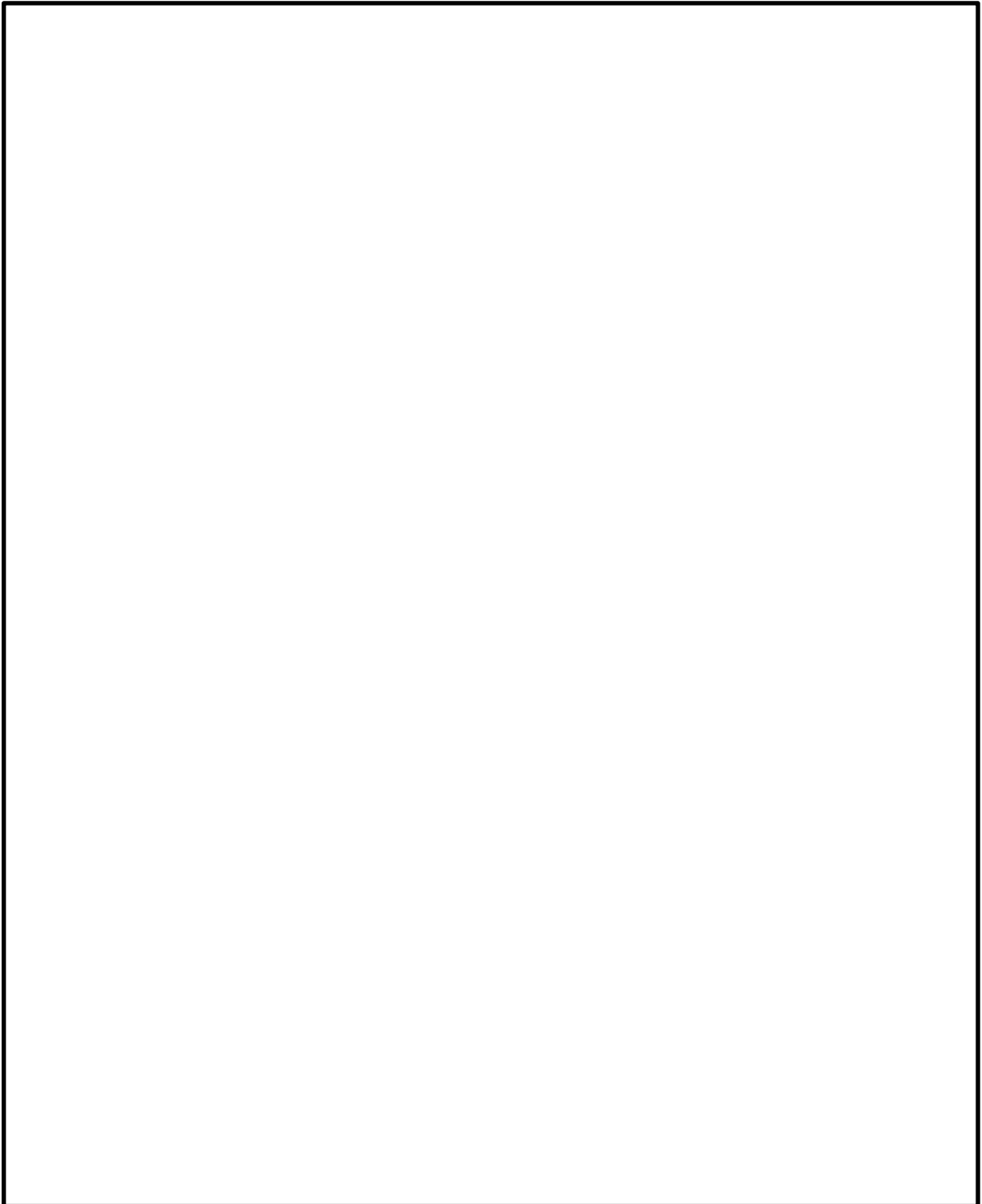
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Draw sketches



Plant Propagation by vegetative structures:

Bulbs:.....

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Tubers:.....

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Tuberous roots:

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Rhizomes:

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Corms:.....

.....

Runners:.....

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Suckers:.....

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Offsets/ offshoots:.....

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Exercise No. 7

Objective: Preparation of potting mixture.

Materials required:

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Potting:

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Procedure:

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Repotting:

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Propagation Media:.....

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Objective: Training and Pruning of Fruit Plants

Materials Required:

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Procedures:
Central leader:

Open centre:

Modified leader system:

Methods of pruning: The different methods of pruning commonly followed in fruit plants are:

1. **Thinning out:**.....

.....
.....

2. **Heading back:**

.....
.....

3. **Disbudding or rubbing off:**

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.....

4. **Pinching and topping:**

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.....

5. **Ring and Girdling:**

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.....

6. **Notching:**

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.....

7. **Nicking:**

.....
.....

8. **De-suckering:**

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.....

9. **Root Pruning:**

.....
.....

10. **Ring:**.....

.....
.....

11. **Smudging:**.....

.....
.....

12. **Bending:**

.....

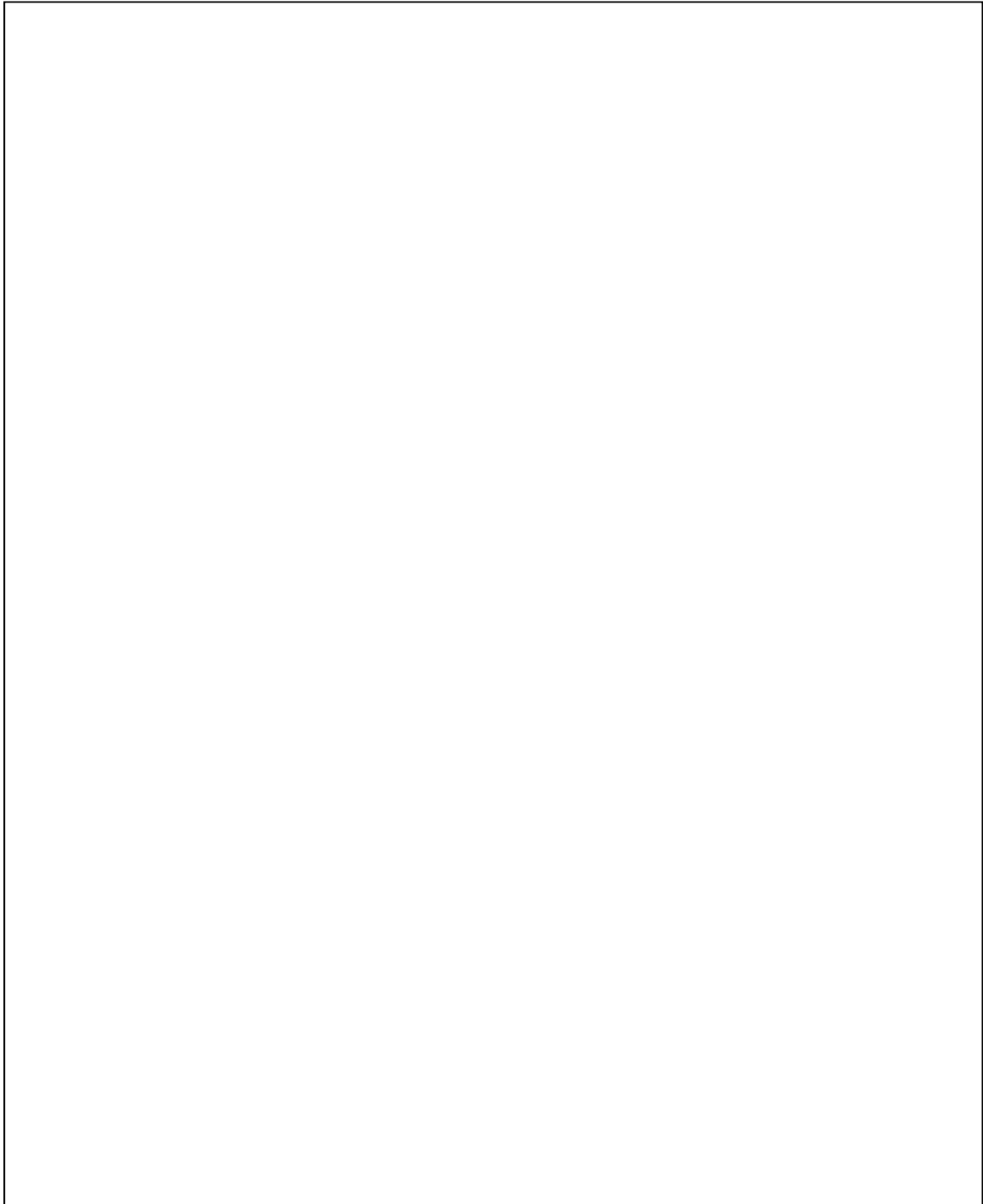
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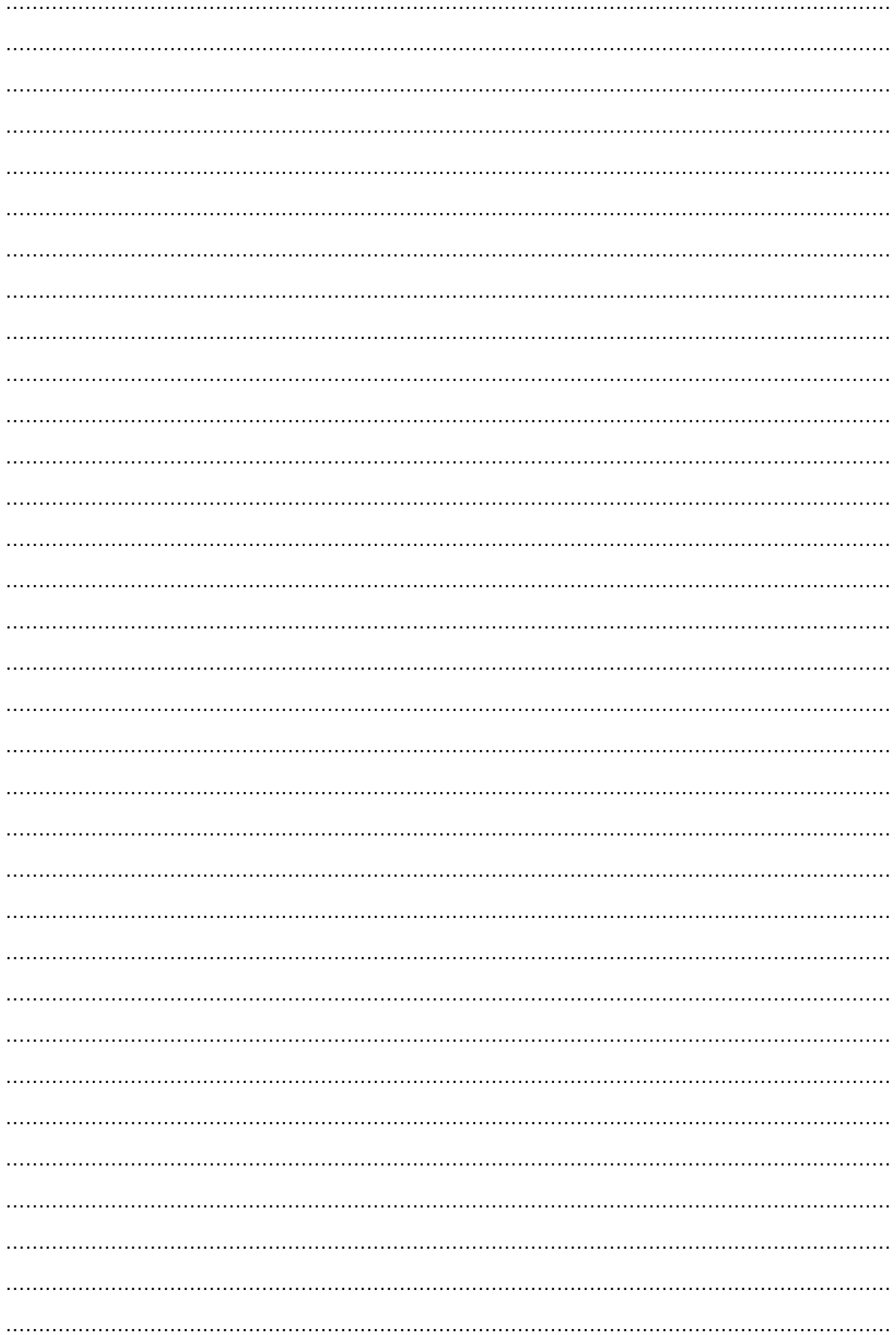
13. **Disbudding:**

.....

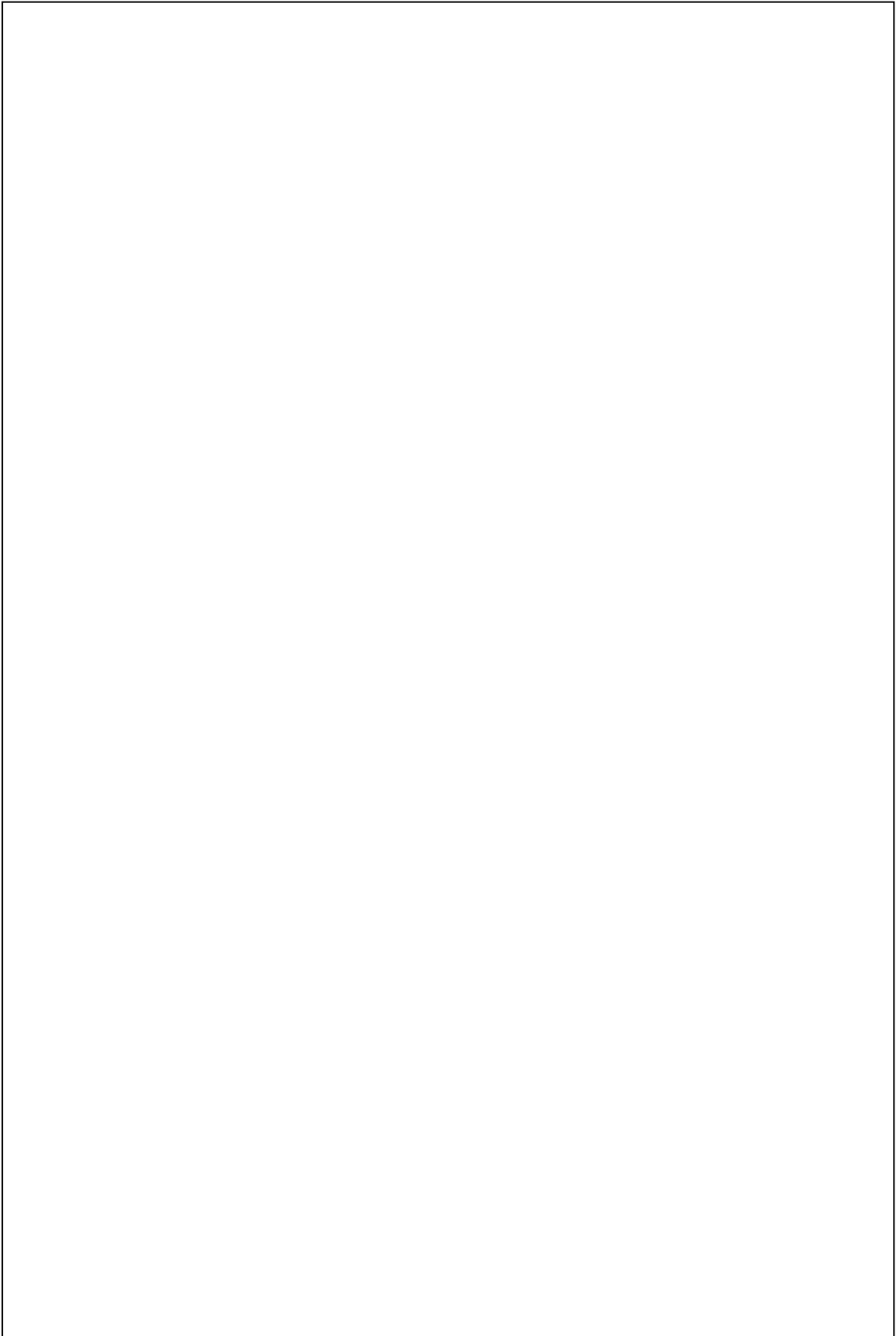
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Assignment: Practice the procedures and draw sketches.

A large, empty rectangular box with a thin black border, occupying the lower half of the page. It is intended for the student to draw sketches related to the procedures mentioned in the assignment.



Problem: Draw a neat sketch of an orchard (10.0 ha)

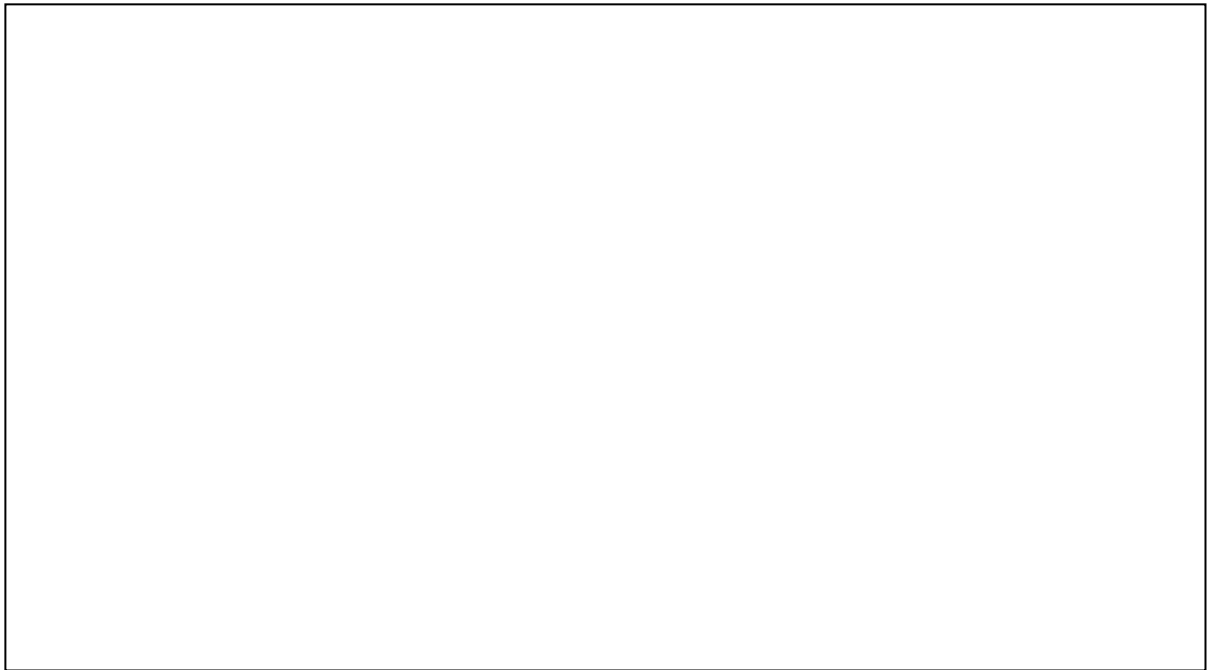


Objective: Prepare Layout of Different Planting Systems of Orchard

Materials Required:
.....
.....

Planting system: Vertical row planting pattern

Square System:

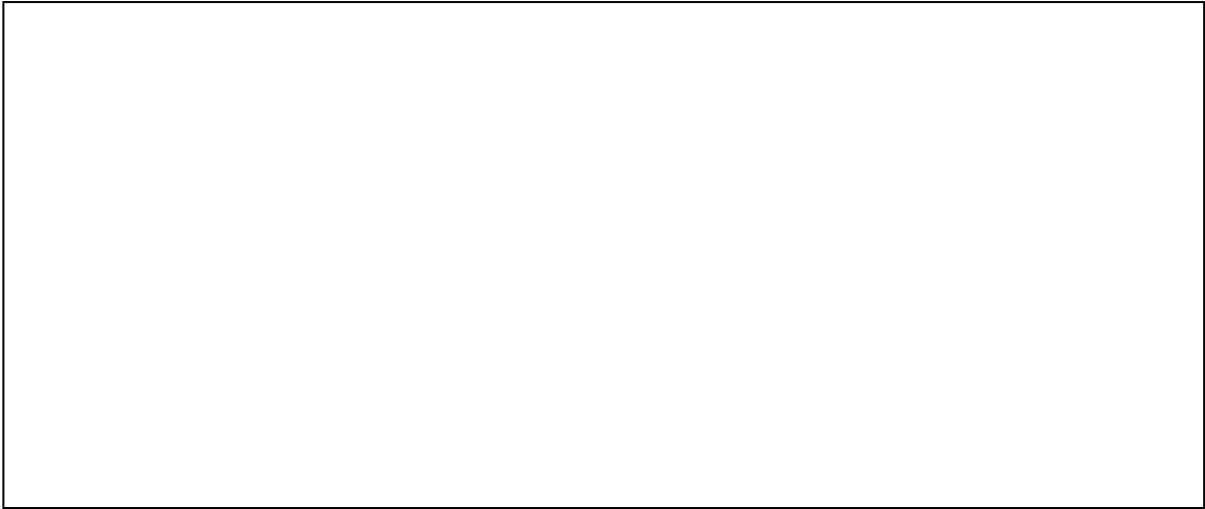


Rectangular system:

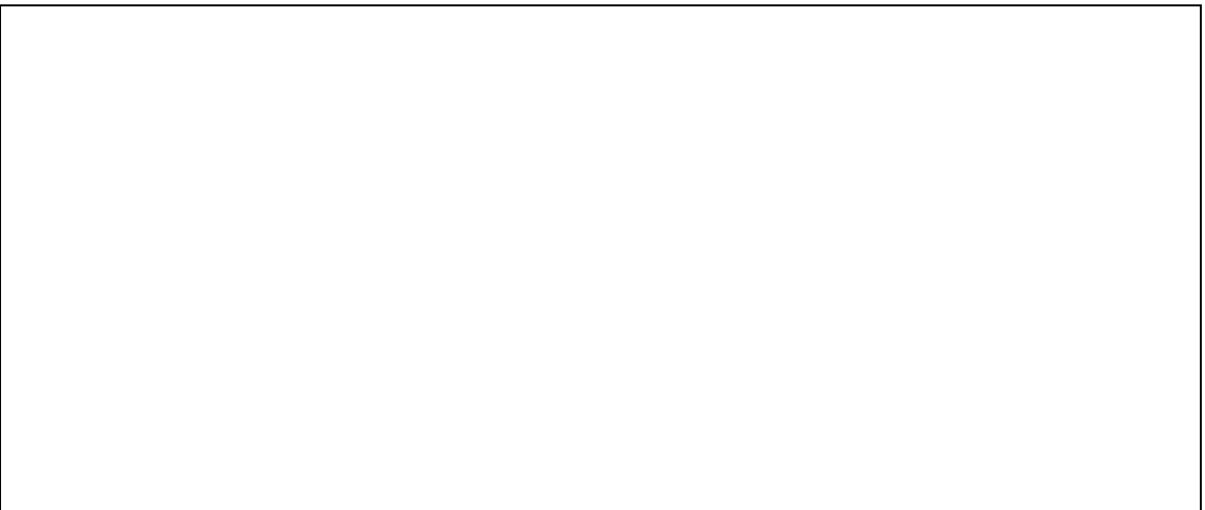


Alternate row planting pattern:

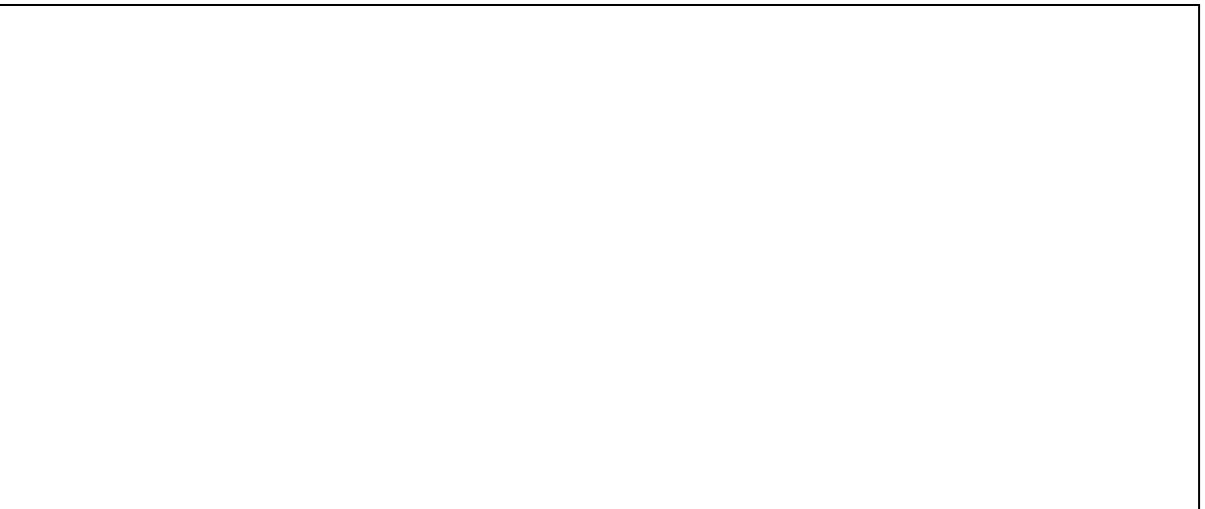
Diagonal or Quincunx system:



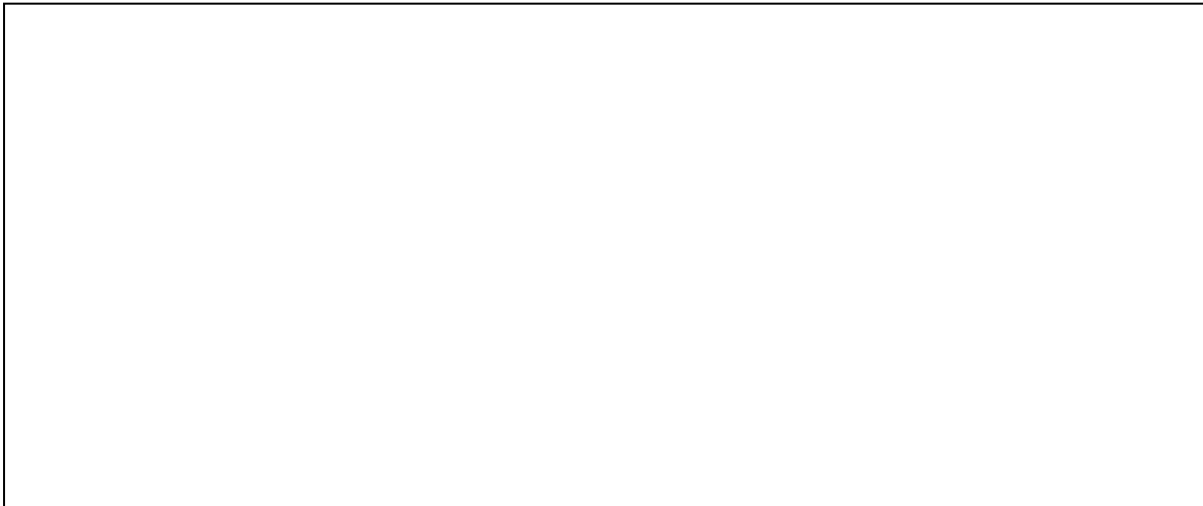
Hexagonal system:



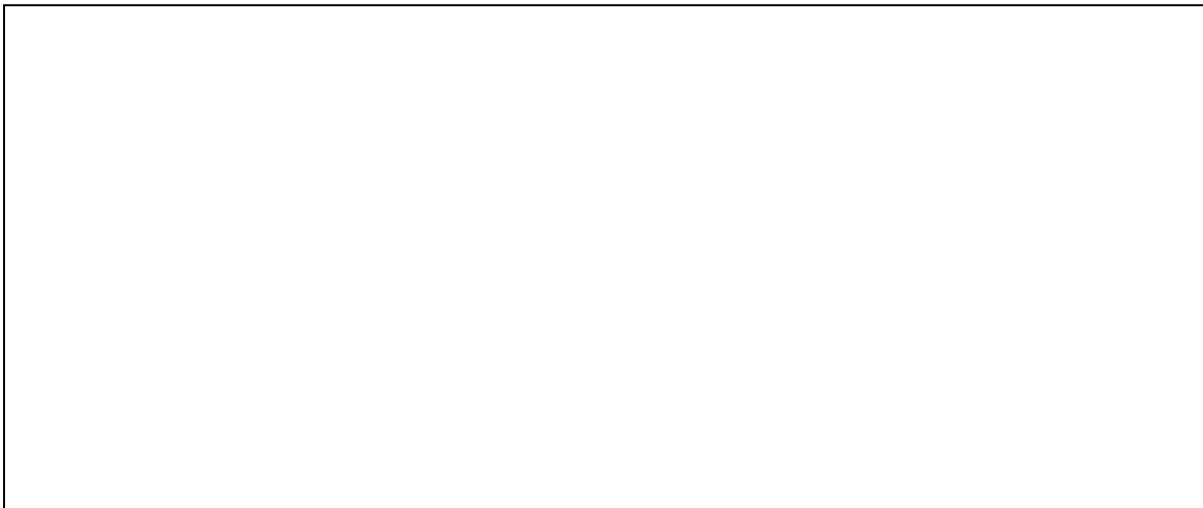
Triangular system:



Double Row System:



Contour system



Calculation of number of trees required per unit area

Quincunx system

$$\text{No of plants / ha} = \frac{\text{Total Area}}{(\text{Row to row distance}) \times (\text{Plant to plant distance})}$$

If Row to Row distance and Plant to Plant distance is 10m, then

$$\text{No of plants / ha} = \frac{10,000}{10 \times 10}$$

$$\text{No of plants / ha} = 100$$

Additional plants planted in centre of square = (No. of rows length wise - 1) × (No. of rows width wise - 1)

$$\begin{aligned} &= (10 - 1) \times (10 - 1) \\ &= 9 \times 9 \\ &= 81 \end{aligned}$$

Therefore, total no. of plants = 100 + 81 = 181

Hexagonal system:

$$\text{No of plants / ha} = \frac{\text{Total Area}}{(\text{Row to row distance}) \times (\text{Plant to plant distance})}$$

$$\text{No of plants / ha} = \frac{10,000}{10 \times 8.65}$$

$$\text{No of plants / ha} = 115$$

If plant to plant distance = 10 m, then as per equilateral triangles;

$$\text{The row to row distance} = AD = \sqrt{AB^2 - BD^2}$$

$$= \sqrt{100 - 25}$$

$$= 8.65 \text{ m}$$

Triangular system:

$$P = \frac{S}{d^2}$$

Where,

P= Plant population

S= Total Area

d= length of the triangle arm

Double Row System:

$$\text{No of plants / ha} = \frac{\text{Number of the Rows} \times \text{Total area cropped}}{(\text{Plant to plant distance}) \times (\text{Row to Row}) + (\text{Bed to Bed distance})}$$

If, the plant to plant distance is 25 cm, row to row distance is 35 cm and bed to bed distance is 90 cm.)

$$\text{No of plants / ha} = \frac{2 \times 10000}{0.25 \times (0.35 + 0.90)}$$

$$\text{No of plants / ha} = 64000$$

Observations to be performed:

Calculate of number of different fruit crops per hectare under different planting system.

Problem:

Practice the planting system on the field and draw neat sketches

Arrangements of vegetable and spice crops in different plots

| Time | Name of the vegetable & spice |
|----------------------|-------------------------------|
| July – October | |
| November - March | |
| April - June | |
| June – August | |
| October – February | |
| March – June | |
| June – October | |
| October – January | |
| January – May | |
| September – December | |
| January – March | |
| March – July | |
| August – December | |
| December – March | |
| March – July | |
| October – December | |
| January – June | |
| July – September | |
| November – March | |
| April – July | |
| August – October | |

Bund crops:

Fence crops:

Assignment: Draw a neat sketch of a model nutritional garden.

.....
Solvents for dissolving plant growth regulators

| Name of growth regulator | Solvent |
|---|--|
| Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), 4 CPA, NAA | Ethyl alcohol, Methanol, Potassium hydroxide, Sodium hydroxide |
| 2, 4-D and 2, 4,5-T | Water |
| Gibberellic Acid (GA3), 6-Benzyl Adenine, Benzyl Amino purine, Kinetin 2 ip | Ethanol or Methanol, 0.1 N HCL |

Procedure:

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Example: Before preparation, the following aspects should be known-active ingredients or strength of pure chemical that is mentioned in the label of the pack, the amount of chemical required for the desired strength and volume are calculated by the following formula.

$$V_1S_1 = V_2S_2$$

Where V_1 = chemical required.

S_1 = strength of chemicals/hormone.

V_2 = water or powder required.

S_2 = concentration or strength of chemical/ hormone required.

[1% = 10,000 ppm]

Solved Problem:

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Assignment: Practice the job and record the calculation

Details of various tissue culture rooms/chambers

| S. No. | Name of the room / chamber | Facilities available | Details of the work being done at the time of visit |
|---------------|-----------------------------------|-----------------------------|--|
| 1. | Washing room | | |
| 2. | Media preparation room | | |
| 3. | Inoculation room | | |
| 4. | Growth chamber | | |
| 5. | Hardening room / glass house | | |

Details of various tissue culture techniques

| Name of Lab | Types of tissue culture technique followed (Name them) | Fruit/Plantation crops in which the work is in progress | Protocols developed | Feature plans |
|-------------|--|---|---------------------|---------------|
| | | | | |

Details of tissue culture media

| Name of Media | Ingredients | | | | |
|----------------------|-----------------------|-----------------------|-----------------|-------------|----------------------|
| | Macro elements | Micro elements | Vitamins | PBRs | Miscellaneous |
| | | | | | |

Write in brief about the important uses of the following in tissue culture.

Refrigerator:

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.....
.....

Analytical balance:

.....
.....

Autoclave:

.....
.....

pH meter:

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.....

Laminar airflow hood:

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.....
.....

Agar:

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PBRs:

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.....

Surface sterilant:

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Precautions to be followed while working in a tissue culture lab:

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Objective: Visit to commercial Horticultural Nursery

Materials required:

Method of observations:

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Report of the visit:

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Objective: Visit to commercial fruits Orchard

Materials required:

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Method of observations:

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Report of the visit

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