

**PRACTICAL MANUAL**

**FUNDAMENTALS OF HORTICULTURE**

**HFS 101 3(2+1)**

**For Undergraduate Horticulture Students**

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## SYLLABUS

**Practical:** Features of orchard, planning and layout of orchard, tools and implements, identification of various horticultural crops, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

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.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
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25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			

**Plantation crops**

<b>S. No</b>	<b>Common name</b>	<b>Botanical name</b>	<b>Family</b>
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.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
<b>14.</b>			
15.			
16.			
17.			
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19.			
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24.			
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26.			
27.			
28.			
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.							
6.							
7.							
8.							
9.							
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.							
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**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.							

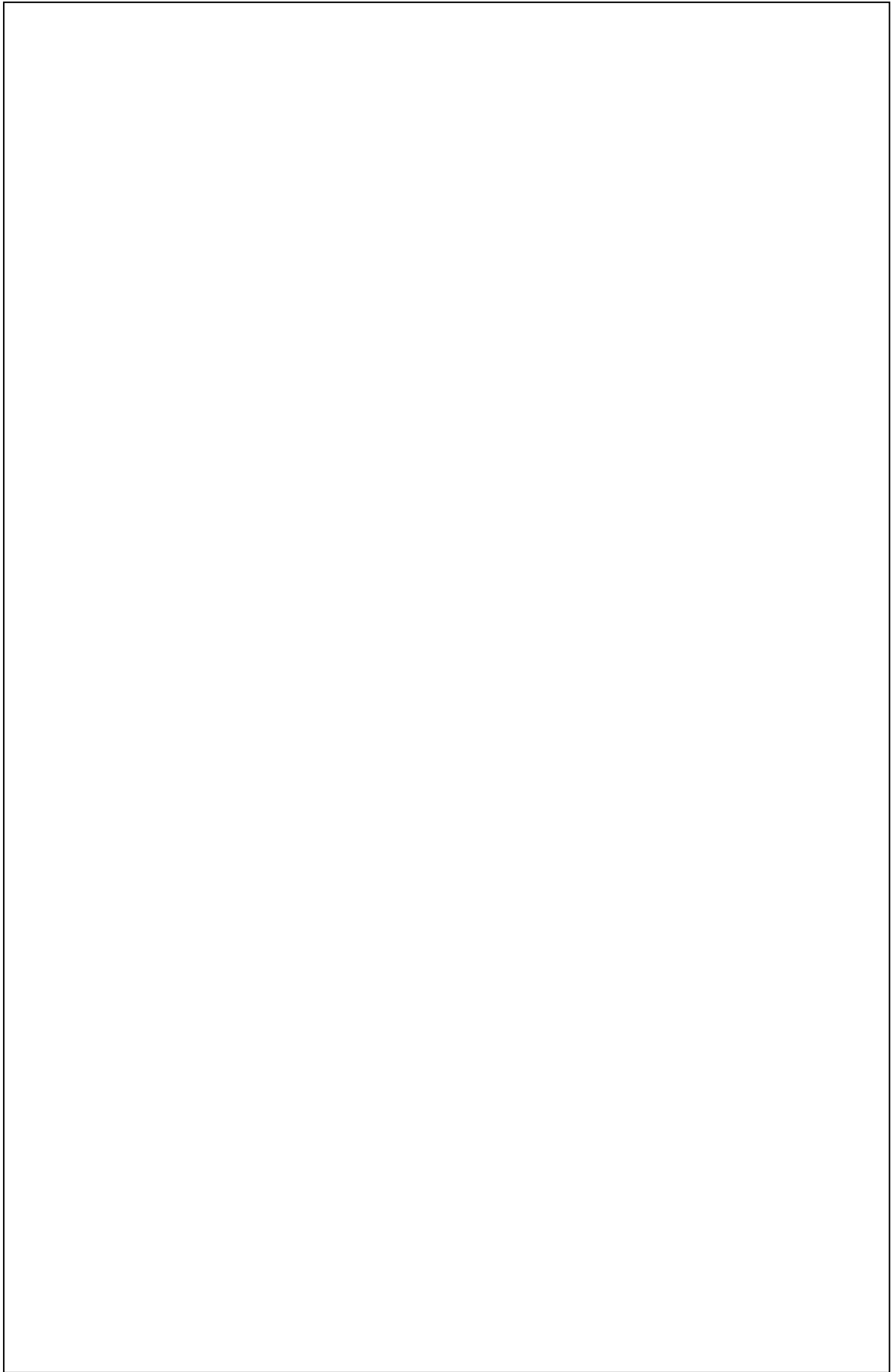
**Ornamental conifers**

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.							
5.							
6.							
7.							
8.							
9.							





**Objective: Training and Pruning of Fruit Plants**

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

.....

**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:** .....

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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:** .....

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8. **De-suckering:** .....

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9. **Root Pruning:** .....

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

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

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12. **Bending:** .....

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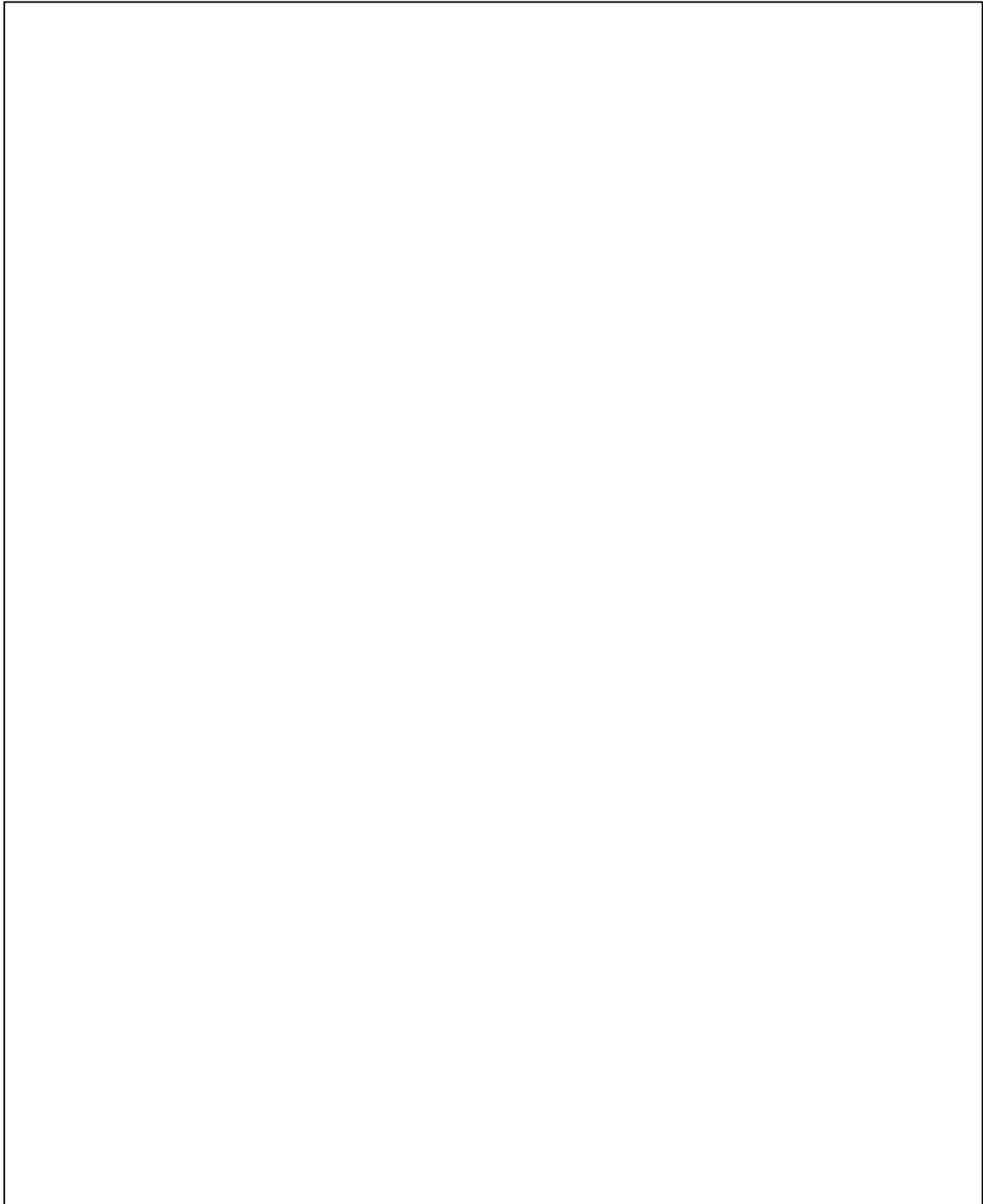
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13. **Disbudding:** .....

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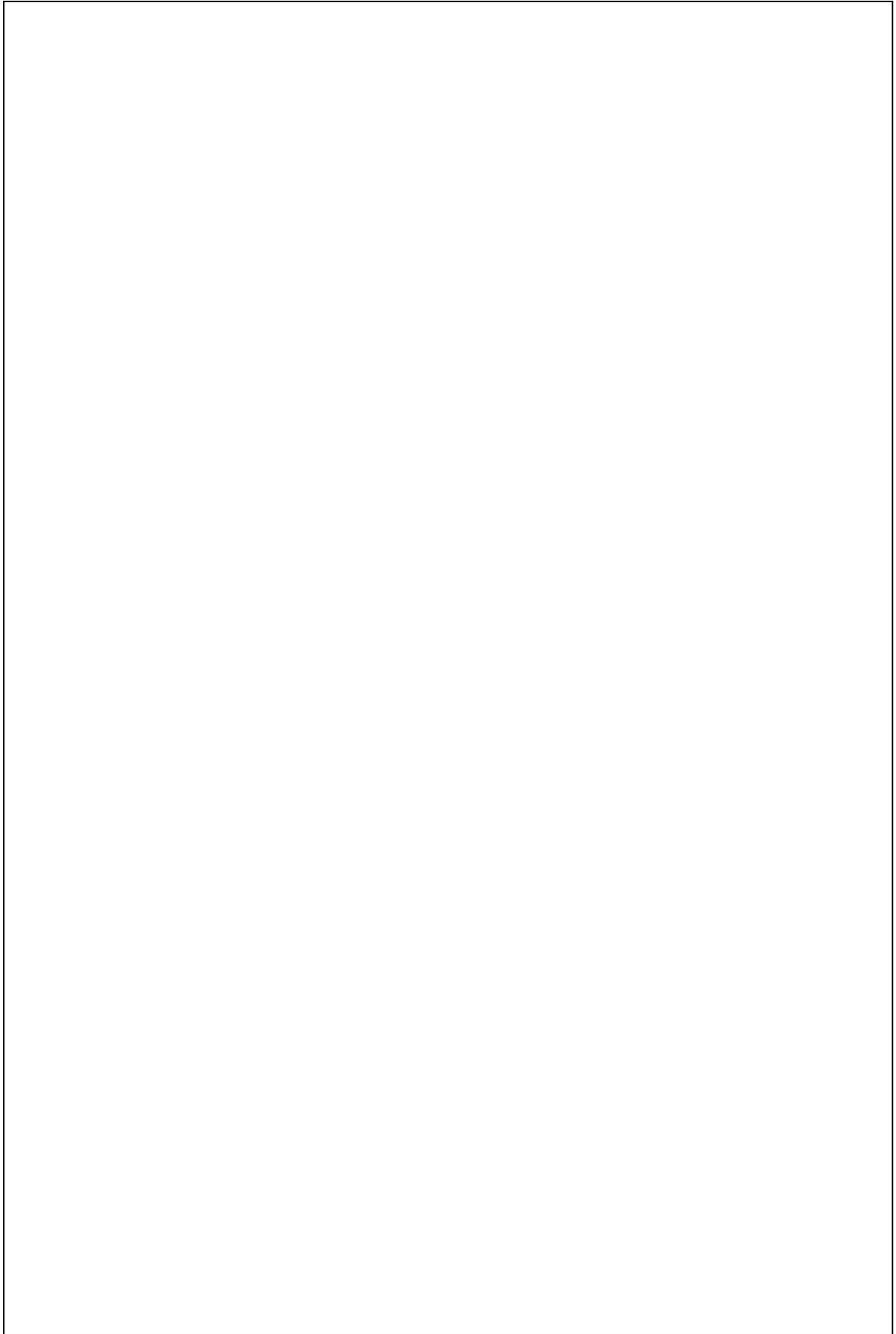
**Assignment:** Practice the procedures and draw sketches.

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.



Dotted lines for sketching.

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



**Objective: Prepare Layout of Different Planting Systems of Orchard**

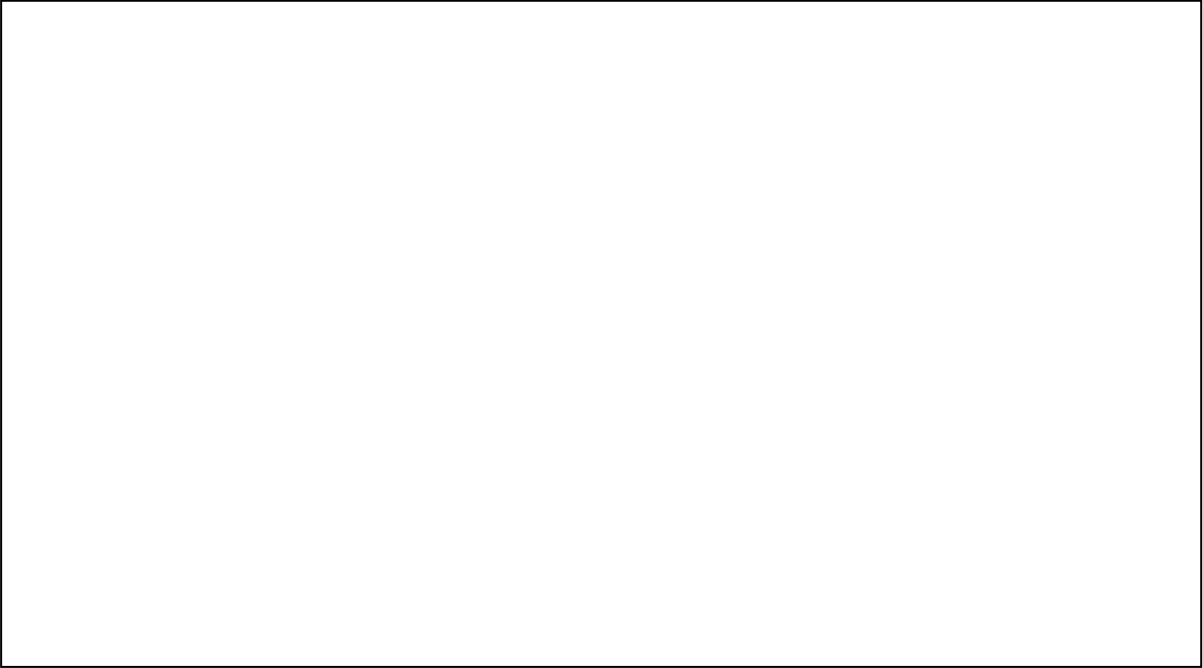
**Materials Required:** .....  
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**Planting system: Vertical row planting pattern**

**Square System:**



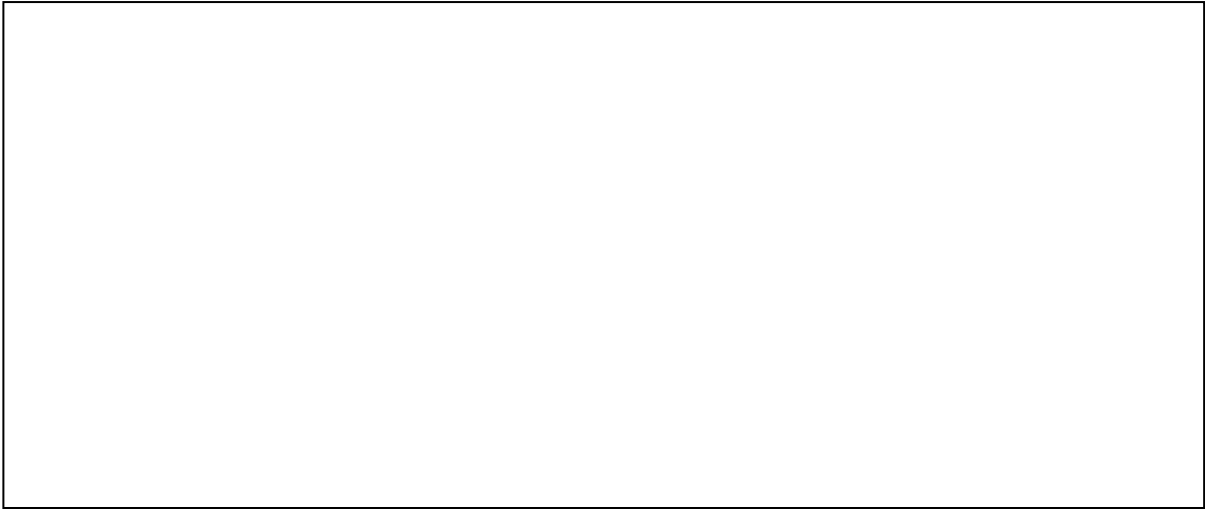
**Rectangular system:**



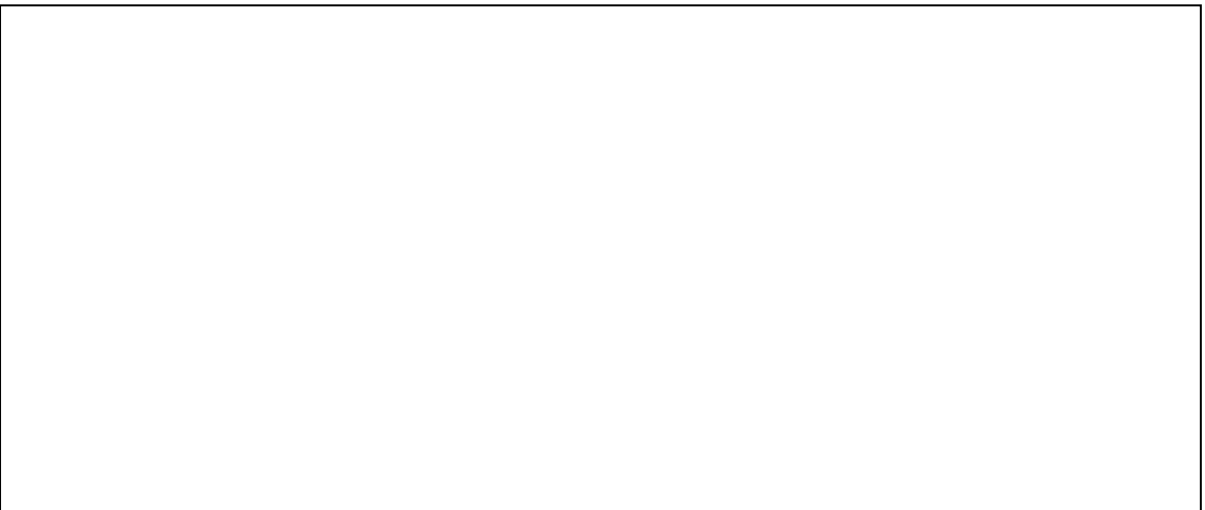


**Alternate row planting pattern:**

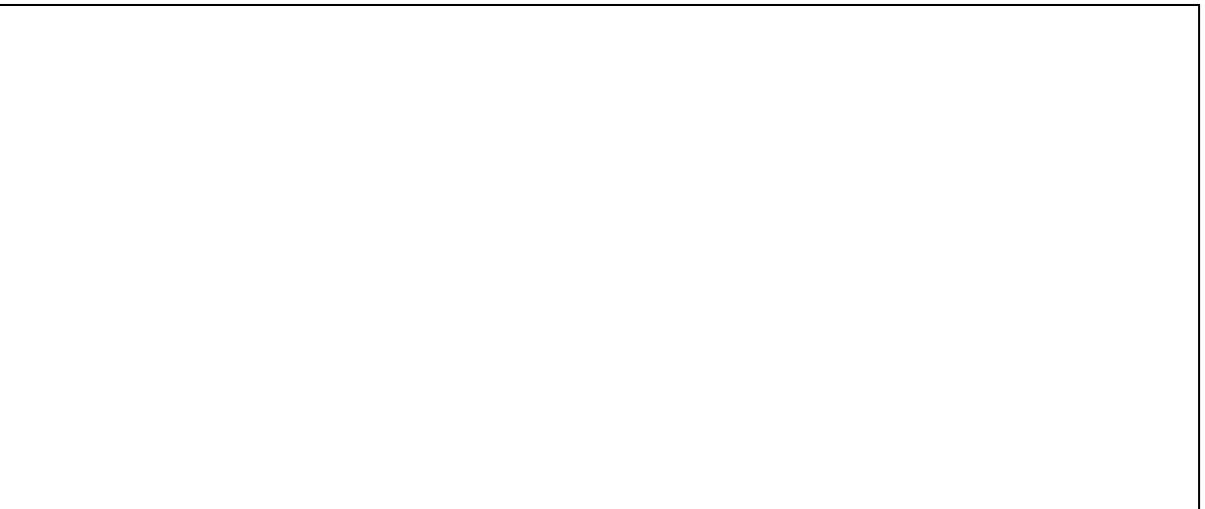
**Diagonal or Quincunx system:**



**Hexagonal system:**

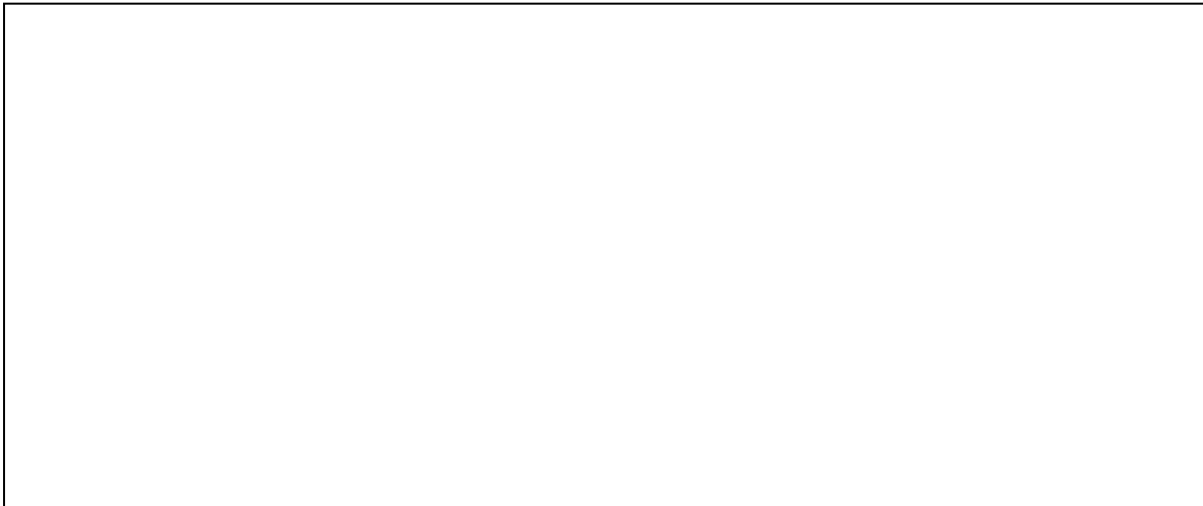


**Triangular system:**

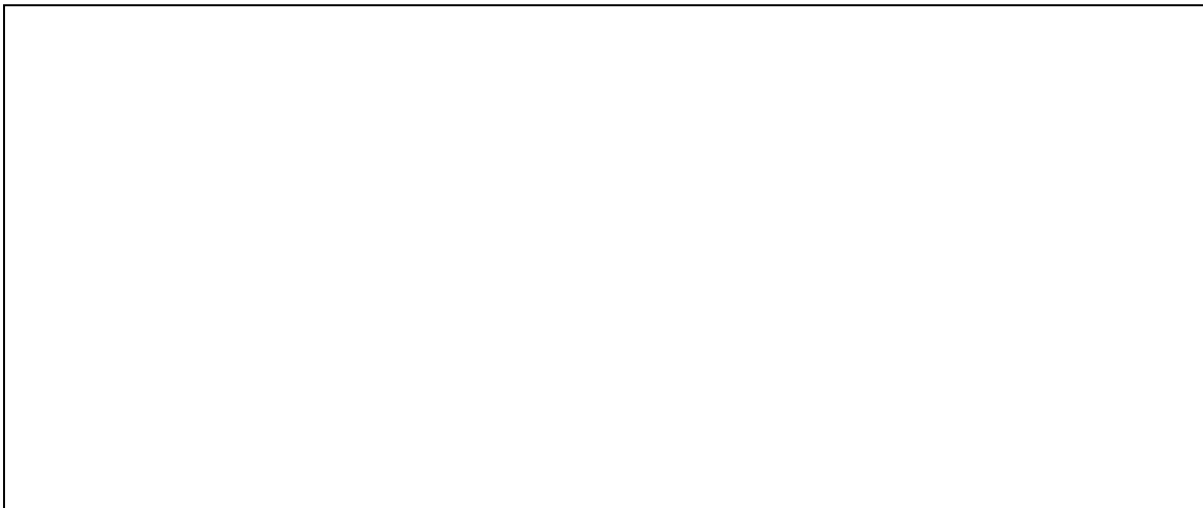




## Double Row System:



## 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

**Objective: Layout of a Nutritional / Kitchen Garden**

**Kitchen Garden:** .....

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**Importance:** .....

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**Selection of Land:** .....

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**Selection of Crops:** .....

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**Important Consideration:** .....

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**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.





**Objective: Digging of Pits for Planting of Fruit Plants (Banana)**

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

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**Procedure:** .....

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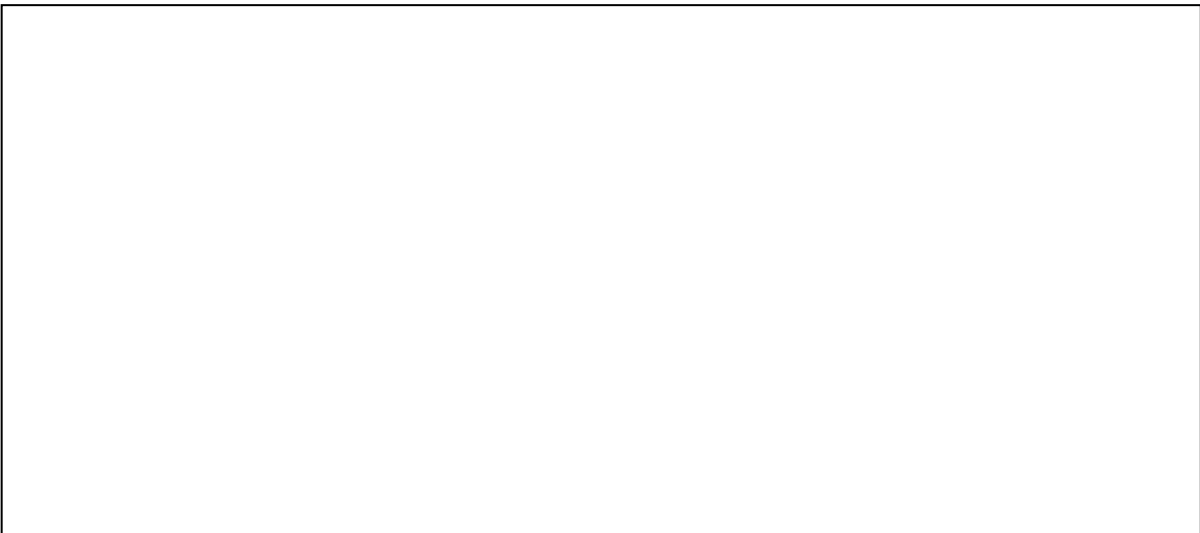
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**Problem:** Practice the job on the field and draw neat sketch



**Objective: Preparation of Fertilizer Mixtures and Field Application**

**Materials required:**.....

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**Method of Application:** .....

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**Precautions:** .....

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**Precautions:**.....

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**Problems:** Practice the job on the field.



**Exercise No. 13**

**Objective: Identification and Management of Nutritional Disorders in Fruit Crops**

**Nutrient Disorders in Fruits**

S. No.	Nutrition	Deficiency Symptoms	Corrective Measures
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

**Problem: Diagnose the disorder on the field and observation to be recorded crop-wise**

S. No.	Crops	Symptoms on the plant	Remarks
1.			
2.			
3.			

4.			
5.			
6.			
7.			
8.			
9.			
10.			

**Objective: Maturity Standard of Fruits & Vegetables**

**Maturity Indices of some fruits and vegetables:**

**Banana:** .....  
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**Mango:** .....  
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**Papaya:** .....  
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**Guava:** .....  
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**Jackfruit:** .....  
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**Pineapple:** .....  
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**Sweet orange:** .....  
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**Mandarin:** .....  
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**Litchi:** .....

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**Pomegranate:** .....  
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**Aonla:** .....  
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**Apple:** .....  
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**Grape:** .....  
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**Tomato:**.....  
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**Cucumber:**.....  
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**Watermelon:**.....  
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**French bean:**.....  
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**Objective: Layout of Different Irrigation Systems**

**Surface irrigation.**

Flooding System: .....  
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Basin system: .....  
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Border: .....  
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Furrow irrigation: .....  
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**Sub-surface irrigation:**

Sprinkler/Overhead/Aerial irrigation: .....  
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Drip irrigation: .....  
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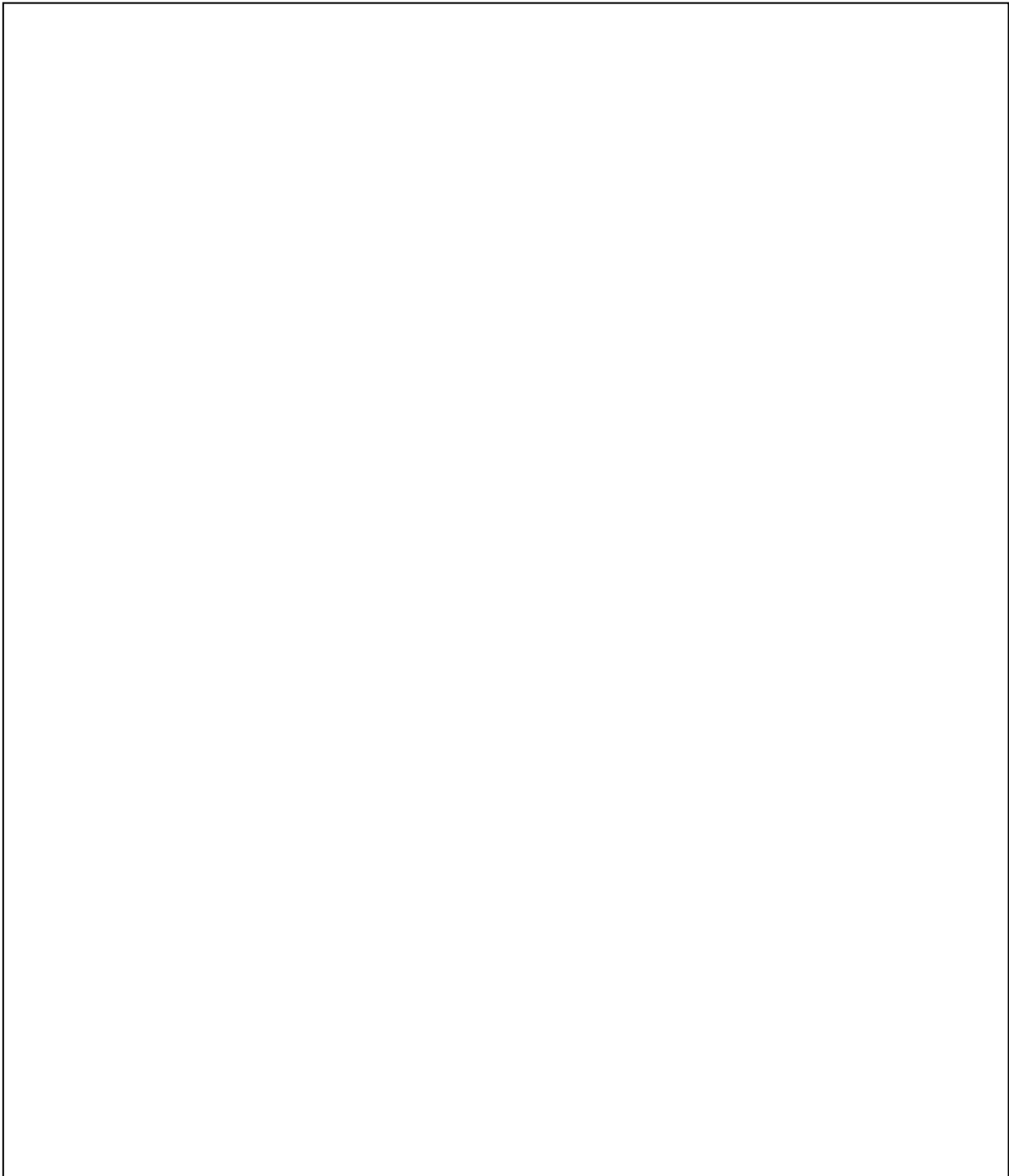
Pitcher system irrigation: .....

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Funnel system: .....

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**Problem:** Practice the job on the field and draw neat sketch





**Objective: Preparation and Application of Growth Regulators**

**Materials Required:** .....  
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**Preparation of growth regulators**

**Dust form:** .....  
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**Lanolin** **paste:**

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**Solution form:** .....

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**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



## DIFFERENT SYSTEM OF TRAINING

**Different methods of training in fruit tree plants:**

- Central leader system
- Open centre or vase form
- Modified leader system

**Systems of Training for Dwarf trees**

- Dwarf Bush
- Dwarf Pyramids
- Spindle bush
- Slender spindle
- Free palmette
- Cordons and double cordon
- Espaliers
- Tatura trellis

**Training system for grape vine**

- Head system
- Kniffin system
- Overhead trellis or Telephone system
- Bower system
- Y-Trellis

## PLANTING DISTANCE OF DIFFERENT TYPES OF FRUIT CROPS

S.No	Name of the Crops	Spacing (Plant to Plant and Row to Row) Metre
1.	Banana, Papaya	2-3 × 2-3
2.	Phalsa	3 × 3
3.	Passion fruit	3-4 × 3-4
4.	Pomegranate	3-6 × 3-6
5.	Custard apple	4-5 × 4-5
6.	Ber, Fig, Lemon	5-6 × 5-6
7.	Pumelo, Grapefruit	6-7 × 6-7
8.	Guava, Mulberry	6-8 × 6-8
9.	Persimmon	7-8 × 7-8
10.	Sapota, Avocado, Water apple, Rose apple	8-9 × 8-9
11.	Mandarin orange, Sweet orange	5 × 6
12.	Aonla, Bael	9-11 × 9-11
13.	Litchi	10-12 × 10-12
14.	Jackfruit, Mango, Jamun	12 × 12
15.	Pineapple	0.25 × 0.35 × 0.9
16.	Date palm	10 × 10
17.	Loquat	6 × 6
18.	Karonda	3-4 × 4-5
19.	Carambola	5 × 5
20.	Grape	2-3 × 3
21.	Apple (Non-spur type)/ Apple (Spur type)	6 × 6 / 4 × 4
22.	Pear	5 × 5
23.	Peach	5 × 5
24.	Palm	5 × 5
25.	Apricot	6 × 6
26.	Strawberry	Matted Rows: 40cm × 60cm Spaced Beds: 30-50cm × 90-100cm Hill Rows: 30cm × 100cm
27.	Cherry	10 × 10
28.	Almond, Hazelnut	6 × 6
29.	Walnut	10 × 10
30.	Cashew Nut, Tamarind, Pecan Nut	12 × 12

### NUTRIENT CONTENT OF ORGANIC MANURES

Organic Manure	N %	P <sub>2</sub> O <sub>5</sub> %	K <sub>2</sub> O %
Farmyard manure	0.50	0.25	0.50
Cattle dung	0.40	0.20	0.17
Poultry manure	3.03	0.63	1.40
Vermicompost	3.00	1.00	1.50
Rural compost	0.75	0.20	0.50
Urban compost	1.75	1.00	1.50
Castor cake	4.37	1.85	1.39
Coconut cake	3.00	1.80	1.90
Neem cake	5.22	1.08	1.48
Blood meal	12.00	2.00	1.00
Groundnut cake	7.30	1.50	1.30
Pressmud	2.10	4.40	0.80
Safflower cake	4.8	1.4	1.2
Sesamum cake	6.2	2.0	1.2
Fish mean, fish manuring and fish guano	4.0	3.0	0.3
Bono mean (Raw)	3.0	20.0	-
Bone mean (Steamed)	1.0	25.0	-
Settled sludge (Dry)	2.0	1.0	0.4
Night soil	1.2	0.8	0.4
Human urine	1.0	0.1	0.2
Cattle dung and urine mixed	0.60	0.15	0.45
Horse dung and urine mixed	0.70	0.25	0.55
Sheep dung and urine mixed	0.95	0.35	1.00

### COMPOSITION OF INORGANIC FERTILIZERS

Fertilizers	N %	P <sub>2</sub> O <sub>5</sub> %	K <sub>2</sub> O %	Sulphur	Calcium
Ammonium nitrate	35				
Calcium ammonium nitrate	26				
Ammonium sulphate nitrate	26			12.1	
Sodium nitrate	15.6	-	-		
Calcium nitrate	15.5	-	-		19.5
Potassium nitrate	13.0	-	-		
Ammonium sulphate	20.6			24	
Ammonium chloride	26.0				
Anhydrous ammonia	82.0	-	36.4		
Urea	46	-	-		
Calcium cyanamide	20.6				
SSP	-	16	-		
Double SP	-	32	-		
Triple SP	-	46-48	-		
Diammonium Phosphate (DAP)	18	46	-		
Potassium chloride			60		
Potassium sulphate			48		
Calcium Chloride					15