TROPICAL FRUIT PRODUCTION

HFS-501, 3 (2+1)

PRACTICAL MANUAL

Dr. Ranjit Pal
Dr. Govind Vishwakarma
Dr. Sukanya Misra

DEPARTMENT OF FRUIT SCIENCE
COLLEGE OF HORTICULTURE& FORESTRY
RANI LAKSHMI BAI CENTRAL
AGRICULTURAL UNIVERSITY
JHANSI-284003

Course: Tropical Fruit Production, HFS-501, 3 (2+1)

Practical: Distinguished features of tropical fruit species, cultivars and rootstocks. Demonstration of planting systems, training and pruning. Hands on practices on pollination and crop regulation. Leaf sampling and nutrient analysis. Water management and weed management Physiological disorders-malady diagnosis. Physico-chemical analysis of fruit quality attributes. Field/Exposure visits to tropical orchards. Project preparation for establishing commercial orchards.

Name of Students: ....

Roll No...…………. Batch…………………………....……..

Session ………………………….…….. Semester…………………………………......

Course Name ....

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

Certificate

This is to certify that Shri./Km. ....…..................................…....

ID No: .... has completed the practical of courses .... courses No ....…..................... as per the syllabus of M. Sc (Horticulture) Fruit Science..semester in year ....…….…. in the respective lab/field of college.

Date: Course Teacher

CONTENTS

S. No	Title of Exercise	Date	Signature
1.	To study the morphological characters of tropical fruits: Mango and Guava		
2.	To study the morphological characters of tropical fruits: Banana and Papaya		
3.	To study the morphological characters of important fruit varieties		
4.	To study the establishing commercial orchards		
5.	Layout of different planting systems of orchard		
6.	To study the training and pruning of tropical fruits: Guava		
7.	To study the floral biology & pollination of tropical fruits		
8.	To study the pollination of tropical fruits		
9.	To study the crop regulation of Guava		
10.	To study the leaf sampling and nutrient analysis of tropical fruits		
11.	To identify and management of nutritional disorders in tropical fruit crops		
12.	To study the analyses of quality attributes of TSS and Acidity		
13.	To study the analyses of Sugar content & Vitamins		
14.	Layout of different irrigation systems		
15.	To study the management of weeds in fruits orchard		
16.	To study the mapping of agri export zones of India		
17.	To study the production economics for commercial cultivation of fruit crops		
18.	To visit to commercial orchards and diagnosis of maladies		

Objective: To study the morphological characters of tropical fruits: Mango and Guava

Materials required: …………………………………………………………………………...

……………………………………………………………………………………………………

……………………………………………………………………………………………………

1. Mango

A. General parameters

    i.   Common name:

    ii.   Botanical name:

    iii.   Type of planting material (Seedling/grafted/layered):

    iv.   Name of the variety:

    v.   Name of the rootstock:

    vi.   Age of the plant:

    vii.   Parentage name:

Observation:

Parameters	Remarks
Tree growth habit	
Leaf blade shape	
Leaf attitude in relation to branch	
Leaf apex shape	
Inflorescence shape	
Inflorescence colour	
Rachis colour	
Time of flowering	
Number of Male and hermaphrodite flowers per panicle	
Fruit Shape	
Fruit beak	
Fruit size	
Fruit weight (g)	
Stone weight (g)	
Time of fruit maturity	
Fruit maturity group	

2. Guava:
A. General parameters
- i. Common name:
- ii. Botanical name:
- iii. Type of planting material (Seedling/grafted/layered):
- iv. Name of the variety:
- v. Name of the rootstock:
- vi. Age of the plant:
- vii. Parentage name:

Observation:

Parameters	Remarks
Tree height (cm)	
Tree spread (cm)	
Tree habit	
Inflorescence type	
Time of flowering	
Duration of flowering	
Fruits	
Maturity period	
Maturity index	

Objective: To study the morphological characters of tropical fruits: Banana and Papaya

Materials required: ………………………………………………………………………………...

……

……

1. Banana

A. General parameters

   i.   Common name:

  ii.   Botanical name:

 iii.   Type of planting material (Seedling/grafted/layered):

 iv.   Name of the variety:

  v.   Age of the plant:

 vi.   Parentage name:

Observation:

Parameters	Remarks
Pseudo stem height (cm)	
Pseudo stem girth (cm)	
Pseudostem colour:	
Leaf habit	
Number of suckers per plant:	
Inflorescence:	
Bunch:	
Male flower:	
Fruits:	
Maturity period:	
Maturity index:	

2. Papaya:
A. General parameters
i.   Common name:

ii. Botanical name:

iii. Type of planting material:

iv. Name of the variety:

v.   Age of the plant:

vi. Parentage name:

Observation:

Parameters	Remarks
Tree height (cm)	
Tree spread (cm)	
Flower type / Sex ratio	
Fruit:	
Maturity Period:	
Maturity index:	

Objective: To study the morphological characters of important fruit varieties

Materials required: …………………………………………………………………………..

…………………………………………………………………………………….………………..

………………………………………………………………………………………………….....

| **1. Mango:** |
| **Dashehari:** |
| **Amrapali:** |
| **Mallika:** |

2. Guava:
Allahabad Safeda:
Lucknow-49:
Lalit:
Shweta:

2. Aonla:

NA 7:

NA 10:

Chakaiya:

Objective: To study the establishing commercial orchards
Materials required: ……………………………………………………………………………..

…………………………………………………………………………………………………..………..

……

Important Features/Components of an Orchard: …………………………………………………..

……………………………………………………………………………………………………..……

………………………………………………………………………………………………………

………………………………………………………………………………………………..………..

……

………………………………………………………………………………………………..………..

……

…………………………………………………………………………………………..………………

……

………………………………………………………………………………………..………………..

……

………………………………………………………………………………………..………………..

……

…………………………………………………………………………………………..………………..

……

…………………………………………………………………………………………..………………..

……

………………………………………………………………………………………..…………………

……

…………………………………………………………………………………………..………………..

……

………………………………………………………………………………………..………………..

……

…………………………………………………………………………………………..………………..

……

………………………………………………………………………………………..………………..

……

…………………………………………………………………………………………..………………..

……

………………………………………………………………………………………………………

…………………………………………………………………………………………..………………..

……

....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

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

Objective: Layout of different planting systems of orchard

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

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

(A). Planting system: Vertical row planting pattern

   I.   **Square System:**

Procedure of lay out:

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

II.   Rectangular system:

Procedure of lay out:

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Calculation of number of trees required per unit area

Calculation of number of different fruit crops per hectare with different system of planting by using the following formulae:

Square and rectangular systems:

No. of plants required for 1 ha = 10, 000 sq. m
Row to row distance (m) × plant to plant distance (m)

No of plants / ha

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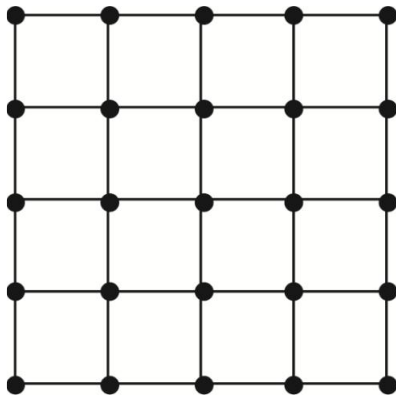
Square System   *Rectangular system*

Problem:

(B). Alternate row planting pattern:
  1. **Diagonal or Quincunx system:**

Procedure of lay out:

....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

2. Hexagonal system:

Procedure of layout:

....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

3. Double Row System:

Procedure of layout:

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
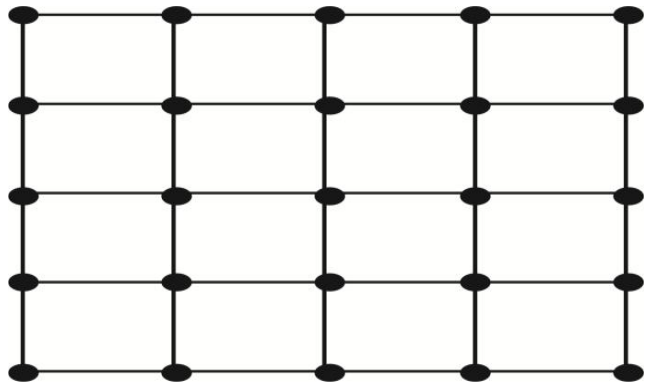
Calculation of number of trees required per unit area

Quincunx system

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

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

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

No of plants / ha = 100

Additional plants planted in centre of square = (No. of rows length wish – 1) × (No. of rows width wish – 1)
= (10– 1) × (10 – 1)
= 9 × 9
= 81

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

Hexagonal system:

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

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

No of plants / ha = 115

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

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

= $\sqrt{100 - 25}$

= 8.65 m

Double Row System:

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

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

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

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: To study the training and pruning of tropical fruits: Guava

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

……

……

……

……
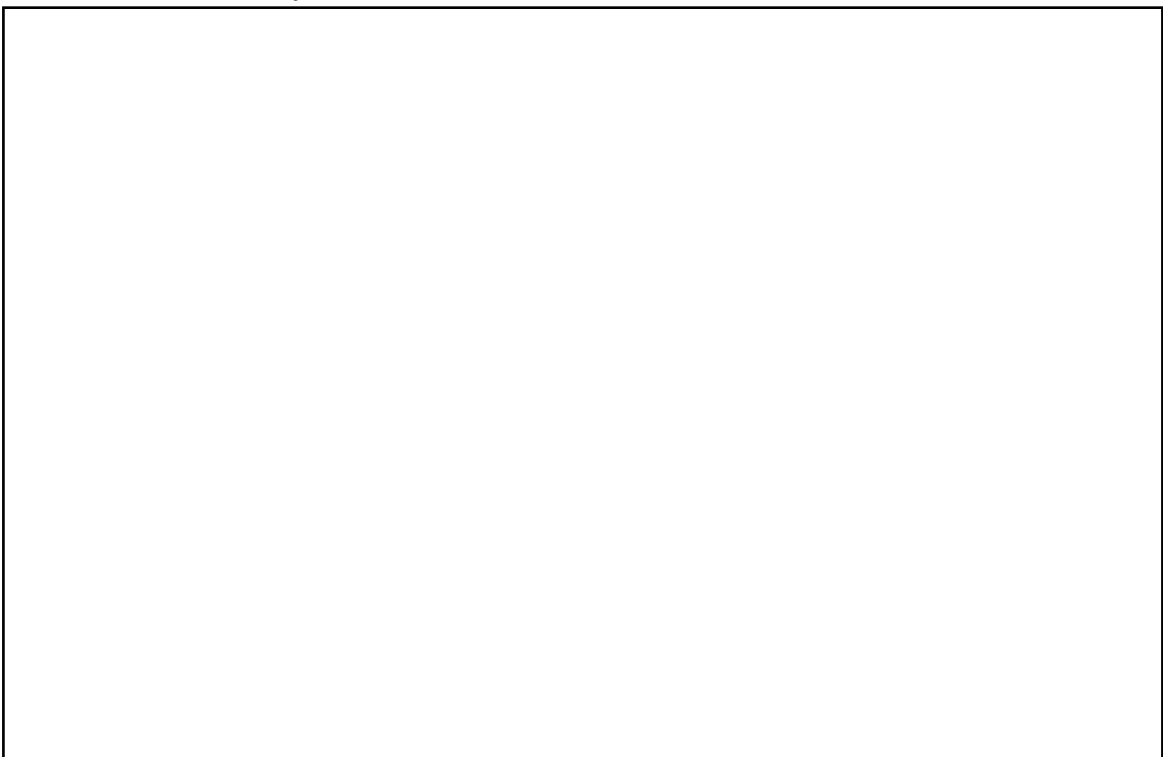
Methods of training and pruning: Open center, Modified leader and Bending system

Procedures:

  A. Open center

  B. Modified leader system

C. Bending Technology

Procedure of pruning

....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

Assignment: Practice different system of training and pruning

Objective: To study the floral biology of tropical fruits

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

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Flower characters: ……………………………………………………………………….

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Procedure:………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Observation: Time of anthesis (out of 10 selected flowers)

	Time							
	7.00 am		8.00 am		9.00 am		10.00 am	
	Male	Hermaphrodite	Male	Hermaphrodite	Male	Hermaphrodite	Male	Hermaphrodite
No of flower								
Percentage of flowers opened								

Time of dehiscence (out of 10 selected flowers)

	Time							
	7.00 am		8.00 am		9.00 am		10.00 am	
	Male	Hermaphrodite	Male	Hermaphrodite	Male	Hermaphrodite	Male	Hermaphrodite
No of flower								
Percentage of flowers opened								

Observation: Time of anthesis (out of 10 selected flowers)

	Time			
	7.00 am	8.00 am	9.00 am	10.00 am
No of flower				
Percentage of flowers opened				

Time of dehiscence (out of 10 selected flowers)

	Time			
	7.00 am	8.00 am	9.00 am	10.00 am
No of flower				
Percentage of flowers opened				

Assignment:

Objective: To study the pollination of tropical fruits

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

………

………

Procedure: ……………………………………………………………………………………………………

………

………

..……..

………

..………

………

..………

………

………..

………

………

………

……………………..……………………………………………………………………………………………

………

……………………..……………………………………………………………………………………………

………

…………………..…………………………………………………………………………………………………

………

……………………..…………………………………………………………………………………………..

………

……………………..…………………………………………………………………………………………..

………..

………

………..

…….....

………

………

………..

………

………

Observation: Record the number fruit

Date	Female Parent	Male Parent	Date of pollination	Fruit set (yes/No)

Objective: To study the crop regulation of Guava

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

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Methods of crop regulation: ……………………………………………………………..

……………………………………………………………………………………………………

…………………………………………………………………………………………….....

Procedures:

Objective: To study the leaf sampling and nutrient analysis of tropical fruits

For determination of total N in plant, organic N in plant sample is converted to NH4-N by digestion with concentrated H2SO4 containing substances (K2SO4 or Na2SO4) that promote this conversion. The NH4-N the digest is determined from the amount of NH3 liberated by distillation of the digest with an alkali (NaOH). Ammonia absorbed in the boric acid containing mixed indicator is determined with a standard acid.

Reagents required: ……………………………………………………………………………………
………
………
………
………
………
………
………
………
………
………
………
………

Procedure: ………………………………………………………………………………………………
………
………
………
………
………
………
………
………
………
………
………

Reaction
Sample digestion:………………………………………………………………………………………
………
………
………
………
………

Distillation: …………………………………………………………………………………………

....
....
....

Titration: ....

....
....
....

Calculations:

Amount (g) of N in the sample (S) = (ml of acid used for sample - ml of acid used for blank)
x normality of acid x 14 x 10^{-3}.
N in sample (%) = (S x 100) / Sample weight (g)

....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

TOTAL NITROGEN IN PLANT SAMPLE

Reagents

➢ Catalyst mixture/ Digestion accelerator, 10 g anhydrous sodium sulphate and 1,0 g of pure dry copper sulphate pentahydrate persample.

➢ Mixed indicator: Dissolve 0.1 g bromo-cresol green and 0.07 g methyl red indicator in 100 ml of 95% ethyl alcohol.

➢ Boric acid solution: Dissolve 40 g H_3BO_3, per lire of distilled water. As a general practice 5 ml mixed indicator solution is added toeach litre of boric acid solution

➢ Sodium hydroxide solution: 40% NaOH solution using N free sodium hydroxide flakes. This solution should be allowed to stand for 24- 48 hours so as to precipitate out sodium carbonate and other impurities.

➢ Concentrated sulphuric acid, sp. gr. 1.84, C.P.

➢ Salicylic acid.

➢ Sodium thiosulphate.

➢ 0.1 N H_2SO_4

Reactions:

i. Digestion:

$(C_6H_{10}O_5)$ n+ $2nH_2SO_4$ = 6n CO_2 + 7n H_2O + 2n SO_2

$2[R – COONH_2) + 2H_2SO_4 +5H_2 = 2 (NH_4)_2 SO_4 + 2 [R - COOH)$

ii. Distillation:

$2(NH_4)2SO_4 + 4NaOH = 2Na SO_4 + 4H_2O + 2NH_3$

$2NH_3 + 2 H_2O = 2 NH_4OH$

$NH_4OH + H_3 BO_3 = NH_4 [B (OH)_4]$

iii. Titration:

$2 NH_4 [B(OH)_4] + H_2SO_4 = (NH_4)_2 SO_4 + 2 H_3 BO_3 + 2 H_2O$
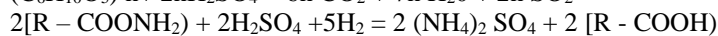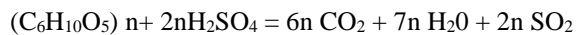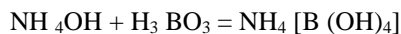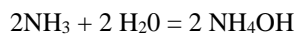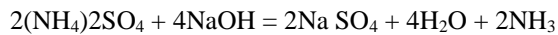
Procedure

➢ Take a 0.25-0,5 g finely ground plant sample to pass 40-mesh sieve in a piece of butter paper or any thin paper and after properly wrapping it, transfer to a 500 ml Kjeldahl flask.

➢ Add 25 ml of concentrated H_2SO_4, and allow to stand

➢ Allow to stand for 30 minutes and then add 5 g sodium thiosulphate.

➢ Again, allow to stand for 30 minutes. add catalyst mixture and heat Kjeldahl flask first slowly till frothing continues after that heat it briskly. Continue digestion for half an hour after the digest gets clean

➢ Cool and add 150 ml of water carefully.

➢ Cool again. Add 120 ml 40 % NaOH solution along the sides of Kjeldahl flask, few glass beads and a drop of a mineral oil and immediately connect it to distillation bulb in the distillation unit.

➢ Distillation should be continued till 150 ml distillate is collected.

➢ Titration of ammonia evolved against standard sulphuric acid.

➢ Run a blank simultaneously with a piece paper (same size as used for wrapping of sample) and other reagents.

Objective: To identify and management of nutritional disorders in tropical fruit crops

Identify the disorder and record.

Disorder	Cause and Symptoms	Control

Objective: To study the analyses of quality attributes of TSS and Acidity

Materials required for estimation of total soluble solids (TSS): …………………………………..

………

………

Procedure: …………………………………………………………………………………………………

………

………

………

………

………

………

………

Observations:

Samples	Name of crops:	TSS (^{0}Brix)

Conversion of the reading of the refractometer with scale indicating Sucrose for a temperature different from 20±0.5^{O}C

Temperature ^{0}C	Scale reading for soluble solids content (%)													
	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	Subtract from actual reading													
15	0.29	0.31	0.33	0.34	0.34	0.35	0.36	0.37	0.37	0.38	0.38	0.39	0.39	0.40
16	0.24	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.31	0.32	0.32
17	0.18	0.19	0.20	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24
18	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16
19	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Add to actual reading													
21	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
22	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.14	0.16	0.16	0.16	0.16	0.16	0.16
23	0.20	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.24
24	0.27	0.28	0.29	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.32
25	0.35	0.36	0.37	0.38	0.38	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
26	0.42	0.43.	0.44	0.45	0.46	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
27	0.50	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
28	0.57	0.60	0.61	0.62	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
29	0.66	0.68	0.69	0.71	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
30	0.74	0.77	0.78	0.79	0.80	0.80	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81

Source: Proceeding of the ninth session of the International Commission for Uniform Methods of sugar analysis, London, 1936.

Materials required for estimation of titratable acidity: ……………………………………………
……
……
……
……

Procedure: ………………………………………………………………………………………………
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Calculation:

$$\text{Titratable acidity } (\%) = \frac{titre \ \times \ Normality \ of \ NaOH \ \times \ volume \ made \ up \ \times \ equivalent \ weight \ of \ acid}{Volume \ of \ sample \ taken \ \times \ volume \ of \ aliquot \ taken \ \times 1000} \times 100$$

Milli equivalent weight of acid:

Malic acid - 0.0067g	Oxalic acid - 0.0045g	Citric acid monohydrate - 0.0070g	Tartaric acid - 0.0075g
Lactic acid – 0.0090g	Acetic acid – 0.0060g	Oleic acid – 0.00282g	

……
……
……
……
……
……
……
……
……
……

Objective: To study the analyses of Sugar content & Vitamins

Materials required for estimation of reducing sugar: ……………………………………………..

………

………

Procedure: ……………………………………………………………………………………………………

………

………

………

………

………

………

………

………

………

………

………

………

………

………

………

………

………

Calculation:

$$Reducing\ sugar\ (\%) = \frac{Factor\ \times\ Dilution}{titre\ value\ \times weight\ of\ sample\ taken} \times 100$$

………

………

………

………

………

………

………

………

………

………

Materials required for estimation of total sugar: ....
....
....
....
....

Procedure: ....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

Calculation:

$$Total\ sugar\ as\ invert\ sugars\ (\%) = \frac{Factor\ \times\ Dilution}{titre\ \times weight\ of\ sample\ taken} \times 100$$

$$\% Sucrose = (\%\ total\ invert\ sugars\ -\ \%\ reducing\ sugars)\ x\ 0.95$$

$$\% Total\ sugars = (\%\ reducing\ sugars\ +\ \%\ sucrose)$$

Materials required for estimation of ascorbic acid: ....

....

....

....

....

Procedure: ....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

Calculation:

$$Ascorbic\ acid\ (mg/100\ g) = \frac{Titre\ \times\ Dye\ factor\ \times\ volume\ made\ up}{Aliquot\ of\ extract\ taken\ \times\ Weight\ of\ sample\ taken} \times 100$$

....

....

....

....

....

....

Objective: Layout of different irrigation systems

Drip Irrigation System: ....
....
....
....
....

Drip Irrigation System – List of components and their Function

  i. **Filter:**..
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

 ii. **Main Line:**...
....
....
....
....
....
....
....

iii. **Submain line:** ………………………………………………………………………………

……

……

……

……

……

iv. **Laterals:** …………………………………………………………………………………………

……

……

……

……

……

v. **Emitters or Drippers:**………………………………………………………………………………

……

……

……

……

……

……

vi. **Controls Valves (Ball Valves):** …………………………………………………………………

……

……

……

……

……

……

vii. **Flush Valve**:……………………………………………………………………………………

viii. **Air Release Cum Vacuum Breaker Valve:** ………………………………………………………

……

……

……

……

……

ix. **Non-Return Valve**: …………………………………………………………………………

……

x. **Pressure Gauge:** ……………………………………………………………………………

xi. **Gromate and Take-off**: ……………………………………………………………………

....

....

....

....

xii.   **End Caps (End Sets):** ....

....

xiii.   **Fertilizing System**: ....

....

....

Layout:

Objective: To study the management of weeds in fruits orchard

Materials required: …………………………………………………………………………..…

……………………………………………………………………………………………….......

…………………………………………………………………………………………………..…

………………………………………………………………………………………………………

Procedure: …………………………………………………………………………………….…

……………………………………………………………………………………………….......

………………………………………………………………………………………………..…

…………………………………………………………………………………………………

………………………………………………………………………………………….......

……………………………………………………………………………………………….…

…………………………………………………………………………………………………

………………………………………………………………………………………….......

……………………………………………………………………………………………….…

…………………………………………………………………………………………………..…

…………………………………………………………………………………………………

……………………………………………………………………………………………….......

………………………………………………………………………………………………..…

……………………………………………………………………………………………………

………………………………………………………………………………………….......

……………………………………………………………………………………………….…

…………………………………………………………………………………………………..…

…………………………………………………………………………………………………

…………………………………………………………………………………………….......

……………………………………………………………………………………………….…

…………………………………………………………………………………………………..…

…………………………………………………………………………………………………

……………………………………………………………………………………………….......

…………………………………………………………………………………………………

……………………………………………………………………………………………….…

…………………………………………………………………………………………………..…

…………………………………………………………………………………………………

…………………………………………………………………………………………….......

……………………………………………………………………………………………….…

…………………………………………………………………………………………………..…
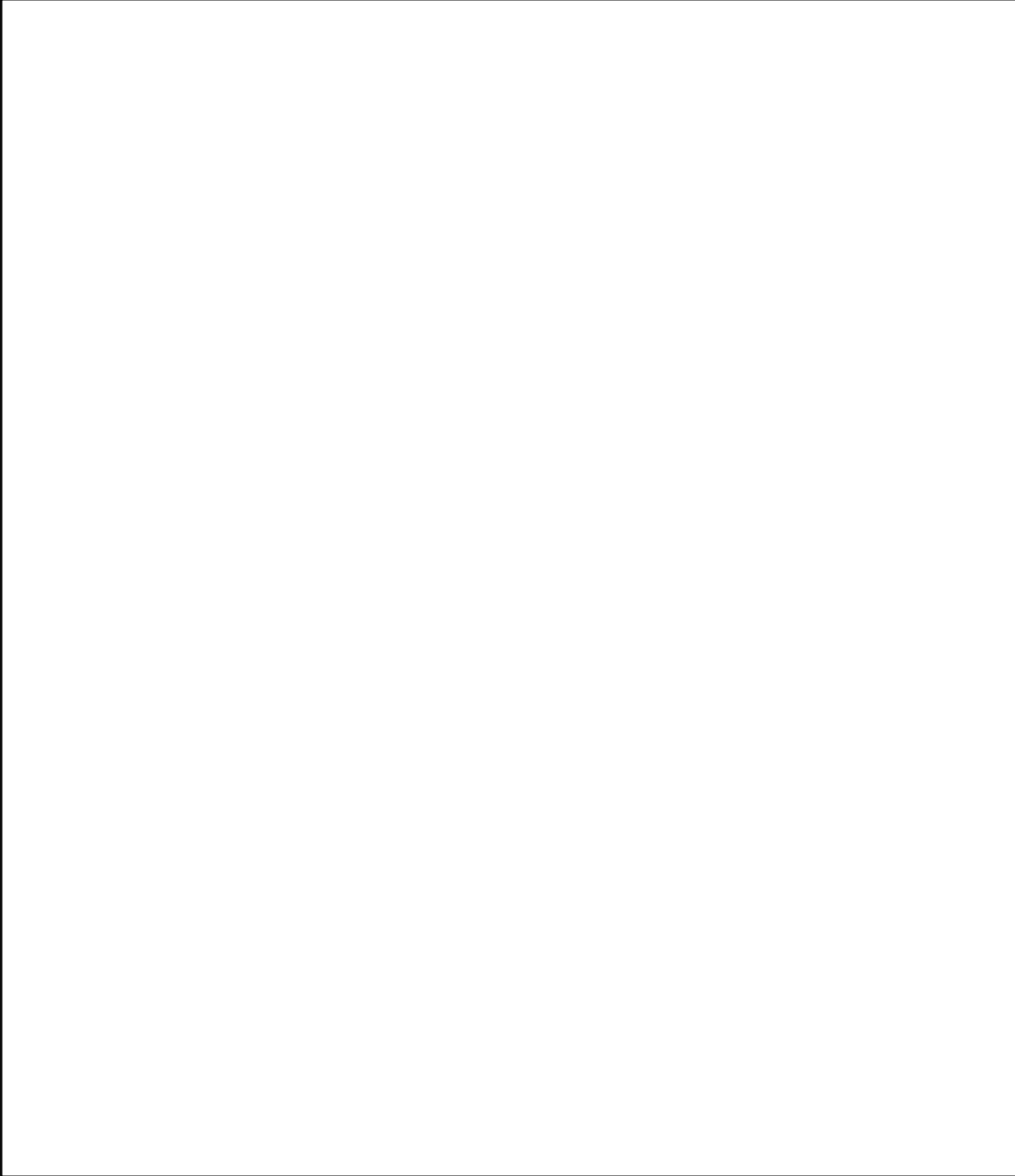
Observation

Particulars	Description
About herbicide	
Trade name	
Quantity of formulated product for a given area and crop	
Stage of application	
About requirement	
Name of equipment	
Working condition	
Type of nozzle	
Walking speed	
Spray volume for given area	

Note: Weed counts should be taken at monthly interval after laying out the management systems. Take three replicated observation under each systems.

Problem:

Objective: To study the mapping of agri export zones of India

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

List of major tropical fruits grown in India: ....
....
....
....
....
....

State wise description of Agri-export zones in India: ....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....
....

Assignment: Draw sketches of Indian political map and mansion agri-export zones. Point out major fruits producing area and production.

Objective: To study the production economics for commercial cultivation of fruit crops

Items for calculating the cost of cultivation for 1 ha. area

Sl. No.	Component	Proposed Expenditure
1.	**Plantation Expenses**	
	Cost of field preparation	
	Cost of planting material	
	Cost of Manures & fertilizers	
	FYM	
	Nitrogen	
	Phosphorus	
	Potassium	
	$FeSO_4$	
	$CuSO_4$	
	$FeSO_4$	
	Cost of any others nutrients and plant growth regulators	
	Cost of Insecticides & pesticides	
	Cost of labour for field preparation, planting, application of manures, fertilizers, pesticides, weeding and harvesting	
	Others, if any, (Power)	
2.	**Irrigation**	
	Tube-well/submersible pump	
	Cost of Pipeline	
	Others, if any, please specify	
3.	**Cost of Drip/Sprinkler**	
4.	**Infrastructure**	
	Store	
	Labour shed & Pump house	
	Farm Equipment	
5.	**Land Development**	
	Soil Leveling	
	Digging	
	Fencing	
	Others, if any, please specify	
	Grand Total	

Total expenditure

Total yield of ……………..

Sold @ ………..

Net income = gross income – expenditure

Net income growing one ha. will be …..

Benefit cost ratio: Net income / total cost

Conclusion:

The major components of the model are:

- ➤ **Land Development:** This is the labour cost of shaping and dressing the land site.
- ➤ **Fencing:** It is necessary to safeguard the orchard by a barbed wire fencing.
- ➤ **Irrigation Infra-structure:** For effective working with drip irrigation system, it is necessary to install a bore well with diesel/electric pumpset and motor. This is post cost of tube-well.
- ➤ **Drip Irrigation:** This is average cost of one acre drip system for apple inclusive of the cost of fertigation equipment. The actual cost will vary depending on location, plant population and plot geometry.
- ➤ **Implements:** For investment on improved manually operated essential implements a provision of another Rs.15 thousand is included.
- ➤ **Building and Storage:** A one acre orchard would require minimally a labour shed and a store-cum grading/packing room & pump house.

Objective: To visit to commercial orchards and diagnosis of maladies

Materials required: ....

....

....

....

Procedure of observation

Observation

Type of maladies	Symptoms	Suggestion for remedial measure

A brief report on the visit