PRACTICAL MANUAL

DRYLAND HORTICULTURE

HFS 205 2(1+1)

B.Sc. (Hons.) Horticulture IV semester

Course instructors

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SYLLABUS Dryland Horticulture HFS 205 2(1+1): Practical: Study of rainfall patterns. Contour bunding/trenching, micro catchments, soil erosion and its control. Study of evapotranspiration, mulches and micro irrigation systems. Special techniques of planting and aftercare in dry lands. Study of morphological and anatomical features of drought tolerant fruit crops.

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: Cou rse Teacher

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18.		Visit to dryland Orchard and diagnosis of maladies in fruit crops		

Exercise No. 1

Objective: To study on various rainfall patterns

Rainfall Pattern: ……..

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Types of Rainfall:

Rain: ……

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Type	Rainfall Intensity

Snow: ……

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Drizzle: ……

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Glaze: ……

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Sleet: ……

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Hail: ……………………………………………………………………………………………………….

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Frontal Rainfall: ……..……………………………………………………………………………………….

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Convective Rainfall: ………………………………..………………………………………………………..

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Orographical Rainfall: ……..…………………………………………………………………………………

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Exercise No. 2

Objective: To study on various types of soil erosion

Soil Erosion Principle: ……

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Factors affecting soil erosion: ……..

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Types of Erosion: ……

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Geologic erosion: ……

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Accelerated erosion: ……

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Water erosion: ……..

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Mechanics of water erosion: ……

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Raindrop or Splash erosion: ……

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Sheet erosion: ……

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Rill erosion: ……

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Gully erosion: ……

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Streambank erosion: ……

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Glacial erosion: ……

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Snow erosion: ……

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Organic erosion: ……

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Anthropogenic erosion: ……

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Exercise No. 3

Objective: To study on erosion control measures

Gully control measures:

Principle: ……..……...

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Control by vegetation: ……..

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Control by structures: ……

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Classification of check dams: ……

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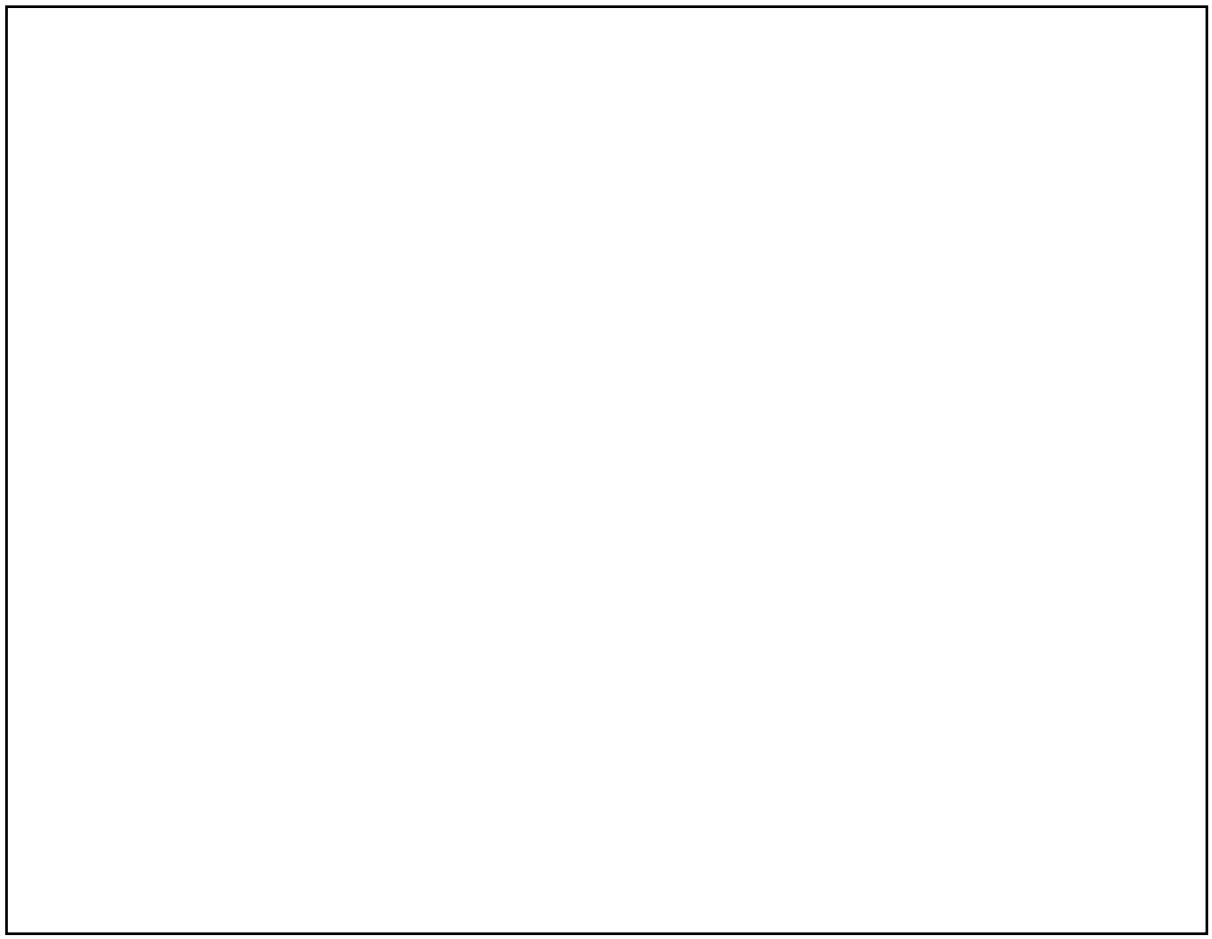

Permanent gully control structures: ……

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Drop-inlet spillway: ……

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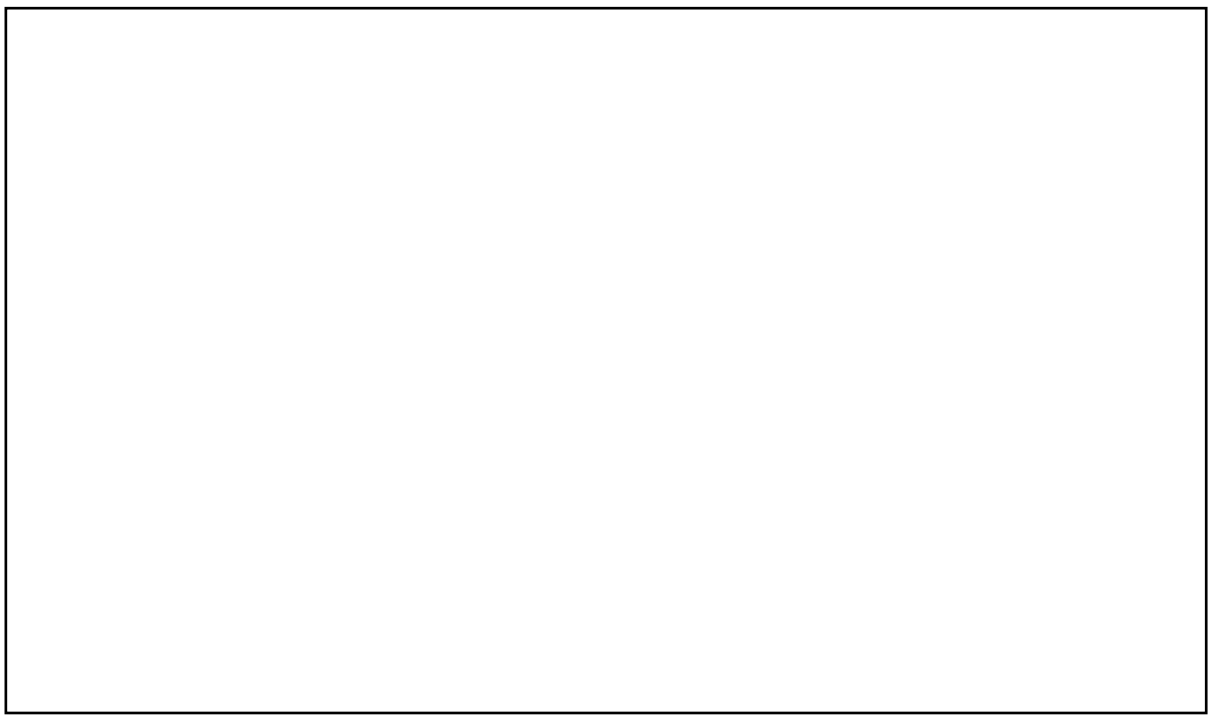

Straight drop spillway: .....

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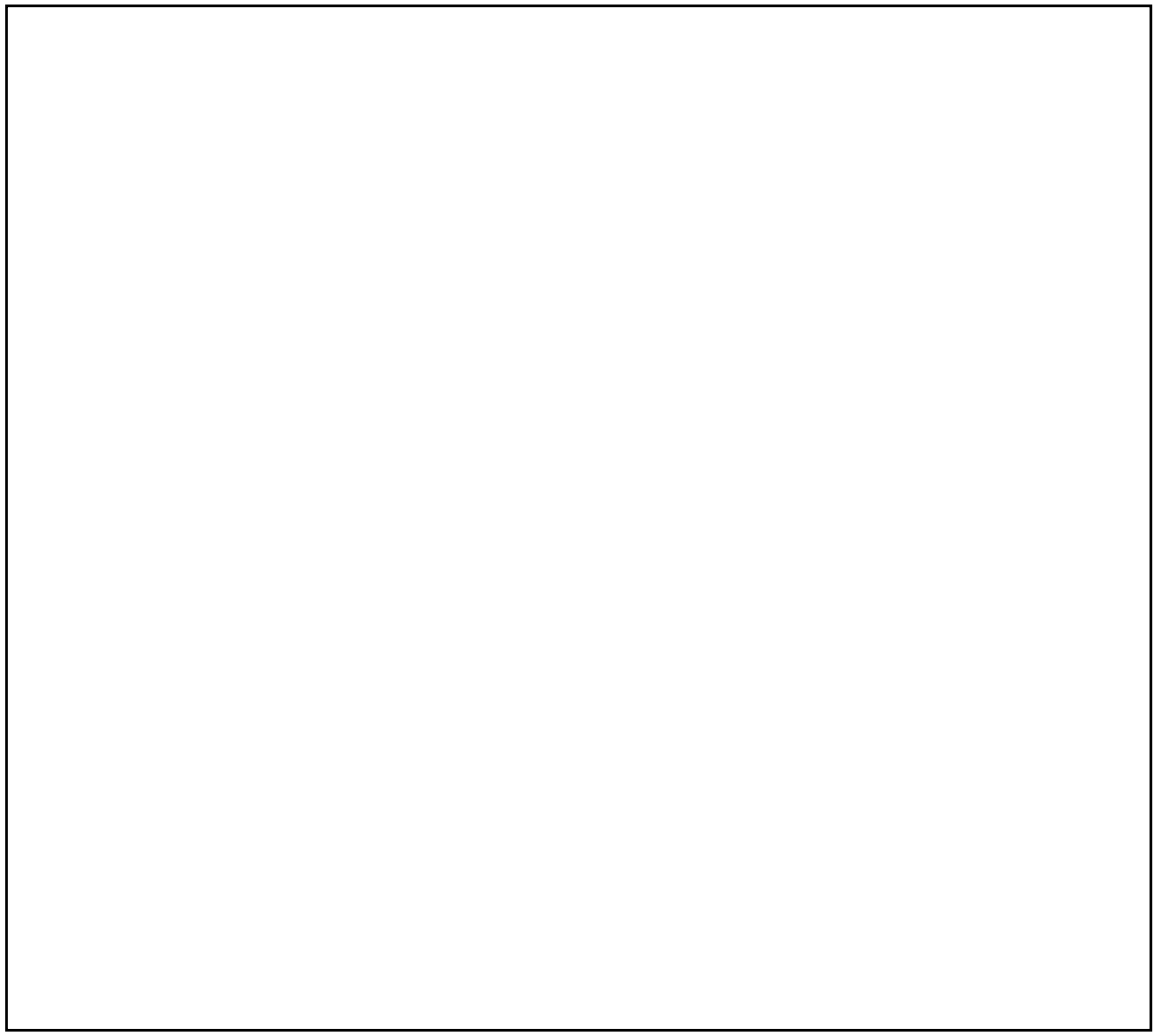

Chute spillway: ……

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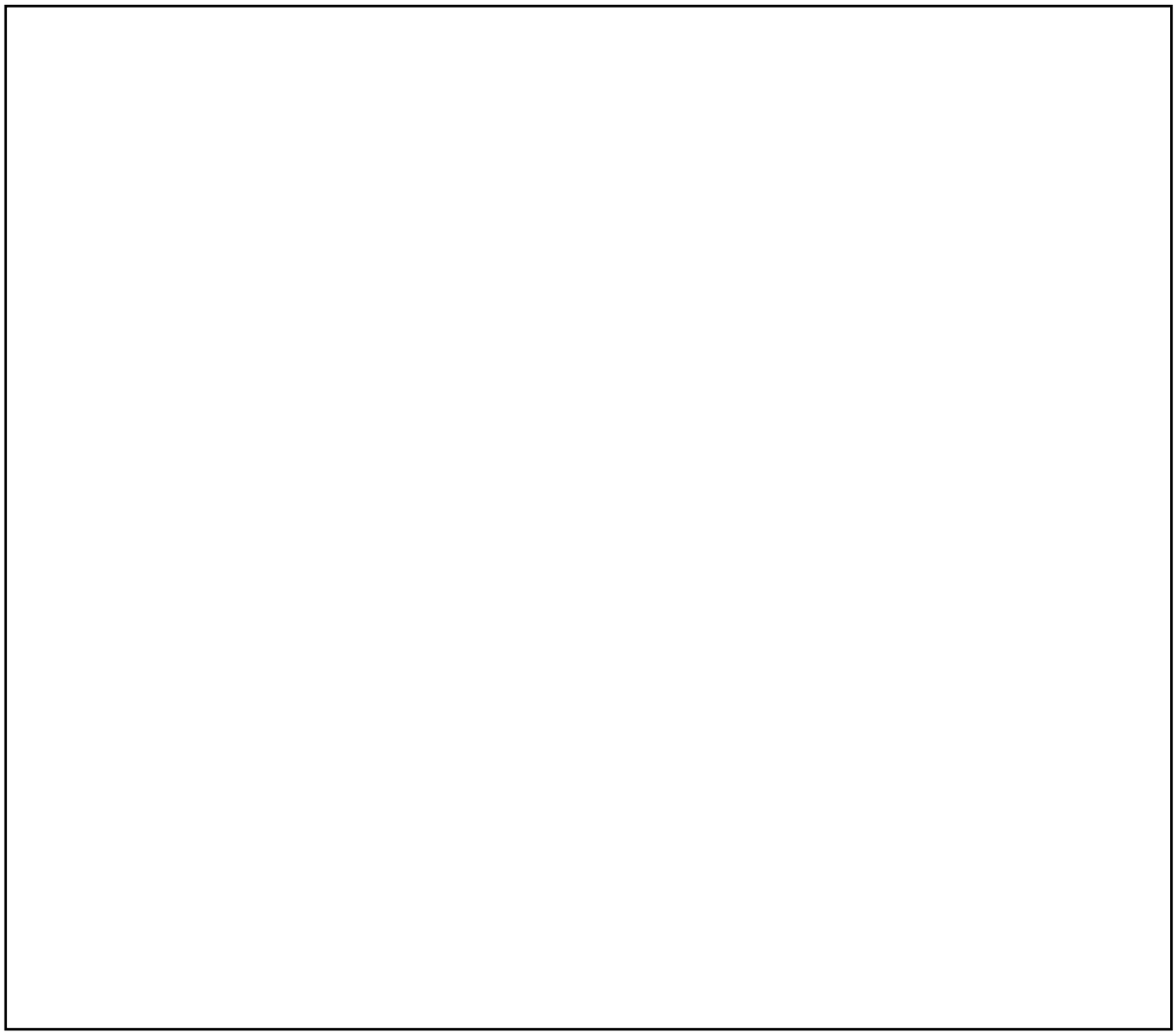

Exercise No. 4

Objective: To study on engineering measures to conserve the water and erosion

Bunding: ……

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Types of bund: ……

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Contour bunding: ……

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Types of contour bunding: ……

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Graded bunding: ……..……..

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Types of graded bunding: ……..

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Contour trenching: ……

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Graded trenches: ……..

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Staggered trenches: ……..

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Terracing: ……..

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Bench terrace: ……..

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Hill type bench terraces: ……..

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Irrigated type bench terraces: ……

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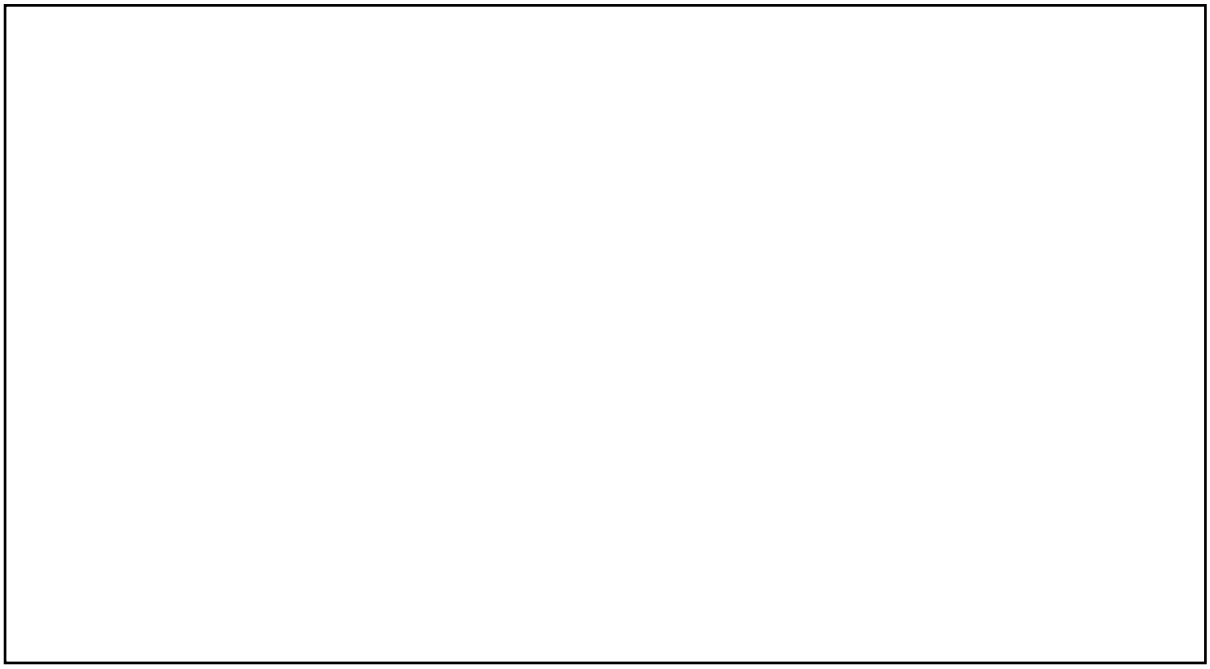

Orchard type bench terraces: ……..

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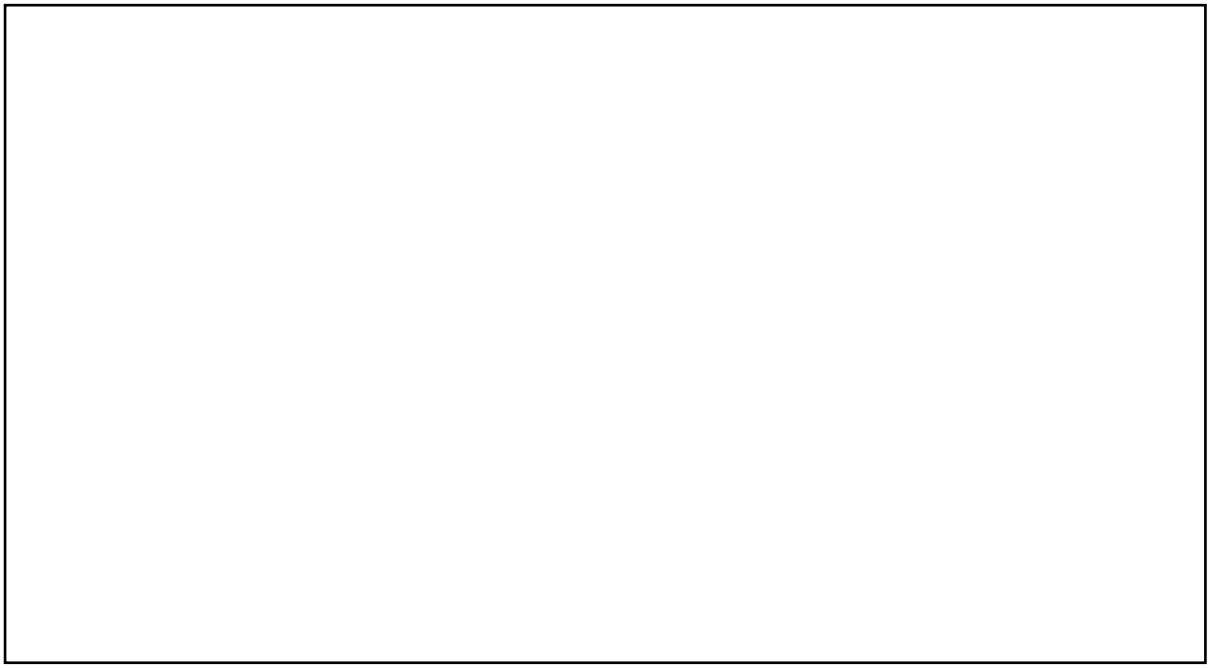

Exercise No. 5

Objective: To study about moisture conservation techniques

Mulch Tillage: ……..……..

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Mulching: ……..

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Mulching materials: ……..

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Types of mulches: ……

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Exercise No. 6

Objective: To study on various water harvesting techniques

Water harvesting: ……

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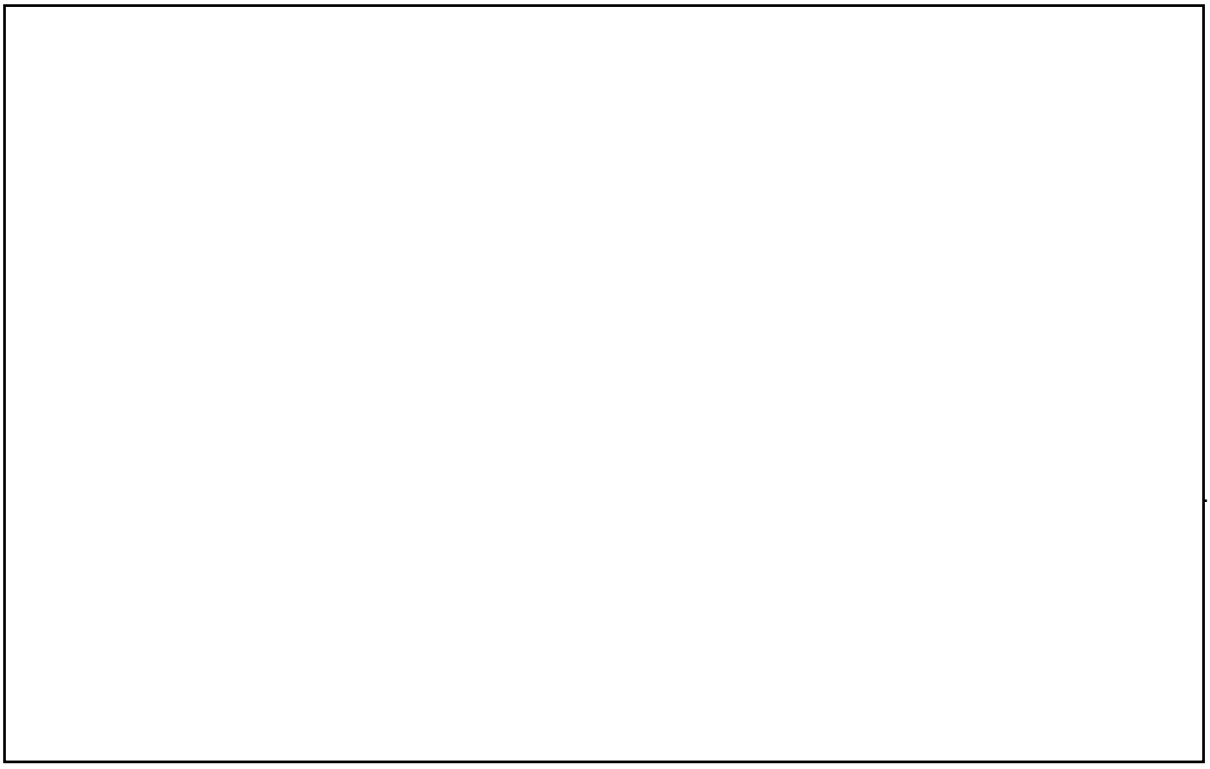

Catchment area treatments: ……

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Roof top water harvesting: ……

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Micro-catchment system: ……

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Negarim micro catchments (for trees): ……

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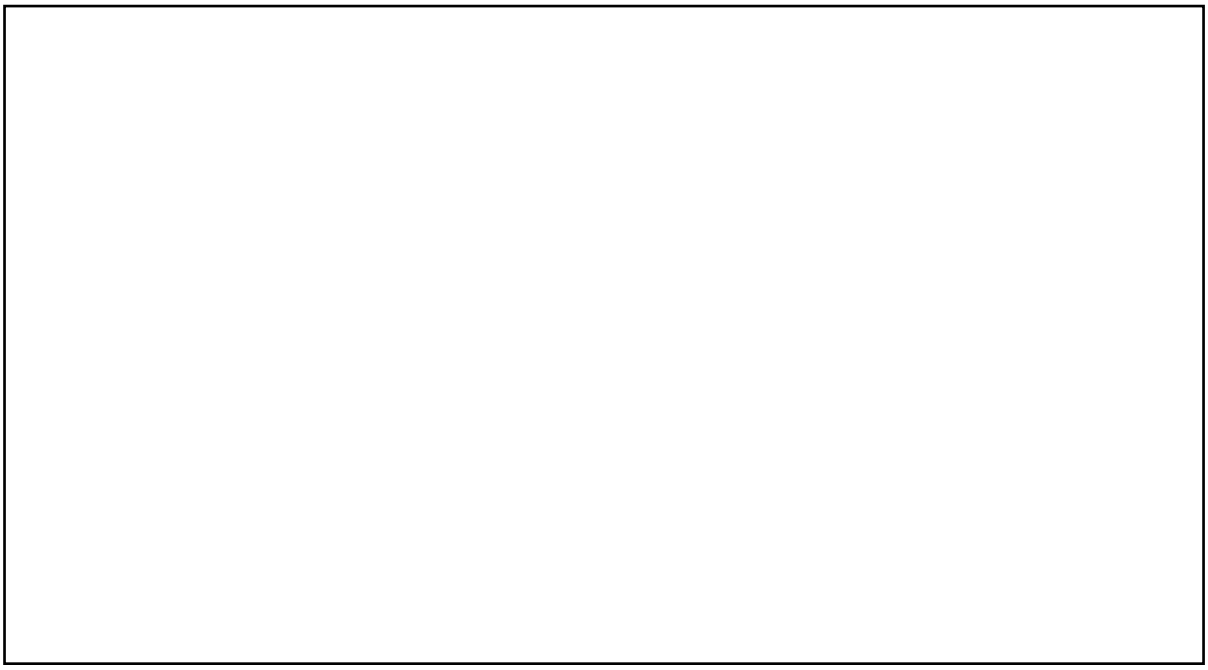

Contour bunds (for trees): ……

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Contour ridges (for crops): ……..

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Semi-circular bunds (for range and fodder): ……..

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Macro catchment system of rainwater harvesting: ……

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Flood water harvesting: …….

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Water harvesting using storage structures: ……

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Water harvesting through spreading of water: ……...

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Exercise No. 7

Objective: To study on methods of evapotranspiration

Measurement of evapotranspiration: ……

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Lysimeters: ……

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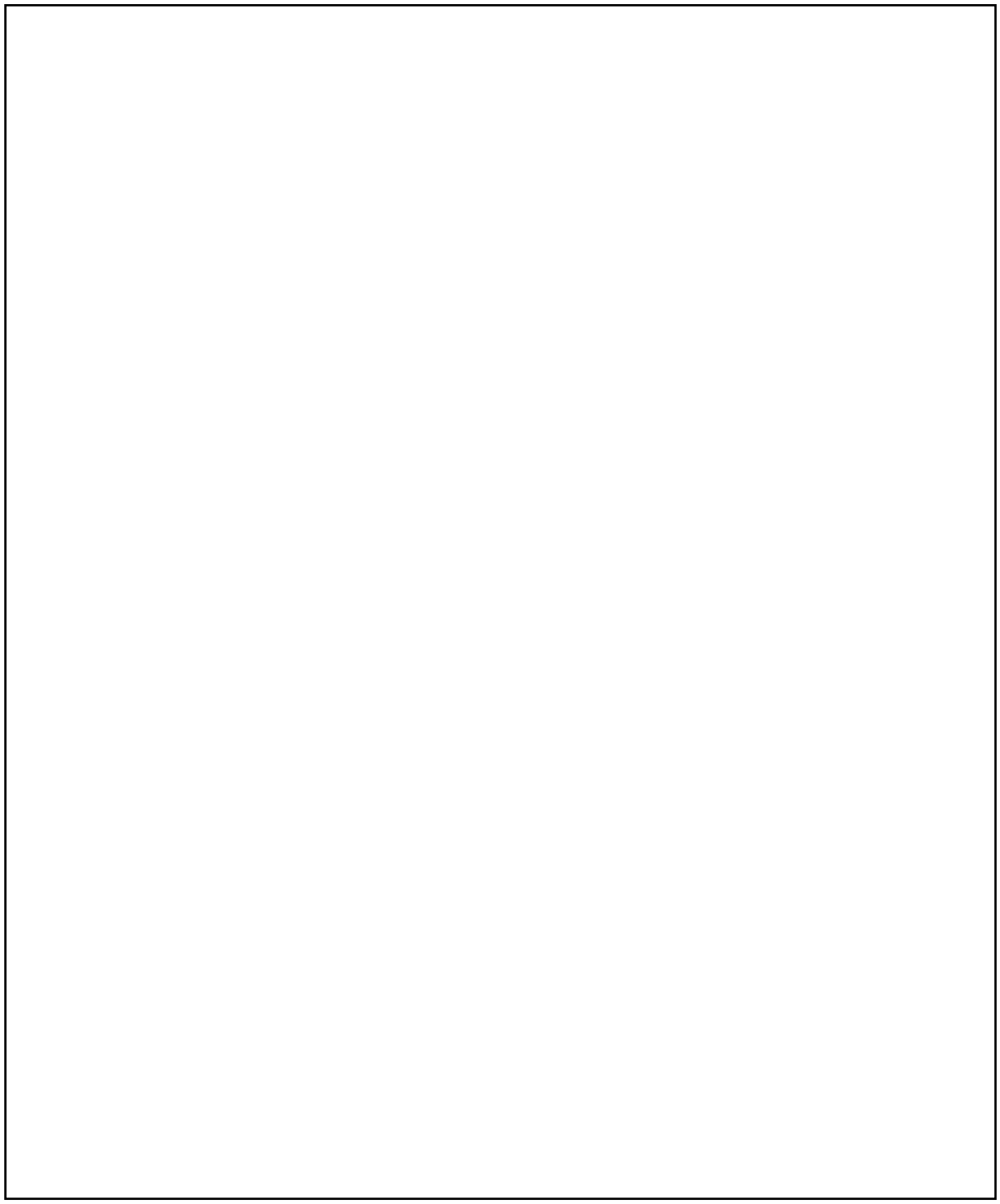

Field plots: ……

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Exercise No. 8

Objective: To study on importance of micro-irrigation systems

Sprinkler irrigation: ……

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Components of a sprinkler system: ……

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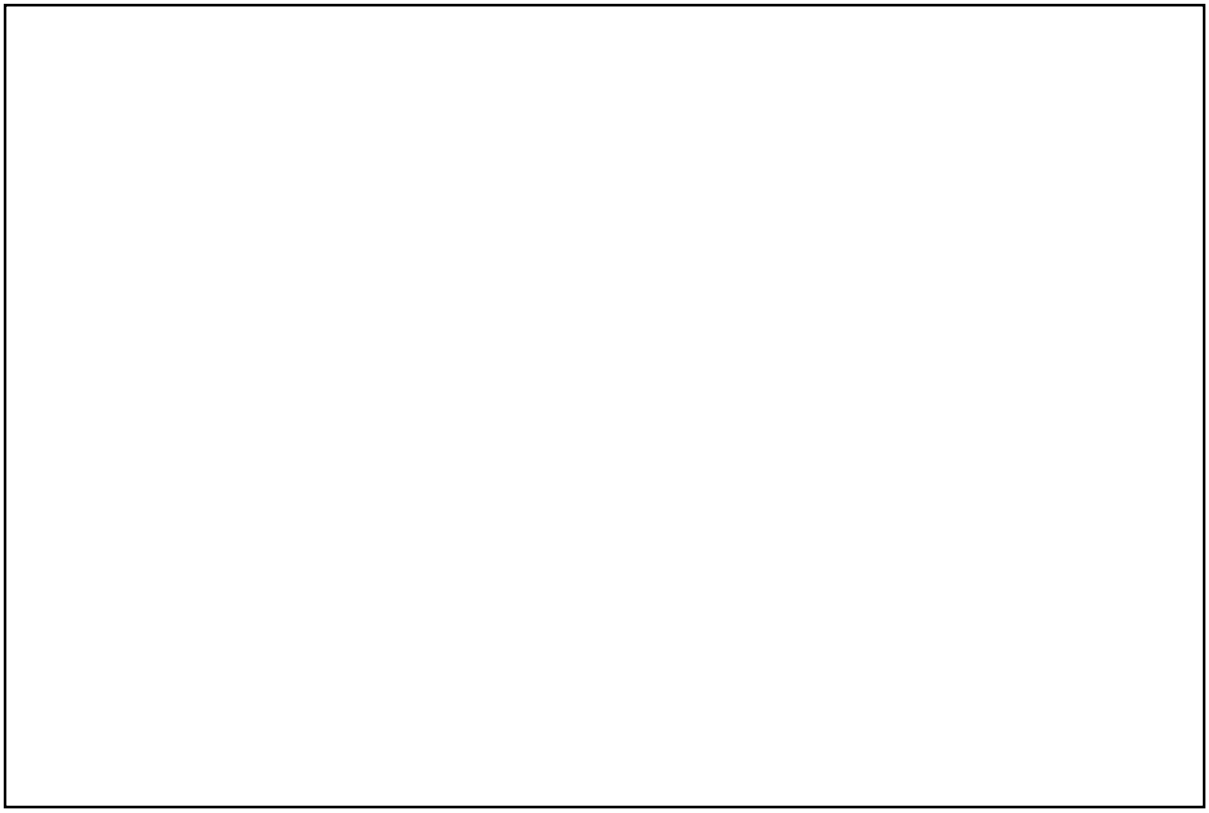

Types of sprinkler systems: ……

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Design of sprinkler system:

Quantity of water to be applied: ……

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Capacity of the System: ……

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Application Rate: ……

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Selection of sprinklers: ……

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Design of laterals: ……

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General consideration for layout: ……..

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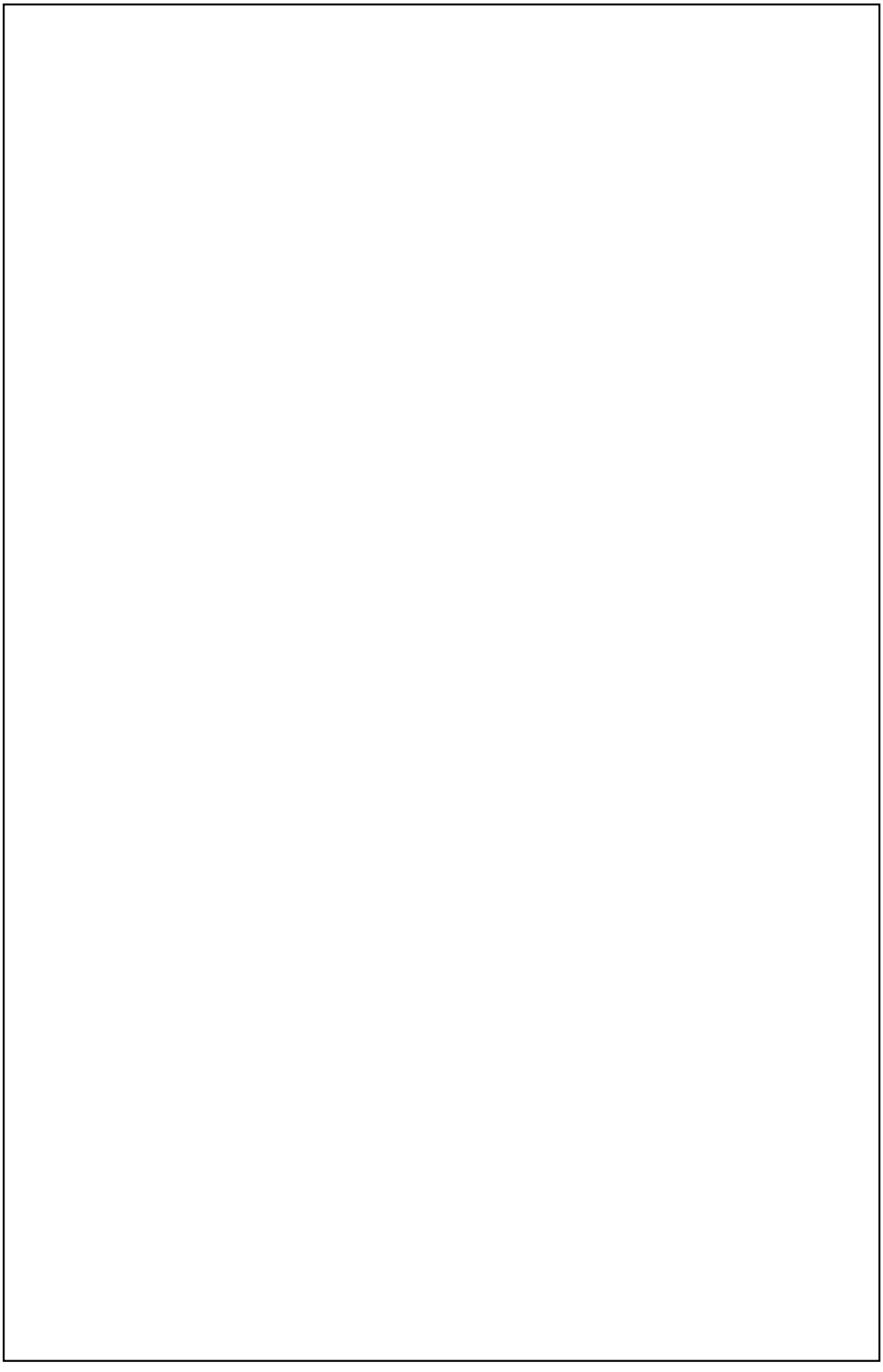

Efficiency of the system: ……

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Drip irrigation system: ……..

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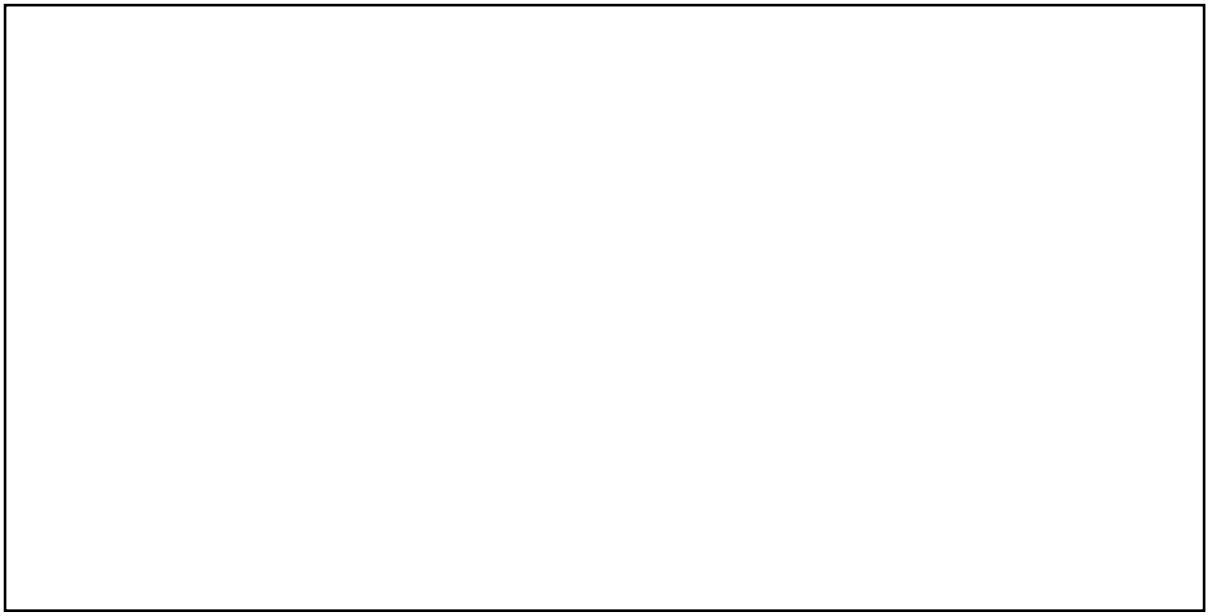

Components of a drip irrigation system: ……

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Emitters: ……

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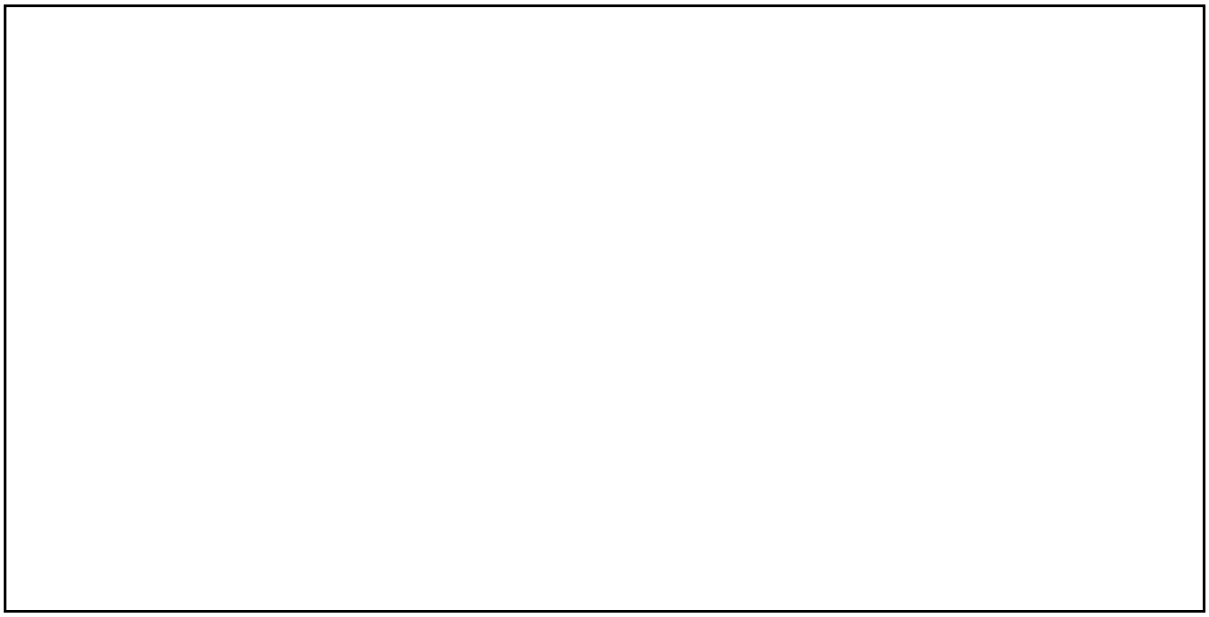

Design of drip irrigation system: ……

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Uniformity coefficient: ……

Exercise No. 9

Objective: To study on morphological characters of dryland fruit crops (Aonla)

General Characteristics:

Common name: .....

Botanical name: .....

Variety: .....

Type of planting material: .....

Name of rootstock: .....

Age of the plant: .....

Parentage (if hybrid): .....

Vegetative characteristics:

Tree height (m): .....

Trunk girth (cm): .....

Tree spread (m): .....

Tree shape: .....

Young shoot colour: .....

Spines: .....

Leaf petiole: .....

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Leaf blade: .....

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Flower characters:

Inflorescence position: .....

Time of blooming: .....

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Duration of bloom: .....

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Frequency of blooming: .....

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Type of flowers: .....

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Colour of flower buds: .....

Pedicle length: .....

Calyx: .....

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Corolla: .....

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Stamen: .....

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Gynoecium: .....

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Fruit Characters

Type of fruit: .....

Time of maturity: .....

Size: .....

Peel colour at maturity: .....

Kind of fruit: .....

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Surface: .....

Shape: .....

Apex: .....

Seed: .....

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Use of fruits: .....

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Assignment: Study the morphological characters of commercial fruits and their varieties based on the above parameters.

Exercise No. 10

Objective: To study on morphological characters of dryland fruit crops (Ber)

General Characteristics:

Common name: .....

Botanical name: .....

Variety: .....

Type of planting material: .....

Name of rootstock: .....

Age of the plant: .....

Parentage (if hybrid): .....

Vegetative characteristics:

Tree height (m): .....

Trunk girth (cm): .....

Tree spread (m): .....

Tree shape: .....

Young shoot colour: .....

Spines: .....

Leaf petiole: .....

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Leaf blade: .....

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Flower characters:

Inflorescence position: .....

Time of blooming: .....

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Duration of bloom: .....

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Frequency of blooming: .....

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Type of flowers: .....

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Colour of flower buds: .....

Pedicle length: .....

Calyx: .....

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Corolla: .....

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Stamen: .....

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Gynoecium: .....

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Fruit Characters

Type of fruit: .....

Time of maturity: .....

Size: .....

Peel colour at maturity: .....

Kind of fruit: .....

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Surface: .....

Shape: .....

Apex: .....

Seed: .....

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Use of fruits: .....

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Assignment: Study the morphological characters of commercial fruits and their varieties based on the above parameters.

Exercise No. 11

Objective: To study on morphological characters of dryland fruit crops (Pomegranate)

General Characteristics:

Common name: .....

Botanical name: .....

Variety: .....

Type of planting material: .....

Name of rootstock: .....

Age of the plant: .....

Parentage (if hybrid): .....

Vegetative characteristics:

Tree height (m): .....

Trunk girth (cm): .....

Tree spread (m): .....

Tree shape: .....

Young shoot colour: .....

Spines: .....

Leaf petiole: .....

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Leaf blade: .....

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Flower characters:

Inflorescence position: .....

Time of blooming: .....

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Duration of bloom: .....

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Frequency of blooming: .....

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Type of flowers: .....

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Colour of flower buds: .....

Pedicle length: .....

Calyx: .....

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Corolla: .....

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Stamen: .....

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Gynoecium: .....

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Fruit Characters

Type of fruit: .....

Time of maturity: .....

Size: .....

Peel colour at maturity: .....

Kind of fruit: .....

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Surface: .....

Shape: .....

Apex: .....

Seed: .....

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Use of fruits: .....

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Assignment: Study the morphological characters of commercial fruits and their varieties based on the above parameters.

Exercise No. 12

Objective: To study on morphological characters of dryland fruit crops (Custard apple)

General Characteristics:

Common name: .....

Botanical name: .....

Variety: .....

Type of planting material: .....

Name of rootstock: .....

Age of the plant: .....

Parentage (if hybrid): .....

Vegetative characteristics:

Tree height (m): .....

Trunk girth (cm): .....

Tree spread (m): .....

Tree shape: .....

Young shoot colour: .....

Spines: .....

Leaf petiole: .....

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Leaf blade: .....

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Flower characters:

Inflorescence position: .....

Time of blooming: .....

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Duration of bloom: .....

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Frequency of blooming: .....

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Type of flowers: .....

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Colour of flower buds: .....

Pedicle length: .....

Calyx: .....

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Corolla: .....

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Stamen: .....

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Gynoecium: .....

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Fruit Characters

Type of fruit: .....

Time of maturity: .....

Size: .....

Peel colour at maturity: .....

Kind of fruit: .....

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Surface: .....

Shape: .....

Apex: .....

Seed: .....

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Use of fruits: .....

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Assignment: Study the morphological characters of commercial fruits and their varieties based on the above parameters.

Exercise No. 13

Objective: To study on morphological characters of dryland fruit crops (Bael)

General Characteristics:

Common name: .....

Botanical name: .....

Variety: .....

Type of planting material: .....

Name of rootstock: .....

Age of the plant: .....

Parentage (if hybrid): .....

Vegetative characteristics:

Tree height (m): .....

Trunk girth (cm): .....

Tree spread (m): .....

Tree shape: .....

Young shoot colour: .....

Spines: .....

Leaf petiole: .....

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Leaf blade: .....

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Flower characters:

Inflorescence position: .....

Time of blooming: .....

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Duration of bloom: .....

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Frequency of blooming: .....

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Type of flowers: .....

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Colour of flower buds: .....

Pedicle length: .....

Calyx: .....

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Corolla: .....

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Stamen: .....

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Gynoecium: .....

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Fruit Characters

Type of fruit: .....

Time of maturity: .....

Size: .....

Peel colour at maturity: .....

Kind of fruit: .....

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Surface: .....

Shape: .....

Apex: .....

Seed: .....

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Use of fruits: .....

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Assignment: Study the morphological characters of commercial fruits and their varieties based on the above parameters.

Exercise No-14

Objective: To study on use of mulches in dryland fruit crops

Materials required: .....

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Procedure: .....

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Observations to be taken

1. Record soil moisture contents and soil temperature of 15days internal from 30cm soil depth.
2. Count the number of weeds if any and record their dry weight.
3. Record soil organic matter contents of the end of season.

Exercise No-15

Objective: To study on propagation through in-situ grafting and budding

Materials required: .....

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Procedure: .....

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Assignment:

Exercise No-16

Objective: To study on training and pruning of dryland fruit crops

Materials required: ……

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Methods of training: …………………………………………………………………………………………………

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Procedures: ……

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Methods of Pruning: ………………………………………………………………………………………………………

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Procedure for pruning: ………………………………………………………………………………………………

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Assignment: Practice the procedures and draw sketches.

Exercise No-17

Objective: To study on soil moisture content measurement

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

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Method of determination: ……………………………………………………………………………

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Procedures: ……………………………………………………………………………………………

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Observations and calculations

Weight of empty moisture box, g = x
Weight of moisture box + moist soil, g = y
Weight of moisture box + oven dry soil, g = z
Moisture content in soil, g = (y – z)
Weight of oven dry soil, g = (z – x)

Per cent moisture in soil (w) = (y – z) × 100/(z – x)

Inference: Based on the average value of soil moisture content, draw inference of the effectiveness of different management system in conserving soil moisture.

Problem:

Exercise No-18

Objective: Visit to dryland Orchard and diagnosis of maladies in fruit crops

Materials required: .....

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Procedure of observation: .....

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Observation

Type of malady	Symptoms	Suggestion for remedial measure

Annexure-1

SELECTION OF MULCH

The selection of mulches depends upon the ecological situations and primary and secondary aspects of mulching.

Rainy season	- Perforated mulch
Orchard and plantation	- Thicker mulch
Soil solarisation	- Thin transparent film
Weed control through solarisation	- Transparent film
Weed control in cropped land	- Black film
Sandy soil	- Black film
Saline water use	- Black film
Summer cropped land	- White film
Insect repellent	- Silver colour film
Early germination	- Thinner film

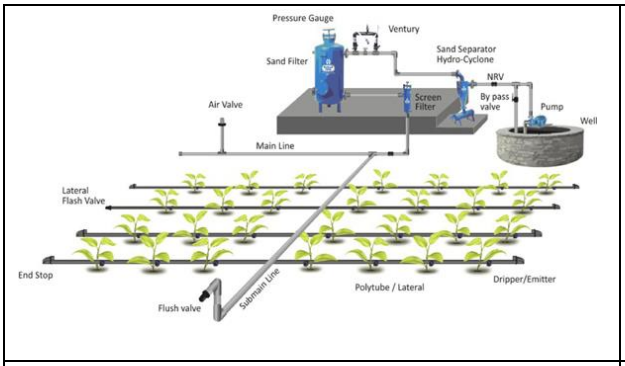
Methods of plastic mulching

- Mulching area should preferably be equivalent to the canopy of the plant.
- Required size of mulch film is cut from the main roll.
- Clean the required area by removing the stones, pebbles, weeds etc.
- Till the soil well and apply a little quantity of water before mulching.
- Small trench could be made around the periphery of the mulching area to facilitate anchoring of the mulch film.
- Cover the film to the entire area around the tree and the end should be buried in the ground.
- Semi-circular holes could be made at four corners of the film in order to facilitate water movement.
- The position of the slit/opening should be parallel to the wind direction.
- Cover the corners of the film with 4-6 inches of soil on all sides to keep the film in position.
- In hard soil, make a trench of 1'x1'x2' depth on four corners of the mulching area and fill it up with gravel or stones, cover the trenches with the mulch film and allow the water to pass through the mulch to the trenches via semi-circular holes on the film.

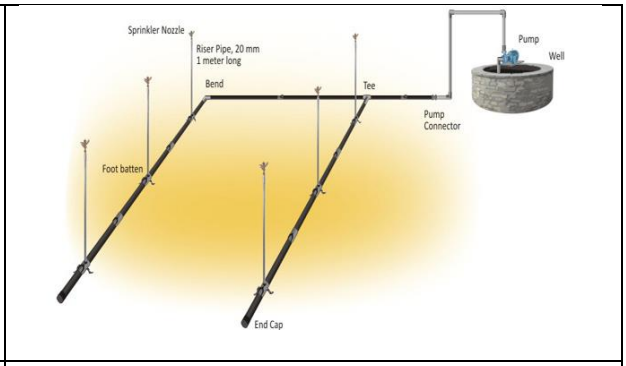
Mulch Laying Techniques

- Mulch should be laid on a non-windy condition.
- The mulch material should be held tight without any crease and laid on the bed.
- The borders (10 cm) should be anchored inside the soil in about 7-10 cm deep in small furrows at an angle of 45°.

Organic Mulch Materials	Inorganic Mulch Materials
Composts, Dry leaves, Dust mulching, Grass Clipping, Hulls and ground corncobs, Hydro mulching, Living Mulch, Paper-based mulches, Peat mulch, Poultry Mulch, Old carpet, Sand, Sod, Straw	Plastic mulching, Rock and gravel, Rubber mulch, Lithic-mulches, UV-reflective mulches, White or aluminium reflective mulch



DRIP IRRIGATION SYSTEM



SPRINKLER IRRIGATION SYSTEM

METHODS OF PRUNING

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

1. **Thinning out:** This refers to the removal of the branches entirely from its base leaving no stubs.
2. **Heading back:** A basic pruning cut which consists of cutting back the terminal portion of a branch to a bud; also called pinching.
3. **Disbudding or rubbing off:** Here the young buds are nipped without giving them the chance to sprout.

4. **Pinching and topping:** This refers to the removal of the tip of the shoot alone with a view to stimulate mainly the lateral growth. This is practiced regularly in “coffee” to remove the apical dominance and to allow the side branches to grow vigorously.
5. **Ringing and Girdling:** In this process, a circular ring of bark measuring about 3 cm in length is removed. It hastens flowering by allowing greater accumulation of photosynthates in upward portion of plant.
6. **Notching:** Making a notch above a bud by removing a wedge shape piece of bark is termed as notching. It checks the influence of hormone and encourages growth.
7. **Nicking:** Making a notch below a bud by removing a wedge shaped piece of bark is termed as nicking. This ensuring accumulation of carbohydrates from the leaves to the bud and may result in formation of fruit bud.
8. **Root Pruning:** A circular trench of 45cm away from the stem is dug out annually and the roots are cut-off every year with a sharp knife.
9. **Ringing:** It is one of the known practices to increase fruit bud formation in certain fruit crops. The operation consists of removal of a complete ring of bark from a branch or the trunk.
10. **Bending:** Bending of branches is widely practiced in the Deccan and West Bengal for increasing fruit production in guava, especially in the erect growing varieties.
11. **Disbudding:** The practice of removing unwanted flower buds in a cluster so as to encourage the remaining buds to develop into a large, showy, quality bloom is called disbudding.
12. **Pruning for rejuvenation:** In this system of pruning technology involves the heading back of exhausted trees showing marked decline in annual production and quality of produce to the extent of 1.0 to 1.5 meter height above the ground level during May-June or December-February with the objective of facilitating production of new shoots from below the cut point and allow the development of fresh canopy of healthy shoots. The newly emerging shoots are allowed to grow up to 40-50 cm length and then further pruned for emergence of multiple shoots below the pruning point to modify the tree structure and maintain canopy size. Profusely emerging shoots in the inner canopy are also pruned out to promote branching. The multiple shoots developed as a result of second pruning are capable of producing flower buds.

IN SITU **GRAFTING**

In this method of propagation also, softwood grafting technique is employed, but he the entire exercise is carried out in the main field itself instead of the nursery practice. Various steps involved are:

- Layout the main field and dig-open the pits for curing during May. Fill the pits with top soil mixed Farm yard manure (FYM). Plant 2-3 selected seeds in the first week of June, in the centre of each pit filled with soil and FYM to raise the root stocks in the main field.
- Graft the desired pre-cured scion as described in 'soft wood' grafting' on 3-4 months old, healthy root stock seedlings during September-October period and cover the scion with plastic cover. Other seedlings can be used if graft take is failed in the first attempt.
- Once the buds are sprouted, remove the plastic bag and remove the plastic strip January or February to avoid gird ling. Remove the side shoot on the root stock below the grafting union.