Diploma in Watershed Management
"Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances."

— Indira Gandhi

“शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गित विषमताओं को दूर करते हुए समुदाय को इन सबसे ऊपर उठाती है।”

— इंदिरा गांधी
PRACTICAL MANUAL

EXPERIMENT 1
Layout of an Orchard 5

EXPERIMENT 2
Nursery Raising (Fruits and Vegetables) 8

EXPERIMENT 3
Crop Water Requirements and Selection of Irrigation Methods 11

EXPERIMENT 4
Pit Digging and Manuring 14

EXPERIMENT 5
Preparation of Jam 16

EXPERIMENT 6
Preparation of Jelly 18

EXPERIMENT 7
Preparation of Squash 20

EXPERIMENT 8
Preparation of Pickles 22
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In Course 6, learners have been exposed to various aspects of horticulture. In order to understand these aspects clearly and apply them effectively, it is essential that the learners are trained on practical aspects as well. Therefore, a considerable emphasis has been laid on practical hands-on exercises.

Following practical exercises will be undertaken by the learners:

- Layout of an Orchard;
- Nursery Raising (Fruit and Vegetables);
- Crop Water Requirement and Selection of Irrigation Methods;
- Pit Digging and Manuring;
- Preparation of Jam;
- Preparation of Jelly;
- Preparation of Squash; and
- Preparation of Pickles.

**Study Guide**

The practicals will be evaluated under two components: (i) guided experiments and (ii) unguided experiments. The guided experiments will be performed under the guidance of the counsellors. The unguided experiments shall be undertaken by the students on their own. For unguided experiments, students will not be provided any guidance during conduct of experiments.

Both the components will be evaluated. 70 per cent weightage will be assigned to the guided experiments and 30 per cent to the unguided experiments. Each experiment performed by the student would be evaluated. The performance of the students would be assessed by the counsellors based on manipulative skills, observations and their understanding of the basic concepts related to the experiments.

For successful completion of the programme, a participant is required to have a minimum of 75 per cent attendance in the Practical Training sessions at the identified Water Harvesting Agencies. A student will not be eligible to appear in Term-end Practical Examination, if the percentage of attendance in Practical Training Sessions falls below 75 per cent. He/she, however, may appear for theory papers.

We would advice the students to critically go through the study material related to the particular exercise before conducting it in the field/laboratory.
EXPERIMENT 1  LAYOUT OF AN ORCHARD

Structure

1.0 Objective
1.1 Introduction
1.2 Experiment
   1.2.1 Requirements
   1.2.2 Procedure
   1.2.3 Observations
1.3 Precautions
1.4 Results

1.0 OBJECTIVE

After completing this practical exercise, you should be able to:

• prepare a suitable plan for establishing a new orchard.

1.1 INTRODUCTION

An orchard is a long term investment and deserves a very careful planning. Any mistake made initially in the selection of location, site, planting distance, varieties and the nursery plants used may considerably reduce your returns on the investment. Therefore, you must select a suitable location, site etc. and prepare a tentative plan for the orchards.

1.2 EXPERIMENT

1.2.1 Requirements
   • Tractor with leveler;
   • Spade;
   • Measuring tape;
   • Pegs;
   • Hammer; and
   • Rope etc.

1.2.2 Procedure
   • Select fairly level land for fruit plants. The soil should be deep, well drained, loamy and fertile. The water table should be below 3 meter and the soil should be free from salinity alkalinity and water logging;
   • Prepare land for planting by proper leveling and laying out before the plants are put in the field;
There are four systems of laying out an orchard (Fig. 1.1) which are commonly followed.

a) **Square System:** In this system, a tree is planted on each corner of a square whatever the planting distance may be. It is easy to layout and intercropping and cultivation is possible in two directions.

b) **Hexagonal System:** In this method, the trees are planted in each corner of an equilateral triangle. In this way, six trees from a hexagon with the seventh tree in the centre. By this plan 15 per cent more trees can be planted.

c) **Diagonal or Quincunx System:** It is derived from the square system by planting an additional tree usually a filler tree which you can keep for short period.

d) **Contour System:** It is usually followed on the hills with high slopes. In this case, the tree rows are planted along a uniform slope and usually at right angle to the slope with the idea of reducing the loss of top soil due to erosion.

After laying out the orchard, pegs are planted with hammer at a proper distance. It depends upon the fruit tree you want to plant in your orchard.

**Table 1.1: Recommended Distance for Various Fruit Plants**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Fruit Tree</th>
<th>Row to Row &amp; Plant to Plant, Distance, m</th>
<th>Number of Plants/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mango</td>
<td>8-9</td>
<td>178-138</td>
</tr>
<tr>
<td>2</td>
<td>Sweet Orange</td>
<td>7</td>
<td>222</td>
</tr>
<tr>
<td>3</td>
<td>Kinnow mandarin</td>
<td>5-6</td>
<td>385-272</td>
</tr>
<tr>
<td>4</td>
<td>Lime and lemon</td>
<td>5-6</td>
<td>385-272</td>
</tr>
<tr>
<td>5</td>
<td>Grapes</td>
<td>3</td>
<td>1075</td>
</tr>
<tr>
<td>6</td>
<td>Guava &amp; Loquat</td>
<td>6-7</td>
<td>272-222</td>
</tr>
<tr>
<td>7</td>
<td>Ber</td>
<td>8-9</td>
<td>178-138</td>
</tr>
<tr>
<td>8</td>
<td>Litchi</td>
<td>8</td>
<td>178</td>
</tr>
<tr>
<td>9</td>
<td>Pomegranate</td>
<td>5</td>
<td>385</td>
</tr>
<tr>
<td>10</td>
<td>Papaya</td>
<td>1.5-2.0</td>
<td>3315-2603</td>
</tr>
</tbody>
</table>

You can plant fruit plants in two seasons i.e. December – February and July – September. The deciduous plants such as grapes, peach, plum, pomegranate, pear etc. can preferably be planted during December-February and evergreen plants such as citrus, mango, ber, litchi etc. should be planted during July-September.
1.2.3 Observations

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Fruit Plant</th>
<th>Fruit Variety</th>
<th>Plant to Plant &amp; Row to Row, Distance, m</th>
<th>Number of Plants/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 PRECAUTIONS

- All the pegs should be in a straight line.
- Avoid planting during extreme cold and extreme hot weather.
- Select healthy vigorous good quality plants free from diseases.

1.4 RESULTS

- Report the type of soil in the orchard
- Report the layout system used.
- Report the number of plants accommodated for one ha.
- Report the distance maintained between plant to plant and row to row.

Fig. 1.1: System of layout of orchard
2.0 OBJECTIVE

After completing this practical exercise, you should be able to:

- prepare beds for raising seedlings in the nursery for fruit plants and vegetables crops.

2.1 INTRODUCTION

Nursery raising is an important step in cultivation of vegetables and in some fruits like papaya, phalsa, kagzi-lime, jamun and some citrus and mango rootstocks which are usually propagated from seed. This method, being the easiest and the cheapest is generally employed on commercial sale in these fruit crops. However, in other fruits, the plants are multiplied by vegetable propagation such as cuttings in grapes and grafting in mango.

Raising nursery in vegetables crops is very important because almost all the vegetables are first raised in nursery and then these are transplanted in the field at a proper spacing.

2.2 EXPERIMENT

2.2.1 Requirement
- Suitable site for nursery raising;
- Spade;
- Khurpa; and
- Watering can etc.

2.2.2 Procedure
- Select the mature fruits for extraction of seeds;
- Extract the seeds by cutting the fruits and wash them thoroughly;
• Dry the seeds under shade for about one to two days. The seeds of papaya, citrus and mango should be sown within a week of their extraction;
• The seeds are sown in carefully prepared and raised beds. The size of the seed beds should be 2-2.5 m long and 1.25 to 1.50 m wide alternated with irrigation channels. The soil of the beds should be well pulverized and mixed with well decayed farm yard manure (FYM);
• Sow the seeds in lines in the prepared seed beds 2-3 cm deep and in rows 10-15 cm apart for most fruits. Cover the seeds with sand or leaf mould about 1.0 cm thick;
• Irrigate the beds lightly with watering can;
• The seedling will be ready in about 2 months for transplanting or for propagation; and
• Transplant the seedling at a distance of 30 x 30 cm. After every, two rows, give a space of 45-60 cm to facilitate hoeing, weeding and to carry out budding/grafting. The best time for transplanting the seedling is February March and August-September and for deciduous plant (which shed their leaves in winter) i.e. December-January.

Procedure for raising nursery
• Select a suitable site for preparation of raised beds;
• Dig the soil at least 45 cm deep and well decomposed compost or farmyard manure should be evenly spread throughout;
• To ensure good irrigation, each bed is sub divided into 3-4 parts and a narrow trench is dug on one side;
• For winter season crops, the seeds are sown in June-July and for spring season, the seeds are sown in November – December;
• Irrigate the nursery with watering can;
• Protect the nursery against hot sun and heavy rains; and
• Remove the unwanted plants (weeds) regularly.

2.2.3 Observations

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Fruit/ Vegetable</th>
<th>Variety</th>
<th>Plant to Plant &amp; Row to Row, Distance, m</th>
<th>Quantity of Seeds/acre (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.3 PRECAUTIONS
• Select light sandy loam soil for nursery.
• Mix the well rotten FYM before preparing bed.
• Vegetable seeds should not be sown deeply.
• Protect the seedling from rains and hot sun.
2.4 RESULTS

- Report the type of soil in the field.
- Report the quantity of FYM mixed in soil.
- Report the number of times, watering is done.
- Report the time taken to germinate the seedlings.
EXPERIMENT 3  CROP WATER REQUIREMENTS AND SELECTION OF IRRIGATION METHODS

Structure
3.0 Objective
3.1 Introduction
3.2 Experiment
  3.2.1 Requirement
  3.2.2 Design of Irrigation Methods
  3.2.3 Procedure
  3.2.4 Observations
3.3 Precautions
3.4 Results

3.0 OBJECTIVE

After completing this practical exercise, you should be able to:
• estimate water requirement of fruit crops and to understand various designs for irrigation of fruit trees.

3.1 INTRODUCTION

Irrigation is one of the important factors to ensure the success of an orchard. Productivity of fruit plants can be increased by proper management of available water by using improved methods of irrigation at critical stages. Irrigation should aim at wetting the entire root system of a fruit tree without allowing any wastage of water beyond the root zone. Since irrigation cost is most critical in orchard management, the irrigation methods have to be properly devised so that the need of is plants met at the minimum expenditure and without any wastage of water.

3.2 EXPERIMENT

3.2.1 Requirement
  • Leveler;
  • Spade;
  • Rope; and
  • Measuring tape.

3.2.2 Design of Irrigation Methods

There are various methods of irrigation depending upon the water availability, topography, fruit variety, age of the tree etc.

1) Flooding: This is wasteful method of irrigation. Water is applied to the fields unchecked and whole area is flooded without leveling and roots of fruit trees
are submerged in excess quantity of water. This method is easy and does not require much planning but there is high loss of water through runoff.

2) **Ring basin**: Circular or square basins are prepared around the trees as shown in Fig. 3.1. These basins are connected to main channel. Water moves from one basin to another basin. It is very useful during early establishment of orchard as only limited area is wetted and discourages weed growth.

3) **Check basin**: In this system, basins are not interconnected but are connected only with main channel. This method saves water and disease spread is eliminated but intercultural operations become difficult.

4) **Furrow**: This method can be used for strawberry cultivation where planting is done on ridges and water is applied in the furrow.

5) **Sprinkler system**: In this system of irrigation, water is pumped through pipes with high pressure and sprinkled on crops with water jet. This system is best for sandy, steep and terraced lands. The cost of establishment is high in this system.

6) **Drip Irrigation**: It is also known as ‘Trickle irrigation’. This system gives about 90 per cent water use efficiency. In dry region, where soils are light in texture underground water is of poor quality, drip irrigation is the only economical method. Fertilizers and pesticides can be applied with irrigation, water.

![Ring basin](image)

### 3.2.3 Procedure

Water requirement of some important fruit crops are given below:

1) **Ber**: Ber requires 4-5 irrigations from November to March. Non-bearing plants should be irrigated at 15 days interval.

2) **Citrus**: Irrigate at 7-10 days interval from March to Juice and at 15-20 days interval during winter months.

3) **Grapes**: Apply first irrigation in first fortnight of February and from March to June irrigate at 10-15 days interval.

4) **Mango**: Irrigate at weekly interval from April to June. Avoid irrigation at flowering and fruit bud differentiation.

5) **Guava**: Irrigate guava orchard at 7-10 days interval in summer and at 15 days interval during winter.
6) **Aonla**: It is sensitive to water logging. Young plants should be irrigated at fortnight interval and during April-June weekly.

### 3.2.4 Observations

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Fruit Crop</th>
<th>Date of Irrigation</th>
<th>Total Number of Irrigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 PRECAUTIONS

- Papaya and Aonla are sensitive fruit crops. Avoid water stagnation in the basin.
- Stop irrigation before harvesting of fruits i.e. in grapes, to maintain quality.
- Do not over flood the basins/field with water.

### 3.4 RESULTS

- Record the system of irrigation and quantity of water used in one irrigation.
EXPERIMENT 4  PIT DIGGING AND MANURING

Structure

4.0 Objective
4.1 Introduction
4.2 Experiment
   4.2.1 Requirement
   4.2.2 Procedure
   4.2.3 Observation
4.3 Precautions
4.4 Results

4.0 OBJECTIVE

After completing this practical exercise, you should be able to:

- prepare a pit and mix manures and fertilizers for planting fruit crops.

4.1 INTRODUCTION

After selection of proper site for planting of fruit trees, the fruit grower is interested for optimum growth of trees and the maximum production of fruit. You can do it by proper planting of trees. Since the fruit trees have deep root system, their roots penetrate up to 1.0-1.2 m deep in the soil to get moisture and nutrients. If there is a hard soil or soil contains hard pans, stones etc., the growth of the tree will be restricted affecting fruit production adversely.

Fruit trees also remove large amounts of nutrients from the soil than most other crops. Therefore, to maintain fertility of the soil and good production of fruits, it is essential to apply required quantities of organic mature such as leaf mould and farmyard manure beside inorganic manures having nitrogen, phosphorus and potash as main elements. In this experiment, you will learn as to how to prepare pits and apply fertilizers and manure.

4.2 EXPERIMENT

4.2.1 Requirement

- Measuring tape;
- Spade; and
- Manure/Fertilizer.

4.2.2 Procedure

- After selecting a suitable site for planting, level the land by maintaining proper slope not more than 0.3 per cent;
• Depending upon the fruit tree, fix the pegs at suitable plant to plant and row to row, distance, 30 cm;

• Dig the 1 x 1 m pit. The top one soil should be kept on one side and remaining soil on the other side;

• Allow the exposed pits for weathering action for a period of atleast 15-20 days prior to planting;

• After weathering, fill up the loose soil in the pit and allow settling down by watering, if necessary;

• If the soil has poor fertility, you may add a basket of well decomposed FYM along with 1-2 kg of super phosphate in each pit;

• Pit is ready for planting after one month;

• After planting of fruit plants, regular manuring should be done according to the age of plant; and

• In case of Guava fruit, for one year age of plant, add 15 kg of FYM, 0.5 kg of CAN (Calcium Ammonium Nitrate), 0.250 kg of Super phosphate 100g of Pot sulphate. Every year increase the doses.

### 4.2.3 Observation

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Fruit Plant</th>
<th>No. of Pits/ha</th>
<th>Quantity of Manure Added</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>FYM (kg)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.3 PRECAUTIONS

• Use only well rotten farmyard manure.

• Irrigate the refilled pits before planting.

• Add BHC 10 per cent dust in each pit before filling.

• Apply FYM and half dose of CAN, Super phosphate and Potash in the month of February and remaining half in July 0.6-0.9 m away from the trunk.

### 4.4 RESULTS

• Report the size of pit.

• Report the distance from row to row and plant to plant.

• Report the structure/texture of soil.
EXPERIMENT 5  PREPARATION OF JAM

Structure
5.0 Objective
5.1 Introduction
5.2 Experiment
  5.2.1 Requirement
  5.2.2 Procedure
  5.2.3 Observation
5.3 Precautions

5.0 OBJECTIVE

After completing this practical exercise, you should be able to:

• prepare jam from fruits and preserve.

5.1 INTRODUCTION

The jam is a product made by boiling fruit pulp with sufficient sugar to a reasonably thick consistency, firm enough to hold fruit tissues in position. Apple, pear, sapota (Chiku), apricot, loquat, peach, papaya, karonda, carrot, plum, strawberry, mango, tomato, grapes and muskmelon are used for preparation of jams. It can be prepared from one kind of fruit or from two or more kinds. Jam contains 0.5-0.6 per cent acid and inert sugar such as glucose with not more than 40 per cent. As per fruit product order (FPO), Fruit jam should have minimum 68 per cent sugar (TSS) and minimum 45 per cent of fruit portion (25 per cent in case of strawberry and raspberry).

5.2 EXPERIMENT

5.2.1 Requirement

• Peeling and cutting knives;
• Grater or pulper stainless steel utensils;
• Glass jar;
• Refractometer; and
• Thermometer.

5.2.2 Procedure

• Select good quality ripe but firm fruits.
• Wash the fruits and peel them. There is no need of peeling in case of raspberry, strawberry, plums, grapes etc.
• Extract the pulp from fruits and discard peel and stone/seed.
• Crush the pulp to make it uniform;
• Add required quantity of sugar and citric acid as mentioned in Table 5.1;
• Boil the pulp along with sugar and citric acid. Add little water to make the pulp soft and to dissolve the sugar;
• Concentrate it till the total soluble solids (sugar) reaches 68 per cent or temperature up to 105°C;
• Add colour and flavour if desired;
• Fill the jam in sterilized wide mouth bottles up to the neck and seal it with cap;
• Invert the bottle till it cool down. It will help to block the air passage from the cap; and
• Store the bottles in cool and dry place.

### Table 5.1: Recipe for Preparation of Fruit Jam

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Product</th>
<th>Pulp (kg)</th>
<th>Sugar (kg)</th>
<th>Citric Acid (g)</th>
<th>Water (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apple jam</td>
<td>1.0</td>
<td>0.750-1.000</td>
<td>2.5</td>
<td>200</td>
</tr>
<tr>
<td>2</td>
<td>Mango jam</td>
<td>1.0</td>
<td>0.750-1.000</td>
<td>3.0</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Pineapple jam</td>
<td>1.0</td>
<td>0.750-1.000</td>
<td>1.5</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>Sapota jam</td>
<td>1.0</td>
<td>0.750-1.000</td>
<td>3.0</td>
<td>125</td>
</tr>
<tr>
<td>5</td>
<td>Plum jam</td>
<td>1.0</td>
<td>1.000</td>
<td>1.5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Pear jam</td>
<td>1.0</td>
<td>0.750</td>
<td>2.0</td>
<td>125</td>
</tr>
<tr>
<td>7</td>
<td>Karonda jam</td>
<td>1.0</td>
<td>1.000</td>
<td>1.0</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>Strawberry jam</td>
<td>1.0</td>
<td>1.000</td>
<td>1.0</td>
<td>125</td>
</tr>
</tbody>
</table>

### 5.2.3 Observation

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Product</th>
<th>Weight of Fruit (kg)</th>
<th>Weight of Pulp (kg)</th>
<th>Volume of Sugar (kg)</th>
<th>Volume of Water (ml)</th>
<th>Quantity of Citric Acid (g)</th>
<th>Total Product (kg)</th>
<th>Approx. Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td>3</td>
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</table>

### 5.3 PRECAUTIONS

• Firm ripe fruits should be used.
• It is necessary to have pectin, acid and sugar present in correct proportion to get well set jam.
• Jam should be boiled rapidly until end point (68 per cent) is reached.
• Use sterilized bottle and cap for packing jam.
EXPERIMENT 6 PREPARATION OF JELLY

Structure

6.0 Objective
6.1 Introduction
6.2 Experiment
   6.2.1 Requirement
   6.2.2 Procedure
   6.2.3 Observations
6.3 Precautions

6.0 OBJECTIVE

After completing this practical exercise, you should be able to:

- prepare jelly from fruits and preserve it.

6.1 INTRODUCTION

A Jelly is a semi solid produced prepared by boiling a clear, strained solution of pectin containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well set, but not too stiff and should have the original flavour of the fruit. It should be of attractive colour and keep its shape when cut. It should not be gummy, sticky or syrupy or have crystallized sugar in. Guava, sour apple, plum, karonda wood apple, loquat, papaya are generally used for preparation of jelly. Pectin (present in fruits), acid, sugar and water are four essential ingredients. Pectin test and determination of end point of jelly formation are very important for the good quality jelly.

6.2 EXPERIMENT

6.2.1 Requirement

- Knives;
- Grater;
- Jelly thermometer;
- Jelmeter;
- Utensils;
- Glass jars; and
- Caps etc.

6.2.2 Procedure

- Select ripe and firm fruits;
- Wash the fruits, peel and make slices;
• Boil the slices with equal quantity of water;
• Add citric acid (g) while boiling;
• After 30 min boiling, strain the extract through a muslin cloth;
• Perform pectin test using jelmeter. Fill the jelmeter with extract and allow to drop the extract for one minute. Note the level of extract. It will indicate the amount of sugar to be added;
• Add about 750 g sugar for 1 litre of guava fruit extract;
• Boil the mixture till the consistency reached above 65 per cent (TSS). It can be checked by refractometer or when temperature reaches 105°C in jelly thermometer;
• Remove the scum and pour the jelly in bottles; and
• Let the jelly cool and cover it with a tight cap.

### 6.2.3 Observations

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Product</th>
<th>Weight of Fruit (kg)</th>
<th>Volume of Water (l)</th>
<th>Volume of Extract (l)</th>
<th>Volume of Sugar (kg)</th>
<th>Total Product (kg)</th>
<th>Approx. Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tbody>
</table>

### 6.3 PRECAUTIONS

• The fruit slices should simmer gently and be thoroughly broken up before it is strained.
• The pulp should be allowed to strain without squeezing if a clear jelly is required.
• The sugar should be added only when the strained juice has sufficiently boiled.
EXPERIMENT 7 PREPARATION OF SQUASH

Structure

7.0 Objective
7.1 Introduction
7.2 Experiment
   7.2.1 Requirement
   7.2.2 Procedure
   7.2.3 Observations
7.3 Precautions

7.0 OBJECTIVE

After completing this practical exercise, you should be able to:

• prepare and preserve squash from fruits.

7.1 INTRODUCTION

In India cold drinks are in demand practically throughout the year. Among these fruit juices acid squashes have an important place. These are quite popular being rich in essential vitamins, minerals and other nutrient.

Squash is a type of fruit beverage which contains at least 25 per cent of fruit portion (juice/pulp) and not less than 40 per cent of total soluble solids (sugar). In also contains edible acid in the range of 1-2 per cent. Since the sugar content in squash is quite less therefore to preserve it, approved chemical preservative such as sodium or potassium metabisulphite or sodium benzoate should be added along with colour and flavour. Squash can be prepared from fruits such as mango, orange, pineapple, litchi, lemon etc.

7.2 EXPERIMENT

7.2.1 Requirement

• Ripe fruits, Juice extractor;
• Pulper;
• Knives;
• Bottles;
• Utensil; and
• PP Cap sealing machine.

7.2.2 Procedure

• Select good quality fully ripe fruits;
• Wash and peel the fruit and extract juice as in orange, juice can be recovered and in mango, pulp can be extracted;

• Mix the pulp well to make it a smooth paste;

• Take sugar, water and citric acid as mentioned in Table 7.1;

• Mix the ingredients and give one or two boils to dissolve the sugar;
  o Cool the sugar syrup, and add the fruit pulp;
  o Mix the pulp and sugar thoroughly and pass through a muslin cloth;

• Add approved colour and flavour (essence);

• Add preservative i.e. potassium/sodium metabisulphite (KMS/SMS) @ 0.7g/litre or sodium benzoate (SB) @ 1.0g/litre of finished product; and

• Fill the squash in sterilized bottles and seal it with pilfer proof (PP) Cap and store in cool dry place.

Table 7.1: Recipe for Preparation of Fruit Squash

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Product</th>
<th>Quantity of Juice/pulp</th>
<th>Sugar (kg)</th>
<th>Water (ml)</th>
<th>Citric acid (g)</th>
<th>Preservative to be added</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orange squash</td>
<td>1.0</td>
<td>1.5</td>
<td>0.750</td>
<td>25-28</td>
<td>KMS/SMS</td>
</tr>
<tr>
<td>2</td>
<td>Lime or lemon squash</td>
<td>1.0</td>
<td>2.0</td>
<td>0.500</td>
<td>-</td>
<td>KMS/SMS</td>
</tr>
<tr>
<td>3</td>
<td>Mango Squash</td>
<td>1.0</td>
<td>1.5</td>
<td>1.000</td>
<td>25-30</td>
<td>KMS/SMS</td>
</tr>
<tr>
<td>4</td>
<td>Pineapple Squash</td>
<td>1.0</td>
<td>1.7</td>
<td>1.250</td>
<td>25-28</td>
<td>SB</td>
</tr>
<tr>
<td>5</td>
<td>Litchi Squash</td>
<td>1.0</td>
<td>1.5</td>
<td>0.750</td>
<td>25-28</td>
<td>SB</td>
</tr>
<tr>
<td>6</td>
<td>Bael Squash</td>
<td>1.0</td>
<td>1.5</td>
<td>1.000</td>
<td>20</td>
<td>SB</td>
</tr>
</tbody>
</table>

7.2.3 Observations

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Product</th>
<th>Weight of Fruit (kg)</th>
<th>Weight of Pulp (kg)</th>
<th>Volume of Sugar (kg)</th>
<th>Volume of Water (ml)</th>
<th>Quantity of Citric acid (g)</th>
<th>Total Product (litre)</th>
<th>Approx. Cost (Rs.)</th>
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<tr>
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</table>

7.3 PRECAUTIONS

• Do not heat the juice.

• Do not mix hot sugar syrup in juice or pulp.

• Do not use sodium or potassium metabisulphite for coloured squashes.

• Always use stainless steel utensils, knives etc.
EXPERIMENT 8  PREPARATION OF PICKLES

Structure
8.0 Objective
8.1 Introduction
8.2 Experiment
  8.2.1 Requirement
  8.2.2 Observations
8.3 Precautions

8.0 OBJECTIVE

After completing this practical exercise, you should be able to:

- prepare and preserve the pickle from fruits and vegetables.

8.1 INTRODUCTION

The preservation of food in common salt or vinegar is known as pickling. It is one of the most ancient methods of preserving fruits and vegetables. Pickles are known to impart flavour and taste to the food. Pickles are appetizers and add to the palatability of a meal. In pickles, spices and oil are also added. Various kinds of pickles are made in India in large quantities both from fruits and vegetables. In Indian pickles, mustard oil, rapeseed oil, and sesame oil are generally used. However, some pickles are made in lime juice and vinegar only. The most common pickles prepared from fruits as well as from vegetables are mango pickle, lime pickle, aonla pickle, jack fruit pickle, tint and lasora pickle, vegetable pickles are prepared from mushroom and mixed vegetable pickles (cauliflower, carrot and turnip).

8.2 EXPERIMENT

8.2.1 Requirement

Mature fruits, vegetables, knives, species, oil etc.

1) Mango pickle

Recipe

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>Mango Slices</td>
<td>1 kg</td>
</tr>
<tr>
<td>Black Pepper</td>
<td>20 g</td>
</tr>
<tr>
<td>Fenugreek (methi)</td>
<td>100 g</td>
</tr>
<tr>
<td>Fennel (Saunf)</td>
<td>50 g</td>
</tr>
<tr>
<td>Salt</td>
<td>150 g</td>
</tr>
<tr>
<td>Turmeric</td>
<td>25 g</td>
</tr>
<tr>
<td>Kalaunji</td>
<td>10 g</td>
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<tr>
<td>Mustard oil</td>
<td>500 ml</td>
</tr>
<tr>
<td>Red chilies</td>
<td>25 g</td>
</tr>
</tbody>
</table>
Procedure

- Select good quality firm green mango. Wash and cut into long slices.
- Dry the slices under sun for 4-5 hours.
- Coarsely grind the spices and heat in little oil and add spices.
- Add all the fruit slices and mix well with spices and fill it in clean jars.
- Add remaining oil after 1-2 days after to cover up the slices.
- Leave the pickle for 2-3 weeks before consuming.

2) Mixed vegetables pickle (sweet)

Recipe

| Carrot slices | 350 g | Rai powder | 30 g |
| Turnip slices | 350 g | Red chilies | 20 g |
| Cauliflower pieces | 350 g | Hot spices | 25 g |
| Jaggery (Gur) | 200 g | Salt | 40-60 g |
| Onion | 250 g | Mustard oil | 250 ml |
| Ginger | 50 g | Vinegar | 100 ml |
| Garlic | 25 g |

Procedure

- Select the good quality vegetables and wash and cut into desired size slices.
- Boil the slices for 2-5 min by tying in a muslin cloth and dry the slices for half an hour.
- Heat the oil and fry onion, ginger and garlic and add rai powder acid other spices.
- Prepare jaggery from gur by adding little water and give one boil and mix the jaggery in mixture.
- Add vinegar in the prepared mixture well and fill it in clean dry jar.

8.2.2 Observations

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Pickle</th>
<th>Weight of Slices (kg)</th>
<th>Other Spices Added (g)</th>
<th>Total Product (kg)</th>
<th>Approx. Cost (Rs.)</th>
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</table>

8.3 PRECAUTIONS

- Always take firm mature fruit and tender vegetable.
- Use good quality spices and oil.
- Do not add concentrated vinegar.
- Cover the pickle slices with oil to protect it from spoilage and early ripening.
<table>
<thead>
<tr>
<th>Block 1</th>
<th>AGROFORESTRY SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>Agroforestry Systems</td>
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<tr>
<td>Unit 2</td>
<td>Agroforestry Management</td>
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<tr>
<td>Unit 3</td>
<td>Survey and Documentation of Existing Practices (Practicals)</td>
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<tr>
<th>Block 2</th>
<th>PLANNING AND MANAGEMENT OF HORTICULTURE CROPS</th>
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<tr>
<td>Unit 4</td>
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<td>Unit 8</td>
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<td>Unit 9</td>
<td>Medicinal and Aromatic Plants</td>
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