PART I

THE CULTIVATION OF FRUITS

Chapter 1

FRUITS

The nutrition value of fruits places them on the crest of our edibles. Fruits contain vitamins and minerals in large quantities. Fruits are the oldest food of mankind. Taking fruits everyday strengthens our vitality. Nutrition scientists advise us to take at least 115 grams of fruit everyday for balanced diet. But at present our country has the capacity to provide each of us with only 38 grams of fruits every day.

We need fruits for economic reasons too. Most fruit trees live for years. Fruit farming is quite profitable although it may be a little expensive at the beginning. Fruits can be processed for preservation in many ways. For example, different kinds of healthy foods like jam, jelly, candy, etc. and drinks can be made from fruits. Some fruits can be dehydrated for marketing.

Most fruits available in our country do not grow in the cold countries. It gives us an opportunity to export our fruits there for foreign currency.

Trees usually bear two kinds of flowers: female and male. The ovum of a female flower or part of it gradually grows in health, size and shape into a fruit. Many a time the whole flower evolves into a fruit.

Classification of fruits

Fruits are mainly divided into two categories: (a) Periodical and (b) Seasonal.

(a) Periodical fruits

Different fruits grow in different countries. Fruits may be classified into two other groups on the basis of the amount of time the trees take to bear them after plantation: Short term fruits and long term fruits.

Short term fruits: Fruits that grow on trees in two or less than two years after plantation are called short term fruits. For example: banana, pineapple, papaya, etc.

Long term fruits: Fruits that grow on trees in more than two years after plantation
are called long term fruits. For example: mangoes, jackfruits, wood apple, etc.

**The table below shows the list of short-term and long-term fruits:**

<table>
<thead>
<tr>
<th>Short term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
<td><strong>Name</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td>Litchi</td>
</tr>
<tr>
<td>Papaya</td>
<td>Mangoes</td>
</tr>
<tr>
<td>Pineapple</td>
<td></td>
</tr>
<tr>
<td>Watermelon</td>
<td></td>
</tr>
<tr>
<td>Melon</td>
<td>Jackfruits</td>
</tr>
<tr>
<td></td>
<td>Guava</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sapota</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pumelo</td>
</tr>
<tr>
<td></td>
<td>Plum</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pomegranate</td>
</tr>
<tr>
<td></td>
<td>Amloki</td>
</tr>
<tr>
<td></td>
<td>Coconut</td>
</tr>
</tbody>
</table>

**(b) Seasonal fruits**

Fruits may be classified on the basis of the seasons in which they grow. For example: Summer fruits, Winter fruits and All season fruits.

**Summer fruits:** Fruits available in our country from mid April to mid October [Baishakh to Ashwin] are called Summer fruits. Mango, berry, litchi, jackfruit, guava, hog plum, pineapple, sapota, chalta, lemon, palmyra, etc. are the most available ones. However, lemon, pineapple and guava are found almost round the year.

**Winter fruits:** We do not usually have many indigenous winter fruits. The main fruits of this kind are orange, olive and wood apple.
All season fruits: Some fruits are available in our country throughout the year. For example: Banana, papaya and coconut.

A list of seasonal fruits

<table>
<thead>
<tr>
<th>Summer</th>
<th>Winter</th>
<th>All Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>Guava</td>
<td>Orange</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>Hog plum</td>
<td>Olive</td>
</tr>
<tr>
<td>Litchi</td>
<td>Pineapple</td>
<td>Wood apple</td>
</tr>
<tr>
<td>Berry</td>
<td>Sapota</td>
<td></td>
</tr>
<tr>
<td>Palmyra</td>
<td>Chalta</td>
<td></td>
</tr>
<tr>
<td>Pomegranate</td>
<td>Kodbel</td>
<td></td>
</tr>
<tr>
<td>Lemon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Importance of fruits

As food: We usually consider rice and wheat as our staple food. In many countries, people eat fruits as their staple food. For example: People in the South American countries eat banana as the main course of their meal. Banana, Jackfruit, Guava, Pineapple, etc. can reduce our food deficit to a great extent. Output of fruits is much more than that of field crops. A probable increase in the production of fruits may bring down the demand for rice and wheat.

As nutrient: Fruits are important as food because they have sufficient amount of vitamin and mineral. We should eat 115 grams fruit every day. Fruits increase our digestive power. An intake of fruit every day keeps us hale and hearty.

The table below shows the amount of vitamin our homegrown fruits contain and the symptoms of their deficiency on the human body:

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>The amount of vitamin in every 100 gram fruits</th>
<th>Symptoms &amp; Diseases caused by vitamin deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>vitamin A</td>
<td>mango - 8300 micro gm papaya - 8100 micro gm jackfruit - 4700 micro gm</td>
<td>decreased resistance to diseases; stunted natural growth; night-blindness</td>
</tr>
<tr>
<td>vitamin B 1</td>
<td>banana - 0.10 mg peanut (raw) - 0.90mg cashew nut - 630 mg</td>
<td>Loss of appetite; obstructing the starch breaking process; berry-berry</td>
</tr>
</tbody>
</table>
Fruits of our country like papaya, mango, guava, jackfruit, pineapple, lemon, etc. abound with vitamins A, B and C. Moreover, they have calcium, magnesium, iron, and potassium. Phosphorus and amino acid abound in adequate amount in wood apple, litchi, almond, karamcha, etc.

<table>
<thead>
<tr>
<th>vitamin B2</th>
<th>papaya - 0.03 mg</th>
<th>litchi - 0.06 mg</th>
<th>wood apple - 0.02 mg</th>
<th>peanut (raw) - 0.13 mg</th>
<th>the reddening of eyes; ulcer in the corners of the mouth; weight loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>niacin</td>
<td>guava - 0.4 mg</td>
<td>wood apple - 0.9 gm</td>
<td>cashew nut - 2.1 gm</td>
<td></td>
<td>disruption in the starch absorption process; pellagra</td>
</tr>
<tr>
<td>vitamin C</td>
<td>amloki - 600 mg</td>
<td>guava - 210 gm</td>
<td>orange - 40 mg</td>
<td></td>
<td>the slow-healing of ulcers; the attack of scurvy</td>
</tr>
</tbody>
</table>

Fruits of our country like papaya, mango, guava, jackfruit, pineapple, lemon, etc. abound with vitamins A, B and C. Moreover, they have calcium, magnesium, iron, and potassium. Phosphorus and amino acid abound in adequate amount in wood apple, litchi, almond, karamcha, etc.

**A list of nutrients of different fruits [in each 100 gm edible portion]**

<table>
<thead>
<tr>
<th>Name</th>
<th>Mineral (gm)</th>
<th>Starch (gm)</th>
<th>Energy (Calorie)</th>
<th>Calcium (mg)</th>
<th>Phosphorus (mg)</th>
<th>Iron (mg)</th>
<th>Carotene (mg)</th>
<th>Vit. B1 (mg)</th>
<th>Vit. C (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>0.4</td>
<td>16.9</td>
<td>74</td>
<td>14</td>
<td>16</td>
<td>1.3</td>
<td>2743</td>
<td>0.08</td>
<td>16</td>
</tr>
<tr>
<td>Banana</td>
<td>0.8</td>
<td>27.2</td>
<td>116</td>
<td>17</td>
<td>110</td>
<td>1.5</td>
<td>11</td>
<td>0.10</td>
<td>1</td>
</tr>
<tr>
<td>Pineapple</td>
<td>0.204</td>
<td>6.2</td>
<td>46</td>
<td>30</td>
<td>18</td>
<td>....</td>
<td>...</td>
<td>1830</td>
<td>21</td>
</tr>
<tr>
<td>Papaya (ripe)</td>
<td>0.5</td>
<td>7.2</td>
<td>32</td>
<td>17</td>
<td>13</td>
<td>0.5</td>
<td>666</td>
<td>0.04</td>
<td>57</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>0.9</td>
<td>19.8</td>
<td>88</td>
<td>20</td>
<td>41</td>
<td>0.5</td>
<td>175</td>
<td>0.03</td>
<td>7</td>
</tr>
<tr>
<td>Litchi</td>
<td>0.5</td>
<td>13.6</td>
<td>61</td>
<td>10</td>
<td>35</td>
<td>0.7</td>
<td>...</td>
<td>0.02</td>
<td>31</td>
</tr>
<tr>
<td>Guava</td>
<td>0.7</td>
<td>11.2</td>
<td>51</td>
<td>10</td>
<td>28</td>
<td>104</td>
<td>...</td>
<td>0.03</td>
<td>210</td>
</tr>
<tr>
<td>Lemon</td>
<td>0.6</td>
<td>10.4</td>
<td>47</td>
<td>40</td>
<td>...</td>
<td>2.3</td>
<td>...</td>
<td>...</td>
<td>47</td>
</tr>
<tr>
<td>Amloki</td>
<td>0.5</td>
<td>13.7</td>
<td>58</td>
<td>50</td>
<td>20</td>
<td>1.2</td>
<td>9</td>
<td>0.03</td>
<td>600</td>
</tr>
</tbody>
</table>
As cash crops

Few indigenous, fruits are commercially cultivated in Bangladesh. It is quite difficult to find the correct statistics of land under fruit cultivation and the state of production. However, it is true that the output of fruits from a hectar of land is more than that of other crops. The production of fruits from the same plot of land brings in more money than that of other crops. For example, a hectar of land gives an output of fruits ten to twelve times more than that of rice or wheat. Moreover, fruits bring more money than field crops.

The amount of land cultivated for some fruits and the quantity of their yield are given below:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>50300</td>
<td>186625</td>
<td>50400</td>
<td>186760</td>
</tr>
<tr>
<td>Banana</td>
<td>39700</td>
<td>628425</td>
<td>39600</td>
<td>624735</td>
</tr>
<tr>
<td>Pineapple</td>
<td>13800</td>
<td>148485</td>
<td>13800</td>
<td>148580</td>
</tr>
<tr>
<td>Papaya</td>
<td>4200</td>
<td>39000</td>
<td>4700</td>
<td>41000</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>26500</td>
<td>265480</td>
<td>26700</td>
<td>266835</td>
</tr>
<tr>
<td>Litchi</td>
<td>4700</td>
<td>12550</td>
<td>4800</td>
<td>12755</td>
</tr>
<tr>
<td>Guava</td>
<td>6100</td>
<td>44000</td>
<td>6200</td>
<td>46000</td>
</tr>
<tr>
<td>Coconut</td>
<td>32400</td>
<td>89255</td>
<td>32100</td>
<td>89320</td>
</tr>
</tbody>
</table>

We can plant fruit trees around our homesteads, on the high fallow land, on the sides of ponds, etc. If we do so, we can earn a handsome amount of money with a comparatively less capital and labour. However, fruit farming requires many people for the production of saplings, seeds and cuttings as well as for the processing and marketing of the yield. As a result, it opens job opportunities for many people. The processing of fruits can be done at home with a little effort. So it creates further employment for women. We can produce different foodstuffs like jam, jelly, pickles, candy, drinks, etc. with fruits for sale. We can even export them for foreign currency.
Besides, we may use the leaves of many fruit trees as fodder. For example, leaves of jackfruit trees are a good feed for goats. People make expensive furniture with the wood of fruit trees. We may use the foliage of fruit trees and their dead branches as fuel. Fruit trees help protect environment and prevent soil erosion.

PRACTICAL

**Topic:** Classification of fruit trees

**Materials:** A chart for listing fruit trees; pen, pencil and paper.

**Steps of the work**

1. List the fruit trees you come across in your homestead and around your school. Mention in the list the fruits available in your local market.

2. Collect information about nutrients and mineral contents of different fruits.

3. Inform yourself about the economic significance of the fruits you have listed. You may ask your class teacher for help in collecting the data. You may read a book that may help you in this regard.

4. Now make a list of different fruits according to the table below and submit it to your teacher:

<table>
<thead>
<tr>
<th>Serial number</th>
<th>Names of the fruits</th>
<th>Locations of the fruit trees or the fruits</th>
<th>Kinds of the fruits: short term or long term</th>
<th>Vitamin and mineral contents</th>
<th>Symptoms and diseases owing to the deficiency of these vitamins</th>
</tr>
</thead>
</table>
Exercise

Multiple Choice Questions

1. What is the amount of Vitamin A in micrograms in 100 grams of mango?
   a. 8100  b. 8200  c. 8300  d. 8400

2. The importance of fruits is unlimited, because in the fruits -
   a. There is much protein  b. There is much carbohydrate  
   c. There is much vitamin  d. There is much water

3. Short-term summer fruit is -
   i. Banana
   ii. Pineapple
   iii. Water-melon
Which one is correct?
   a. i and ii  b. ii and iii  c. iii  d. i, ii and iii

Read the following passage and answer question numbers 4 and 5.

Five/six years ago Mr. Zaman planted in his yard mango, jackfruit, banana, olive, papaya and coconut sapling which he bought from the tree fair. Mr. Zaman can meet up the demand of fruits well for the members of his family as the plants bear the fruits more or less all the year round.

4. The planted trees of Mr. Zaman bearing fruits all the year round are -
   i. Sugarcane, papaya & coconut.
   ii. Olive, jackfruit & banana.
   iii. Banana, papaya & coconut.
Which one is correct?
   a. i  b. ii  c. iii  d. i, ii and iii
5. Among the trees of Mr. Zaman which one contains the most Carotin?
   a. Ripe papaya  b. Jackfruit
   c. Mango  d. Banana

Creative Question

Rahim Mia cultivated paddy in his one acre of high land. But at present for the increase of production cost he was in a very difficult position to maintain his family. He started to cultivate short-term fruit banana in that piece of land instead of cultivating paddy following the advice of his neighbour Shamsu Mia. Rahim Mia cultivated papaya side by side with banana; as a result his family becomes solvent.

a. What is short-term fruit?

b. Describe how much carbohydrate and food energy is there in banana.

c. Explain the cause of cultivation of papaya beside banana.

d. 'Cultivation of banana is more profitable than rice'- analyse it.
Chapter 2
THE REPRODUCTION OF FRUIT TREES
Methods of the Reproduction of Fruit Trees

Like other crops, fruit trees reproduce themselves through seeds and through stems.

Reproduction through seeds
The fertilized and mature ovum of flowers is called a seed. The reproduction of mango, berry, litchi, jackfruit, papaya, guava, etc. is possible through seeds. It has some advantages and disadvantages.

Advantages
1. Many saplings can be grown easily with a little money and labour.
2. Trees born of seeds live longer. They grow big, become strong with many branches and bear more fruits.
3. The development of new species is done through seeds.
4. Seeds are the only medium of reproduction for betelnut, coconut, palmyra, papaya, etc.

Disadvantages
1. The tree born of a seed does not always have all the attributes of the parent tree.
2. There is no easy method for the reproduction of pineapple and banana with seeds.
3. Trees born of seeds take longer to bear fruits.

Reproduction with stems (vegetative propagation)
Reproduction with stems means to reproduce a tree with its stem. Stems are used to reproduce pineapple, banana, mango, lemon, etc. This method of reproduction has some advantages and disadvantages.

Advantages
1. Trees reproduced with stems have all the characteristics of the parent tree.
2. The flower and fruit earlier than those reproduced through seeds.
3. Variation in fruiting plant may be brought willingly. For example: plum, mango, etc.
4. The only convenient way of the reproduction of banana, pineapple, etc. is vegetative or stems cutting method. The reproduction with seeds of banana and pineapple plants is very difficult.

**Disadvantages**

1. The stem reproduction method does not allow development of new varieties.
2. The cost of growing saplings in this method is higher than that of growing them from seeds.
3. Diseases of the parent tree may spread through the trees grown from stems.
4. These trees are comparatively short lived and smaller in size.

**The method and means of stem propagation**

**Sucker:** The new sapling that peeps out of the parent tree and lives on its food is called a sucker. Pineapple, banana, etc. reproduce through suckers. They appear at the stump of banana plants. They are planted for the cultivation of banana. Suckers of banana are of two kinds: 1. Sword suckers 2. Water suckers.

Sword suckers sprout from the bottom of the parent stem. Their lower ends are quite fat. They have long leaves that look like swords. Their leaves are strong though narrow in width. These saplings are good for plantation. The lower ends of water suckers are comparatively slim, not as plump as those of the sword suckers. Their leaves are thick and broad, and are not good for plantation.

In addition to the saplings described above, we can also reproduce a banana sapling using the whole or part of the stump of a parent plant. But it takes some more time to
be fruitful. We can use the stump of a growing plant or a fruit-bearing one for producing saplings.

**Pineapple**

Pineapple has four kinds of reproductive suckers. A description of the four suckers is given below:

1. Two kinds of saplings grow at the top of a pineapple. The sapling standing upright on the head of the fruit is called the crown sucker. The sapling, which comes out of the lower end of the crown sucker, is called the crown slip.

2. A stalk sucker is one that grows at the bottom or at the top of the stalk of the pineapple.

3. A sapling that comes out of the trunk below the stalk but above the ground is called a side sucker or trunk kekri.

4. A sapling that breaks out of the ground from the bottom of the plant is called the ground kekri or ground sucker. Ground sucker and side suckers are the best for pineapple cultivation.

![Different kinds of sucker of pineapple](image.png)
Lemon and Guava Cutting

The use of roots, branches or leaves of trees to grow their kinds is called the cutting reproduction or stem reproduction method. Cuttings are processed in various ways, such as, Root cutting and Branch cutting.

**Root cutting:** Roots, roughly as thick as a pencil, should be cut in 15 - 20 cm long pieces. These roots should be kept parallel to one another in a seedbed or in a tub or in a pot and be covered with soil. They may be partially buried with 3 - 4 cm of their bottoms over ground. Saplings will grow in 3 - 4 weeks after the roots have been placed in the seedbed or in the tub. The roots of wood apple, guava, pomegranate, etc. are used for cuttings.

![Horizontal method](image1.png)  ![Vertical method](image2.png)

**Branch cutting:** Sparsely shaded high land should be selected for producing branch cuttings in beds. Dig the bed half a hand or 20cm deep. Throw away the extracted earth. Fill in the bed with a mixture of 2: 1 sand and decomposed cowdung. However, if water stands on the land, do not dig it. In this case, make a bed half a hand high on the land. The bed would consist of a mixture of 2:1 sand and decomposed cowdung. Besides, branches can be planted densely in earthen tubs or wooden trays filled with sand only. Shoots will come out of them in a few days. You may extract the saplings with much caution after 4-5 weeks of the plantation and preserve them in individual tubs.

Fresh branches, 15-20 cm long, like pencils or in some cases a little thicker or thinner are usually selected for cutting reproduction. If they are planted on the ground, new saplings sprout from them. You may collect 6 -12 month old, strong or well-nourished branches of lemon trees for cuttings. The selected branches must be healthy, strong, fresh, smooth, and gray or green in colour. There should be at least three nodes on them. Leaves must be plucked off if there are any. Their tops should be cut in a circular shape near the upper node, while their bottoms should be cut
diagonally for roots to grow. Subsequently, they should be planted a bit diagonally on the ground, about a half of their length beneath the soil. This process produces branch cuttings in 4 - 6 weeks.

Layering: The reproduction of guava, lemon, litchi, etc. are generally done through the layering method. You can do it anytime in the year except winter. If you do it in the wet season, you need not irrigate. First, find a tree of your choice. Then select some finger or pencil size branches which are nourished, strong and healthy tree. People usually prefer oneyear-old branches. It is better if the branches are parallel to the ground. Cut round the bark of the branches, 40-50 cm off the top and right below a node, with a sharp knife. Again do the same, 3-4 cm below the first incision. Now peel off the bark from the space between these two incisions. Scratch this bare part. Then make dough of clay and decomposed cowdung or compost, 3:1. Fashion them into some balls; press each ball on and around, and 2-3 cm up and down the scratched part of each branch. Wrap it up with a piece of polythene, 20 cm long and wide. Tie it up round and round with a rope. It is better if you wet the lump of the mixture with 2-3 teaspoonfuls of water before tying it up. In 4/5 weeks, roots will sprout through the plaster at the top end of the barked up portion of the branch. The roots change from being white to deep brown or copper. Branches and sub-branches also begin to peep at this time. At this stage, amputate the cutting along with the bandage off the tree. Then cut off unnecessary stems and leaves; untie the rope and remove the polythene carefully and place it in the seedbed or a tub for hardening. The cuttings become ready for plantation after 4-5 weeks of hardening in this manner.
Daba layering

A branch, 1-2 years old, of the parent tree near the ground should be selected for the Daba layering of lemon and guava. The branch should be barked up according to the layering method mentioned before. The barked up part of the branch should be covered with decomposed cowdung and then the branch would be lowered to the ground. A weight would be put on it. Roots will grow from the buried part in 4-6 weeks. The branch would be amputated off the parent tree below the roots that have grown on it. Let it convalesce for 2-3 weeks and then plant it in a selected place.

PRACTICAL

**Topic:** Identification of pineapple and banana saplings

**Requirements:** Banana plantation, pineapple plantation, texts, notebook & pen
Steps of the work
1. Visit a pineapple plantation.
2. Identify different kinds of saplings and compare them with the descriptions and pictures in the text.
3. Identify the saplings and explain the characteristics in front of your class teacher.
4. Now go to a banana plantation.
5. Identify saplings and compare them with sword suckers and water suckers as described in the text.
6. Identify and explain the characteristics to your class teacher.
7. Write in order what you have done to identify the saplings of pineapple and banana in your practical exercise book.

Topic: How to make the layering of lemon and guava

Materials: Parent tree, decomposed cowdung and clay, rope and polythene, sharp knife for cutting.

Steps of the work
1. Select a parent tree for blister (gooti) cutting.
2. Select about a year old, fresh, strong and disease-free branch of the tree you have chosen. It is good if the branch is close and parallel to the ground.
3. Then cut the bark round below a node, 40-50 cm from the top of the branch, with a sharp knife.
4. Cut the bark round once again 3-4 cm below the earlier cut.
5. Now bark up carefully between the two cuts. Scratch the bare portion a little.
6. Mix a portion of decomposed cowdung with three-time more clay. Now add water to the mixture and roll it between your palms to balls.
7. Cover the bare portion of the branch along with 2-3 cm beyond it.
8. Put a layer of earth on the covered place and wrap it up with a piece of polythene, 20 cm long and sufficiently wide. Wet the earth with 2-3 spoonfuls of water and then tie it tightly with ropes.
9. If it is kept in this state, roots will grow and burst through the plaster at the top of the barked up part in 4-5 weeks. The roots will look white at the beginning and then will turn copper brown.
10. Cut the cutting below the bandage when the roots are copper brown. At this stage cut off the unnecessary stems and branches.
11. Then take off the ropes and polythene carefully. Keep the cutting in a half-shaded bed or a tub for 4-5 weeks. Now you can plant it in a place you like.

12. Write down the jobs you have done in order to grow blister (gooti) cutting in your practical exercise book.

**Topic:** Daba cutting of Lemon and Guava.

**Materials:** Parent tree, knife for cutting, decomposed cow-dung, loam, brick and bamboo sticks.

**Steps of the work**
1. Select a parent tree.
2. Select a 1-2 year old branch that is very close to the ground.
3. Cut round the bark below the node, close to the ground. Cut round again 3-4 cm below the earlier cut. Bark up the gap between the two cuts.
4. Plant the bare part of the branch in loam, mixed with decomposed cow-dung. Use a V-shaped bamboo contraption or a brick to keep it down.
5. Roots will grow at the node above the cut in 4-6 weeks.
6. Now cut it below roots. Leave it in this state for 2-3 weeks. Then dig it out together with some earth and plant it in a selected place.
7. At last write the jobs you have done in your practical exercise book.

**Exercise**

**Multiple Choice Questions**

1. The seed of which tree does not produce any sapling?
   a. Papaya  
   b. Litchi  
   c. Hog plum  
   d. Pineapple

2. Which one is more suitable for cultivation of pineapple?
   i. Crown sucker  
   ii. Side sucker  
   iii. Ground sucker

Which one is correct?
   a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii
Read the following passage and answer question numbers 3 and 4:

Abul became interested to cultivate banana seeing the banana cultivation of his neighbour Samad. So he made banana plantation buying the saplings of banana from local market and he was benefited.

3. What is the banana plant bought by Abul called?
   a. Seed  
   b. Sucker  
   c. Cutting  
   d. Layering

4. The characteristic of these types of plants is-
   i. New sapling grows from mother plant.
   ii. It takes food from the mother plant at the first stage of growth.
   iii. It dies if it is detached from the mother plant.

Which one is correct?
   a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii

Creative Question

a. What type of vegetative propagation is the above mentioned figure?

b. Explain one advantage of this type of propagation.

c. Show the description of the next step with figure of the step mentioned in the figure above.

d. Write down showing argument whether vegetative propagation possible for all kinds of trees.
Chapter 3
GENERAL PRINCIPLES OF CULTIVATION

Fruit plantation is different from the cultivation of field crops like rice, jute, wheat, mustard seeds and vegetables. Field crops and vegetables are mainly seasonal; their farming cycle ends in a few months. But fruit trees live for years. Most fruit trees begin to fruit 5-6 years after plantation and continue to do so as long as they live. Banana, pineapple and papaya fruit roughly in ten months. It shows how fruit farming differs from field crop farming.

Saplings production

Saplings are grown from the seeds of papaya, jackfruit, berry, hog plum, etc. and then they are planted. On the other hand, seeds can be sowed straightaway. The method of saplings production has been described in stages below:

A. Preparing the bed on the ground: Seeds are usually sown on the bed to grow saplings. How to select land for bed and how to prepare the bed are described below:

1. A seedbed should be on a piece of highland that is wide open to air and to the sun most of the day.

2. A patch of land one metre wide and three meters long or of convenient length should be selected. A drain, 30 cm wide and 15 cm deep, should be dug around the bed.

3. The soil of the bed should be sand or loam. If this kind of soil is not available, sandy loam can be brought from elsewhere and spread 20-25 cm thick on the selected place.

4. It is better to surround the bed with perforated bricks or with something similar so that the soil is not washed away by rain or blown away by wind.

5. Two or three baskets of decomposed cowdung or compost are necessary to be blended with the soil for a 1 m wide and 3 m long bed.

6. There may be worms or germs in the bed. Pour hot water or burn rubbish on the bed to get rid of them.

7. After making the bed free from worms and germs, the soil should be spaded soft and loose.
B. Making bed in a pot

It is possible to make a seedbed in a pot too. The method is described below:

1. An earthen tub or any kind of pot is needed for making a seedbed.

2. The soil for the pot should be 3:1 sandy loam and decomposed cow dung or compost. It should be made germ-free like a ground seedbed.

3. The sandy loam and the decomposed cowdung should be mixed and put in the pot or the tub.
C. Sowing seeds

1. The seeds of papaya should be sown 1 cm deep and 5-7 cm apart from one another in mid-April to mid-June (Baishakh - Jaistha). The seeds of papaya grow in 2-3 weeks.

2. The seeds of guava do not grow easily. So they should be dipped in water for 24 hours and then sown in lines 10 cm apart, 1.5 cm deep.

3. The seeds of lemon should be taken out of ripe fruits and planted 10 cm apart at the same depth in lines right away.

D. Intercultural operations

1. The bed should be irrigated regularly, but care should be taken so that water does not stand on it.

2. A shed of mat or of similar material should be put up to protect the bed from rain and from the heat of the sun.

3. The soil of the bed should be spaded loose whenever necessary and weeds should be root out by weeders or hand hoe.
Preparing the bed

The selection of land: In our country, sufficiently high land with loam suitable for horticulture is not available. We usually cultivate fruits around our homesteads or on fallow land. Loam or sandy loam is very good for fruit cultivation. If the land has no loam, it may be dug and refilled with loam from elsewhere. The selection of land for horticulture depends on the following factors:

1. If underground water seeps into the bottom of the land once it is dug in the rainy season, it is not right for the cultivation of fruits.
2. The land is not good for fruit cultivation if it has stones or gravels 30-40 cm beneath the surface.
3. Land with bad drainage is not good for fruit farming.
4. The top soil should be deep enough for fruit trees.
5. Most of the fruit trees can not tolerate the stagnant water at the base; so land well above flood level is good for fruit farming.
A deep drain may be there to take water out from the selected land for fruit cultivation.

**Making pits and applying fertilizers**

Making pits is essential for planting fruit trees. The size and shape of the pits depend on the following: (a) Size of the tree (b) Longevity of the tree (c) Type of the roots (d) Soil texture and fertility. 1x1x1m pits are usually necessary for large trees; 70x70x70cm pits are necessary for medium ones while 50x50x50cm ones are necessary for small trees. The size of the pits could be a little wider if the soil is not fertile, and the pits would be filled in with fertile loam collected from elsewhere. It will help the trees grow easily. A mixture of well decomposed cowdung or compost, ground bone, ash and chemical fertilizer should be put in the hole.

**How to make pits**

1. Half of the top soil and half of the bottom soil should be kept aside separately at the time of digging the pit. The pit and the soil need to be dried in the sun at least for 7-10 days. It trees the pit and the soil from germs.

2. A half of the topsoil of the hole should be put at the bottom, and a half of the bottom soil should be given at the top to fill in the pit.

3. Fertile soil brought from elsewhere should be used to fill in the pit if its soil is not fertile.

4. Fertilizer should be applied 10-15 days before planting. Quantity of fertilizer for each pit is given below:
5. The soil around the base of the tree should be 10-12 cm higher than the level of the land. It will not allow water to stand at the base of the tree.

6. If necessary, the pit should be filled in with soil, watered and kept for 7 -8 days until the soil attains the right texture for planting.

**Tree plantation**

**Raising saplings from bed and planting them in the pits:** We consider well the nature of the growth, size, life span of the selected species, design of plantation, fertility of the land and its category when we decide for fruit tree plantation. We make the design on the basis of the method of plantation.

Methods of planting in the shape of gardens are as follows:

1. Square  
2. Rectangular  
3. Triangular  
4. Hexagonal  
5. Quinkangs  
6. Contour

<table>
<thead>
<tr>
<th>Size of trees</th>
<th>Decomposed cowdung or compost</th>
<th>Oil-cake</th>
<th>Urea</th>
<th>TSP</th>
<th>MP or Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large permanent trees</td>
<td>20 kg</td>
<td>2 kg</td>
<td>500 gm</td>
<td>1 kg</td>
<td>600 gm</td>
</tr>
<tr>
<td>e.g. mango, jackfruit, litchi.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium trees</td>
<td>15 kg</td>
<td>1.5 kg</td>
<td>350 gm</td>
<td>700 gm</td>
<td>400 gm</td>
</tr>
<tr>
<td>e.g. guava, lemon, hog plum.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small trees</td>
<td>10 kg</td>
<td>1 kg</td>
<td>250 gm</td>
<td>500 gm</td>
<td>300 gm</td>
</tr>
<tr>
<td>e.g. papaya, pumelo, pomegranate, bullock's heart.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. **Square method**

First, we prepare the land quite well. Next, we plant the saplings at a certain distance in a square design. It means every line will be at an equal distance from the other. Similarly, every sapling will stand at an equal distance from the other on a line. This method is good for mango, jackfruit, litchi, etc.

2. **Rectangular method**

Prepare the land. Decide on the space among the lines. Draw the lines. Look at the recommended space among the saplings. Draw lines for saplings accordingly and thus divide the land into small rectangles. Plant a sapling at every corner. Plantation of papaya, banana, pineapple, etc. usually follows this method.

3. **Triangular method**

Prepare the land. Draw lines at fixed spaces. Plant the saplings on two lines in a triangular shape. You can plant an extra sapling on every third line in this method. This method allows more space among lines.

4. **Hexagonal method**

Prepare the land. Draw lines at fixed spaces into hexagonal shapes. Plant six saplings at six corners of each hexagon and one in the middle. It is expensive to start but the most profitable. You can plant more saplings if you follow this method.
5. Quinkangs method

It is basically a square method. You may plant mango, jackfruit, lichi, etc. in this method. It accommodates a sapling of a big short-lived fruit tree in the middle of each square. As the main trees thrive, the tree in the middle loses its strength to survive. However, it gives fruits quite for a long time. For example, if you plant a lemon or guava sapling among the four saplings in your mango orchard, you can harvest its fruits for 7-8 years.

6. Contour method

This method suits the orchards on hills. You make contours between spaces. Plant the saplings on them. The contours do not let the water out. As a result, soil erosion is little and yield is satisfactory.

Space required between one sapling and the other, and between a line and the other is shown below:

Spacing may differ depending on the condition of the land as well the species of the saplings.

<table>
<thead>
<tr>
<th>Name of the tree</th>
<th>Plant spacing in metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango, jackfruit, wood apple, blackberry</td>
<td>10-12</td>
</tr>
<tr>
<td>Star fruit, amloki, sapata</td>
<td>8-10</td>
</tr>
<tr>
<td>Olive, pumelo</td>
<td>6-8</td>
</tr>
<tr>
<td>Hog plum, plum, lemon (kagozi), guava</td>
<td>4-6</td>
</tr>
<tr>
<td>Karamcha</td>
<td>3-4</td>
</tr>
<tr>
<td>Banana, papaya</td>
<td>2-3</td>
</tr>
<tr>
<td>Water melon</td>
<td>1-2</td>
</tr>
</tbody>
</table>

The distance of a sapling from the other and of a line from the other may vary depending on the fertility of the land, variety of the saplings and their kinds. It is usually good to plant saplings in mid April-mid June (Baishakh -Jaistha) before the start of the rains. You can plant at the end of the rainy season or even in mid-February - mid-March (Falgun - Chaitra), if you can irrigate. However, it is not wise to plant in winter.

Collecting saplings or cuttings

Sapling of improved variety collected from reliable nursery may be used for gardening.
Extracting saplings from the bed and planting them in the pits: It will be easier to extract the saplings if you wet the bed earlier. Extract the saplings with the soil attached to the roots with a hand hoe. Plant them in the middle of the pits. Let the roots find the same breadth and depth they had in the bed.

Extracting from the tub and planting in the pit: Separate the lump of soil stuck fast in the interior wall of the tub. How? Enter a blunt knife between the lump and the wall of the tub. Drive it all around the lump. Hold the tub upside down and hit on the bottom softly. The sapling will eventually come out along with the lump of soil. Plant it as such in a pit. Firm the loose soil on the base of the sapling with your hands. Put up a hard stick 15 cm from the sapling.
**Intercultural operations:** Look in on the saplings regularly from the day they are planted. Irrigate them when necessary. But keep an eye on their base. Don’t let water stand there. Put down the weeds. Cultivate other seasonal fruits in the orchard if possible. Provide the saplings with nutrients on a regular basis. Normally, you have to apply fertilizer before and after the onset of the rainy season. You need to spade the soil on the base of the saplings and further around them sometimes to loosen it. Take care that you don’t spade many roots to death.

![Wrong method](image1.png)  ![Correct method](image2.png)

**Fig:** Loosing of soil from the base of a tree

**Applying fertilizer**

The table below shows progressively increasing annual doses of fertilizer after plantation.

<table>
<thead>
<tr>
<th>Application of Fertilizer</th>
<th>Compost or cow dung</th>
<th>Oil-cake</th>
<th>Urea</th>
<th>TSP</th>
<th>MP or Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large trees (10 years and above)</td>
<td>6kg</td>
<td>300 gm</td>
<td>150 gm</td>
<td>200 gm</td>
<td>150 gm</td>
</tr>
<tr>
<td>Medium trees (7 years and above)</td>
<td>6kg</td>
<td>250 gm</td>
<td>150 gm</td>
<td>200 gm</td>
<td>150 gm</td>
</tr>
<tr>
<td>Small trees (4 years and above)</td>
<td>5 kg</td>
<td>200 gm</td>
<td>200 gm</td>
<td>250 gm</td>
<td>175 gm</td>
</tr>
</tbody>
</table>
A table showing annual application of fertilizer to trees bearing fruits:

<table>
<thead>
<tr>
<th>Size of the tree</th>
<th>Compost or cowdung</th>
<th>Oil-cake</th>
<th>Urea</th>
<th>TSP</th>
<th>MP or Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large trees (10 years and above)</td>
<td>80 kg</td>
<td>5 kg</td>
<td>2kg</td>
<td>2kg</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Medium trees (7 years and above)</td>
<td>60 kg</td>
<td>3 kg</td>
<td>1.5k</td>
<td>2kg</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Small trees (4 years and above)</td>
<td>30 kg</td>
<td>2 kg</td>
<td>1 kg</td>
<td>1.5kg</td>
<td>1 kg</td>
</tr>
</tbody>
</table>

Apply the doses of fertilizer a little further from the base but within the canopy of the trees once before the rainy season and once after it every year.

**Irrigation:** Irrigate the saplings after a day or two, if necessary, at the first stage of plantation. If you loosen the earth on the base of the trees and cover it with straw, leaves or water hyacinths, the moisture in the soil does not evaporate, and you do not need to irrigate them often. Besides, the rubbish rots into manure. During summer, erect a ring of earth around each tree with a slope towards the base at a radius of 50 - 300 cm. The size and type of the tree determines the radius. But raise the base during the rainy season to let the rain water roll down.

Fig: Situation during rainy season (Sloping base)

Fig: Situation during dry season (Interverior sloping to the bottom end)
**Protection from the cattle:** To protect the saplings from the cattle is one of the most important jobs of horticulture. Goats hardly miss a chance to eat up the leaves and bark of the saplings. It is necessary to protect the saplings with a fence around them. Hundreds of thousands of the planted saplings cannot survive because they had no fence around them on time and as a result, they fell a victim to the cattle.

![Protection from cattle and goat](image)

**Pruning:** To cut out the unimportant parts of a tree is called pruning. A tree is pruned for controlling its free style growth. It means you prune the tree to let it grow in a way you want. Besides, you prune a tree because you want some particular branches to grow stronger or you do not want the tree spread too much.

**Pruning period:** Winter is the time for pruning hog plum, wood apple and star fruit. The right time for pruning jackfruit, berry, mango, litchi, guava, lemon, etc. is soon after their fruits are harvested.

**Modes of pruning:** Young trees are lightly pruned while the old ones are done heavily.

**Trunk pruning**
Trunk is used as valuable wood. For example: jackfruit and berry. To grow their trunks long you need to cut off their stems and branches. A jackfruit tree gives more fruits if you prune the branches that grow at the base and on the main trunk. If you smash some leaves off a litchi tree while plucking the fruits, it will grow more leaves to team up with more fruits. If you prune all the branches at the top of a plum tree, it will have fewer chances of diseases. The newly grown branches bear more fruits.
Root pruning: Some trees may not bear fruits or as much as you expect because they have grown more than enough. If you prune their roots, they will bear more fruits. However, it is not wise to prune the roots of palms like coconut, betelnut, date, etc.; they are called Monocotyleadones (ekbeejpatri).

Dig a drain, 1 - 3 m wide, round the tree, a little away from the base. Cut some of the roots off as you dig the drain. This is called root pruning. You may prune roots by ploughing or digging a drain or spading.

Thinning flowers and fruits: All the fruits do not grow equally big if too many appear on a tree. If you thin out them by plucking off some, they will grow bigger in size and better in quality. If there are too many flowers on the tree, you may nip some of them. If a tender tree flowers, it may grow weak. If you nip its flowers, it does not grow weak.

Harvesting fruits and their disposal

Almost all fruits gradually change their colour as they ripen. We usually harvest fruits after they have ripened on the trees. If you want to sell them in a market, you should harvest them a little earlier. You can pluck the fruits off the trees if they are small in size. You may use a bamboo prong (kota) if the trees are very tall and large.

Marketing of fruits: You may hurt many fruits as you harvest them. You need to separate them along with those with spots, the rotten ones and the worm eaten ones. Finally, you grade the fruits according to their sizes: small, medium and large.

This arrangement will fetch you better prices. You have to pack fruits in baskets or other containers to transport them for sale. People usually spread straw inside bamboo baskets and then pack fruits in them.
You can sell fruits to the customers straightaway in cities and towns, and in big market places. However, in most cases, fruits are sold through wholesale traders and middlemen. Fruit traders often buy the fruits of a garden before they are ripe. They collect the fruits from the gardens and send them to many places for sale.

**Preservation of fruits:** Preservation of fruits means protection of fruits from getting rotten. If you want to preserve fruits, you need to know why fruits rot.

The main causes of rotting are as follows:

1. Too much heat; too much humidity
2. Germs causing decomposition
3. Reaction in the inner cells of fruits
4. Presence of much water in fruit

You can preserve fruits if you can halt the causes mentioned above to work on them.

Some methods of preservation of fruits are given below:

1. Preserve in low temperature
2. Preserve after destroying the germs in the fruits
3. Preserve by reducing the water content of the fruits or by drying them.
4. Preserve in air tight packets or containers
5. Preserve by processing fruits into foods

**PRACTICAL**

**Topic:** Production of compost

**Materials:** (1) Bio-degradable garbage (2) Cowdung (3) Urea (4) TSP (5) Water (6) Mud

**Steps of the work**

1. Select a patch of land, 3m long and 1.25 m wide, beside your house or school. Watch as such the place does not go under water during floods.
2. Mark the place with sticks. Then make a 15 cm thick layer with garbage, water hyacinths, foliage, etc. on it.
3. Sprinkle 200 gm urea and 200 gm TSP on the layer. Mix mud with cow dung and give a 2 - 5 cm thick coat with it on the layer.
4. Build layers as above with garbage; every time put a coat of mud and cowdung; in this way make the heap 1.25 m high.
5. Put up a shed over the heap. Give a coat of mud on and around the heap if you cannot put up a shed.
6. Enter a stick in the middle of the heap and check if it is too wet after a week of its completion.
7. If you find it too wet, make some holes on it with a stick so that air can enter. Keep the holes for 2 - 3 days and then close them.
8. If the heap dries up too much, make some holes on it and pour in the urine of cow or water.
9. When the heap is about two weeks old, put its garbage upside down. Again do the same after a month. You can use the compost of the heap in two months time if you follow this course.
11. You may prepare compost as a group activity. You may also observe how the students of senior classes do it.

**Topic:** Experiment with the growth-potential of papaya seeds

**Materials:** An earthen plate or something like this; fine sand; papaya seeds; water.

**Steps of the work**
1. Count up 100 seeds.
2. Sieve the fine sand and throw away the dirt and grits.
3. Leave the sand soak in a bucket or any other pot of water. Now scoop up the wet sand and spread it into a 6 cm thick layer on an earthen plate.
4. Level off the layer. Lay the seeds one by one in rows. Take care that a seed does not collide with the other.
5. Cover the seeds with a 2 cm thick layer of the wet sand.
6. Keep the pot in a safe place.
7. Water it once a day as required.
8. Count the seedlings after 14 days. The seedlings with roots, trunk and leaves are the healthy ones. The number of healthy seedlings indicates the potential of the seeds to reproduce.
9. Now write the procedure in order in your practical copy; show it to your class teacher and get it signed by him.
**Exercise**

**Multiple Choice Questions**

1. In which plantation process the most fruit trees can be planted?
   a. Triangular  b. Quinkangs  
   c. Square  d. Hexagonal

2. The seed of papaya is sown in the month of -
   i. Baishakh-Jhaistha  
   ii. Jhaistha-Ashar  
   iii. Ashar-Shraban  
   Which one is correct?
   a. i  b. i and ii  
   c. ii and iii  d. i, ii and iii

Read the following passage and answer question numbers 3 and 4.

Harun at the time of digging holes of size 70 cm x 70 cm x 70 cm at a high land beside his homestead filled up the holes with loam soil removing the soil of that land. He transplanted all year round fruit plant by rectangular transplanting process.

3. What size of plant can be transplanted in the hole made by Harun for transplantation of fruit trees?
   a. Large size  b. Medium size  
   c. Small size  d. Any size

4. Which plants of fruit Harun planted in his orchard?
   i. Guava  
   ii. Lemon  
   iii. Pomelo  
   Which one is correct?
   a. i and ii  b. i and iii  
   c. ii and iii  d. i, ii and iii
**Creative Question**

Neaz wishes to cultivate fruit in his 50m x 40m land. When Neaz consults with the forest officer, Mr. Mafiz Ali, he advises Neaz to cultivate fruit in Quinkangs and Hexagonal method. Neaz selects Quinkangs and transplants mango plants keeping the distance 10 meters. He also transplanted lemon in the same land.

a. After how many years of planting will the most of the fruit trees continue to give fruit?

b. Why does Neaz select Quinkangs method?

c. Write down with figure how many mango and lemon plants did Neaz transplanted in his land.

d. Analyse comparatively the Quinkangs and Hexagonal method.
Chapter 4
CULTIVATION OF FRUITS

Banana

Banana is a popular fruit in Bangladesh. It occupies 42% of the total output of fruits in our country. It grows almost everywhere in Bangladesh. It contains almost all kinds of ingredients found in other foods. So banana is called a complete food. A banana plant fruits in a year's time after plantation. Every part of a plant is of use.

Thirty-two kinds of bananas are cultivated in Bangladesh. However, the widely known varieties are amritasagar, sabri, champa or chini champa, jahaji, mehersagar, kobri, ganasundari, jalkathali, katchkala, beechikala, etc.

Preparation of land and plantation: Select land which is high and enjoys sunshine round the year. The soil should be silty loam. The land must let water out. Banana can be planted in all kinds of soil if they have sufficient sap. Irrigation facility must be there for banana plantation.

Mid August to mid October (Bhadra-Ashwin) is the best time for planting banana. The table below shows distances among saplings in square method as well as in hexagonal method, and the number of saplings on a hectare of land.
Plough the land well in mid August (Bhadra); smoothen the surface with a leveler. Dig pits, 45 cm depth and 45 cm in circumference each, at a distance approved for the selected variety. The quantity of fertilizer to be applied to every pit is as follows:

<table>
<thead>
<tr>
<th>Species</th>
<th>Space between plants (metre)</th>
<th>Plants per hectar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Square method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hexagonal Method</td>
</tr>
<tr>
<td>Amritasagar</td>
<td>2.0</td>
<td>2500</td>
</tr>
<tr>
<td>Sabri</td>
<td>2.5</td>
<td>1600</td>
</tr>
<tr>
<td>Champa</td>
<td>2.5</td>
<td>1600</td>
</tr>
<tr>
<td>Jahaji</td>
<td>1.8</td>
<td>3080</td>
</tr>
<tr>
<td>Meversagar</td>
<td>2.0</td>
<td>2500</td>
</tr>
<tr>
<td>Kabri</td>
<td>2.5</td>
<td>1600</td>
</tr>
<tr>
<td>Ganasundari &amp; Jalkathali</td>
<td>3.0</td>
<td>1111</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of fertilizer</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowdung</td>
<td>15 kg</td>
</tr>
<tr>
<td>Oil-cake</td>
<td>240 gm</td>
</tr>
<tr>
<td>TSP</td>
<td>240 gm</td>
</tr>
<tr>
<td>MP</td>
<td>240 gm</td>
</tr>
<tr>
<td>Urea</td>
<td>180-260 gm</td>
</tr>
</tbody>
</table>

Apply a half of the fertilizer mentioned above during the preparation of the land. Apply the remaining half of cowdung, oilcake and 120 gm TSP to the pits. You have to apply $\frac{1}{4}$th of urea, $\frac{1}{2}$ of murate of potash of the total and 120 gm of TSP after one and a half to two months of plantation. You have to put them in a circular drain around the tree, 30 cm away from its base. Again after three and a half months to four months sprinkle a half of murate of potash and a half of the total urea on the whole land and mix them with the soil. Apply the remaining one fourth of urea at the time of flowering.
Cultural practices: Banana plantation requires the following cultural practices:
1. Spade the soil lightly after planting and check the growth of weed.
2. Cut down the growing stems to the level of the ground until the spathe appears.
3. Before the arrival of the rainy season, pick up earth from between the rows and place it on the base of the trees. While doing so, make drains between the rows so that rainwater can flow down.
4. During drought, irrigate the orchard once a month.
5. Cover the bunches of banana as they appear with blue polythene bags. They will protect the bananas from hot wind, dust and insects. Moreover, they will improve the colour of the bananas.
6. Cut down the dried and dead leaves.
7. Cut the spathe off after bananas have come out of the cone.
8. You may keep one or two healthy sword suckers after the appearance of the spathe.

Harvesting bananas: You may reap the bananas when they change from green to light green after 3 - 4 months.

Papaya

Papaya is available round the year. We can eat papaya as a fruit when it is ripe. We can eat it as a vegetable when it is green. Vitamin A lies in sufficient quantities in ripe papayas. Papaya is a short-term nutritious fruit. A substance for digestion called papayene is there in a green papaya in large quantities.

Species: Papaya is grown from seeds. Papaya plants bear flowers of mixed genders: monosex, bisex and polysex. It is difficult to select the right species. A variety called Shahi Papaya is available in Bangladesh. It is mono sexual. It is an approved HYV.

Preparation of land and plantation: You may cultivate papaya in different kinds of land. What you have to consider is that the land must have drainage facilities. If you can apply sufficient fertilizer, papaya grows well in loose soil. You need to till and level the soil well. Dig pits, triangular in shape with sides 45cm in length. The lines will be 2 m apart, and the plants will stand 2 m away from one another. Mix 10 kg cowdung, 500 gm TSP, 24 gm gypsum, 60 gm zinc oxide and 250 gm boric acid with
half of the top soil of the pits and then fill in the pits with the mixture. Keep the pits in this state for 10 days. After 10 days, plant three saplings in each pit, 20 cm apart from one another, in a triangular position.

Get the seeds from a good, sweet papaya. Remove the white film covering them. Sow them fresh on a seedbed or on the soil in polythene bags. Irrigate after sowing if necessary. Seeds will grow in 15-20 days.

When the seedlings are one month old, extract them from the bed and plant them in the pits.

**Application of fertilizer and cultural practices:** The uninterrupted growth of papaya plants demands frequent application of fertilizer. To maintain their health and growth, application of fertilizer is essential.

<table>
<thead>
<tr>
<th>Name of fertilizer (per pit)</th>
<th>Total quantity</th>
<th>During preparation of land</th>
<th>1st split dressing</th>
<th>2nd split dressing</th>
<th>3rd split dressing</th>
<th>4th split dressing</th>
<th>5th split dressing</th>
<th>6th split dressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowdung (kg)</td>
<td>10</td>
<td>entire quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urea (gm)</td>
<td>450</td>
<td>...</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>TSP (gm)</td>
<td>500</td>
<td>entire quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP (gm)</td>
<td>450</td>
<td>...</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Gypsum (gm)</td>
<td>24</td>
<td>entire quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc oxide(gm)</td>
<td>6</td>
<td>entire quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boric acid (gm)</td>
<td>10</td>
<td>entire quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The first installment of fertilizer is to be applied after about two months of planting. Apply the second installment after 45 days of the first installment. Likewise, the remaining installments will follow the 45 days' time lag. You need to weed the orchard both before and after the application of fertilizer. If necessary, you have to irrigate it. Keep one male plant for every twenty female ones, and uproot the other male plants. You may treat the female ones with more fertilizer and care than the male ones.

**Harvesting:** Papaya fruits in four to five months after planting. The fruits begin to ripen in nine to ten months. Pluck them as they begin to wear a light colour. Papaya ripens very fast. It rots very fast. Wrap every papaya with straw. Put them in rows in a bamboo basket to send them to the market. You can have 60-100 papayas from a plant on average.

**Guava**

Guava is a popular fruit in Bangladesh. It is the apple of the tropics. Vitamin C abounds in guava. You may have a guava any day in the year.

**Species:** Kanchannagar, Swaroopkathi, Kajipeyara, Mukondapuri, BARI Guava-2 are the popular varieties in Bangladesh.

**Preparation of land and planting:** A guava tree stands tough. It finds almost all kinds of soil agreeable for its growth. But it cannot survive if water stagnates on its base. High land, rich in bio mass with good drainage facilities, is ideal for guava cultivation.
First, plough the land deeply and then level it well. Dig 60 cm long, 60 cm wide and 45 cm deep pits in rectangular or hexagonal shapes. They should be five to six metres away from one another. Mix 5 - 10 kg of cowdung with 1 - 2 kg of oil cake, 500 gm - 1kg TSP and, a half of the top soil of the pits. Now fill in the pits with the mixture after 15-20 days. Leave them in this state for 7 days. Plant a strong and sturdy cutting at the middle of the pit. Raise the soil of the base to a height of 10 cm. This time post a stick near the sapling and tie it with the sapling. At last, saturate the soil on the base with water.

![Method of planting saplings](image)

**Applying fertilizer and cultural practices:** Guava trees may bear fruits for years. You have to provide them with fertilizer every year. The table below shows the doses of fertilizer required for guava cultivation.

<table>
<thead>
<tr>
<th>Name of fertilizer (per tree)</th>
<th>While preparing pits</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
<th>6th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowdung (kg)</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Urea (gm)</td>
<td></td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>TSP (gm)</td>
<td>500</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>MP (gm)</td>
<td>100</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>
A half of the amount of fertilizer mentioned above is to be applied in mid March to mid May [Chaitra - Baishakh] and the rest in mid August to mid October [Bhadra -- Ashwin]. Notice the canopy of the trees at noon. Plough or spade the area under the canopy, 0.5 - 1.5 m away from the trees. The space to be left undisturbed around the trees depends on their age. Sprinkle fertilizer on the spaded soil and mix them both well. If required, you have to irrigate the land. Prune the dead and the diseased branches and twigs after harvesting every year.

**Harvesting:** Harvest it as it attains maturity. A fruiting tree gives 500 - 1000 guavas.

**Pineapple**

Pineapple is a good source of vitamins A, B and C. It contains calcium, iron and phosphorus. It is short-term fruit. The duration from planting to harvestig is 18-24 months. It is one of the major fruits in Bangladesh.

**Variety:** Giant kew, Honey queen and Ghorashal are being commercially cultivated in Bangladesh.

**Preparation of land and planting:** Sandy soil and sandy loam are good for pineapple cultivation. However, it can be cultivated all over Bangladesh. Crown suckers, stems and bottom suckers are planted for pineapple cultivation. You have to collect these saplings during harvesting and spread them on the ground to dry their bottom ends. Bottom suckers and side suckers are the best of all saplings.

Generally, you have to plough the land deeply and level it well after the rainy season for pineapple cultivation. The next step: make beds, each 1m wide, with a space of 1m among them. Mix 200 gm cowdung or compost with 6 gm TSP and soil for every sapling and apply it at the time of preparing the bed.

Mid September to mid November [Ashwin - Kartik] is the best time for pineapple plantation. However, it may be continued until mid March [Falgun]. You may plant pineapple in one line, two lines or three line methods.
It is better to follow the two line method. You may give the saplings rectangular or triangular configurations. The plants may stand 40cm apart and the lines may lie 50 cm from one another on a metre wide bed.

![Fig: Method of planting for pineapple saplings](image)

**Cultural practices:** You will have to weed the farm regularly and irrigate it when necessary. When the saplings are five months old, they require fertilizer. Give it as top dressing. Fix 18gm urea and 18 gm MP for each plant. Divide the whole amount into five equal portions. Apply a portion every two months. You will have to weed the base of the plants with a hand hoe before you apply fertilizer. You will have to irrigate too. It is better to apply fertilizer after irrigation. Neither the sun nor the shade all day long is good for pineapple. Partial shade is comfortable for pineapple. You may grow pigeon pea or some kind of trees for light shade.

**Harvesting:** Honey queen is harvested from May to June while Giant kew is harvested from July to September. It is possible to grow pineapple round the year applying hormone technology. Harvesting pineapple either green or too ripe is not advisable. You better reap your pineapples when they are half ripe. You may easily grow 40 - 50 tons of pineapple on a hectar of land.

**Lemon**

You may cultivate lemon in any place in Bangladesh. Lemon contains much vitamin C. It is soluble in water. It does not stay in the body. The decay of our body cannot be replenished without vitamin C. Moreover, wounds do not heal quickly without vitamin C. We need to eat lemon each time we eat a meal everyday to keep fit. Here lies the importance of lemon cultivation.
**Variety:** Lemons are of various species. Kagaji lebu, Elachi lebu or BARI lebu-1, BARI lebu-2, BARI lebu-3 and Rangpur lebu are some of them. Besides, some local species like Bijheen and Jamilebu are also worth mentioning.

**Reproduction:** Lemon reproduces in two ways. You have to grow saplings from seeds. But seeds of lemon cannot be easily preserved. You have to get seeds out of lemons and sow them on a seedbed immediately. You can buy saplings of lemon almost in all thana level towns and village markets now-a-days.

**Preparation of land and planting:** Although lemon is a tropical crop, it can be cultivated in all kinds of climate. It grows in all kinds of soil. The land needs to be ploughed deeply and have drainage facilities. One may cultivate lemon in homesteads or on school premises. One can grow lemon in tubs or drums in case there is no space.

You have to dig a pit, 60cm deep and 60cm wide in mid April - mid June [Baishakh - Jaistha]. A line will lie 2-3 m away from the other. A sapling will stand at a similar distance from its fellow being. Dig the pits. Fill them with earth mixed with fertilizer. Keep them in this state for 8-10 days. Now is the time to plant the saplings. You are supposed to mix 10 kg cowdung or compost, 500gm oil cake, 500 gm TSP and 4 kg ash with the soil of each pit to fill in each of them in normal conditions. After this you have to irrigate the soil of the pits. The pits become fit to receive plants after 8-10 days. You must watch with utmost care that every sapling finds the pit deep enough for its roots to stretch as much as they did in the seedbed. You may plant saplings in tubs or drums after filling them with a mixture of soil and fertilizer in the same way.

**Cultural practices:** Regular irrigation and weeding are necessary after plantation. 40 kg cowdung or compost, 2kg oil cake, 1.25 kg urea, 1.5 kg TSP, 1.5 kg MP and 1 kg lime are to be applied to an adult tree, on average. Spade the ground under the canopy of every tree; mix a half of the things mentioned above with the loosened soil before the rainy season. Repeat the procedure after the rainy season. Roots of lemon do not go very deep into the ground. A damp situation or drought does not agree with the upkeep of a lemon tree. You are required to have irrigation and drainage facilities in order to respond to these situations. The sick, dry and unnecessary twigs and branches of lemon trees need to be lopped off. The time of pruning is right after harvesting. Moreover, if a stem appears at the base of the tree, it should also be cut down.
Harvesting: Lemon flowers turn to fruits almost in nine months. Lemon trees usually bear fruits round the year. They are harvested when they are full with kernel. On average output from a tree is about 500 - 600 pieces.

PRACTICAL

Topic: Planting lemon seedlings and cuttings

A. Planting on land

Materials

1. Silty soil or sandy loam
2. Tools for working on the land [spade, crowbar]
3. A tape for measuring land
4. Compost or cowdung
5. Oil cake and chemical fertilizer
6. A hand hoe
7. A watercan
8. Bamboo poles or twigs

Steps of the work

1. Find out a patch of high land of sandy loam fit for lemon cultivation if you can at or around your homestead to plant lemon saplings.
2. Collect the materials required.
3. Prepare a pit 60 cm deep and 60cm wide in mid April - mid June [Baishakh - Jaistha].
4. Right at the outset of the preparation of the pit take up a rope or thread 60cm long. Post a bamboo stick at the point where you want to plant the sapling. Now fold the rope or thread into two. Enter a stick right in the loop formed at the bend. Hold the stick at the centre and draw a circle by turning the other end of the folded rope around.
5. Dig a 30cm deep pit along the line of the circle with a spade or crowbar. Keep the soil on one side. Now, again dig it 30cm deep and put the soil on the other side.
6. Mix well the following fertilizers with a half of the top soil of the pit:

<table>
<thead>
<tr>
<th>Name of fertilizer</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowdung</td>
<td>10kg</td>
</tr>
<tr>
<td>Oil-cake</td>
<td>500 gm</td>
</tr>
<tr>
<td>TSP</td>
<td>500 gm</td>
</tr>
<tr>
<td>Ash</td>
<td>4kg</td>
</tr>
</tbody>
</table>
7. Fill in the pit with the mixture. Watch that the pit is filled in 15-20 cm higher than the ground level. Wet the pit with a pail of water. Keep it in this state for seven days.

8. The soil on the top of the pit will attain the right texture in seven days. If it does not attain this quality, wait for a day or two. Remove the soil from the middle of the surface of the pit with a hand hoe and plant the sapling there. Press the soil around well. Take care that the sapling stands at the depth of the bed.

9. Post a bamboo stick or the branch of a tree. Tie the sapling to it well.

10. Put up a fence around the sapling.

11. Look in on the plant twice a week. Irrigate once a week if it does not ram.

12. If the soil gets hard after irrigation, loosen it with a hand hoe. Uproot the weeds. Break down or prune the old, dead branches if there are any. Prune the tender stems at the base of the tree after six months. Irrigate if required when the tree flowers.

13. Write down the activities in sequence in your practical copy.

**B. Planting in a tub or pot**

**Materials**

1. A drum or pot 50cm high with a rim 40cm wide; a little less or more will do
2. Cowdung or compost 40 kg
3. Sandy soil 40 kg
4. Ash 10 kg
5. Oil cake 500 gm
6. TSP 500 gm
7. A hand hoe
8. A water can
9. Bamboo strips or twigs
10. A rope
11. Dried leaves
12. Broken pieces of brick

**Steps of the work**

1. Mix earth, fertilizer and ash together well.
2. Take a tub or pot with a hole on the bottom.
3. Put some pieces of brick on the bottom and cover them with dried leaves.
4. Fill in the tub or pot with the soil mixed with fertilizer. Fill in the tub in such a way that there is a space of 5 - 6 cm from the brim of the tub or pot.

5. Now wet the soil of the tub.

6. Keep it in this state for seven days and then plant a sapling in the middle of the tub or pot following the rules of planting on land. Tie the sapling well to a stick posted near it.

7. Follow the cultural practices meant for plantation on land like irrigating, weeding and other relevant jobs.

8. Now write down the activities in order in your practical copy.

Exercise

Multiple Choice Questions

1. Ripe papaya contains –
   a. Papayene   b. Vitamin-A
c. Vitamin-B   d. Vitamin-C

2. The cause of giving fertilizer in papaya plant repeatedly is that the plant–
   i. can grown up quickly
   ii. yield properly
   iii. takes less water

Which one is correct?
   a. i and ii   b. ii and iii
c. i and iii   d. i, ii and iii

Read the following passage and answer question numbers 3 and 4.

Nayan's father had an orchard of Guava. He could not select the proper land though he planted the plants maintaining the right distance. As a result all the guava trees died in the last flood and Nayan's father suffered loss financially.

3. Nayan's father should select for Guava cultivation –
   i. the land of less bio mass, high and not water logged.
   ii. the land of more bio mass, low and not water logged.
   iii. the land of more bio mass, high and not water logged.
Cultivation of Fruits  47

**Which one is correct?**

a.  

b.  

c.  

d.  

4.  How much distance in meter did Nayan's father keep during guava planting from one plant to another?

a.  

b.  

c.  

d.  

**Creative Question**

Mr. Azmat is interested to produce banana which is considered as complete food in his two hector land. When he communicated to agricultural officer, he Supplied him the following table.

<table>
<thead>
<tr>
<th>Name of variety of banana</th>
<th>Distance of plant to plant (meter)</th>
<th>The number of plants per 10,000 square meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amritasagar</td>
<td>2.0</td>
<td>2500 Square method, 2875 Hexagonal method</td>
</tr>
<tr>
<td>Sabri</td>
<td>2.5</td>
<td>1600 Square method, 1840 Hexagonal method</td>
</tr>
<tr>
<td>Jahagi</td>
<td>1.8</td>
<td>3080 Square method, 3548 Hexagonal method</td>
</tr>
<tr>
<td>Jal Kathali</td>
<td>3.0</td>
<td>1111 Square method, 1277 Hexagonal method</td>
</tr>
</tbody>
</table>

a.  Why the banana is called a complete food?

b.  Explain why more plants can be planted in hexagonal method than square method?

c.  How many plants will be needed for Mr. Azmat to cultivate Amritasagar banana in hexagonal method?

d.  Write down with argument in the light of the above table which type of banana cultivation in which process is beneficiary.
Healthy and strong calves grow into high yielding cows or quality oxen. We must take care of calves from their very birth to have good cows or oxen. People in rural areas mostly rear indigenous calves. Now-a-days, many cross-bred calves of improved variety are being reproduced through artificial insemination.

We need to take more care for the cross-bred cows because they grow bigger, give more milk and are more hard working. Care for calves implies a panoply of measures like quality nurturing, hygienic accommodation, healthy food, prevention of diseases, protection from diseases, treatment for diseases: over all an environment for uninterrupted growth.

Calves deserve to be nurtured well for growing into quality cows or oxen. A regimen of calf nurturing practices is given below:

**Accommodation for calves:** The living place of calves must be clean and dry. You may lay hay on the floor near the mother cow in the cowshed to make a place for the calf right after its birth. Wipe the floor with dettol, phenyl or any germicidal liquid prior to laying the hay. Make room for adequate light and ventilation in the shed of the calf.

**Care for calves:** Clean the mucus of the mouth and the nostrils of the calf right after its birth with soft cloth or cotton. Put the calf before the cow immediately after it is
born so that the mother can lick her baby clean. Wipe around the navel of the calf as it is born with tincture iodine, and then apply germicides like boric powder, etc. Don't delay to introduce the calf to the teats of its mother. Help it feed on the colostrums as it stands on its four. Colostrums contain sufficient proteins, vitamins and minerals needed for the growth of calves. Moreover, it helps calves grow resistance to diseases.

**Feed for calves:** A calf grows fast for three months after birth. It gains weight fast, too. Their growth is retarded if they do not have adequate nutrition. Lack of nutrition reduces resistance to diseases, which often cause their death. We need to pay special attention to its feed without delay after its birth.

Feed the calf on the colostrums in two hours after its birth. Clean the udder and teats of the cow before you take the calf to them. A calf needs to be fed with milk twice a day. Milk the cow after the calf has fed on the milk in the udder to get the remaining milk out. You may feed the calf by hand if you do not want it to lick the teats of the cow. It does not have any ill effect either on the cow or on the calf.

Give some tender grass and food grains along with milk to the calf after two weeks. It increases its digestive power and the stomach matures faster. The calf may not be allowed to feed on the milk when it is six months old. A model table of mixed grains feed for a calf is given below:

### Table of mixed grains feed for a calf

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat chaff</td>
<td>4kg</td>
</tr>
<tr>
<td>Ground chick pea</td>
<td>1kg</td>
</tr>
<tr>
<td>Ground grass pea [Kheshari]</td>
<td>2kg</td>
</tr>
<tr>
<td>Sesame oil cake</td>
<td>1.5kg</td>
</tr>
<tr>
<td>Rice barn</td>
<td>1.3kg</td>
</tr>
<tr>
<td>Mineral mixture</td>
<td>100 gm</td>
</tr>
<tr>
<td>Salt</td>
<td>100 gm</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10kg</strong></td>
</tr>
</tbody>
</table>

Mix the ingredients well and feed the calf in prescribed amounts.

**Disease of calves**

A calf may have different diseases right after it is born. Any disease may be fatal for a calf, because it has not yet grown resistance to diseases like the adult cattle. Diseases that attack calves in our country are three kinds:


These diseases spread through spoiled food and from unhygienic environment.

**Prevention and treatment of contagious diseases:** You may treat the diseases at the outset with antibiotic or sulphanilamide. But calves cannot be treated to health from every contagious disease. To avoid this situation they need to be vaccinated when they are well.

**Parasitic diseases:** Parasites are two kinds: some work on the interior of the body, some work on the exterior of the body.

**Parasites inside the body:** The parasites inside the body are generally called worms. Worms are three kinds: round worms, leaf worms, tape worms. Among them round worms and leaf worms grow more in our country. They are very dangerous for calves. Worms attack them in damp and dirty places. Calves often die from the bites of worms. They can be protected from the worms if they are treated with medicines according to a vet’s prescription.

A protozoa called coccidia attack calves. They injure the intestine. As a result, the cattle suffer from blood dysentery.

**External parasites:** External parasites like mites or atuli, lice, flies and fleas inhabit the skin of calves and suck their blood to survive. The calves get weak, do not grow in health. The attack of these parasites damages the skin of the cattle. It is an economic loss. If you wash the calves brushing their body well regularly, they will not be the victims of these parasites. You have to follow a vet’s prescription to destroy the parasites.

**Other incidental diseases:** Calves contract some other common diseases like suffering from malnutrition, upset stomach, constipation, indigestion, etc. in addition to the contagious and parasitic ones. Calves need to be treated with balanced feed everyday. If you do not feed the calves on time or if you treat them with stale food or drink or if you feed them too much, they may develop gas in the stomach, suffer from diarrhoea, constipation, indigestion, etc. It is necessary to let the cattle have the right amount of balanced feed and enough water to drink regularly.
PRACTICAL

Topic: Preparing 10 kg grains for a calf

Materials
1. Wheat chaff 5 kg
2. Ground chick pea 2 kg
3. Ground grass pea [khesari]3 kg
4. Sesame oil cake 2 kg
5. Rice bran 2 kg.
6. Mineral mix 500 gm
7. Salt 200 gm
8. Balance and weights of different measures
9. Polythene or a chari and a polythene packet
10. Notebook and pen

Steps of the work
1. Write in your notebook the quantity of each item of 10 kg grains.
2. Weigh every item according to the list written in your notebook and keep every item in a polythene bag.
3. Mix the items and see if it is 10 kg.
4. Take 1 kg mixture and keep it in a polythene packet.
5. Do the practical either alone or in a group of five if necessary.
6. Write the procedure in your notebook and show it to your teacher.

Exercise

Multiple Choice Questions
1. After how many months feeding milk of a calf is not needed?
   a. 2  
   b. 4  
   c. 6  
   d. 8
2. Which parasites are more harmful for the calf?
   a. Leaf worm and fly  
   b. Tape worm and tick  
   c. Round worm and leaf worm  
   d. Mosquito and mites
3. Cross-bred cow rearing is more profitable than local cow rearing, because cross-bred cow—
   i. attacked with diseases easily.
   ii. after slaughtering we can get much meat.
   iii. gives much milk.

Which one is correct?
   a. i and ii  b. i and iii  
   c. ii and iii  d. i, ii and iii

Read the following table and answer the question numbers 4 and 5:
The list of feed stuffs for calf of eight month is given bellow:

<table>
<thead>
<tr>
<th>Feed stuffs</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat chaff</td>
<td>4 kg</td>
</tr>
<tr>
<td>Ground Chickpea</td>
<td>1 kg</td>
</tr>
<tr>
<td>Oil cake of Sesame</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Broken Lathyrus</td>
<td>2 kg</td>
</tr>
<tr>
<td>Rice bran</td>
<td>1.3 kg</td>
</tr>
<tr>
<td>Mineral mixture</td>
<td>100gm</td>
</tr>
<tr>
<td>Salt</td>
<td>100gm</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10 kg</strong></td>
</tr>
</tbody>
</table>

4. Which element is supplied more by the food stuff above?
   a. Vitamin  b. Carbohydrate  
   c. Protein  d. Water

5. There are more similarities on the basis of food value in the mixture of—
   a. Oil cake of sesame and rice bran  b. Wheat chaff and salt  
   c. Ground chickpea and salt  d. Rice bran and wheat chaff.
Creative Question

Mafiz was taking more care of his pregnant cross-brid cow. One day in the morning after waking up from sleep he saw that the cow had given birth to a heifer. But the cow and the heifer were staying far from one another. In this condition he started to take care of the calf quickly. But after some days it is seen that the calf is attacked with disease. The veterinary doctor saw the calf and said that it is attacked not only with contagious disease but also with parasitic disease.

a. How the disease of calf is classified?
b. Which parasite in the body of the calf is more harmful and why?
c. Explain the cause of the parasitic disease of the calf of Mafiz.
d. What were the steps to be taken so that the calf could be saved from the contagious diseases before its birth? Give your opinion.
Chapter 2

HOMESTEAD DAIRY COW REARING

Rearing cows is a profitable occupation. Some time ago, you could find a family in Bangladesh usually rearing one or two cows to meet its daily demand of milk. An increase in the population of the country has greatly increased the demand for milk rearing HYV cows is gaining in popularity to meet this demand for milk. It has opened an opportunity for the employment of the unemployed. It has opened an avenue to increase family income.

There are some basic things you have to know about rearing cows in the household. These are: sheds of the cows; hygienic nurturing, balanced food, right reproduction methodology, prevention of diseases. A discussion follows as under:

**How to identify quality cows:** A cow which has no disease, is healthy and gives milk in large quantities is a quality cow. It has the following characteristics:

1. The cow has all its limbs grown well and they adjust well with one another. Its hide shines bright; its hair glitters. Its eyes are luminous.
2. It is of good size and has an attractive appearance.
3. Its body is slim in the front and plump in the hind. It has a loosely formed body with a thin coat. It has neither flesh nor fat more than enough.
4. You may see the ribs of its chest i.e. they are somehow visible to your eyes.
5. Its milk carrying vessels are thick. They are spread around the navel and the udder, further more visible on the udder.
6. Its udder is quite large; it attaches itself to the body nicely. The udder is beautiful in structure; the teats are of same size and stand at a distance equal to one another.

**The cowshed:** You need to arrange for good accommodation for the cows if you intend to rear them hygienically at home.

Fig: A Cow Shed
A suitable living place or a cow-shed is necessary to protect the cattle from storms and rains, the sun and excessive heat, and too much cold. The living place for the cow should be on a dry, elevated space. It is better if the house faces north and south to let in air and light. To make a cowshed bamboo can be used for the posts and sun grass or leaves for the roof. Wood for the posts and tin sheet for the roof can also be used for a shed.

A cow requires a cubicle of 4 - 5 square metres on the floor. It is better if the shed has a metalled floor or the floor is covered with bricks. Clean the cow dung, urine and the litters regularly and dump them in a ditch at a distance. You may use them as fertilizer on your land later. Cowsheds must be always dry and clean. They make room for more diseases if they are damp and lack in hygiene. Spraying of germicides is necessary to remove bad odour and kill fleas and mosquitoes.

**Balanced feed for cows:** Cows require feed for survival: Cows require more nutrition so that they can give more milk. They need to have balanced feed for more nutrition. People in the villages usually rear indigenous cows. They do not give their cows balanced feed. If we take care of these indigenous species of ours in the right way, rear them in the hygienic way and treat them with balanced feed, they will give us more milk. They will grow stronger to draw the plough. They will give us more meat.

To get more milk and a calf at the end of the year we have to provide the HYV cows with balanced feed. A prescription of balanced feed for cow is given below:

1. Green, tender grass 10-15 kg.
2. Food grains 2 - 3 kg for the production of the first 3 liters of milk; 1 kg food grains for the production of additional 3 litres subsequently.

### A chart of grains mixture

<table>
<thead>
<tr>
<th>Feed ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat peelings</td>
<td>5 kg</td>
</tr>
<tr>
<td>Rice bran</td>
<td>2 kg</td>
</tr>
<tr>
<td>Ground grass-pea</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Sesame or groundnut oil-cake</td>
<td>1.3 kg</td>
</tr>
<tr>
<td>Salt</td>
<td>100 gm</td>
</tr>
<tr>
<td>Minerals</td>
<td>100 gm</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10 kg</strong></td>
</tr>
</tbody>
</table>

3. Straw 3-4 kg.
4. Sufficient clean water.
We usually gather durba for green and tender grass from fields and road sides. We may however, cultivate HYV grass on the fallow land around our homesteads or on the sides of the ponds, roads and embankments. These varieties grow fast and contain more nutrition. HYV grasses like napier, para, german grass, guinea, maize, sorghum, cowpea, grass pea, etc. may be cultivated. You have to visit a veterinary hospital nearby to know about seeds, cuttings or seedlings and the method of cultivation of these grasses. Besides, you can feed cows the leaves of Ipil ipil, jackfruit, daoa, fig, etc.

Cows in the villages of our country are given hay to feed on round the year. Hay is a very low quality feed. Cut the hay into small pieces; soak them in rice broth or water; mix molasses and cereal chaff, rice barn and oil-cake and thus enhance the quality of the feed. As a result, the cows will have more nutrition. We may not throw away roughages like the peelings of fruits, vegetables, etc. and instead we can give them to our cows.

**Different diseases of cows and measures to tackle them:** Cows contract diseases or fall sick. This is the main problem of rearing cows in our country. Cattle die of diseases in large numbers every year. Many people are losing interest to rear cows because of their high death rate. In fact, there is no fear of death or disease if we follow the discipline of rearing cows. For example: Let us set up a healthy shed for our cows; let us nurture them well; let us watch their comforts and discomforts; let us give them balanced feed; let us be informed of their diseases and take necessary measures against them with a sense of moral obligation.

Cattle may contract many kinds of diseases. The following are the most common ones:

1. Contagious diseases
2. Parasitic diseases
3. Infertility diseases
4. Malnutritional diseases
5. Poison related diseases
6. Maintenance related diseases
7. Common disease

We must behave ourselves according to the following instructions to keep our cattle safe from diseases:

1. Keep the cowshed neat and clean, dry, spick and span. Arrange for light and air to pass through the shed. Don't keep the cow in a damp place nor let it graze in such a place. She may contract contagious diseases or worms.
2. Vaccinate the cow against contagious diseases.
3. Quarantine the sick cow from the healthy ones and treat her according to the advice of a vet.
4. Don’t take the sick animal to the market for sale, nor sell it for slaughtering, because it will spread the disease to other animals as well as humans.
5. The dead cow and her belongings must be buried into the ground or burnt. Its shed must be washed with germicidal medicines.

**PRACTICAL**

**Topic:** Preparation of 10 kg grain mixture feed for cows

**Materials**
1. Ingredients according to the recipe
2. A balance and a pair of scales
3. A tub of aluminium
4. A bucket and a polybag
5. A note book and a pen

**Steps of the work**
1. List the items required for preparing 10 kg feed according to a recommended recipe.
2. Measure the ingredients as much as each of them is necessary.
3. Show them to your teacher.
4. Mix them well together.
5. Put the feed in the tub, bucket or polybag.
6. Write the sequence of the work in your notebook.

**Exercise**

**Multiple Choice Questions**
1. How much fresh green grass in kg should be present in the daily balanced feed for the cow?
   a. 3-8  
   b. 10-15  
   c. 17-23  
   d. 25-30
2. The body structure of a good breed cow is –
   i. the structure of body is flaccid.
   ii. heavier in the hind
   iii. slim in the front

Which one is correct?
   a. i
   b. i and ii
   c. ii and iii
   d. i and iii

Read the following passage and answer the question numbers 3 and 4:

Suddenly one of Rashed's cow out of three died of disease. He became worried and went to a veterinary doctor. Hearing the details of the disease the doctor told him that the cow died of contagious disease. He also advised what should be done about the dead body of the cow.

3. The cause of contagious disease of Rashed's cow is –
   i. There were adequate air and sun light in the cow shed.
   ii. The cow shed was dry.
   iii. The cow was not vaccinated regularly.

Which one is correct?
   a. i
   b. i and ii
   c. ii and iii
   d. i, ii and iii

4. What did the veterinary doctor tell about the measure for the dead body of the cow?
   a. to slaughter it
   b. to sell it to the butcher
   c. to bury it in the soil
   d. to through it far away from the house.

Creative Question

Gani Mia rears two high yielding cows. He feeds the cows only straw and keeps them in the room of length 3 meters and width 2 meters. He is not getting the milk as per his expectation.

a. How much dry straw is fed to a hybrid cow?


c. Find out the cause of not getting die milk as per expectation from the cow of Gani Mia.

d. What measures should be taken to get milk as per expectation? Give your opinion.
Chapter 3

GOAT REARING

Many families rear goats in the villages of our country. *The population of goat is 2.075 crore in Bangladesh in the year of 2006-2007. The importance of goat rearing is increasing day by day. The meat and milk of goat can play a major role in meeting the deficit of protein consumption.

**Advantages of goat rearing**
There are many advantages of goat rearing in Bangladesh:

1. You can rear goats successfully on a little space in your homestead.
2. Goats graze on the grass, creepers and leaves that grow on the footpaths among plots of land, sides of roads and fallow land.
3. You can rear 2-3 goats in a little space investing a little capital. Income from this investment is comparatively more satisfactory than elsewhere. It is said that a goat is a poor man's cow. A goat matures in 12-15 months and begins to reproduce. Goats reproduce 1-4 kids in every spell twice a year.

**Species of goats**
Mostly two kinds of goats outnumber other species in Bangladesh. Black Bengal is the most prominent one, and the other one is Jamunapari.

**Black Bengal Goat**
This species of goat is reared almost in all the regions of Bangladesh. They are usually black. However, they may be white, almond, grey or a mix of black and white. Their ears are straight and upright. Their horns are a little bent backward. They are small in size. They can survive feeding on grass, creeping plants, leaves and bark of trees. Their meat and hide are of high quality. Black Bengal goats may give 1 litre milk a day.

![Fig: Black Bengal goat](image)

**Jamunapari or Ramchhagol**
The goats of this species are reared in the north-western region of Bangladesh. Besides, they are also reared in other parts of Bangladesh. They are mainly greyish

almond in colour. They are slender. Their ears are long and hang down. The hair on their loins grows longer. These goats give birth to 1 - 2 kids a year. They give 2-3 litres of milk a day.

**Living place for goats**

You need to keep the living place of goats dry. A damp place spreads diseases. You can clean the shed and dry it in the day time and use it again. Goats prefer living in a place higher than the floor. It is better for the goats if you set up a platform or bed 60 cm high on the floor. It makes cleaning the floor easier. A goat requires a cubicle of one square metre in the form of a platform or bed. More space is required if kids are there. An arrangement must be there for sufficient light and air. It keeps the shed dry. However, you have to give two square metre space to a stud [goat], an uncastrated he-goat for reproduction.

**Nurturing goats**

A female Black Bengal Goat delivers more than a kid at a time. Different care is required if the mother goat gives birth to more kids. After the kid is born, you have to place it in front of its mother to let her lick the kid clean. If the goat does not lick, take some hay or soft cloth to wipe the body of the kid. Spread soft hay and make a separate bed for the kid. It is better to make separate boxes with hay spread on the bottom surface to keep the kids if there live many goats together.

**Care for the kids**

Kids do not need food for several hours after birth. However, you have to feed them the colostrums of the mother goat for the first four days. If there are more than two kids, you have to hold them each by hand and feed them the mother's milk. It is done because if a kid is weak, it may not have a chance to feed on its mother's milk. Make the kid grow the habit of feeding on grass, creeping plants, leaves and grains along with the milk when it is two weeks old. You may allow a kid to continue having its mother's milk for two months at best. Then the kid is to be reared.
separately. A kid grows quickly physically if it is castrated in 2 - 4 weeks' time. These goats are good for meat. Their hides are good too. The mother goat needs to be kept separate at least one week before it gives birth. Don't let it climb high platforms. Make a separate cubicle for delivery on one side of the platform if the goat has already been living there. Make a bed of straw there.

**Care for studs**

As the studs give off a repulsive smell, you have to brush them clean before a bath, 2-3 days a week. There should be 2 -3 studs in a village for procreation.

**Feed for goats**

If any someone wants to succeed in rearing goats, they must provide them with balanced feed. People usually feed them the leaves of jackfruit, creeping grass found on the road sides, leaves and the leftovers of vegetables and fruits brought at home and thus meet their demand for feed. If you want to make your goat strong and obtain more milk, you are obliged to give it nutritious feed regularly. You have to treat it with the correct amount of protein, starch, fat, mineral compounds, vitamins and water. Add grains as supplement. The grass called para is an ideal feed for goats.

---

**Preparing balanced feed for goats at home:**

<table>
<thead>
<tr>
<th>Feed ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broken pieces of rice</td>
<td>4kg</td>
</tr>
<tr>
<td>Bran of manually husked rice</td>
<td>5kg</td>
</tr>
<tr>
<td>Chaff of pulses</td>
<td>50gm</td>
</tr>
<tr>
<td>Salt</td>
<td>30gm</td>
</tr>
<tr>
<td>Ground oyster</td>
<td>20gm</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10kg</strong></td>
</tr>
</tbody>
</table>
An adult requires 250-300 gm grains daily. During scarcity or inadequacy of green grass, feed may be prepared with straw mixed with urea and molasses in the following way:

<table>
<thead>
<tr>
<th>Pieces of straw cut into pieces of 2-3 inches each</th>
<th>1 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molasses</td>
<td>220 gm</td>
</tr>
<tr>
<td>Urea</td>
<td>30 gm</td>
</tr>
<tr>
<td>Water</td>
<td>600 gm</td>
</tr>
</tbody>
</table>

Dissolve the urea in water. Put molasses in the mixture. Now dip the straw in the solution. Offer it to the goat. A goat can feed on 500–800 gm UMS. You need to divide the grains into two parts: give one-half in the morning and one-half in the afternoon. Milk the goat after it has had the grains. You have to fill in the tub with water again. Guide the goat to the shed as night falls.

**Daily feed for the pregnant or the milk-giving goat**

<table>
<thead>
<tr>
<th>Weight of the she-goat (kg)</th>
<th>amount of milk (ml/gm)</th>
<th>leaves, grass (kg)</th>
<th>urea molasses (gm)</th>
<th>grain mixture (gm)</th>
<th>rice broth (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>400</td>
<td>1.3</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>20</td>
<td>500</td>
<td>1.5</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>25</td>
<td>1000</td>
<td>1.5</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>30</td>
<td>1000</td>
<td>2.0</td>
<td>300</td>
<td>400</td>
<td>500</td>
</tr>
</tbody>
</table>
**Diseases of goats**

The most urgent it is to arrest the disease if it has attacked a goat.

**Main Diseases of goats**

<table>
<thead>
<tr>
<th>Contagious disease</th>
<th>Disease from malnutrition</th>
<th>Internal parasites</th>
<th>External parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Udder inflammation</td>
<td></td>
<td>2. Tape worm</td>
<td>2. Lice</td>
</tr>
<tr>
<td>3. Tetanus</td>
<td></td>
<td>3. Leaf worm</td>
<td>3. Mange</td>
</tr>
<tr>
<td>5. Hoof inflammation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Hydrophobia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Goat pox</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. P.P.R.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In addition, goats suffer from bloating stomach, indigestion, diarrhoea, stomachache, food poisoning, etc. Skin diseases harm goats too much.

**Causes of diseases of goats and how to contain them**

1. If you keep a goat in a damp place, it will contract more diseases. It is advised that you will not keep it in such a place.

2. Contact the local veterinary hospital to vaccinate the goats against contagious diseases.

3. Separate the sick goats from the healthy ones and treat them.

4. Don't let the goats stay in a damp place or ditch or marsh. Worms may attack them from these places.

5. You cannot allow a goat to get wet in rain and catch cold. Pneumonia immediately follows cold.

6. Watch the goat does not suffer from malnutrition to indisposition.

Goats can be protected from the contagious diseases like anthrax, hoof infection, smallpox, hydrophobia by vaccination.
PRACTICAL

Topic: Materials required for making goat feed.

1. Ingredients for grain mixture

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chic peas, broken rice</td>
<td>4 kg</td>
</tr>
<tr>
<td>Bran of manually husked rice</td>
<td>5 kg</td>
</tr>
<tr>
<td>Chaff of pulses</td>
<td>50 grams</td>
</tr>
<tr>
<td>Salt</td>
<td>30 grams</td>
</tr>
<tr>
<td>Ground oyster</td>
<td>20 grams</td>
</tr>
<tr>
<td>Total</td>
<td>10 Kg</td>
</tr>
</tbody>
</table>

2. Balance and stone
3. Bags

Steps of the work

1. List all the requirements for making 10 kg feed.
2. Take the ingredients according to the measure mentioned in the list.
3. Blend the ingredients with mineral mixtures and salt.
4. Keep the feed in ten bags, one kg each.

Exercise

Multiple Choice Questions

1. How many matured goats can be fed by 10 kg grain mixture daily?
   a. 20-25        b. 25-35
   c. 35-40        d. 40-45

2. Goats give kids in a year -
   i. 1-4
   ii. 2-8
   iii. 3-12
Which one is correct?

a.  

b.  

c.  

d.  

Answer question numbers 3 and 4 from the following table:

Table- Grain mixture ration for goat

<table>
<thead>
<tr>
<th>Feed ingredients</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broken rice</td>
<td>8 kg</td>
</tr>
<tr>
<td>Husked rice powder</td>
<td>10 kg</td>
</tr>
<tr>
<td>Chaff of pulses</td>
<td>1 kg</td>
</tr>
<tr>
<td>Salt</td>
<td>60g m</td>
</tr>
<tr>
<td>Powder of Oyster-shell</td>
<td>40g m</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20 kg</strong></td>
</tr>
</tbody>
</table>

3. What amount of chaff bran in gram is needed to prepare 5kg balanced feed?

a.  150  
b.  250  
c.  350  
d.  450  

4. What type of food is given more importance in the table above?

a. Protein  
b. Carbohydrate  
c. Mineral mixture  
d. Vitamin  

Creative Questions

1. The financial condition of Saleha Begum is not good at all. As per the suggestion of her neighbour Selima she brought two pairs of Black Bengal goats taking loan from the NGO and started to rear those. The number of goats has increased much within three years. She gets solvency in her family by selling the goats.

   a. How many types of goats are mainly found in Bangladesh?
   b. Describe one characteristic of Black Bengal goat.
   c. Explain the decision of Saleha Begum to rare Black Bengal goat in the light of kids production.
   d. "To remove poverty near goats" -give reasons in favour of it.
2.

a. What is the breed of the goat in figure-A?
b. Write down the differences between the goats of figure-A and figure-B.
c. Describe how the goat of figure-A can be reared.
d. Write down with argument which breed of goat is suitable to rear for economic solvency.
We know hens. However, we need to know about their physiology to rear them profitably. Different parts of the body of hens bear the marks of their genealogy. Their output also largely depends on their shape and size.

Like other birds, they have two legs, two wings, and a strong beak. They have combs on their heads and wattles on the throat. Some of them have big combs and wattles while some of them have small ones. The size of their combs varies depending on their species and kinds. Some of them are single; some of them are double. Some of them look like peas or roses. You may identify different species of hens and have an idea about their output potential if you look at their feathers, colour of their skin, combs on their heads and wattles on their throats.

How to identify healthy hens

Hens do not give as many eggs as you expect or as much meat as you desire if they are not healthy. Diseases may spread to all other birds if you fail to identify and cull the sick hens. Rearing healthy chicks is a pre-condition for profitable poultry farming.
Methods of identification of the healthy hens are described below:
1. Healthy hens are strong and stout.
2. Comps on their heads and wattles on their throats look bright red.
3. Their nose and mouth are clean.
4. Their stomach is full with food.
5. Their normal body temperature is 81.6 degrees Celsius, pulse beat per minute 120-170 and breathing 20 - 25 times every minute.
6. They keep their wings pressed on their body.
7. Their tails stand upright.
8. They will crow early in the morning, and always look alert.
9. They will crow and then make an effort to go away if they come across an enemy.

PRACTICAL

**Topic:** Introduction of fowls body  
**Materials:** A live healthy mature hen  
**Steps of the work:**
1. Go close to the hen.  
2. Observe different parts of the body of the hen.  
3. Compare the parts with the picture of your book.  
4. Discuss with your teacher to understand.  
5. Draw a hen in the practical note book and identify its different parts.  
6. Write down the names of the parts.  

**Caution**  
Do not annoy or agitate the hen. Go quietly close to the hen and observe the parts with care.

**Exercise**

**Multiple Choice Questions**  
1. What is the normal temperature of the body of a fowl?  
   a. 38.6 °C  
   b. 39.6 °C  
   c. 41.6 °C  
   d. 42.6 °C
2. Of a healthy fowl –
   i. the stomach will be filled up with food.
   ii. the tail will be in up-right position
   iii. the wings will always be opened from the body.

   **Which one is correct?**
   a. i 
   b. i and ii
   c. ii and iii 
   d. i, and iii

3. The name of different parts of figure are –
   a. Comb, Nostrils and Secondary feather
   b. Comb, Nostrils and Breast bone
   c. Comb, Nostrils and Ear lobe.
   d. Sickle feather, Nostrils and Wattles

4. Deep red color in figure is –
   i. 'a'
   ii. 'b'
   iii. 'c'

   **Which one is correct?**
   a. i 
   b. i and ii
   c. ii and iii 
   d. i, and iii

5. What will be the respiration rate per minute of a healthy fowl?
   a. 5-10
   b. 10-15
   c. 20-25 
   d. 30-35
Creative Question

Sakib becoming interested bought three fowls for husbandry. Then he measured temperature, pulse and respiration per minute. That is shown in the following chart.

<table>
<thead>
<tr>
<th>fowls no.</th>
<th>Temperature</th>
<th>Pulse per minute</th>
<th>Respiration per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50°C</td>
<td>200</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>40°C</td>
<td>150</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>41°C</td>
<td>160</td>
<td>21</td>
</tr>
</tbody>
</table>

a. Which fowl is sick according to the chart?
b. Identify the healthy fowl with argument.
c. Explain how much suitable to husbandry the sick fowl.
d. Describe the way of finding healthy fowl except measuring the temperature, pulse and the respiration.
Chapter 2

POULTRY CHICK REARING

Poultry chicks are reared almost in every homestead of our country. Poultry diseases and the death of chicks pose major threats to poultry rearing. The death rate is very high because we know very little about the methods and techniques of poultry chick rearing. We can rear poultry chicks profitably if we follow the improved methods.

It is very important to take special care of poultry chicks during the two months' period after the birth of the chicks. The death rate of chicks stands very high during this period. Extra care to keep in order the temperature regime of the brooder is required. There are two methods of rearing poultry chicks. These are as follows:

1. Natural method of chick rearing
2. Artificial method of chick rearing

Natural method of chick rearing

In the natural method of chick rearing, the chicks are reared with the direct help of the fowl. People in rural areas mostly follow this method of chick rearing. Chicks cannot control their body temperature until new feathers grow to cover their body. They require temperature supplement from external sources. They get the required extra temperature naturally from the warmth of their mother's body. Sometimes chicks are found sitting under the wings of the mother fowl. In this way, they warm themselves up when they find it cold.

Generally, the poultry fowls care their own brood. They do not tolerate the chicks brooded by another fowl. In this natural method, at first a brooding fowl of local breed sits on 1-2 eggs. After 2-3 days, artificially hatched chicks or brooded by other chicks are added to her brood at night. The brooding fowl fails to recognize them as aliens. Eventually, she accepts all the chicks as her own. Next day she comes out with all the chicks leaving the eggs that did not hatch. She begins her new role as a mother to rear the chicks.

Sometimes separately hatched chicks may be given to a brooding fowl when her first chick is hatched. In this case she does not hesitate to welcome them. However, it is
not possible for a local breed of fowl to rear more than 15-16 chicks at a time. If you use several country fowls for hatching eggs, keep them separate, so that they can take care of their chicks independently. Otherwise, both the fowls and the chicks may get involved in fighting; a fowl may even kill the chicks of another fowl.

**Artificial method of chick rearing**

It is not possible to rear a large number of chicks at a time in the natural brooding methods. Only 15-16 chicks may be reared at best. But a large number of chicks may be hatched at a time in artificial methods. The following methods and practices should be followed in case of artificial brooding of chicks.

1. Brooding house for chick rearing.
2. Brooder or temperature providing equipment.
3. Making arrangement for supplying feed and water.

**Brooding house**

The house made for chick rearing is known as a brooder house. A brooder house with about 4.6 square metre floor space is required for rearing 100 chicks for one month. It is better for a brooder house to have a brick built floor. You may reduce the cost of making a brooder house if you use inexpensive materials like bamboo slices or sticks, wood slices or split bamboo.

**Description of a brooder house**

A platform of the brooder house 3 m long and 1.5 m wide may be composed of bamboo mats and sticks or wood slices. There is every possibility of being disturbed by the rats if the floor of the brooder house is made of mud. Walls of the shed may be made of bamboo slice mats or wood slices.

The height of the brooder house may be 1.50–2.10 cm. The roof of the brooder house may be made by polythene wrapped straw, golpata, jutestick or bamboo mat. Provide the brooder house with facilities for light and air passage. The windows of the brood house would be at a conveniently higher level so that the air from outside does not come in direct contact with the chicks. Cover the crevices or openings with jute mats during storms and rains. It is better to make frames on the windows. The cold air from outside cannot enter the brooder house if the hedge is plastered inside and outside with a mixture of clay and rice husk.
Litter

A litter bed for poultry chicks is made with dry rice husk or sawdust. It is to be spread as a 5 to 7 cm thick layer on the floor. The litter bed material keeps the floor of the brooder house dry. It maintains the health of the chicks.

Temperature

The temperature of the brooder house needs to be adjusted before releasing poultry chicks in the brooder house. The air temperature of the brooder house should range from 20°C to 21°Celsius. The temperature comfortable for poultry chicks should be created (35°C) artificially in the brooder house. Different types of brooder or temperature equipment are used in the brooder house to supplement the artificial temperature. This temperature regime may be created using electric lights, hurricane, kerosene lamps, or hot water in the brooder house.

The temperature regime needs to be reduced gradually 3°C per week from the starting point of 35°C. The poultry chicks need to be reared in the brooder house for one and a half months or 6 to 7 weeks. However, brooders may not be required for more than four weeks in summer. Brooders may be made with tin, wood, or hardboard. Multistoried brooders may also be constructed.
Optimum temperature for poultry chick rearing

<table>
<thead>
<tr>
<th>Age of chicks</th>
<th>Temperature of the brooder</th>
</tr>
</thead>
<tbody>
<tr>
<td>First week</td>
<td>35°C</td>
</tr>
<tr>
<td>Second week</td>
<td>32.2°C</td>
</tr>
<tr>
<td>Third week</td>
<td>29.2°C</td>
</tr>
<tr>
<td>Fourth week</td>
<td>26.6°C</td>
</tr>
<tr>
<td>Fifth week</td>
<td>23.8°C</td>
</tr>
<tr>
<td>Sixth week</td>
<td>21°C</td>
</tr>
</tbody>
</table>

You may hang 3 to 4 electric bulbs of 100 watts above the brooders from the ceiling of the shed to create temperature regime. The temperature may be adjusted by raising or lowering the hanging electric bulbs.
The shed like an umbrella spread above the brooder is called a hoover. Hoovers may also be designed with hurricanes placed in a basket.

Make a hole in the middle of a bamboo basket. Let the head of the hurricane come out of the hole. Suspend the hurricane from a support. As a result, different gases formed by the fire of the hurricane can get out of the hoover. The temperature of the hoover cannot escape if both sides of the bamboo basket are plastered with a solution of clay and rice husk.

The chicks will be found to stay uniformly spreading throughout the brooder if the temperature is maintained at the right range. If temperature gets low, the chicks will be found to crowd under the brooder. If temperature gets high, the chicks will be found to stay away from the boundary of the brooder guard. Approximately 200 to 250 chicks can be reared in a brooder of one metre radius.

**Boundary guard:** The boundary guard is the fence made of bamboo mat or hardboard or tin having a height of 30 to 45 centimetres across the floor. It should be 75 to 90 centimetres away from the umbrella like brooder or hoover. The chicks cannot go far from the brooder temperature regime because of this boundary guard. It reduces the chance of the chicks catching cold. The periphery of the boundary guard should be increased as the chicks grow bigger.

**Feed and water for chicks**

Chicks usually do not require any feed supplement for 48 hours after hatching. It is quite easy to buy and transport chicks of this age group. Wheat or ground maize may be given to one to two days old chicks in tin plates placed on the litter or on paper as a mat after collection. Chopped green grasses or vegetable leaves may also be given to them along with this feed. Water should be given in a separate pot on the third day under the hoover within the boundary guard. The practice of giving feed on the floor should be stopped when the chicks would be introduced to taking feed from the pots gradually. Feed pots may be made of wood. Four wooden feed pots measuring 60 centimetres long and 7.5 centimetres wide and 5 centimetres high each are recommended for a batch of 100 chicks.
Method of preparing feed for poultry chicks (upto the age of 8 weeks)

<table>
<thead>
<tr>
<th>Name of the feed compound</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat /maize ground</td>
<td>4.5 kg</td>
</tr>
<tr>
<td>Rice bran</td>
<td>2.5 kg</td>
</tr>
<tr>
<td>Sesame oil cake</td>
<td>1.2 kg</td>
</tr>
<tr>
<td>Dry fish meal</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Ground oyster</td>
<td>0.2 kg</td>
</tr>
<tr>
<td>Mineral mixture</td>
<td>0.05 gram</td>
</tr>
<tr>
<td>Salt</td>
<td>0.05 gram</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10kg</strong></td>
</tr>
</tbody>
</table>

Daily feed requirement for a poultry chicks

<table>
<thead>
<tr>
<th>Age of the chick</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1 week of age</td>
<td>10 gram</td>
</tr>
<tr>
<td>Up to 2 weeks of age</td>
<td>20 gram</td>
</tr>
<tr>
<td>Up to 3 weeks of age</td>
<td>30 gram</td>
</tr>
<tr>
<td>Up to 4 weeks of age</td>
<td>40 gram</td>
</tr>
<tr>
<td>Up to 5 weeks of age</td>
<td>50 gram</td>
</tr>
<tr>
<td>Up to 6 weeks of age</td>
<td>60 gram</td>
</tr>
</tbody>
</table>
Usually four water pots of 2-3 liter capacity each are required for a batch of 100 poultry chicks. Arrangement should be made for supplying pure water in sufficient quantities for the chicks.

**Disease of poultry chicks**

The poultry chicks are generally infected with the following diseases:

1. Ranikhet or New castle disease
2. Fowl plague
3. Mareks
4. Gumbaro
5. Cholera
6. Blood dysentery or amoebic dysentery

Timely arrangement should be made for giving injection to the poultry chicks against such diseases in addition to the preventive measures taken in this regard. Most of the injections may be available in the nearby veterinary hospitals and clinics.

Besides, the following important points must be taken care of as a part of hygienic rearing of poultry chicks:

1. The poultry chicks of the same age should be reared in a single flock. If the chicks are of different age, then the younger chicks cannot compete with the older ones in taking feed. As a result, the growth of the younger chicks is retarded and finally they fall ill.
2. Poultry chicks more than the appropriate or fixed number should not be reared in a single shed at a time. Each poultry chick should get a floor space of 450 square centimetres up to one month of its age. If the chicks are found to be crowding densely, it should be understood that the temperature of the shed is not comfortable or the quality of the feed is not good.

3. The healthy chicks should be purchased from the high quality chick producing farms. The weak and sick chicks should be culled or removed from the flock as soon as they are detected; otherwise, the other chicks will be badly affected.

4. The litter or bed should be removed when it is found to be wet or moist. Dry materials should be spread over the litter and it should be pulverized once a week.

5. Outsiders' access to the house of the poultry chicks must not be allowed.

6. Sufficient pure water and balanced feed should be given to the poultry chicks.

7. Injection for Ranikhet should be given before the chicks are older than a week.

**PRACTICAL**

**Title:** Preparing feed for poultry chicks (up to the age of 8 weeks)

**Materials:**
1. Feed raw materials as per list
2. Balance and weights
3. Aluminium dish
4. Buckets and polybag
5. Note book
6. Pen

**Steps of the work**
1. Prepare a list of materials required to prepare 5 kg feed as per sample list for 8 weeks old poultry chicks.
2. Weigh the raw materials of the feed correctly.
3. Show your class teacher the things you have weighed.
4. Blend the ingredients uniformly.
5. Put the feed in an aluminium dish or a bucket or a polybag.
6. Write down the sequence of your jobs in your practical notebook.
7. Treat the poultry chicks of your house or of the school farm with the feed you have prepared.

**Exercise**

**Multiple Choice Questions**

1. What vaccine would be given to the chicken within the first week?
   a. Pox  
   b. Gambaro  
   c. Ranikhet  
   d. Cholera

2. Six waterer of 2-3 litters are given in a brooder -
   i. for 100 chicken  
   ii. for 150 chicken  
   iii. for 200 chicken

   **Which one is correct?**
   a. i  
   b. ii  
   c. iii  
   d. i, ii and iii

**Answer the question numbers 3 and 4 from the following chart:**

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Name of the food ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Broken bits of wheat</td>
<td>9 kg</td>
</tr>
<tr>
<td>2</td>
<td>Rice bran</td>
<td>5 kg</td>
</tr>
<tr>
<td>3</td>
<td>Sesame oil cake</td>
<td>2.4 kg</td>
</tr>
<tr>
<td>4</td>
<td>Dust of fish meal</td>
<td>3 kg</td>
</tr>
<tr>
<td>5</td>
<td>Powder of oyster-shell</td>
<td>0.4 kg</td>
</tr>
<tr>
<td>6</td>
<td>Mineral mixture</td>
<td>0.1 kg</td>
</tr>
<tr>
<td>7</td>
<td>Salt</td>
<td>0.1 kg</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>20 kg</strong></td>
</tr>
</tbody>
</table>

3. What element of food is given to the chicken after collection for first one or two days?
   a. Rice bran  
   b. Broken wheat  
   c. Dust of fish meal  
   d. Sesame oil cake
4. How many chickens of age 5 weeks are given daily the mixture of food mentioned in the chart above?
   a. 50        b. 100
   c. 200       d. 400

Creative Question

a. What is the name of the house in figure?
b. Why chicken are reared in this type of room?
c. Find how many chickens can be reared in the house shown in figure.
d. Show with argument the usefulness of fence made by bamboo and the roof made by wrapping straws.
Chapter 3

DUCKLING REARING

Ducklings are normally reared by hatching hens in rural areas where electricity or gas is not available. In this method, one hatching hen is seated with a few eggs. Next, a day old ducklings are given under the hen at night. At first one or two ducklings are given. When the hatching hen accepts them, the rest of the ducklings are given to her care in the same way. Overall 10 to 15 ducklings may be given to the care of a hen. For the first 5-7 days the hen with the ducklings should be kept in an enclosed place or inside a hedge with sufficient provisions: water and feed. Eventually, the hen with the ducklings may be released to loiter and feed on. The hen and the ducklings at this time should be given meals of ground wheat, rice bran and small snails.

It is possible to rear a small number of ducklings without a local hen. In this method, the ducklings should be kept captive in a structure or in a place, which does not let in cold air but sufficient sunlight. Water and feed should be given at the place. The ducklings will be comfortable at night if they are kept in a basket hang over an oven burning a low fire. They will enjoy the warmth produced by the oven.

It should be kept in mind that the ducklings should not be released to the water, pond or any thing like that until they are four weeks old. They may die of cold or contract other diseases.

Duckling rearing on farm

Duckling rearing on a farm follows the discipline of chick rearing on the poultry farm. Special arrangement should be made as regards separate houses, temperature regime management, feed, water and prevention of infectious diseases.

**Temperature management:** The methods of arranging temperature regime for ducklings are mentioned below:

The house may be brick built or have bamboo hatches, wood or tin for its construction. Arrangement should be there to protect the ducklings from the stormy weather and rainfall by hanging jute sacks over the windows or openings. The jute sacks may be folded or not as needed. The litter bed for the ducklings should be a 5 to 7 cm thick layer of rice.
husk with a jute sack or jute mat on it. A 4.5 square metre space can accommodate 100 ducklings for a month.

**Method of managing temperature:** The temperature regime may be managed with electric bulbs, electric heaters, gas brooders or hurricanes.

Brooders may be made with hardboard, tin or wood. A brooder may be built on four pillars or low legs. It may be a 90 cm square with 30 cm height.

**Boundary guard or brooder guard:** The brooder guard is to be placed 30 to 45 cm away round the brooder so that the ducklings cannot go far from the temperature regime. As a result, they stay comfortably under the canopy of the brooder. The guard may be made of hard board, tin or bamboo mats.

### Temperature required for ducklings

<table>
<thead>
<tr>
<th>Age of the ducklings</th>
<th>Temperature under brooder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>32.2° C</td>
</tr>
<tr>
<td>2 weeks</td>
<td>29.2° C</td>
</tr>
<tr>
<td>3 weeks</td>
<td>26.6° C</td>
</tr>
<tr>
<td>4 weeks</td>
<td>23.8° C</td>
</tr>
<tr>
<td>5 weeks</td>
<td>21.0° C</td>
</tr>
</tbody>
</table>

Usually 3 to 4 electric bulbs of 60 watts each in summer and 3 to 4 electric bulbs of 100 watt each in winter are required to maintain this temperature regime. The temperature of the brooder should be fixed 6 hours prior to the release of ducklings.
You may understand that the temperature of the brooder has fallen if you see the ducklings crowding under it. On the other hand, if you find them going far from the brooder, you should think that the temperature under the brooder has risen to their discomfort. The ducklings will be found to stay uniformly spreading throughout the brooder if the temperature regime remains at the comfortable range. Open the windows or fold the jute sack screens hanging over them when it is day and let fresh air enter.

Temperature supplement is required for 4 weeks in summer and 5 weeks in winter for ducklings. It is better to keep a thermometre for measuring the temperature of the brooder frequently.

The brooder guard needs to be moved to increase the space of the brooder after 4 to 5 days during summer and 7 days during winter. The brooder guard is not usually required after 10 to 15 days during summer and 15 to 20 days during winter. At this stage, the ducklings will loiter on and around the floor of the shed. A duckling needs 450 square metre floor spaces until it is one month old.

The littre bed should be changed after 4 to 5 days or some more littre materials should be added. As a result the ducklings will be able to live in a dry environment. The littre material should be turned up and down or pulverized from time to time, and dry lime should be spread over it.

**Feed and water:** Sufficient amount of clear water and balanced feed should be given to the ducklings. 3 to 4 water pots and 3 to 4 feed trays or plates should be placed at every brooder. The feed trays may be replaced by feed pots after a week. Some glucose may be mixed with the drinking water on the first day if the ducklings are collected from a distant place. Be on guard that the ducklings are not wet with water.

**Feed:** Balanced feed is to be given to the ducklings. The balanced feed may be prepared according to the method given below:

<table>
<thead>
<tr>
<th>Feed items</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>47kg</td>
</tr>
<tr>
<td>Rice bran</td>
<td>25kg</td>
</tr>
<tr>
<td>Sesame oil cake</td>
<td>10kg</td>
</tr>
<tr>
<td>Fish meal</td>
<td>15kg</td>
</tr>
<tr>
<td>Ground oyster</td>
<td>2kg</td>
</tr>
<tr>
<td>Vitamin and mineral salt</td>
<td>500 gram</td>
</tr>
<tr>
<td>Common salt</td>
<td>500 gram</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100kg</strong></td>
</tr>
</tbody>
</table>
Shark liver oil if available may be mixed with the feed at the rate of 1 % or green vegetable leaves may be given as supplement.

**Feed of ducklings according to age**

<table>
<thead>
<tr>
<th>Age</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st week</td>
<td>10 - 20 gram</td>
</tr>
<tr>
<td>2nd week</td>
<td>21-30 gram</td>
</tr>
<tr>
<td>3rd week</td>
<td>31 - 40 gram</td>
</tr>
<tr>
<td>4th week</td>
<td>41-55 gram</td>
</tr>
<tr>
<td>5th week</td>
<td>55 - 65 gram</td>
</tr>
</tbody>
</table>

**Water:** Sufficient clean water should be provided to the ducklings. The plastic pots or tin pots available in the market may be used for offering drinking water. If appropriate pots are not available in the market, you may put a water filled earthen kalsi upside down on an earthen plate called shanki and thus make a watering hole for your ducklings. However, in this case, a narrow hole should be made on the neck of the kalsi. The hole should go below the upper rim of the shanki when the kalsi is placed upside down on it. This hole will help maintain a uniform water level in the shanki.

**Prevention of diseases:** The rearing method of ducklings is mostly similar to the methods of rearing poultry chicks. However, more emphasis should be given on the cleanliness of the duckling house, because, the ducklings usually split water from the pot on the floor and moisten the littre and make the environment dirty. Much care should be taken to keep the environment, floor and littre bed dry. Diseases spread rapidly in damp conditions.

**Preventive injection:** Infection of disease in ducklings is less than in poultry chicks. Ducklings are frequently infected with duck plague. Duck plague may be prevented if you inject them when they are 15 to 20 days old. This injection is found in all livestock hospitals or clinics. The preventive methods of controlling diseases of duckling are mostly similar to those of poultry chicks.

**Problems related to poultry management**

Farming activities are badly affected owing to lack of appropriate management practices. The loss may become very high especially in case of poultry chick and duckling farms. All the chicks or ducklings may die if the right management practices are not followed at the right time. Some of the reasons for which much damages occur generally are discussed here:
Excessive cold

Excessive cold creates a great problem in winter in our country. The ducklings are found to be inactive and gather together to get rid of the cold, make distressing sounds and finally die.

Causes of cold stress of ducklings

1. If the doors and windows of poultry house remain open at night.
2. If the management of temperature regime fails.
3. If the temperate range of the brooder does not function properly.
4. If the space below the brooder is not adequate.

Symptom of cold stress of ducklings

1. The ducklings will stay closely attached to each other in dense concentrations.
2. Stop taking feed, have breathing troubles, show general weakness and finally die.

Practices for the remedy of cold problem

1. Appropriate measures should be taken after identifying the causes of the cold stress.
2. Enough balanced feed and vitamins should be provided to let the ducklings recover the losses they have incurred owing to the cold stress.
3. Maintaining the room temperature at the right range.

Dehydration of the body

Causes of dehydration of the body:

1. If sufficient quantities of drinking water is not provided.
2. If the water pots are kept in too hot or too cold places.
3. If the drinking water supplied does not agree with their taste.
4. If the water pot is not suitable for the ducklings to drink from.
5. If the temperature of the brooder is too high.
6. If water removal from the body of the ducklings is more owing to infections or diseases.

The death rate of the ducklings will greatly increase in 4 to 5 days for dehydration. All the ducklings may die in 7 to 10 days.
Symptoms of dehydration
1. All the ducklings will be very much weak.
2. They will show dryness on the body.
3. The stool or excreta will be hard.

Remedy for dehydration
1. Identify the actual causes of the problem and then find a solution.
2. Sufficient drinking water should be supplied to the ducklings.

Feed deficiency
The body weight of the poultry birds on the farm will decrease gradually if they remain half fed or suffer from any lack of feed. They will lose weight and finally die if the situation continues.

Causes of feed deficiency among ducklings
1. If the temperature of the brooder is low, the ducklings will not go to the feed, and consequently will grow weaker day by day.
2. If the feed space is limited, some ducklings will go there to feed on but the others will fail to reach there. In this way the weaker ones will be deprived of feed and get weaker and weaker.
3. If the feed pots are not uniformly distributed and the quantity of feed is inadequate.
4. If the feed is not to their taste.

PRACTICAL

Topic: Preparing balanced feed for ducklings.

Materials:
1. Feed items as per list.
2. Measuring instruments like balance and weights
3. Aluminum dish/bucket or packets
4. Practical note book
5. Pen/Pencil

Steps of the work
1. Prepare a list of items required for making 5 kg feed.
2. Weigh items after proper calculation.
3. Show the items to your class teacher.
4. Blend the items to make the feed.
5. Put the feed in a dish, bucket or a packet and show it to your teacher.
6. Write down the method of preparing the feed sequentially in the practical note book.

**Exercise**

**Multiple Choice Questions**

1. What square meter floor area of a house is to be made for rearing 100 young ducks for one month?
   a. 2.5  
   b. 3.5  
   c. 4.5  
   d. 5.5  

2. If the litter is not changed time to time then in case of ducklings-
   i. dehydration will be seen in the body
   ii. the excreta will become hard
   iii. it may be attacked with disease

   **Which one is correct?**
   a. i  
   b. ii and iii  
   c. iii  
   d. i, ii and iii  

**Answer question numbers 3 and 4 from the following figure:**

![Figure: Brooder](image)

The figure of the 5th day of rearing of Habib's duckling in winter.

3. After how many days Habib will remove the brooder guard?
   a. 25-30  
   b. 20-25  
   c. 15-20  
   d. 10-15
4. What will be the temperature of the body of duckling at the day of removal of brooder guard?
   a. 32.2  
   b. 29.2  
   c. 26.6  
   d. 23.8  

**Creative Question**

Labony started to rear 250 high yielding and healthy ducklings of 2 weeks age in the new farm collecting from the government duck farm. According to the advice of the agriculturist she started to give balanced feed to the ducklings and set up a brooder to give temperature in the farm. After one week she arranged the duckling to go to the pond safely. But after 4/5 days about 50 ducklings died for being ill.

   a. What is brooder?  
   b. Explain the cause of death of the ducklings.  
   c. Prepare a list of balanced feed with amount for one day for the living ducklings.  
   d. Write down how Labony's duck farm can influence the neighbours.
Chapter 4

PIGEON REARING

Pigeons are very popular domestic birds. People rear pigeons like other poultry birds in most homesteads of our country. Pigeon meat is very delicious. Pigeon rearing has a respectable history across ancient Europe, America, and India during the Mogul rule. The pigeons that accompanied the great saint Hazrat Shahjalal (R.A) to Sylhet is known as 'Jalali Kabutor'. Pigeons are quiet and cool.

Pigeons can be domesticated very easily. Pigeons may be reared at homesteads, on the roof tops of any shed, etc. It is said that pigeons were trained to carry letters in ancient times. Pigeons can be trained to learn different attractive acrobatics very easily.

Advantages of pigeon rearing

1. Pigeons start to lay eggs when they are only 6 months old.
2. On average a single pair of pigeons reproduce two chicks every month.
3. Pigeon chicks attain the table size in 3 to 4 weeks. No feed is required for the chicks for 10 days. Their parents feed them with a milk like substance grown in their food sacs.
4. The meat of pigeon is highly nutritious and tasty.
5. The feed cost of pigeon is very low.
6. The pigeon house may be made with low cost materials.
7. The children can easily rear them in the house. Its husbandry is delightful.
8. It is possible to be economically benefited very easily investing only a little capital and labour.
Breeds of pigeon: There are about 200 to 300 breeds of pigeon in the world. Giribaz, Shirajee, Moyur Panki, Silver King, White King, Gora, Homar, Jalali, Fan, Loton, etc. are the most familiar breeds among them. The amateurs rear pigeons for games and other entertainments. The Giribaz pigeons display acrobatics in the open sky. People enjoy as they fly high and somersault down.

Housing

No specific house is required for rearing pigeons. Pigeon may be reared on the slopes of the roofs, on the window sheds or balconies. The housing requirement for pigeons is described below:

1. The house may be made with light wood, thin tin, bamboo or packing wood.
2. There should be a space to accommodate two pigeons in each apartment.
3. The size of an apartment should be 30 cm wide and 30 cm high for each pair of pigeon.
4. There should be sufficient space for movement inside the apartment. Care should be taken so that no rainwater can enter the pigeon apartments.
5. The house of the pigeons should be in an elevated place so that dogs, cats, rats, etc. cannot harm them.
6. The apartments of the box cages of pigeons may be arranged horizontally or designed vertically like a multistoried building. Each box cage or apartment should have a door 12 cm X 12 cm.
7. The excreta of the pigeons should be cleared off once or twice a month.
8. The house should be kept clean and dry.
9. The water pot and feed pot for the pigeons should be kept near the box cages or the apartments.
10. Water and dust for bathing and straw for making nests should be kept within their easy reach.
Feed: Pigeons usually feed on grains such as wheat, pea, grass pea, mustard, maize, pulses, paddy, rice, millets, sorghum, etc. Pigeons feed on these kept in a pot near their shed. It is better to give them some green vegetable leaves, ground oyster and mineral salts.

The balanced feed prepared for poultry birds may be given to pigeons. Pigeon feed should contain 15 to 16 percent protein. Every pigeon requires about 35 to 60 gram feed daily.

Controlling diseases of pigeons
The major diseases of pigeons: How to control them.

<table>
<thead>
<tr>
<th>Name of the disease</th>
<th>Symptoms of the disease</th>
<th>Controlling methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pox</td>
<td>Soft warts show up on the sink without feather, lesions develop on the inner wall of the throat.</td>
<td>Pigeon pox injection should be given on the chest or leg or thigh at the age of four weeks.</td>
</tr>
<tr>
<td>Cholera</td>
<td>High body temperature; loss of appetite; loss of weight; breathing difficulty; green or yellow excreta.</td>
<td>Terramycin should be given.</td>
</tr>
<tr>
<td>Blood dysentery</td>
<td>Weakness, excreta mixed with blood</td>
<td>ESB-3 or Ambazin or Aludron should be given diluted in water.</td>
</tr>
<tr>
<td>Worms</td>
<td>Weakness, anemia, Diarrhoea.</td>
<td>Avipar or Uvilon should be given at an interval of 3 months</td>
</tr>
</tbody>
</table>

Remedial measures should be taken after consultation with a vet when the pigeons are found to be ill.

Exercise

Multiple Choice Questions
1. Which type of pigeon does play somersaults in the air at flying stage?
   a. Jalali       b. Shikari
   c. Giribaz      d. Loton
2. How much food grains in gram does a pigeon take daily?
   a. 30-50  
   b. 35-60  
   c. 40-65  
   d. 50-70

3. Which bird can be reared with least expenditure among the domestic bird?
   a. Quail  
   b. Hen  
   c. Pigeon  
   d. Duck

**Read the following passage and answer the question numbers 4 and 5:**

Shamoly went to the veterinary doctor due to the sudden illness of her one pigeon out of six. Veterinary doctor prescribed her to feed Ambazin mixing with water for three days. The pigeon cured as it was fed Ambazin.

4. According to the advice of the veterinary doctor by feeding Ambazin to the pigeon-
   i. the weight increased.  
   ii. taste returned  
   iii. passing of blood with excreta stopped.  

   Which one is correct?
   a. i  
   b. i and ii  
   c. ii and iii  
   d. iii

5. What is the name of the disease by which Shamoly's pigeon is attacked with?
   a. Pox  
   b. Cholera  
   c. Blood dysentery  
   d. Disease due to worms

**Creative Question**

Mina Begum bought two pigeons as a hobby. Thinking about extra solvency in her family she bought some more pigeons as rearing of pigeon is easier. Now her number of pigeon is 14. She has made a multistoried, air and light passing house with pigeon holes by packing wood for her pigeon.

   a. Write down the name of a variety of pigeon.  
   b. Describe how rearing of pigeons brings solvency in the family of Mina Begum.  
   c. Determine the area and the number of holes of the house of pigeon.  
   d. Besides solvency the pigeon gives pleasure in various ways. Explain its rationality.
Bangladesh is mainly an agricultural country. Fish plays a very important role in its economy. Fish enriches our meals with nutrition. At present, the contribution of fish to the national income is 5%. About 63 percent of the protein supplement in our diet comes from fish. Fish is the main source of animal protein. Protein is essential for the fitness and growth of our body. It helps us to grow resistance to diseases. Protein helps develop our brain and merit in a significant way.

The climate, weather, water and soils of Bangladesh are very suitable for cultivation of fishes. But fish production is gradually decreasing day by day because of different natural causes. Improved methods of fish culture are being adopted now to increase fish production in our country.

**Importance of fish**

**Importance as food:** Protein is an important factor of nutrition and development of the body. Protein is essential for health and vitality. We usually get protein from plant and animal sources. Animal protein is very important for our body. Fish, meat, milk, and eggs are the main sources of animal protein. Among these sources, 63% of the total protein comes from fish. There are so many nutrients in fish oil in addition to mineral salts and vitamins. Thus, we need fish to get rid of our malnutrition problem.

The quality of fish protein is very high. Fish is easily digested in the body; its fat content is low. Fish is highly enriched with vitamin A and vitamin D. So fish provides us with the essential vitamins as food. Hundreds of thousands of children of the country are affected by night blindness owing to the deficiency of vitamin A. The fishes namely Mola and Dhela contain sufficient quantities of vitamin A. Deficiency of vitamin D causes Ricket.

Fish oils contain sufficient quantities of vitamin D, calcium and phosphorus. They help to form and develop our bones and teeth. Small fishes eaten with their bones supply calcium and phosphorus. Sea fish contains sufficient quantities of iodine.
Economic importance of fish: Fish is very much important for national economy regarding employment and earning foreign currency. A big portion of the working people of our country are directly or indirectly engaged in cultivating, harvesting, marketing fish and other jobs related to fish. Out of these about 10-12 lakh people are engaged in fishing in the sea and inland waters round the year. Besides, about 12 million people find part time employment in the fish sector. The country earns much foreign exchange through exports of fish and fish products. The place of fish in export is second among all export products. Fishes are grown naturally in the open waters. But fish is required to be cultivated in closed waters. There is an ample scope of solving the unemployment problem through the cultivation of fish in closed waters. The fish sector has immense importance in the national economy: earning foreign currency and solving the unemployment problem.

Causes of the depletion of fish resources
Fish is one of the main sources of earning foreign currency, creating jobs for the unemployed, doing away with the deficit of protein and eradicating the poverty of a major portion of the population.

The fish resources include inland open water like rivers, haors, bils, lakes and flood plains. Their area is about 40 lakh 47 thousand 316 hectors. The closed water of the country include ponds, baors and coastal shrimp culture, areas. Their are as is about 5 lakh 28 thousand 390 hectors. Besides, there is a vast area of marine fishing in the southern part of the country. Presently, a large quantity of fish is harvested in the country. But the trend of production is failing to cope with the demand of the increasing population. It is due to the decrease of fish production in the main inland open waters. However, production has increased in the closed water and the sea.

There are two main reasons for depletion of fish resources. The first one is natural and the second one human.

Natural causes
The rivers of the country are getting silted every year. This is the natural cause of decrease in fish output. The course of the water flow of rivers and streams has changed. The rivers and canals have silted owing to the accumulation of the eroded soil particles from the floodplains. As a result, they have become unsuitable for fish culture.

Natural production of fish in the rivers depends on its stream dynamics. Reduction of water in the rivers seriously hampers the reproductive activities and adaptation of fishes. It hinders the flow of water. Moreover, it does not rain as much as required, because forests are losing ground to civilization.

Rainfall contributes much to fish fry production as a natural factor. Most rivers and canals are getting dry because of draught. New islets are forming in the rivers. As a result, environment is degrading very rapidly. The environmental changes in the waters are seriously hampering the reproduction of fishes through spawn and fry production. No life can survive without its specific ecosystem. Fishes also require a compatible environment to live and thrive in a normal way. Environmental degradation has already made many species of fish extinct. Many others are at the risk of extinction.

**Man made problems**

Man, made problems are no less responsible for the decrease in the production of fish in the country. The mejor causes for the decreased fish production are mentioned below:

**A. Over harvesting**

Fish is being harvested at accelerated rates to meet up the food requirement of the over-increasing population. As a result, the quantity of fish in the waters is decreasing.

**B. Destruction of brooder fish and fish fries**

Fishermen harvest brooder fishes and fish fries in their desperate struggle to survive. This activity of theirs is seriously thwarting the future reproduction of fish.

**C. Development of agriculture**

Many waters have been turned into agricultural plots to increase food production. As a result, the area of waters suitable for fish production is diminishing.

**D. Reaction of pesticides**

Farmers spray different toxic pesticides on the crop fields to produce high yielding varieties. These toxic pesticides seriously hamper the growth and reproduction of fish. Besides, they also reduce the production of natural feed.

**E. Industrialization**

Setting up industries with disregard to their ill effects on the environment is a threat to fishes. The toxic wastes of these industries are getting mixed with the river water. Toxin causes different diseases and even death to fishes.

**F. Damming the rivers**

People are damming rivers or erecting barriers across their cropland for controlling flood or for irrigation. These constructions stand in the way of fishes and thus restrict their natural movement.
G. Development of infrastructure

The environment of fish reproduction is disturbed and distorted by the infrastructure put up in the rivers and large waters as part of development programs.

Fish cultivation cannot proceed properly because of multiple ownerships of the most ponds.

Importance of fish cultivation

Fish is our main source of protein. It is also a source of employment and earning foreign currency. It keeps the environment clean.

We usually harvest fishes from the open waters, the closed waters and the sea. Fish is cultivated in the closed waters while it grows on its own in other aquatic spaces.

We have quite big tanks and ponds in our country. The average rate of the production of fishes in our country is far less than that of the countries applying improved methods to fish cultivation. But the climate of our country is highly suitable for fish cultivation. Fish cultivation can create jobs for the unemployed people. The protein requirement of the rural poor people can be met very easily.

There are many abandoned ponds and ditches in the country. They have become breeding grounds of mosquitoes polluting the environment. They have helped spread many pathogenic diseases in the community. We may clear these tanks and ponds and cultivate fish in them. These waters, now polluting the environment, breeding mosquitoes and spreading pathogenic diseases, can generate protein, financial income and employment.

Presently, we can cultivate fish in a short period adopting modern fish production technology. We can increase the fish production in our ponds manifold if we use these technological know-how.

Characteristics of cultivable fish species

There are more than 260 fish species in the sweet waters of our country. But all these species are not suitable for cultivation in the ponds. Now projects are being taken to develop technologies through different research programs to increase the production of fish in the country. About twelve species of fishes have been brought from abroad. Some local species have been improved.

Fish fries are being produced artificially with the aids of improved technology. The exotic fish species is being crossbred with the local ones.
The characteristics of exotic and local cultivable fish species

- These fishes grow very fast in the pond.
- These fish species do not compete with each other for feed and space.
- These fishes take feed from different layers of water; so environment remains safe.
- These fishes are very delicious.
- These fishes have high demand in the market. They can be marketed at a very short time.
- The fishes are not voracious.
- Their fries are found in the open waters.
- Fries of fishes may be produced by artificial injection methods.
- These fish species have resistance to diseases.
- These fishes can have supplementary feed in the ponds in addition to natural feed.

The fishes having the above characteristics are Rui, Katla, Mrigel, Kalibaus, Silver carp, Mirror carp, Rajpunti, etc.

Exercise

Multiple Choice Questions

1. Which element is most important for the nutrition of the body?
   a. Carbohydrate  
   b. Fats
   c. Protein  
   d. Minerals

2. Eating of sea fish may resist–
   i. Goiter
   ii. Rickets
   iii. Mental disorder.

Which one is correct?

   a. i and ii  
   b. i and iii
   c. ii and iii  
   d. i, ii and iii
3. In fish-oil there are sufficient amount of-
   a. Potassium and Calcium   b. Phosphorus and Manganese
   c. Sulphur and Phosphorus   d. Calcium and Vitamin-D

Read the following passage and answer question numbers 4 and 5.
Shimu likes to eat fish very much from childhood. Big and small variety of fish more over sea fish is very favorite to her.

4. Fish helps Shimu-
   i. to increase merit
   ii. to resist diseases
   iii. to get good sleep.
Which one is correct?
   a. i   b. i and ii
   c. ii and iii   d. i, ii and iii

5. Which element Shimu gets a lot from sea fish?
   a. Potassium   b. Sodium
   c. Iodine   d. Magnesium

Creative Question
Mr. Rahman started to live permanently in his paternal property after retirement. Fishing is his hobby. So he went to the river to catch fish with his brother. But he did not get any fish. Later he came to know that now a days fish is very rare in the river. So he decided to culture big fish in his pond. He started culturing small fish beside big fish.

   a. Which food element is high in the fish?
   b. Describe the cause of not getting fish in the river by Mr.Rahman.
   c. Explain the rationality of culturing small fish beside big fish.
   d. What type of big fish culturing is profitable you think? Give your opinion with argument.
Chapter 2
DIFFERENT KINDS OF FISH

Introduction
Many kinds of fish populate the waters of Bangladesh. Some economically viable fishes are described below:

Carp species
Carp or Rui-katla variety is the most important because of its economic value and demand in the market. Fishes of this group have adaptability. Their natural abode is the sweet water rivers. However, you can fix them in a pond for cultivation. The significant feature of these fishes is that they belong to the same family; they do not feed on each other's fries. They do not compete with each other for feed. They may have some agitation among themselves about feed and movement, but it does not have an adverse effect on their living together.

Carps mostly do not spawn in the ponds or the closed waters. They reproduce naturally in the rivers. However, it may reproduce in the closed waters after artificial treatment.

Rui, Katla, Mrigel, Kaliboush, Silver carp, Mirror carp, Common carp, Grass carp and Big head carp, etc. are known as carp. These fishes are very tasty. They forage in different layers of the pond and keep it well. Carps of all types may be cultivated together in a pond. This is called mixed carp culture.

Local carp
Rui, Katla, and Kaliboush are the fishes of the rivers of this country. They are known as local Rui or local carp.

Rui: Rui is a fish of rivers. It is one of the main fishes suitable for cultivation in ponds. It is very tasty. Its head is triangular, and small in relation to its body. The dorsal (back) line or level is more curved than the ventral (belly) level. The colour of the back is slightly brown. The colour of both sides of the belly is silvery white to light golden. They forage in the mid layer of the pond. They feed on zooplankton at the early stage of their growth, but phytoplankton, soft leaves of aquatic plants and organic materials later on. They also feed on supplements like oil cake and bran. Its rate of growth is slightly lower than Katla. Rui does not spawn in ponds. Their time to spawn is from April to August (Baishakh to Sraban). Fries may be produced in artificial methods. They attain a size of about 1 metre in length when grown naturally in rivers or large waters.
Katla: Katla is a fish of the river. However, it is amenable to cultivation in ponds. The size of the head of katla is big; the back is elevated; the body is broad and a bit flat. The colour of the dorsal side is greyish but the colour of ventral side or belly is white. The colour of the dorsal fin is black. The mouth is curved upward. They forage in the upper layer of the pond and grow very fast. At the early stage, they live on zooplankton, but feed on small shells and phytoplankton later in their life. They also treat themselves with supplementary feed. They do not spawn in the pond. Fries grow in the natural environment of the rivers. However, fries may be grown in the ponds through artificial treatment. The time of spawning extends from April to July (Baishakh to Ashar). When grown naturally in rivers or large waters, they may grow 1.5 metre in length.

Mrigel: Rivers are also the natural abode of Mrigel. It is a major fish to culture like Rui and Katla. Its dorsal side is slightly more curved than the ventral side. Its head is smaller than Rui’s. The colour of the body is whitish to light golden. The fins are light red. The mouth is curved downward. It has two antennae on both sides of the mouth. Mrigels mostly move on the bottom of the pond. They feed on whatever is there. Like Katla they eat zooplankton at an early stage. However, they feed on the rotten organic material, small insects and soft soil. They follow Rui and Katla in reproduction. They spawn from April to August (Baishakh to Sraban).
Kaliboush: Kaliboush is also a fish of rivers like Rui and Katla. They can be cultivated in the pond in the mixed culture system with Rui and Katla. The colour of their body and fins is blackish. Their mouth is narrow. They have two pairs of antennae on both sides of the mouth. Kaliboush stays on the bottom of the pond and forage there like Mrigels. They do not spawn in the pond. However, fries may be produced through artificial treatments. Kaliboush spawns in rivers during the rainy season.

Exotic carps

The fishes called Silver carp, Common carp, Mirror carp, Grass carp, Bighead carp etc. are the exotic fishes brought from abroad to our country. For this season, these fishes are called foreign carps.

Silver carps: Silver carps grow faster than others of their family. They may be cultivated with local carps in a mixed culture system. They were first introduced in Bangladesh in the year 1969. First Silver carp fries were produced in 1976 artificially. The scales on their body are very small and silver in colour. Their ventral or lower side is boat shaped. They look like chapila at their infancy and look like Hilsa or Jatka.
at their adolescent stage. They forage in the upper layer of ponds and lakes like katla. At the early stage, they grow a fancy for small phytoplankton and algae. They feed on the decomposed aquatic plants when they grow bigger. Silver carps enjoy supplementary feed as well. They do not spawn in the closed waters.

**Common carp:** Among all the exotic carps introduced to our waters from abroad, common carps are more popular than any other in Bangladesh. They go by the name of carpeo. This carp has been picked up from Nepal in the year 1979. Carpeo feeds on waste matter, insects and protein found on the lowest layer of the water of a pond. Sometimes common carps stir while taking feed and loosen the soil of the bottom, banks and other points, even make holes over there. This fish is adapted to reproduce in the ponds and spawn during winter and summer.

**Mirror carp:** Mirror carps were brought in here in 1979. The fish is not cultivated throughout the country. Mirror carps belong to the species of common carp. The scales of Mirror carp are few in number, large in size, and scattered over the body. The colour of the body is yellow and golden. The lower part of the mouth is narrow.
Grass carp: Grass carps may be cultured with local carps in ponds as it is done with silver carps. The fish was first brought to Bangladesh in 1966. Fries were produced in 1980 for the first time through artificial treatment. They look like Mrigels, but they forage in the mid water of the ponds. Their dorsal area is bronze while the body is slightly green. Their fins are small. The main feed of the fish is aquatic plants. They are reproduced like silver carps. They grow very fast.

Bighead carp: Bighead carps were brought to Bangladesh from Nepal in 1981. The original habitat of this fish is the Chinese rivers. This is a very rapidly growing fish species. A fish can gain 2 kg per year.

Local fishes suitable for mixed culture
Catfish: Catfish includes Shing, Magur, Boal, Pabda, Tangra and Aire. Catfish possesses two pairs of antennae. One pair antenna is very long. These fishes are known
as catfish for the presence of the antennae. These fishes do not have scales on their body. Their skin is covered with a layer of a slimy material. The slimy material protects this fish from infections. Shing and Magur are known as 'Jeol Fish'. Catfishes are generally found in the canals and ponds.

**Jeol-fish:** Koi, Shing, Magur and Shol are known as Jeol fish. They can live and survive in a small place in the little water of pots, buckets and dishes. They have extra respiration mechanisms. As a result, they can take oxygen from the atmosphere. These fishes may be cultivated in large numbers together. They are very nutritious. They contain more iron and protein but less fat and are digested very easily. These fishes are recognized for their high food value and prescribed for patients.
**Voracious fishes:** Boal, Shol, Taki, Chital, etc. are known as voracious fishes. They not only compete with other fishes for feed and space, but also feed on their own species and other fishes if feed is not available. Voracious fishes threaten the cultivation of fishes in ponds. It is essential to clean a pond of voracious fishes to cultivate fish in it.

![Fig : Boal](image1)

![Fig : Chitol](image2)

![Fig : Shol](image3)

**Small fishes:** The small fish group includes Mola, Dhela, Batashi, Punti, Kachki, etc. These fishes are very small. Their economic status is not recognized well. Their reproduction and multiplication occur naturally. These fishes become the competitors for feed and habitat of the cultivable fishes. They are ubiquitous in all the layers of the pond water and feed on all types of feeds both natural and supplementary. Mola and Dhela are rich in vitamins. A small number of fishes are sufficient to supplement minerals and vitamin A for a person per day. They grow naturally in the natural waters. They provide the rural poor with the minerals and vitamins they require. We need to understand the real economic and healthful benefits we receive from these neglected small fishes. That’s why we should take more care to cultivate these fishes.

![Fig : Mola](image4)

![Fig : Dhela](image5)
PRACTICAL

Topic: Observation of different types of fishes

Materials
1. Rui, Silver carp, Mirror carp, Shing, Magur, Tangra, Aire, Pabda, Boal, Shol, Mola, Dhela, Batashi, Punti, Kachki and other fishes discussed in the chapter.
2. Formalin
3. Tray
4. Forceps
5. Bottle or glass jar

Steps of the work:
1. Collect the sample fishes for practical class after discussion with your teacher.
2. Preserve the fishes in formalin in bottles or glass jars for use in the next classes. Label the jars with relevant names.
3. Asked your teacher regarding the types of fishes.

Exercise

Multiple Choice Questions
1. Which are cat fishes?
   a. Koi and Shing           b. Chitoal and Tangra
   c. Taki and Magur          d. Pabda and Boal
2. Which fish takes food of all layer of the pond?
   a. Tangra                  b. Pabda
   c. Taki                    d. Kachki
3. Jeol fish –
   i. can live in a small area
   ii. has extra respiratory system
   iii. has extra fats
Which one is correct?

a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii  

Read the following passage and answer question numbers 4.

Mr. Selim decided to culture Rui, Katla and Boal fish at the same time in his pond. He communicated with the fisheries officer to know about various aspects of fish culturing. Fisheries officer gave him some advice.

4. Fisheries officer told Mr. Selim that –
   i. It will not be wise to culture Boal with Rui and Katla in the same pond.
   ii. To remove the voracious fish from the pond before fish culturing.
   iii. To culture Shol fish with Rui, Katla and Boal in the same pond.

Which one is correct?

a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii  

Creative Question

Upper layer

Middle layer

Lower layer

a. What is local carp?

b. Explain what type of fish culturing is shown in the figure.

c. Why do you culture fish in the method shown in figure in a pond? Show reasons.

d. With which fish culturing among the fish shown in the figure you will be benefited financially you think. Give your opinion with reason.
Chapter 3

SHRIMP CULTURE

Shrimp is a very valuable fishery resource of Bangladesh. The demand and price of shrimps are progressively increasing in the world market. Shrimp occupies a very important place among the commodities that earn foreign currency. We are earning a handsome amount of foreign money every year by exporting shrimp to other countries. About 4.3% of the export income of the country comes from the shrimp sector. We earned about Tk.118,100,00000 from shrimp export in 1997-98. The income from shrimp export is showing a rising trend every year. Shrimp appears to be as valuable as gold to us.

Hopefully, the environment of our country favours shrimp culture. We can cultivate Bagda variety in saline water and Galda variety in sweet water in most parts of our country. The yield of shrimp may be increased several folds if we adopt modern techniques of shrimp culture. If we did so, we would earn more from export of shrimp. Moreover, the shrimp culture would employ many people.

Importance of shrimp: At present, shrimp is a highly valued commodity of our economy. Most of the export earnings from our fisheries sector emanate from shrimp exports. The foreign exchange earned from shrimps was Tk.1,045 crores in 1994-95. *We have earned 2992.33 crore in the year of 2006-2007 by exporting shrimp.

Shrimp is very palatable and considered an alternative food at home and abroad as it is boneless, rich in protein, easily digestible, soft and tasty. Galda grows fast and attains the largest size among the sweet water shrimps. As galda grows in sweet water, it can be grown in all our waters as a lone species or together with Rui and carps, and even in rice fields. At present Bagda is cultivated in 1 lakh 15 thousand hectors of land in the Cox's Bazar, Satkhira and Khulna regions. About 28 thousand tons of Bagda are produced from these regions and the whole produce is sent to foreign countries. The average production rate of shrimp in our country is 399 kg per hectar. This production rate may be increased to 5000 - 8000 kg/ha adopting modern techniques of shrimp cultivation. Our objective is to increase per hector production of shrimps rather than extending the area of cultivation.

*Sources: FIQC, DOF Dhaka 2007-2008
Physical features of shrimps

The whole body of the shrimp may be divided into two parts:

1. Thorax or head portion
2. Abdomen or abdominal portion

The head or the thorax part is covered by a shell known as carapage. There is a sharp saw like organ curving upward at the apex of the carapage. It is known as rostrum. The upper and lower parts of the rostrum are segmented. There are three pairs of long, thread like antennae in front of the head. There are two blackish eyes on each side of the head. Five pairs of legs exist at the lower part of head.

The abdominal part is divided into six segments. Every segment is called a pleura. The first five segments have a pair of legs each below them. They are called swimming legs as they are mainly used for swimming. The needle like organ found behind the sixth segment is known as telson. The leaf like two organs found below the telson are known as uropods.

Different organs of shrimp

The total organs of a shrimp may be divided into three parts. Out of total 19 pairs of organs, first 5 pairs are head organs, next 8 pairs are thorax organs and the rest six pairs are known as abdominal organs.

Head organs

First antenna: This is the first part of the shrimp body. This first organ consists of three parts: pre-coxa, coxa and basis. Shrimps feel with this antenna.
Second antenna: This antenna consists of two parts: coxa and basis. It contains the excretory organ and has fish scale like squama. It controls the excretory mechanism and balances the body as the shrimp swims.

Jaw: Jaw is there on two sides of the mouth. These are hard organs. Shrimps feed on with it and grind the feed with it.

First maxella: It lies behind the lower part of the mouth. It consists of three fine scale like parts. These organs help the shrimp swallow feed.

Second maxella: This organ lies behind the first-maxella. It is a thin scale like organ. It facilitates respiration of shrimps.

Thorax organs

Out of total 8 pair thorax organs, the first three pairs are known as maxilliped and the last one as movement organ.

First-maxilliped: This pair of organs is the smallest of the maxillipeds. This pair is used for crushing food materials and respiration.

Second maxilliped: This is less flat than the first one. This organ helps the shrimp to take food.

Third maxilliped: This is the largest of all the maxillipeds. It helps shrimps feed on hard feed items and move.

Movement organs: There are five pairs of movement organs. The structure of all these organs is similar. The fourth movement organ is known as the typical movement organ. There is a forceps like curved appendage at the end of the first movement organ. This is known as chilla. The chilla of a male shrimp is large. It helps the shrimp to feed on. The second movement organ is mostly similar to the first organ. This is very large in size and hard. The third and the fifth organs are like the fourth organ. The shrimp usually walks with the help of the third, fourth and fifth movement organs.

Abdominal organs: Six pairs of organs are there in the abdomen. Shrimps use all the abdominal organs to swim. They are rightly called swimming organs.

The third organ is known as a typical organ. The first part of the abdominal organ is known as coxa and the second part is known as basis. The abdominal organs are like petals. They have two parts: expodite and endopodite. The telson rests at the end of the abdomen. It propels shrimps to jump.
Life cycle

The life cycle of Galda has four main stages: Spawn, Larva, Post larva or Juvenile and Adult stage.

![Stages in life of galda](image)

(a) eggs  
(b) larva  
(c) post larva  
(c) adult

**Fig: Stages in life of galda**

**Egg:** The eggs are found to be attached to the abdomen by a slimy material. The colour of the egg is bright orange. It turns brown after 10 to 12 days. It hatches in 18 to 23 days.

**Larva:** The larva comes out breaking the shell of the mature eggs. The duration of the larval stage is 20 to 45 days. Larvae live on Zooplanktons.

**Post larva or juvenile:** The post larva or juvenile stage starts after the larval stage. The shrimp can walk and move or swim at this post larval stage.

**Adult shrimp:** The post-larva size develops to adult shrimps after 1 to 2 months. They become ready for reproduction in 8 to 10 months. Usually mature female Galda shrimps can spawn 80 thousand to 1 lakh eggs.
PRACTICAL

Topic: Observing Shrimps (Galda and Bagda)

Materials: One Galda, one Bagda, water, tray, pins, forceps, notebook, pencil.

Steps of work:
1. Collect one Galda and one Bagda.
2. Wash them thoroughly with clean water.
3. Put the shrimps separately in the trays and attach them lengthwise to the pins.
4. Observe the Galda and Bagda with the forceps.
5. Write the characteristics of the shrimps separately.
6. Write the major differences in the practical note book.

N.B. If it is not possible to bring the students to a shrimp farm, collect the shrimps from other sources and work on them.

Exercise

Multiple Choice Questions

1. With which organ the shrimp can jump backward?
   a. Coxa           b. Basis
   c. Pleura         d. Telson

2. There is one male galda shrimp among three reproductable galda shrimps. How many eggs they can lay?
   a. 1, 60,000-2,00,000    b. 1, 80,000-2,20,000
   c. 2,00,000-2,40,000    d. 2, 20,000-2, 60,000

3. First antenna –
   a. helps to swim    b. helps for breathing
   c. helps to take food  d. works as a sensational organ.
Read the following passage and answer question numbers 4 and 5:

Kamal of Satkhira thought to culture shrimp with other fishes in the pond. But he started to culture fish in the field of paddy beside cultivation of paddy instead of doing that. He made much profit culturing both fish and paddy in the same field.

4. Kamal choose the fish to culture-
   i. Harina shrimp
   ii. Bagda shrimp
   iii. Galda shrimp

Which one is correct?
   a. i  
   b. ii 
   c. iii 
   d. i, ii and iii

5. Which type of fish with shrimp Kamal thought to culture at the beginning in the pond?
   a. Local carp  
   b. Foreign carp 
   c. Cat fish  
   d. Jeol fish

Creative questions

a. What do you understand by the figure above?

b. Mention a characteristic of figure-C

c. Show different parts completing figure-D.

d. Explain the importance of shrimps to earn foreign currency.
Chapter 4
CULTURE OF THAI SARPUNTI/RAJPUNTI

Introduction:

This fish is cultured in different countries of South-East Asia. The fish was imported to our country from Thailand in 1977.

It looks almost like a local Sarpunti. The fish is of a harder build than a local Sarpunti. The body of this fish is flat and thin. Although the upper portion of its dorsal side is lightly mud coloured, the body is bright silvery. The tail is segmented. The colour of the ventral fin is light yellowish. There are three rows of teeth in the cavity of the mouth. The fish grinds its feed with these teeth.

A Rajpunti has got no stomach; it digests its feed in its small intestines. These intestines are two to three times the length of its body together. A Rajpunti feeds on all kinds of feed. But it is fond of "Khudipana".

![Fig: Rajpunti](image)

Characteristics

1. Rajpunti is a hard built, more productive and tasty.
2. This fish can live in water with little oxygen and in high temperature.
3. It feeds on almost all natural feed materials, but small aquatic plants are its favourite feed.
4. This fish can be cultured in all types of pits, ponds, large tanks and abandoned waters.
5. Rajpunti can be cultured in muddy or turbid water also.
6. The natural environment of this country is very suitable for Rajpunti.
7. This fish can be cultured easily comparatively in a short period of time and with less cost.
8. It can be cultured in mix-culture system.
9. Disease infestation incidence is low in case of this fish.
10. A Rajpunti becomes 150 to 200 gm in weight in six months and can be marketed.
11. The fish can be cultured twice a year in the same pond.

**Potential of culture**

There are many abandoned ponds and ditches where fish is not cultured. Some ponds or ditches are usually there beside most of the homesteads. Water does not stay there for more than 6-7 months. These are called seasonal ponds. Rajpunti is suitable to be cultured in the seasonal ponds. Carps are not suitable to be cultured in them. As they are very near the dwelling houses, women can also culture Rajpunti in them along with their household chores. It can help reduce protein deficiency of rural families. Moreover, the surplus fish can be sold out in the market. As a result, it will generate income. No cash investment is required for supplementary food. The water used for washing vegetables after they are cut into pieces can be thrown onto the pond. It will prove a feed supplement for rajpunti. As a hard built fish, rajpuntis are less likely to be attacked by diseases. Rajpuntis can be cultured with a little money. The small, abandoned and neglected waters can also be well utilized. One can profit from culturing rajpunti in small waters, ponds or perennial ditches with a little effort.

**Work to be done for culturing rajpunti**

Task to be done necessarily for the cultivation of Rajpunti fish in the pond are discussed here successively:

**Preparation of the pond:** It will be good if the area of the pond measures 15-35 decimals. It is desirable to have water 2/3m deep during the rainy season. Preparation of pond includes proper dressing of its banks and the bottom, clearing weeds, and making it free of voracious and predatory animals.

**Dressing the banks and the bottom properly:** If the banks of the pond have subsided at some points or dug out somewhere, they need to be raised or filled in to the required level. The uneven bottom is to be leveled. Otherwise, netting will be very difficult. If mud is there at the bottom, it should be removed. Excessive mud may trigger poisonous gases. If big trees are there on the banks of the pond, their branches are to be pruned. Otherwise, the leaves will fall in the pond, decompose and degrade the water.
**Control of weeds:** All weeds like kalmi, helencha, and the creepers in the pond will have to be removed.

The rooted weeds are to be uprooted. Weeds create problems like:

They

::: Hinder the sunlight to reach the water of the pond.
::: Act as host of the pathogen of diseases and parasites.
::: Hinder the movement of fish.
::: Cause depletion of oxygen at night and on cloudy days.
::: Reduce the dissolved feed ingredients in water.

Weed control is an urgent task for pond preparation.

**Removal of voracious and predator fishes**

Predator fishes of the pond can be removed in two ways:

**A. By netting or by drying out the pond:** Before you culture fish, remove the predator fishes like shol, boal, taki, chitol, etc. by repeated netting. If they cannot be removed by netting, dry out the pond.

**B. By applying chemicals:** If you fail to remove the predator fishes by netting, apply chemicals: one phostoxin tablet for every decimal of the pond with 30 cm deep water. The tablet is to be equally spread throughout the whole pond and the water is to be thoroughly stirred by netting. After 1-2 hours of the application of the chemical when the fishes begin to float on the water, pick them up. The effect of this poison lingers for 7 days. You may also mix rotenon with water and sprinkle the mixture through the length and breadth of the pond. The fishes killed by rotenon or phostoxin remain edible. Rotenon looks like gum. For every decimal of the water, 35 gram of the powder is to be mixed with water to spray. Sometimes after the application of rotenon, the fishes will be floating on the water. Net them up. The toxic effect of rotenon persists in the pond for 7 days maximum.

**Application of lime and fertilizers**

Treat the water with lime and fertilizers for the growth of natural feed.

**Lime:** After 1-2 days of application of toxic materials or drying out the pond, apply lime at the rate of 1 kg per decimal. Dolomitic or calcite lime should first be mixed with water in an earthen pot or drum. Let it cool down. Spray it all through the pond.
The application of lime will
- destroy the harmful germs of diseases;
- retain the characteristics of the soil and water;
- increase resistance of the fishes to diseases and
- increase the amount of calcium in the water.

**Fertilizers:** After 6-7 days of the application of lime, apply organic fertilizers: 5-7 kg cow-dung and 3-5 kg poultry-dung (excreta of ducks, and fowls) per decimal surface of the water.

After 4-5 days of the application of organic manure, dissolve 100-150 gram urea with 50-75 gram TSP in water for a decimal of the water and sprinkled it. After 5-7 days of the application of fertilizers when the colour of the water becomes green, it is to be understood that natural feeds have grown in the water. It is now ready to host fishes.

**Collection of fish fries and their transportation**

**Collection of fish fries:** Fries are to be collected from the nearby government or non-government farms 70-75 fries about 5-7 cm in length can be released to a decimal of the water. Usually fries are available from mid April to mid October (Baishakh-Kartik).

**Transportation of fish fries:** Fries are to be transported in polythene bags or earthen or aluminium pots. The containers should have some additional oxygen from the farms. The bags of the fries should always be kept in shades. If they are kept in the sun, the fries will die from the water getting hot. The polythene bags should be dressed with gunny bags. It will protect the bags from damage. You may transport fries in earthen or aluminium containers, too.

**Stocking and rearing fish fries**

**Stocking:** It is not wise to stock the fries straight away after they are brought in from the farm. The temperature of the water of the bags or the pots is not equal to that of
the water of the pond. In this condition, the bags or the pots filled with fries are to be dipped in the pond water for sometime. Then those bags or pots should be kept in a slanting position so that the water of the bags gradually go to the pond and the water of the pond enters the bags. If the bags or pots are kept in this state, the fries will also slowly move in a procession to the pond.

**Providing feed:** Rajpuntis can take any material edible to fish. However, you may give them a mixture of rice bran and mustard oil cake as supplementary feed. From the second day of releasing the fries, feed is to be given twice a day in the mornings and in the evenings. Besides these, fresh leaves of plants or different vegetables can be supplied after cutting those into small pieces. Khudipana is the best food for rajpuntis. Khudipana is to be collected from drains and rice fields and supplied to the pond as food. In order to increase the natural production of the pond's organic manures, inorganic fertilizers are to be applied at an interval of 7 days.

**The quantity of supplementary feed for a decimal of the surface of the water:**

<table>
<thead>
<tr>
<th>Month</th>
<th>Gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st month</td>
<td>45</td>
</tr>
<tr>
<td>2nd month</td>
<td>90</td>
</tr>
<tr>
<td>3rd month</td>
<td>180</td>
</tr>
<tr>
<td>4th month</td>
<td>210</td>
</tr>
<tr>
<td>5th month</td>
<td>260</td>
</tr>
<tr>
<td>6th month</td>
<td>320</td>
</tr>
</tbody>
</table>

**Examining the health and growth of fish:** The health of fish should be examined by netting the pond once a month. Weights of fish should also be examined after taking a few fishes in a small tub. It is to be noticed if they are gaining weight. If they look bright and transparent, are slimy, have no sores; fins are in good condition and look fresh, it is to be understood that they are in good health.

**Harvesting and marketing**

**Harvesting:** After 4-5 months of nursing, the fishes become big enough. When they are 150 grams or above in weight, they qualify for marketing. The big ones are to be netted. The small ones are to be released to the pond again. In the same way, all the fishes are
to be harvested in 6-7 months. Otherwise, the water of the seasonal pond will dry out. If the pond is a perennial one, the fishes may be allowed to grow more, and when they are big enough to your desired level, you may put them up for consumption. This course of operation will give more yield and fetch more economic benefits.

**Marketing:** Fishes perish soon. They get soft and decompose in a short period. Rotten fishes do not agree with our taste. They do not sell well. They perish more in summer than in winter. Fishes are to be collected early in the morning to market them fresh. If they are kept in ice as soon as they are caught, they remain fresh. But if ice is not available, fishes are to be caught at a time consistent with the market time. In this way, you can dispose them up while they are fresh.

### PRACTICAL

**Title:** Making fish feed.

**Materials:** Rice bran, mustard oil cake, khudipana, vegetables, soft aquatic plants

**Steps of the work :**

1. See the feed materials in the practical class.
2. Know from your teacher where you can which feed material.
3. Write about the feed materials in the practical notebook.
4. Now prepare fish feed according to the following recipe.
5. Let the oil-cake soak up water overnight.
6. Mix rice bran with the soaked oil cake, and make small balls.
7. Write down the method of preparation you have followed.
8. While releasing khudipana in the pond, take care that it does not cover the entire surface of the water; it may cause oxygen deficiency in the water.
9. Surround the khudipana at a certain space of the pond with bamboo or rope or both.

### Exercise

**Multiple Choice Questions**

1. Which part is absent in 'Rajpunti' fish?
   a. Scales  
   b. Teeth  
   c. Small intestine  
   d. Stomach
2. Which is the favorite food of Rajpunti fish?
   a. Aquatic weeds           b. Supplementary food
   c. Khudipana              d. Mastered oil cake

3. For Rajpunti fish-
   i. Abundant and clear water is needed to culture.
   ii. More yield and tasteful.
   iii. Possible to culture in mixture culturing system also.

Which one is correct?
   a. i and ii                b. i and iii
   c. ii and iii              d. i, ii and iii

Read the following passage and answer question numbers 4 and 5:
Rahim has a pond of 10 decimals. He applied Rotanon and required amount of lime and fertilizer to make the pond suitable for culturing fish.

4. Why did Rahim apply Rotenon?
   a. To make the water clear    b. To destroy voracious fish
   c. To prepare natural foods.  d. To increase the growth of the fish.

5. The amount of lime applied in Rahim's pond is-
   i. 5 kg
   ii. 10 kg
   iii. 13 kg

Which one is correct?
   a. i and ii                b. i and iii
   c. ii and iii              d. i, ii and iii

Creative Question
Sheuli tried to make the family more solvent by culturing 'Razpunti' fish in the pond of 20 decimal by the side of her house. After few months she found that most of the fish fries were not found in the pond. Later she became gainer by applying lime and fertilizer in the pond as per the suggestion of the fisheries officer.

a. From which country 'Razpunti' fish was brought first in our country?
b. Explain one of the causes of not remaining most of the fish flies in the pond.
c. What is the amount of Urea and TSP fertilizer to be applied in Sheuli ’s pond?
d. What role can Sheuli ’s 'Razpunti culture' play in the society? Give your opinion.
Chapter 1

EXTENT OF FORESTS

Definition of forest

It is not easy to define a forest satisfactorily. However, a forest generally appears to our eyes as a vast area full of trees. On the trees, in the trees, around the trees live different wild animals, different birds, various insects and various mites. Forestry science designates a space as a forest if it has tall, woody plants. It is the primary characteristic of a forest. We shall not call an area a forest if it has only small trees and wild animals and no trees for timber. These areas are called savana.

In Bangladesh, you may come across natural forests in the hilly regions of Moulavibazar, Sylhet, Chittagong, Cox'sbazar, Khagrachari, Rangamati; in the plains of Gazipur, Tangail, Mymensigh, Rangpur and the coastal areas of Khulna, Bagerhat and Satkhira.

The tall, woody trees found in the rural homesteads do not qualify for a forest. These are popularly called rural forests. These rural spaces had different trees in the distant past but now they no longer enjoy the abundance of those sylvan shadows. Demand of land for agriculture, markets, urban ports, roads, educational institutions and dwelling houses cleared them of trees. The process of destruction of forest has begun since ancient times in the name of development and civilization.

Kinds of forests

The forests of our country do not belong to a single category. The forests of the hilly areas differ greatly from those in the coastal belt or ones in the plains of Bhawal or Madhupur. Generally, forests fall in groups over the species of trees; mode of origin; elevation of land; climate, etc. The forests of Bangladesh divide themselves into two kinds as regards their original characteristics:

1. Natural forests
2. Man made forests

Natural forests

A natural forest grows naturally. Almost all the forests of the world have grown naturally. The main characteristic of a natural forest is that different types of trees, wild animals, insects and mites co-exist there. On the basis of their location, the natural forests of
Bangladesh come under three heads:

1. Hilly forests
2. Plain land forests
3. Coastal forests

**Hilly forests:** These natural forests are found in the eastern parts of Moulavibazaar, Sylhet, Khagrachari, Rangamati, Bandarban, Chittagong and Cox's Bazaar. The area of hilly forests of Bangladesh is almost 1.36 million hectares. The tribal people of these regions have been practising Jhum cultivation by denuding the forests since they inhabited the area.

Laws regarding forest management in these regions are not effective enough. As a result, this vast area has now become almost barren, and different kinds of ecological problems have popped up. Valuable trees like garjan, chapalish, champaphool, telsur, shilkarai, etc. grow in these forests. Other forests and orchards have been created by the Forest Development Corporation in the hilly areas. Some trees of foreign species are also found in these forests and orchards. The well known foreign species are teak, mahogony, lohakath, etc. Different kinds of furniture and luxury items are made with the wood of these trees. Railway slippers are made of *Dipterocarpus* (Garjan) wood. Bamboos and canes are available in the hilly forests. Fashion goods and industrial materials are made with bamboo and canes. These industrial materials or handicrafts are of great demand in foreign countries. Bamboo is widely used in the construction of houses and in the paper mills. Many wild animals like elephants, hogs, deer, monkeys, wild fowls, reptiles, etc. are found in these forests. They have tremendous environmental effects. These forests control the water flow of the rivers of those areas. The hilly forests act as an enormous sponge.

Forests conserve rain water. During winter when there is no rainfall, water flow of the rivers is maintained by the leaching water of the hilly forests. Farmers produce winter crops by utilizing this water. The hilly forests help prevent excessive floods and soil erosion.
**Forests of the plains:** The forests scattered in the plains of Gazipur, Tangail, Jamalpur, Mymensingh, Dinajpur, Rangpur and Rajshahi are called the forests of the plains. Shal (Shorea) is the main species of these forests. So these forests are also called Shalbon (forests of Shal). They are also known as Gazari forests. They are also called Gazariban because stems grow from the stumps after the Shal trees are felled. The area of the forests of the plains is approximately 1.2 lakh hectares.

These forests of the plains are on the verge of extinction. They have been burnt down to meet the demands of additional agricultural land and dwelling houses. These demands are mainly due to excessive population growth. In order to prevent the destruction of these forests the Government has undertaken a programme of social afforestation with the active participation of the local people.

Shorea, Karai, Haritaki, Amloki, Bohera, Chalta, Turmeric, etc. are found in the forests. Shorea trees (shal) are very suitable for the pillars of houses. These forests supply sufficient fuel wood, too.

No more wild animals other than monkeys and some birds can now be seen in these forests. But there was a time when tigers, hogs, wild fowls, peacocks and other animals roamed these forests.

**Coastal forests:** The forests found in the saline coastal regions of Cox's Bazaar, Chittagong, Noakhali, Bhola, Khulna, Bagerhat and Satkhira are called the coastal forests. The area of these forests is almost 7.6 lakh hectares. The coastal forests of Khulna, Bagerhat and Satkhira are widely known as the Sundarban. Sundari is the main tree of these forests. The Sundarban is named after it. According to the terminology of forestry science, this forest is called a mangrove forest. The characteristics of these forests are that the trees there grow in the saline water of the coastal areas. They have respiratory roots. The sundarban is the largest coastal forest of the world. The area of this forest is almost 6.6 lakh hectares. The unparalleled beauty of this forest is its world famous Royal Bengal Tigers. The Sundarban is a proud possession of ours.

Trees for wood, fuel, leaves and spices abound in this forest. Sundari, Geyoa, Pashur, Bain, Kaora, Golpata, etc. are the most well known trees of this forest. Geyoa is used to make newsprint. Golpata is used for roofing and thatching houses. Sundari and Garan trees provide us with house building materials and fuel wood.
You will find the Royal Bengal Tigers, Chitra deer, Monkeys, Hogs, Crocodiles, Tortoises and many kinds of beautiful birds in this forest. Every year thousands of local and foreign tourists come here to see the Royal Bengal Tigers, Chitra deer, and to enjoy the natural beauty of this forest. This forest protects people and their properties from natural calamities. It was seen during the last tornados and tidal waves that damages were less in the coastal areas where there were forest plantations.

**Man-made forests:** Natural forests grow naturally. Man has no hand in it. On the other hand, man-made forests are the work of man. They are also called forest gardens. The man-made coastal forestry in Bangladesh covers an area of 1.34 lakh hectors. It is on the newly raised land. It is the first and largest in the world. The main trees of this forest are Kaora, Bain and Kankra. This forest protects the newly raised land from erosion by the sea. It also keeps the people of the small islets safe from the paws of tidal waves and cyclones.

These forests have also been made an abode of wild animals. Now deer, monkeys, many kinds of reptiles and birds are sighted in them. Forests are also being created on the two sides of roads, barrages and railway lines.

The creation of this forestry was first started by the government in the name of social afforestation. Now-a-days tree plantations are being done in many areas by non-government organizations. Mahogony, Shishu, Karai, etc. are the main trees of these forests. Besides supplying valuable wood, these road side trees spread their shade for the tired travelers and offer shelter and food to the birds. Moreover, afforestation is also being done on the bare spaces of the hills and the plains. The area of such forests on the hilly area is about 2.10 lakh hectors; in the plains, it is about 0.36 hundred thousand hectors.

**Extent of forests in different areas of Bangladesh:** The area of forest in Bangladesh is far less than required for its total land area. The forest area covers only 17 percent of its area. Moreover, this insufficient forest area is not uniformly spread throughout the country. Almost 90 percent of the forests are in the hilly areas of the eastern and southern coastal regions of Bangladesh.
Fig: Forest Land of Bangladesh
Division-wise forest areas are shown in the following table:

<table>
<thead>
<tr>
<th>Names of division</th>
<th>Area of forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Chittagong Division</td>
<td>700000 hectares</td>
</tr>
<tr>
<td>2. Khulna Division</td>
<td>600000 hectares</td>
</tr>
<tr>
<td>3. Dhaka Division</td>
<td>100000 hectares</td>
</tr>
<tr>
<td>4. Sylhet Division</td>
<td>8000000 hectares</td>
</tr>
<tr>
<td>5. Barisal Division</td>
<td>50000 hectares</td>
</tr>
<tr>
<td>6. Rajshahi Division</td>
<td>2894 hectares (Appx)</td>
</tr>
<tr>
<td>7. Rangpur Division</td>
<td>12332 hectares (Appx)</td>
</tr>
</tbody>
</table>

Because of this uneven distribution, forest materials are not easily available equally throughout the country. The government has undertaken the programme of social afforestation. Under this programme afforestation has been going on in the courtyards of the dwelling houses, offices and courts; on the sides of roads, barrages, fallow land, etc. It will play a great role in the creation of forest resources in the near future. It will also reduce pollution and improve the quality of environment.

The extent of forest in some countries of the tropical zone including Bangladesh is shown in the following table:

<table>
<thead>
<tr>
<th>Name of the countries</th>
<th>Percentage of forest land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>17</td>
</tr>
<tr>
<td>India</td>
<td>23</td>
</tr>
<tr>
<td>Srilanka</td>
<td>27</td>
</tr>
<tr>
<td>Thailand</td>
<td>29</td>
</tr>
<tr>
<td>Myanmar (Burma)</td>
<td>49</td>
</tr>
<tr>
<td>Peninsular Malaysia</td>
<td>36</td>
</tr>
</tbody>
</table>

This table reveals that our country is far behind others in owning forests. For healthy environment and for a steady supply of forest materials, the extension of forest is essential.
Exercise

Multiple Choice Questions

1. Which one is the tree of hill forest?
   a. Garjan  
   b. Sundari  
   c. Garan  
   d. Shal  

2. Forest of plain land is situated in –
   a. Cox's Bazaar, Bagerhat and Satkhira  
   b. Chittagong, Moulavibazaar and Khagrachari  
   c. Gazipur, Dinajpur and Rajshashi  
   d. Sylhet, Jamalpur and Khulna  

3. Preserving the rain water hill forest –
   i. prevent the over flood  
   ii. maintain the flow of the rivers during winter.  
   iii. prevent soil erosion.  
Which one is correct?
   a. i  
   b. ii  
   c. iii  
   d. i, ii and iii  

Read the following passage and answer question numbers 3 and 4.

Shaikat has seen different types of forest before. Shaikat has seen Sundari, Garan, Golpata, Geyoa etc. at the time of visiting the Sundarban with his uncle in the summer vacation for the first time. There he noticed much dissimilarity between this forest and the others.

3. The Sunderban is a –
   i. Mangrove forest  
   ii. Hill forest  
   iii. Coastal forest  
Which one is correct?
   a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii
4. What are the dissimilarities noticed by Shaikat between the Sundarban and other forests?
   a. The trees are more beautiful  
   b. The height of the trees is more 
   c. The trees have respiratory roots  
   d. The trees are grown disorderly.

**Creative Question**

The Agriculture teacher of class VII Mr. Zahid Hossain discussed in the class about the forest of 6 divisions of Bangladesh with the help of the following table.

<table>
<thead>
<tr>
<th>Divisions</th>
<th>Area (square kilometer)</th>
<th>Area of Forest (Square kilometer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhaka</td>
<td>31120</td>
<td>1000</td>
</tr>
<tr>
<td>Chittagong</td>
<td>33771</td>
<td>7000</td>
</tr>
<tr>
<td>Rajshashi</td>
<td>34514</td>
<td>150</td>
</tr>
<tr>
<td>Khulna</td>
<td>22273</td>
<td>6000</td>
</tr>
<tr>
<td>Sylhet</td>
<td>12596</td>
<td>8000</td>
</tr>
<tr>
<td>Barishal</td>
<td>13297</td>
<td>500</td>
</tr>
</tbody>
</table>

a. What should be the minimum area of forest of a country?

b. Why a certain area of forest is needed for a country? Explain.

c. Find out the percentage of forest of Bangladesh from the table above.

d. Plan a forestation program for the division of Bangladesh that has least forest in the table.
Chapter 2

PREPARATION OF SAPLINGS OF TREES IN THE NURSERY

Generally, afforestation is done by planting saplings. In some cases afforestation is done by planting stumps instead of saplings. It has two advantages: stumps can be transported easily. Their transportation cost is less than that of carrying saplings. In case of stumps, damage on the way is the minimum. Afforestation in hills and inaccessible areas with stumps saves money and time. However, there are some disadvantages, too. All kinds of trees do not grow from stumps. When afforestation is done with stumps, taproots of the trees cannot enter very deep into the soil. As a result, there is every possibility that the trees will be uprooted during cyclones. Of the trees planted with stumps, the most important ones are teak, gamar, etc.

Afforestation with stumps

Preparing the stumps

A stump is an essential part of a sapling. A length of 2.5-5 cm stem along with a length of 13-21 cm root of a sapling is generally cut to size for a stump. Steps of preparing a stump are shown in the following picture.

A stump is usually prepared with a 10-12 months old sapling. First of all the sapling is to be extracted with its roots. While extracting the sapling, care should be taken so that the stem and the roots are not affected. It is wise to wet the bottom of the sapling with water before extraction.

The sapling should be cut at one blow by a sharp sickle at a height of 2.5-5 cm towards the stem and 13-21 cm down towards the root. A 15.5-26 cm long stump can be prepared with such an extracted sapling. The cut should be oblique. This will check the possibility of the stump being pounded. A stump, prepared in this way, cannot be preserved for a long period. It should be planted in 2-3 days; otherwise, it will be unfit for plantation.

Planting stumps: The technique of planting stumps is not much different from that of saplings. The best time for stump plantation is the beginning of the rainy season. This is also true about planting saplings. A hole measuring 30 cm x 30 cm x 30 cm is to be
dug before 3-4 weeks of planting the stump. Mix 1 kg cow-dung, 40 gram TSP and 60 gram MP with the earth of the pit. Put it in the pit. The mixture will undergo a physical and chemical change. Thus food will be easily available for the stump.

The stump is to be planted after 3-4 weeks of the application of cowdung and fertilizers in the pit. At the time of planting, the contents of the pit should be turned upside down. It will balance the mixture. The stump is to be planted at the centre of the pit in a slightly diagonal position. During planting, it is to be noticed that only the root of the stump is covered with soil. Afterwards, the soil at the bottom of the stump is to be pressed well so that the stump does not move easily or the soil on the base does not go away with the rain water. If stumps are planted in the slopes of hills, there is a possibility of the stumps to be washed away with the strong current of rainwater. At the time of planting a stump, the soil at the bottom of the stump should be slightly raised to avoid water logging and the consequent rot of the stump.

10-15 days after the shoot has emerged from the stump, apply 10-15 grams of urea at the bottom of every stump. If the soil is fertile, you may not apply fertilizer.

**Inter-culture:** Many saplings are planted in our country every year. But most of the saplings die from want of nursing. If we want the saplings to mature, we must nursing and maintain the saplings, especially when we plant them in the lawns of our houses or offices or by the sides of roads, embankments and railways. In these areas the disturbance of cows and goats is more than elsewhere. Soon after the planting of saplings enclosures should be put up. They should be in place for at least 3-4 years. Generally, in 3-4 years the saplings grow to a height beyond the reach of the cattle.

For the first 2-3 years the saplings should be irrigated during drought. During this period the roots of the plant cannot go very deep into the soil. As a result, the saplings may die from want of water. On the other hand, weeds may grow at the bottom of the saplings during the rainy season. Those are to be cleared regularly. Saplings do not grow well if weeds grow at their foot. After 4-5 years the plants do not require nursing and gradually grow into a valuable tree resource.

**PRACTICAL**

**Title:** Observation and planting of stumps

**Materials:** Stumps should be more than double of the number of the students: spades, weeders or hand hoes, bamboo cages equal to the number of stumps, water pot, cow-dung, chemical fertilizers, etc.
Steps of the work
1. Before a month of planting, select the side of a road, or the lawn of a house or an office with the help of your class teacher.
2. Dig pits at the selected places.
3. Mix the cow-dung or fertilizer with the earth of the pits.
4. Ask your teacher to show you please how to groom stumps in the nursery of the school or in any one nearby.
5. Each of the students makes at least two stumps.
6. Plant the stumps in the pits already dug.
7. Post-planting intercultural operations such as irrigation, application of fertilizers, weeding, mulching, etc. should be done as and when required.
8. Write down your jobs chronologically in your practical notebook.

Exercise

Multiple Choice Questions
1. A stump is planted after its preparation within -
   a. 12 hours  
   b. 18 hours  
   c. 24 hours  
   d. 36 hours
2. The advantages of forestation by stumps is -
   i. Easy to transport
   ii. All trees can be planted by stumps
   iii. Forestation can be done in remote area.
Which one is correct?
   a. i and ii  
   b. i and iii  
   c. ii and iii  
   d. i, ii and iii

Read the following passage and answer the question numbers 3 and 4.
Mamun prepared land for teak trees. He dug a hole of certain size and he put certain amount of fertilizer into it. He planted stumps after a few weeks. He turned upside-down the soil mixed with fertilizer at the time of planting the stumps.
3. Mamun turned up-side-down the soil mixed with fertilizer at the time of planting the stumps because-
   i. soil and fertilizer can be mixed equally
   ii. stumps can absorb nutrient easily
   iii. stumps can consume fertilizer for a long time.

Which one is correct?
   a. i and ii  
   b. ii and iii
   c. i and iii  
   d. i, ii and iii

4. After how many weeks of applying fertilizer in the hole Mamun planted the stumps of teak trees?
   a. 1-2  
   b. 2-3
   c. 3-4  
   d. 4-5

Creative Question:
Paran Babu of Gazipur has gone to Khagrasori due to his service. He noticed that a lot of teak trees was planted in the slope of the hill by the management of government there. When he was coming back in his house during vacation he took 500 stumps of teak tree with him. Paran Babu planted those in a slope land a little bit away from his house. Paran Babu came back during vacation after three months and found that the saplings grew well. But later for a long time he could not take care of the plot. After one year he had seen that half of the plants were dead.

   a. What is stump?
   c. What are the causes of death of most of the plants of Paran Babu's plot? Explain.
   d. If most of the plants were not dead then the plot might be a wealth. Analyse it.
Chapter 3

TREE PLANTATION IN THE HOMESTEAD

Trees of many kinds we find in and around our homesteads in the village. Most of them bear fruits: mango, black-berry, jackfruit, tamarind, guava, jujube, wood-apple, olive, coconut, betel nut, etc. Some forest trees like Raintree, Karai, Kadam, Neem, Mandar, etc. also stand among them. Different species of bamboo are also planted in rural areas. Recently, forest trees like Mahogany, Teak, Shishu, etc. can also be seen in the yards of homesteads. Such configurations of trees in the spaces of rural homesteads are called rural forestry.

These rural forests of personal ownership improve the economic situation of their owners. As such they contribute significantly to the national economy. The villagers retrieve wood for their houses, furniture and fuel from these homestead forests. These trees provide different seasonal fruits. They ensure a family against economic mishaps. People sell these trees to collect money for marriage ceremonies of their sons and daughters, religious rituals and other special occasions. These trees lining the boundaries of homesteads have got immense environmental importance. They create a peaceful environment with their shade. Moreover, they protect the houses and their inmates from severe storms and cyclones. They stop soil erosion.

If we had sufficient trees in our homesteads, we would not have burn straw or cowdung for cooking. We could have used these organic matters as manure in our agricultural fields. It would have reduced the use of chemical fertilizers. As a result, the environment, especially water, would have been polluted less than now.

Population is on the rise in our country. People cut down the trees of their homesteads in numbers to meet the demand for dwelling houses and other facilities. They are not replenished in equal numbers; the gap widens progressively. For this reason, the number of trees in the courtyards of homesteads has dwindled disturbingly. As a result, the standing trees are not in a position to meet the demand of the increased population. It is, therefore, a necessity to plant trees in the yards of homesteads extensively.

In this section, we will discuss which trees will be profitable to plant in which part of the yard of homestead and also how saplings can be planted and cared for afterwards.
Site Selection for tree plantation

The site selection is an important step in homestead tree plantation. The things to be noticed for the site selection are: (1) The trees on the site will not make the house inaccessible to light and air.

(2) It should be surveyed well that the trees do not damage lives or sheds if they fall down during storms or owing to other reasons.

(3) It would be desired that the plantation would enhance the beauty of the homestead and create a refreshing environment.

The selection of plants and the locations of their plantation according to the guidelines mentioned above are discussed below:

The southern and eastern sides of the homestead should be kept open for enough air and light. On these sides small and medium size trees should be planted. These are Wood-apple, Guava, Coconut, Shishu, etc. On the south-western side of the homestead hard deciduous trees should be planted. The northwesterns usually strike our country from the southwestern direction. It is better if sunlight can enter the dwelling house in the afternoons in winter. So the trees that shed their leaves in winter should be planted on that side. Karai, Shishu, Teak, etc. are quite hard. They shed their leaves when winter sets in. These trees can be planted on the south and the west of the home.

All kinds of trees can be planted on the north, north-west and northeastern sides. If there is sufficient empty space in the homestead, bamboo is good for plantation on the north-eastern side.

Bamboo is an important commodity in the rural economy. Other big trees like Jamboline, Olive, Tamarind, Raintree, Mahogony, Mango, Jackfruit, etc. also qualify for a place on the northern fringe of a homestead.

Method of tree plantation in homesteads and inter-culture

The technology of tree plantation in homesteads and their nursing are similar to the tree plantation in other areas. The main advantage of the tree plantation in homesteads is that nursing of the trees can be done most carefully. On the other hand, the disadvantage of the tree plantation in homesteads is that the young trees are often eaten up by cows and goats.

To avoid damage by the cattle, it is wise to plant big saplings with strong fences around them. Two merits emanate from this technique:

Firstly, cows and goats cannot damage them. Secondly, young adult saplings bear
fruits soon. However, during planting big saplings, care should be taken so that the main root is not twisted or coiled up during planting or the roots are not damaged in any way.

The pit or hole should be dug one month before the start of the seasonal rains as done in other cases of plantation of trees. The pit would measure 50 cm X 50 cm X 50 cm. 10 kg of decomposed cow-dung, 50 gm of TSP and 50 gm of Potash are to be mixed with the soil of each pit.

The Texture should be kept in the pits for at least one month. After one month when the seasonal rains begin, the saplings are to be planted.

First of all, the soil of the previously dug pit is to be removed. It would be equal in quantity to the soil in the polybag holding the sapling. Then the polybag containing the sapling is to be cut with a sharp knife or a blade. Remove the polythene in the way shown in the picture. Take care the soil holding the sapling does not break up. After you have set the sapling in the pit, fill up the empty space around it with earth.

Notice two things during planting the sapling: the green portion of the sapling should not be covered with earth; the soil at the bottom of the sapling should be slightly raised so as to avoid water logging at the bottom. The sapling may rot and die from water logging.

To let the sapling attain maturity; nurse it properly and regularly. It also requires proper maintenance. In our country, many saplings die because we do not nurse or maintain them. So care should be taken for nursing the sapling. Nursing or intercultural operations after planting includes putting up a strong stick for support.
irrigation, cleaning the base of the sapling, mulching and the application of fertilizers, fencing, etc. These are discussed below:

**Support stick:** When a big sapling is planted, it is found that the sapling cannot stand upright. Many saplings lean on a side after plantation because of the force of cyclones, strong winds, etc. For these reasons, after the sapling is planted or at the time of planting, a bamboo stick should be posted on the ground near the sapling. The sapling is to be tied to the stick by a rope. The knot should be as loose as to allow the sapling swing comfortably. This bamboo stick is called a support stick.

**Irrigation:** The best time for planting saplings is the beginning of the rainy season. There is no need of irrigation during the rains. But during the drought, they need to be watered regularly in the evenings. When you notice the soil lacks moisture during the dry seasons, irrigate regularly.

![Fig: Support stick](image1.png) ![Fig: Irrigation](image2.png)

**Clearing the base of the sapling and mulching:** In our country, weeds grow everywhere. When weeds grow at the base of the saplings, they should be cleared regularly. Weeds take in moisture and nutrition from the soil. As a result, saplings cannot grow well. We know that the moisture of soil decreases during winter. If creepers, leaves, straw, water hyacinths, etc. are densely spread on and around the base of the sapling, moisture of the soil can be retained for a long time. As the straw decomposes eventually, it adds organic matter to the soil. As a result, the sapling grows well. The sapling remains fresh and strong during winter also. This way of spreading straw or weeds on the base of the sapling is called mulching.

**Application of fertilizers:** Generally, there is no need of applying fertilizers in the first two months after a sapling is planted. After this period, fertilizers are to be applied after observing the fertility of the soil and the growth of the sapling. The indiscriminate application of fertilizers may damage the sapling, the soil and the environment.
If the growth of the sapling is not as expected, fertilizers are to be applied after 3-4 months of its plantation. At this time 50 gram of urea is to be applied to a sapling in dibbling method. Application of fertilizers in dibbling method is that some 8-10 holes are to be made with a thin but hard stick around the base of the sapling. The holes are to be made 12-15 cm away from the base of the sapling; 50 gram fertilizer is to be equally distributed into these holes. If the soil is dry, soak it well with water after the application of fertilizers. If fertilizers are given in this way, misuse of fertilizers can be minimized, and the roots of the trees get fertilizers for a long period.

After the plantation of saplings, the application of fertilizers may continue for 3 years. During this time, fertilizers can be applied every year once at the beginning and once at the end of the rainy season. Each time 75 gram of urea, 50 gram of TSP 50 gram of MP are to be applied at the base of the sapling in the dibbling method. Afterwards, the tree will take care of itself and grow naturally.

**PRACTICAL**

**Title:** Planting of saplings in homesteads and intercultural operations.

**Materials:** Required number of saplings, spades, weeder, support sticks, bamboo cages, ropes, water pots, cowdung, chemical fertilizers, scissors or blades, etc.

**Steps of the work**

**A. Work to be done before 5-6 weeks of the planting:**

1. Prepare a sketch map of the homestead on the lawn of which saplings will be planted.
2. Mark on the map which variety of plants is to be planted on which side of the house.
3. Dig pits in the selected points and follow the tasks described in the next section.

**B. Work to be done during and after planting saplings:**

1. Plant the selected variety of the sapling in the pit.
2. Post a support stick on the ground and arrange for fencing.
3. Follow the post-planting nursing procedures.
4. Write down these activities serially in your practical notebook mentioning the date, place and time.
Exercise

Multiple Choice Questions

1. Which forest tree can be seen in homestead lawns?
   a. Sundari   b. Mahogony
   c. Geyoa   d. Gamar

2. By Mulching-
   i. The moisture of soil remains for a long time
   ii. It supplies manure to the soil
   iii. The sapling remains healthy in winter also.

Which one is correct?
   a. i and ii   b. i and iii
   c. ii and iii   d. i, ii and iii

Read the following passage and answer the question numbers 3 and 4.

Salam prepared a fallow land for his fruit garden. At Mid-May he planted plants of different size. It was seen that some plants were fallen due to storm at that night.

3. The plants of which size were fallen in Salam's garden?
   a. small   b. medium
   c. large   d. of all sizes.

4. What was the main duty of Salam after this storm?
   a. to give support stick straightly to the plants
   b. to cut the head of the sapling straightly
   c. to replace new sapling.
   d. to put soil at the bottom of the sapling keeping it straight.

Creative Question

Mr. Rashed takes decision to make a rural forest in his new house as a conscious man about environment. He has finished his plantation programme in his new house considering all the rules of plantation.

a. What is rural forest?

b. Mr. Rashed has given importance on which subject in case of plantation- explain.

c. Draw a design of planned plantation in Mr. Rashed ’s house.

d. What kind of role may be played by rural forest of Mr. Rashed in the national economy? Give your opinion.
Chapter 4

INTRODUCTION OF TREES

We like to give some primary but important information about some valuable trees. We know the names of many trees mentioned in the chapter. But we do not know much how they look; where they are found; when their fruits mature or when their seeds are to be collected; how the quality of their wood is; how to utilize their wood, etc. It is necessary for us to know all these. If we are informed, it will be easy for us to decide when the seeds of which trees are to be collected or which trees are to be planted for which purpose. An introduction to Shilkarai, Chapalish, Debdaru, Jarul, Mahogany and Teak is given below:

Shilkarai: Shilkarai is found almost everywhere in Bangladesh. It is a big deciduous tree. Deciduous trees shed their leaves in winter. On the other hand, the trees that do not shed their leaves in winter are called evergreen trees such as Debdaru. Shilkarai grows 25 metres tall the maximum. The bark of this tree is smooth and slightly yellowish-white. Its stem is straight and round.

The fruits of this tree mature in mid-March to mid-May (Chaitra- Baishakh). They look like a long, flat bean.

In order to get mature seeds, the fruits are to be collected in mid-March to mid-May (Chaitra-Baishakh). If the collected fruits are dried in the sun for some days, they will burst and the seeds will come out. Seeds are flat and round in shape. Almost 8 to 10 thousand seeds weight one kilogram. The seeds of Shilkarai can be preserved after drying them well in the sun.

These seeds can be used next year for growing saplings in the nursery. Seeds of this tree are sown in nurseries in the months of Jaistha-Asharh (mid May to mid July).

The wood of Shilkarai is slightly black, heavy and durable. Its wood can be well utilized in making frames of doors, windows, and the legs of chairs and tables. It is also used for making pillars and furniture. During winter, its branches can be cut down for use as fuel-wood. Their leaves and fruits are good food for cows.

Chapalish: Chapalish is not found much in rural areas. But it is sufficiently available in the hilly forests. Chapalish is an evergreen tree. It grows big. Branches grow adequately on this tree. The stem is straight and round. This tree grows 30 meters tall. Its bark is not smooth and looks brownish.

The fruits of this tree mature during the month of Asharh-Shraban (mid of June to mid of August). The fruits look like jackfruits but very small in size. Animals and birds
are very fond of its fruits. Its seeds are to be collected from the mature and healthy fruits. Its seeds cannot be preserved. So they are to be sown fresh in the nurseries for the production of saplings. 2000-2500 seeds weight one kg.

The wood of Chapalish is yellow. It is very hard and durable. For being comparatively light, this wood is mostly used for making chairs, tables, almiras, etc. Its branches can be used as fuel-wood.

**Debdaru:** Debdaru is noticed everywhere in Bangladesh. It is a fascinatingly ornamental tree. It is an evergreen tree. It grows large in size. It grows 30 metres tall. Its stem is straight and round; the bark is smooth and looks greenish. Its branches are slender. Recently debdaru trees of small size are seen in urban areas, these are called drooping debdaru. The slender branches of this tree hang towards the soil. It is planted on the two sides of roads as ornaments.

The fruits of this tree mature during the months of Shrabon-Bhadra (mid of July to mid of September). During this time the mature and healthy fruits are to be collected. These fruits are kept in the gunny bags to rot in water; later on they are collected one by one. Its seeds cannot be preserved. Soon after collection they need to be sown in the nursery.

The wood of debdaru is soft. Its wood cannot be used for making strong furniture. But its wood is very cheap. Its wood is used to make wooden stools, chairs, tables, etc. in rural areas. Debdaru is well-known as an ornamental tree. Its branches are widely used in making gates on the occasion of marriage ceremonies or festivals.

**Jarul:** Jarul is hardly found in the rural areas now-a-days. You may come across it in low-lying areas especially by the sides of the waters. Jarul can mostly be seen in the low-lying areas of hilly forests of Bangladesh. It is a deciduous tree of medium size. This tree does not grow more than 15 metres in height. Normally, its stem is not straight, slightly crooked. Its bark is smooth and appears gray.

During Baishakh-Jaistha (mid of April to mid of June) beautiful flowers of bluish colour appear on this tree. Fruits of this tree mature during the months of Poush-Magh (mid of December to mid of February). In order to collect good seeds, the mature and healthy fruits are to be collected during this time. Afterwards these fruits are to be dried in the sun and then the seeds are to be extracted from the fruits. These seeds can be preserved after they are dried in the sun. More than one hundred thousand seeds make a kilogram. The seeds of Jarul are to be planted in the nursery after the end of winter.

The wood of Jarul is very hard and durable. It is used for making boats, windows,
doors, stools, bodies of trucks, etc. The wood of Jarul is heavy and crooked. It is not usually preferred for furniture. The flowers of Jarul are very beautiful. Jarul may be planted on both sides of roads as ornamental trees.

**Rain Tree:** Rain trees grow fast. They are also called Rendi Karai or Phool Karai. They grow big and branchy in a few years. They reach a height of 15-20 metres. Their stems are round. They are usually planted on the borders of homesteads and the sides of roads. They give shade on the roads.

Rain trees also grow on wet land. They shed their leaves at the end of winter. Every year they can be pruned and their branches and twigs can be used as fuel-wood. Their wood is used for constructing houses and making furniture. They bloom in Bhadra-Ashwin (mid August to mid October). Their fruits ripen in the months of Chaitra-Baishakh (mid of March to mid of May). Their seeds are to be collected during this time. Their saplings are produced by sowing the seeds directly on the soil. Saplings may be raised in polybags, too.

**Mahogany:** Now-a-days Mahogany is a common scene everywhere in Bangladesh. It is an exotic tree. There are many forests of Mahogany in the hilly regions of Bangladesh. Mahogany is a large evergreen tree. It reaches a height of 30-35 metres. Its stem is straight and round, and the bark is reddish brown and rough.

The fruits of Mahogany mature in the months of Magh-Falgoon (mid of January to mid of March). During this time, the healthy fruits are to be collected for seeds. After they are dried in the sun for some days, the fruits burst and the seeds come out. The seeds of Mahogany are light, flat and of reddish colour. Many seeds can be obtained from one fruit. 2000-2500 seeds make one kilogram. Seeds of Mahogany are shy of preservation. They need to be sown immediately in the nurseries after collection for sapling production in Mag-Falgoon (mid of January to mid to March).

The wood of Mahogany is deep black. It is very strong and durable. It can be polished nicely. It is used for making beautiful furniture. Luxurious handicrafts are made with this wood.

**Teak:** Teak is a very popular wood tree. Now teak can be found almost everywhere in Bangladesh. Teak grows well in the eastern hilly regions of our country. It is also an exotic plant and traveled from abroad.

Teak is a large deciduous tree. It grows about 30 meters tall. Its stem is straight, elongated and round. Its bark is smooth and light brownish. The fruits of teak mature in from mid-December to mid-February (Poush- Magh). During this time, the mature and healthy fruits are to be collected. The entire fruit of teak is to be used as seed.
seeds of teak can be preserved after they are sun-dried. A kg contains 2000-2500 seeds. The common practice is that in mid-May (Baishakh) when the seasonal rain starts, the seeds are sown in the seed-beds or in polybags. In natural condition, the seeds take a few months to germinate. It is better to process the seeds before sowing.

Teak gives very high quality timber. It is light but very durable. It is yellowish. Its fibres are very delicate. It can be easily polished to a desired quality. The furniture of improved quality can be made with this wood. This wood is also used for luxury items. Teak is the most expensive timber in our country.

**An easy method of processing teak seeds**

First of all, the seeds are to be kept in a gunny bag. Then the gunny bag is to be dipped in water and kept there for 3-4 days. After this, the bag is to be raised and dried in the sun. Then again the bag is to be kept under water for 1-2 days. At this stage, the seeds are to be collected from the bag and kept in a heap in a light shady place. The seeds are to be covered with gunny cloth. The gunny cloth is to be wetted intermittently. If the seeds are kept in this state for some days, they will germinate and be ready for sowing in beds or polybags.

**PRACTICAL**

**Title:** Introduction trees

**Materials:** barks, leaves, fruits, seeds and wood of the tree selected for the practical class are to be collected. If possible, it will be helpful to go to that tree.

**Steps of the work**
1. Be familiar with the name, size and height of the tree.
2. Notice the smoothness and colour of the bark.
3. Observe the size of the leaves, colour of the flowers, size of the fruit.
4. Watch the size and weight of the seeds.
5. Write down sequentially the information you have got from your observation in the practical note book.
Exercise

Multiple Choice Questions

1. Which one is the ever green tree?
   a. Debdaru    b. Jarul
   c. Rain Tree  d. Teak

2. Which are foreign trees?
   a. Shilkarai and Chapalish  b. Rain Tree and Teak
   c. Debdaru and Jarul       d. Kadam and Nim.

3. The timber of Jarul is strong and long-lasting. So it is good to make-
   i. furniture
   ii. doors and window
   iii. body of boats and trucks.
Which one is correct?
   a. i and ii     b. i and iii
   c. ii and iii   d. i, ii and iii

Read the following passage and answer the question numbers 4 and 5

Mr. Karim made some chairs and tables by one Debdaru tree out of five in his house and sold the rest at taka 200 per tree. For each tree cost of cutting and transportation was taka 200.

4. How much money did Mr. Karim earn by selling the Debdaru tree?
   a. 6000/-   b. 6800/-
   c. 7200/-   d. 7800/-

5. Debdaru tree gets taller up to –
   a. 10 meter  b. 20 meter
   c. 30 meter  d. 40 meter
Creative Question

Mahabub Alam of Faridpur thought to plant Debdaru tree in a large, highs and slope land at the back of his house. But he decided to plant deciduous big Teak tree following the advice of his friend. Mahabub Alam collected the seed and planted it in seedbed at the month of 'Magh' (January). He became anxious as the saplings were not germinated for a long time. He went to his friend and his friend told him that the saplings of Teak were not germinated because the seeds were planted without proper processing.

a. What is deciduous tree?
b. Describe one of the practical importance's of timber of teak.
c. How could Mahabub Alam process the seed of teak to produce the sapling properly.
d. How logical the decision was to plant Teak rather than Debdaru? Give your opinion.
বঙ্গবন্ধুর স্বপ্ন- দারিদ্র্য ও নিরক্ষরতামুক্ত সোনা বাংলাদেশ গড়তে নিজেদের যোগ্য নাগরিক হিসাবে গড়ে তোল

- মাননীয় প্রধানমন্ত্রী শেখ হাসিনা

গুরুজনকে মান্য কর

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Preface

Education is the key to development. A progressively improved education system largely determines the pace and the quality of national development. To reflect the hopes and aspirations of the people and the socio-economic and cultural reality in the context of the post independent Bangladesh, new textbooks were introduced in the beginning of the 1980s following the recommendations of the National Curriculum and Textbook Committee.

In 1994, in accordance with the need for change and development, the textbooks of lower secondary, secondary and higher secondary were revised and modified. The textbooks from classes VI to IX were written in 1995. In 2000, almost all the textbooks were rationally evaluated and necessary revision were made. In 2008, the Ministry of Education formed a Task Force for Education. According to the advice and guidance of the Task Force, the cover, spelling and information in the textbooks were updated and corrected.

To make assessment more meaningful and in accordance with the need of the curriculum, Creative Questions and Multiple Choice Questions are given at the end of each chapter. It is hoped that this will reduce the dependency of students on rote memorisation. The students will be able to apply the knowledge they have gained to judge, analyse and evaluate real life situation.

The economy and development of Bangladesh is dependent on agriculture. The study of Agriculture Science is the main instrument to acquire the necessary skills for development of agriculture. In the lower secondary classes learners need to know about the technology that can be applied in the field of agriculture. They also need to learn both theoretical and practical aspects. Keeping this in mind Agriculture Science, gardening, crops & planting, forestation, pisciculture, livestock management, etc. have been included in the syllabus. Importance has also been given to develop self-employment and social values through practical classes. Agriculture Science has been made compulsory from class VI to class VIII from 1994.

This book of Agricultural Science for class VII is the English Version of the original textbook entitled 'Krishi Shiksha' written in Bangla.

We know that curriculum development is a continuous process on which textbooks are written. Any logical and formative suggestions for improvement will be considered with care. On the event of the golden jubilee of the Independence of Bangladesh in 2021, we want to be a part of the ceaseless effort to build a prosperous Bangladesh.

In spite of sincere efforts in translation, editing and printing some inadvertent errors and omissions may be found in the book. However, our efforts to make it more refined and impeccable will continue. Any constructive suggestion towards its further improvement will be gratefully considered.

I thank those who have assisted us with their intellect and efforts in the writing, editing and rational evaluation of this book. We hope that the book will be useful for the students for whom it is written.

(Prof. Md. Mostafa Kamaluddin)
Chairman
National Curriculum and Textbook Board
Dhaka.
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