Agriculture Studies

Class Seven






National Curriculum and Textbook Board, Bangladesh

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Agriculture Studies

Class Seven

Revised for the year 2026

National Curriculum and Textbook Board, Bangladesh

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Preface

The importance of formal education is diversified. The prime goal of modern education is not to impart knowledge only but to build a prosperous nation by developing skilled human resources. At the same time, education is the best means of developing a society free from superstitions and adhering to science and facts. To stand as a developed nation in the science and technology-driven world of the 21st century, we need to ensure quality education. A well-planned education is essential for enabling our new generation to face the challenges of the age and to motivate them with the strength of patriotism, values, and ethics. In this context, the government is determined to ensure education as per the demand of the age.

Education is the backbone of a nation and a curriculum provides the essence of formal education. Again, the most important tool for implementing a curriculum is the textbook. The National Curriculum 2012 has been adopted to achieve the goals of the National Education Policy 2010. In light of this, the National Curriculum and Textbook Board (NCTB) has been persistently working on developing, printing, and distributing quality textbooks. This organization also reviews and revises the curriculum, textbook, and assessment methods according to needs and realities.

Secondary education is a vital stage in our education system. This textbook is catered to the age, aptitude, and endless inquisitiveness of the students at this level, as well as to achieve the aims and objectives of the curriculum. It is believed that the book written and meticulously edited by experienced and skilled teachers and experts will be conducive to a joyful experience for the students. It is hoped that the book will play a significant role in promoting creative and aesthetic spirits among students along with subject knowledge and skills.

Bangladesh is basically an agro-based country. Keeping the challenge of 21st century ahead in mind this textbook has been developed to introduce a technique to build up modern agricultural system by capitalising agricultural science and information technology, the best utilisation of limited land, implementation of appropriate technology to bring out the highest amount of crops. It is expected that this textbook will develop students competency on both theoretical and applied agriculture as to help keeping positive role in socio-economic development.

It may be mentioned here that due to the changing situation in 2024 and as per the needs, the textbook has been reviewed and revised for the academic year 2026. It is mentionable here that the last version of the textbook developed according to the curriculum 2012 has been taken as the basis. Meticulous attention has been paid to the textbook to make it more learner-friendly and error-free. However, any suggestions for further improvement of this book will be appreciated.

Finally, I would like to thank all of those who have contributed to the book as writers, editors, reviewers, illustrators and graphic designers.

October 2025

Professor Robiul Kabir Chowdhury
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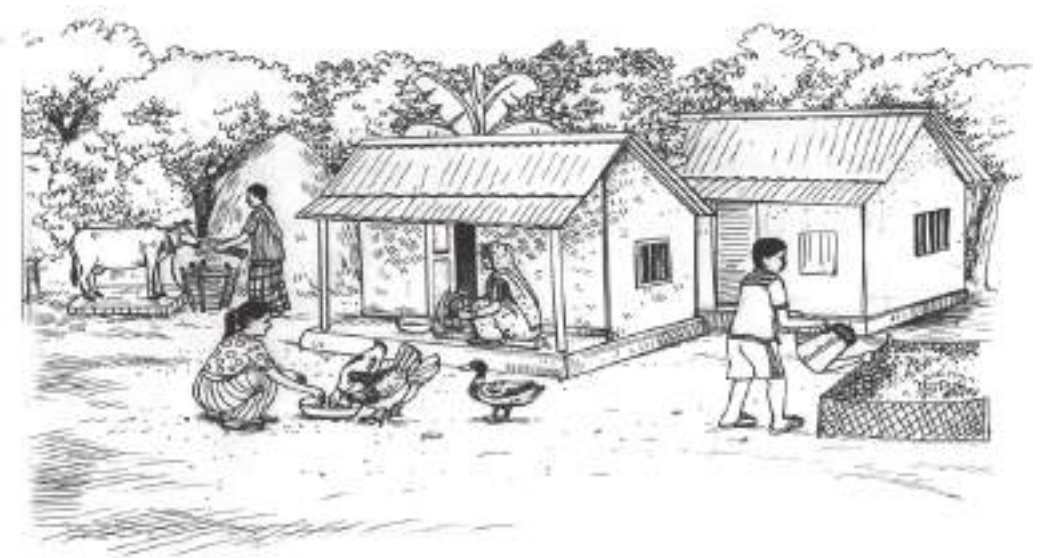
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Chapter One

Agriculture and Our Culture

Agriculture has a relationship with culture. The history of human society has marched forward with people's adopting agriculture. Agriculture has been developed as the prime means of production of the basic needs like food, clothing and housing for man. People have been giving continuous efforts for thousands of years to make human life safe and joyful. During this process family, human society and state were established under different environment into different regional and national characteristics. The production related achievements with the passage of time have been regarded as human culture. This interrelationship between culture and agriculture is discussed in this chapter.



At the end of this chapter we will be able to -

- explain the role of agriculture in developing family and society ;
- relate scientific agriculture and people's dependence on farmers ;
- relate the agricultural production with changing agricultural environment in different seasons ;
- describe the various agricultural production ;
- relate cultural heritage with agricultural seasons.

Lesson-1: Agriculture in forming a family



Fig-1.1: Happy family of parents and two children

Our family and society were formed centering agriculture. Before that, men used to depend on collecting fruits and vegetables from trees and shrubs for their food or they hunted wild animals. Men used to move together to save them from attacks of wild animals. They used to hunt in groups. They did not have any idea about a family. While collecting fruits and vegetables or during hunting they enjoyed wide opportunity to closely observe nature and environment. The mothers living in the caves had a greater opportunity to closely observe the events of nature and environment as they had no work outside. They observed that the seeds of fruits germinated at the place where they had been thrown earlier after eating and they became the same tree. The intelligent women saved the seed from the best fruit and sowed these after loosening soil of the surroundings of cave. When the seedlings emerged they took care of the seedlings and allowed those to grow and in time harvested the fruits. In this way the women started agriculture. Human beings learned the use of fire and they learned how to control it in the era of hunting. Women didn't take time to learn using fire to boil or roast plant and parts of the plant just as they roasted hunted animals.

Most of the fruits could not be stored for a long time after ripening, they started rotting. Therefore, there was a search for the crops which could be stored for a longer time. Thus the importance of cereals like rice, wheat, and pulses were realized because these crops could be stored for quite a long time after harvesting. As a result food crisis decreased. Woman bec me the center of this production system. A peasant woman chose a man for herself to start her own family. This couple and their children formed a family. Through much experience some rules and regulations regarding marriage and family, were formed which were usually obeyed and followed by the families. Some of the rules and regulations are still valid. A family is the smallest unit of a society. This understanding was set at that time. At present families are known as the social,

economic and cultural organization of human society. Nowadays the families are regarded as the provider of all out security to its members, not only the food security. A family protects its members with affection, love, morality and responsibility. The members of the family distributed and performed the responsibilities of a family according to their age and ability.

Activity : Discuss in groups about the an wer of the following two questions to prepare answer and present in class.

1. How did the cave woman initiate agriculture?
2. How did a peasant woman prticipate in formation of a family?

Lesson-2: Agriculture in the Formation of a Society



Fig-1.2 : Social meeting

You must have observed in most of the cases that a farmer works in the field to grow crops. He harvests the crop and brings it home. The farmer's wife undertakes post harvest cares of the crop to store them. The rural women raise poultry in the households. In most of the cases the male farmers take the charge of animal farms, poultry farms for his agricultural production. Earthen-wares are produced by artisans; commodities made from iron like sickles, knives, spades, axes etc. are produced by blacksmiths and so on.

In the early age the family members distributed family responsibilities among themselves according to their respective abilities. This initiated division of labour among the people of a society. Division of labour played a role in the formation of a society. In course of time, the family started growing bigger and the number of the families increased. By nurturing crops, men learnt boosting up agricultural production. They also gathered experiences in long time storage of agricultural products. As a result the area and function of agriculture expanded faster. To adjust themselves with this growth in agriculture, certain changes came along in the human habits and habitats.

Families started giving up cave dwelling and started building households. For that, they collected and cleverly used the building materials like soil, timber, bamboo, and leaves etc. from nature. Several households formed a village. Agriculture made people conscious of environment as they observed that raising crops depends on easonal changes. Thus farmers learnt about cropping season. To produce different materials needed by these households and also in agriculture, some people developed greater efficiency and skills over others in a particular art, and were engaged in that particular job. Potters started making potteries and blacksmiths started making metallic tools. Thus division of labour gave rise to a society where everybody had a role to play. The anthropologists identify this society as an ancient agro-based society. Every member of such a society used to produce according to his/her ability and skill, and consumed according to their respected need. Everybody had equal rights on land and natural resources. They all were united to make their villages safe. In such original pastoral societies there were a lot of problems too. These problems included natural calamities, wild animals and from external aggression to family feuds. The society used to solve these on the basis of general consensus. The desire was to make life easy and happy. The society chief was elected democratically. The chief used to coordinate different issues and performances following the heritage and conventions of the society.

We can see people used their intelligence and labour in making agriculture as the prime means of production. They elevated agricultural practices high to higher level and continuously spread the area of agricultural production. So, agro production system created demand for humanitarian and social changes. For this reason,we can say that agriculture played an important role to develop humanitarian faculties and ethics. The value that the family is more important than 'I' and the society is greater than 'my family' originated in the ancient society. The agro based society could not have progressed without such social values.

Evil thoughts and evil power which aroused among some members of the society also played its role in the transformation, evolution and mutation of human society. Greed and selfishness were major evils. At certain time the agricultural production was in surplus. That means it surpassed the social annual requirements. Some of the members of the society intended to grab

this surplus production . They started putting up this or that reasons why they must be allowed to take this extra. Then they demanded private ownership. It is easy to understand that they were the powerful and cunning persons of the society. Some of the democratically elected chiefs showed such attitudes and actions.These cunning persons were not content by grabbing the surplus productions only. At one stage, by virtue of their muscle power they proclaimed that the election of a social leader was no longer required, it would be inherited. This resulted in two major changes in the society - 1. Private ownership of land wealth, and 2. Feudalism based on inheritance were established. Therefore, the leader of the society became the owner of the land and natural resources while the people of the society became taxpayer subjects. Eventually this became the law. The subjects or tenants had to submit a portion of their products to their landlord. Though the feudal system did not change the production process, variety of agro-based production increased and a kind of agricultural marketing got developed. For the sake of the development of agricultural technologies and to meet the daily requirements of human life, agro-based industry, such as food processing, agricultural machineries, textile etc. flourished one after another. With the advancement of agricultural technologies, and widening of marketing scope, investment of capital in this sector increased.

Lesson-3: Dependence of human being on agriculture and farmers

Agriculture is an inseparable part of our life. Many of our important needs like food, clothing, housing, health, education, entertainment etc. are fulfilled by agriculture.

Food: Food is essential for our survival. Agricultural practices were once developed for the production of food. Still now the main target of agricultural activities is attaining self-sufficiency in food. Food is necessary for the survival of human and man depends completely on agriculture for their food production .

Clothing: Fiber crops are the raw materials for the production of cloth and clothing. Jute and cotton are our main fiber crops. Leather and wool obtained from animals are also used to produce clothing. Agriculture and farmers have

big role in producing fiber crops. People are becoming dependent more and more on natural fibers as they are environment friendly and hygienic. In Bangladesh, area for cultivating cotton is expanding fast.

Housing: Rural housing largely depends on agriculture worldwide. Not only houses, the furniture used in those houses are made from timbers which are supplied by farmers.

Health: Balanced diet is essential for maintaining good health. Agricultural products provide this balanced diet. Human beings are dependent on medicinal plants for the treatment of their various diseases from ancient times. With the advancement of herbal ayurvedic and unanni branches of medicare, cultivation and use of medicinal plants have been extended simultaneously widening the role of farmers in this sector. For various reasons, the tendency of using medicinal plants in treating patients has gained momentum nowadays. Thus, cultivation of these medicinal plants has increased and is being profitable. Among such plants aloevera, stevia, nigella, garlic, etc. gained popularities. One may make a long list of medicinal herbs, shrubs, and trees like chirota, clove, neem, and so on. Not only for human health, extracts of neem leaves, alamanda leaves and garlic have been successfully used to treat and protect cultivated crop from diseases. Extracts of the leaves of Basok and Tulsi are used for curing cough. The extracts of Thankuni and Air plant (Patharkuchi) are also used for curing dysentery. The biggest advantage of using such medicinal plants is that they have no side effects and they are environment friendly.



Fig-1.3: Medicinal Plants

Education: Writing paper is made from sugarcane trash, bamboo and gewya. Pencil is made from the wood of cedar mangrove tree.

Entertainment: Agriculture is a great part of our culture. There is a relationship between our cultural diversification and entertainment with agriculture and

farmer like our seasonal diversification. Agriculture and farmers have contribution in creating folk music *Jaarishari*, *Vatiyali*, *Kobigaan*, *Jatrapala* etc. The farm-workers make their hard work lighter and amusing by collectively singing *vawaia, vatiyali, jaarishari* and other country songs. During 'Nobanno' we see hectic activities of making varieties of cake in the houses.

Activity- Make a list of the products manufactured from the following agro raw materials

Agro raw materials	Products
Rice, cotton, jute, straw, bamboo, garlic, nigella, neem, tulsi, aloevera	Finished rice, rice flakes, popped rice, thread, cloth, carpet, hat, a model house, tablets, oil, capsule, extract, soap, cosmetics.

Lesson-4: Agricultural Environment, Seasonal Cycle of Bangladesh and Agricultural Production

The Seasonal Cycle of Bangladesh and Agricultural Production

Bangladesh enjoys six seasons in a year. The bananas and papaya can be mentioned as examples of season-neutral crops. Except the agricultural products like bamboo, timber, canes almost all other field and horticultural crops are seasonal. To satisfy the consumer demand throughout the year now, the agricultural scientists are engaged in breeding season-neutral varieties of crops. In the mean time several such crop varieties have been released to farmers. It is expected that number of such crop will grow fast. In case of rice, besides the *Aus* varieties (which are naturally season neutral) some BRRI rice varieties have been released, and they are also season neutral. Jute is a very much day length sensitive crop. Therefore, the jute seeds have to be sown within the month of April (between 15th of Chaitra and 15th of Boishakh). For seedlings the seeds of 'Boro rice' must be germinated on the onset of spring in the seedbeds as the seedlings have to be transplanted before the start of April between the last week of Boishakh and 15th of Chaitra.

To meet the demand of market, different leafy vegetables like jute seedlings, coriander leaves, Indian spinach, red and green amaranth, bottle gourd,

sweet gourd, pointed gourd, okra, and tomatoes are grown round the year with special care.

Soil : Though the riverbed areas of Bangladesh are rich in alluvial sandy loam soil, we also have high lands where soil is red, and mostly clayey. The soil in the haor areas is rich in organic matters and black in colour. These areas remain under water for a particular period of the year. Thus, because of soil variety agrobased works also become varied.

Agricultural Seasons : Though Bangladesh is a land of six seasons, there are three agricultural seasons. They are Rabi (winter), Kharif-1 (Summer) and Kharif-2 (Rainy season). There are variations of agricultural production in the different seasons. Such as, vegetables grow in plenty in the winter and fruits in summer. Specially fruits grow in plenty in the month of 'Jaistha'. This is why this month is also called 'Madhumas' in Bengali.

Geographical location of Bangladesh : Bangladesh is located in the subtropical area of the world. In the south of Bangladesh lies the Bay of Bengal, from where clouds are formed . Driven by monsoon wind**,** these clouds move to the north to be stopped by the Himalayan ranges. This causes heavy rainfall during monsoon (post summer rainy season). This same hill range is creating obstacle as a wall to stop the chilly Siberian wind to save this area from extreme cold. Thus Bangladesh is neither too cold nor too hot. This is the reason for our bio diversity, especially plant diversity.

Lesson-5: Diversity in Agricultural production

Diversity in Agriculture in Bangladesh: Diversification in the flora and fauna in Bangladesh is multilateral. Different types of grains, flowers, fruits, vegetables, building materials, fibers and medicinal plants can be grown in this country. On the other hand, this country is not lagging behind in the diversification of poultry, domestic animals and fishes . As a result products of animal origin like meat,milk, eggs etc. are also produced abundantly.

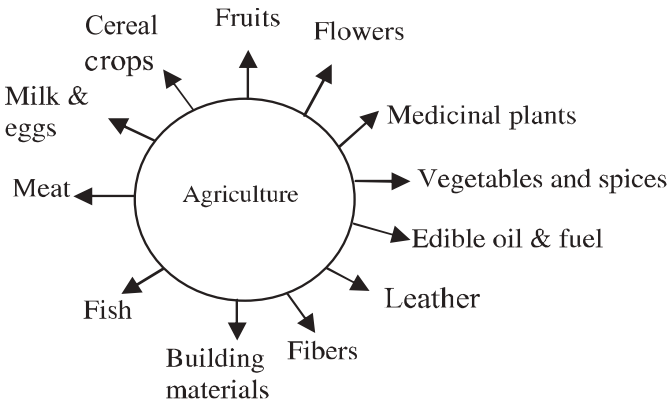


Fig-1.4: Diversity in agricultural products

Diversification in Field Crops : The crops which are grown in open fields are called field crops. The examples of field crops are rice, jute, wheat, sugarcane, various kinds of pulse etc. These are all grown in the open field. The most widely grown field crop in our country is rice. The other important field crop is jute. In the past it was called the golden fiber of Bangladesh because Bangladesh earned lot of foreign currency by exporting jute. Bangladesh is one of the top most jute producing countries. Presently area of jute production is increasing. It is expected that jute will soon regain its respectable place in our national production and economic growth. Our country is very rich in field crop diversification. As a rice growing country, Bangladesh used to produce about 200 cultivable varieties of rice even 50 years back. Modernization of agriculture can be a cause of reduction in crop diversification. We have the example of reduction of crop diversification in our country due to socio-political reasons. For instance, extensive cultivation of high yielding variety rice has caused the extinction of many domestic rice varieties. In Bangladesh only hundred years ago different varieties of cotton were grown. Once upon a time a very fine variety of cotton was produced in Bangladesh and it was used to produce the finest Muslin in the world. That variety unfortunately got extinct. However, production of different high yielding variety of cotton in our country is expanding. Every year new varieties of exotic plants, flowers, fruits and vegetables are being introduced in our country from different countries of the world. These introduced plants are adding to the diversification of agriculture and social forestry.

Lesson-6: Diversification of Horticultural Crops

Fruits, flowers, vegetables, spices etc are considered as horticultural crops.

Fruits : Jackfruit is our national fruit. We are not yet aware how many varieties of jackfruits are grown in Bangladesh. Jackfruits are grown in highlands where flood waters cannot be stagnant. Next to jackfruit the most popular fruits are mangoes, and pineapples. These fruits are grown in abundance in our country. Visible diversification in oranges, lemons, bananas, Jujube etc. can be observed. Papayas and bananas are available round the year though most of our fruits are seasonal. Besides these, there are dozens of varieties of lemons of different flavours and taste are available throughout the year in this country. Recently the cultivation of the exotic fruit- strawberry has become very popular in our country. Our soil and environment are favourable to this fruit.

Vegetables : Farmers of our country grow various kinds of vegetables. It becomes very diverse during winter or within 'Rabi' season. Cauliflower cabbage, tomato, potato, broccoli, bottle gourd, kohlrabi, radish etc are mentionable in winter season vegetables. Among summer and rainy season vegetables pumpkin, pointed gourd, bitter gourd, ribbed gourd, snake gourd, sprout are important. There are red amaranth, spinach, Indian spinach, young jute leaves, water amaranth etc. among the leafy vegetables. The cultivation of papaya, green banana, brinjal, red amaranth etc is done also all the year round.

Flower : Hundreds kinds of flowers, including the aristocratic Roses to common Jesmine and Marigold are grown in this country. It is difficult to meet a person here who can recognize all the flowers which bloom on this land. You would hardly find a person who would not be pleased when presented with some flowers. So flowers are our happy possessions in our culture. Nowadays marketing of flowers has increased as a profitable production in urban life. Even some flowers are being exported abroad.

Spices : As people of a hot humid country we are very fond of spices and condiments. Chilies, turmeric, onions, garlic, ginger, bay leaves, coriander, etc. are produced in our country as spices.

Fuel: In Bangladesh, a portion of fuel for domestic use comes from agricultural practices. Dry plants of different field crops like jute, Dhaincha, maize, pigeon pea and pulses can be used as fuel. Husks of paddy after milling rice, is a good fuel. Moreover, wood from fruit and forest trees are popular as fuel.

Edible oil : Mustard is a popular oil crop in Bangladesh. For last few decades, sun flower and soyabeans have gained popularity as oil crops. Recently edible

oil is being produced from rice bran as milling by-product.

Other Oils : Ground nuts, Nigella etc. oil crops are traditionally parts of agricultural diversification of this country.

Medicinal plant: Plants like Neem, Tulsi, Aloevera, Shotomuli are commonly recognized as medicinal plants in Bangladesh. Besides, garlic, turmeric, nigella, clove etc. are also being used as raw materials to produce different medicine and cosmetics.

Building materials : Bamboo, timber, canes etc. are used as building material in this country.

Raw materials for different industries : Many agricultural products like wood, timber, jute, cotton, indigo, agor, sandalwood are plant product which are used in industries. Besides, hides of slaughtered large animal, horns, bones, wool etc. are used as raw materials in different industries. These are part of our agricultural product diversification.

Activity: Through group discussion in the class fill in the following chart and present it in the class.		
Name of the crops	**Field crops**	**Horticultural crops**
Paddy, tomato, jute, wheat, sugarcane, bottle gourd, maize, mango, jackfruit, and carrot.		

Lesson-7: Diversification of Products of Animal in Agriculture

Fish: Bangladesh is a country of hundreds of rivers, canals, swamps, ponds, natural and artificial lakes. For that matter, this country is blessed with different kinds of fresh water fishes. For this reason, fish is a popular food item. Thus, the Bengalees has a distinct identity as a great enthusiast of rice and fish eaters. Pisciculture is thus a very important branch of agriculture in our country. Culture of fish in ponds and other water reservoirs is profitable too. Therefore, a subsidiary industry, for producing fish feed has been developed.



Fig-1.5 : Shrimp

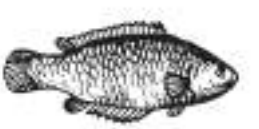


Fig-1.6 : Climbing fish

Nowadays, most of the domestic requirements of fish is met by the fish farms of our country. Experts predict that dependence on cultured fish will increase day by day. In the initial stage, mainly carps (ruhi, katal, mrigel) were cultured. For the last few years, fishes like 'pangas' and Telapia have become very popular for their easy availability and low price. In addition to these fishes, the tasteful fishes like 'pabda', 'koi', 'magur' and 'mola' are also being cultured and marketed. Tiger shrimps are being cultured in the coastal saline water and giant fresh shrimps in the fresh water. A lot of foreign currency is being earned by exporting these fishes.

Crabs : Though crabs are not very popular in this country as a food item, these are being commercially cultured in some areas of the country as an export item.

Chicken and eggs: Since independence of Bangladesh, poultry farming has gained importance. But poultry farming as a household activity has always been a long tradition. A local chicken is delicious but it has low level egg production capacity. Regular poultry farms grow various breeds of layers and broilers, and their management practices are also different.



Fig-1.7: Chicken

Ducks and Duck-eggs : Production of ducks and duck-eggs are popular among the farmer families not only in the areas where natural water reservoirs like 'haors', 'baors', and 'bils' exist but also in the areas where water is available in ponds and canals. Among the different domestic duck varieties 'Khaki Campbell' is popular for its high level egg production.

Other birds : Pigeon raising commercially has been popular in this country for a long time. At present the production of koel and its egg attracts the farmer.

Goat : Among the ruminant animals goat is quite popular. We get milk, meat and hide from goats. Several varieties of goats are domesticated but among them the best local variety is the 'Black Bengal'. This medium sized animal is non-violent and easy to be raised . Meat obtained from this 'Black Bengal' is of very high quality and taste.



Fig-1.8: Goat

Lamb : Though lamb is available throughout Bangladesh, it is commercially grown only in a few areas. Meat obtained from lambs also meets the demand of animal protein. Lambs are less attacked by diseases and small amount of land is needed for farming them. Moreover wool is made from them.

Cow : To the farmers of Bangladesh, cow is the best choice among the large animals. Domestication of cow probably has started with agricultural civilization. As if there is a spiritual relationship between a farmer and his cows. The indigenous bred cows are smaller in size, but they need a light ration of feed, and they are more tolerant to diseases. Some Indian bred cows are raised here for mainly milk. For the same reason, some breeds of cow from Australia and New Zealand have become popular amongst our dairy farmers.

Buffalo : In some areas of Bangladesh buffalo farming is popular. Milk from buffaloes is liked by sweetmeat producers as its milk has higher density. Several breed of buffaloes are raised in our country at different selected areas.

Goats, lambs, cows and buffaloes give us high quality meat, milk, hides and wool. Besides that, the horns and bones are raw materials for some industries for the production of certain products.

As a country located at sub-tropical region of the world and as the country blessed with hundreds of rivers, Bangladesh has a great variety of agricultural products. Proper breeding and farming of these diverse flora and fauna, promises a bright future for Bangladesh.

Activity: Through group discussion in the class make a list of domestic animals. Mention the animals which are usually raised in your area for farming and describe their economic importance.

Lesson-8: Agriculture in Bangladesh and Culture

The Harvest Festival (Nobanno Utsob) : All the members of a farmer's family become very happy when after a hard toiling the new harvest of paddy is brought home and stacked on the threshing yard, leaving behind all the odds like natural calamities, diseases, pests etc. and also the anxieties from being looted way. They become busy in thrashing, winnowing, drying and storing the paddy in the granary. On the other hand the female members remain busy with 'Dheki' in husking the paddy to get some fresh rice and rice flour.

Besides boiled rice, they prepare rice pudding and cakes out of the fresh rice. The seasonal workers of the farm house get new dresses and other gifts from the household chief. Domestic helps get new saree, bangles, lace, ribbon etc. Without going anywhere these things can be bought from the hawkers in exchange of new rice. Nobody is turned away, not even the beggars.



Fig-1.9 : Nobanno Festival

All irrespective of caste or religion joins the festival known as 'Nobanno'. The time and location may vary depending on agricultural environment and the harvest of the main crop. In case of 'Boro rice', it may happen in the Bengali month of Boishakh, and in such case Bengali New Year festival may get blended with that of Nobanno Utsob. And in case of Amon rice harvest, the Nobanno festival may get mingled with the autumn festival. In both cases festivals get a grand gala nature.

Bengali New Year : The First of Boishakh is the Bangali New Year's Day. Everywhere there creates a festive atmosphere centering the New Year's Day. An important part of Bengali New Year festival is 'Mela'. 'Mela' starts in the last day of Bengali year (Chaitra Sankranti) and in the morning of the first day of Boishakh. The villagers buy all their household utensils including earthen pot, jhuri, chopper (tha) etc. The businessmen in the markets entertain their customers on the first day of Boishakh. The customers are entertained with sweets for paying their previous dues. The other name of this ceremony is 'Halkhata' (opening a new book). The new year festival is enriched with Jatrapala, kabigan and several types of games and sports.

Village Fair : Village fair is mostly connected with the Nobanno Utsob and New Year festival. In such a fair the small traders find a place to open up their shops with various essential commodities. The entrepreneurs of different rural industries bring their products for marketing in this fair. The weavers



Fig-1.10: Social and Cultural fair

sell their products like *saree*, *gamchha*, and *lungi*. The artisans bring their earthen potteries and other earthen products. Ironsmiths come with metal products. Various bamboo based commodities are also sold in this fair. In such a village fair 'Jatra' or 'Palagaan' is organized for the recreation of the villagers and this continues for the whole night. People from far away join this enjoyment. These village fairs are actually economic, social and cultural gatherings.

Activity: Present in the class after group discussion.

1. How is the Bengali New Year celebrated in your locality?
2. Describe a village fair that you have visited.

Exercise

Multiple Choice Questions

1. Which one of the following is a medicinal plant?

a. Paddy b. Jute
c. Aloevera d. Cauliflower

2. In the feudal production system-

i. Variety of agricultural products increased

ii. The production process of agriculture developed

iii. Agricultural marketing got developed

Which one of the following is correct?

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

Read the following paragraph and answer the questions 3 and 4.

In the madhumas Jhuma's grandfather carried a basket full of juicy fruits in the midst of drizzles, but when he reached their home, they became very happy.

3. In which season, did Jhuma's grandfather come to visit their house?

a. Summer b. Rainy season
c. Autumn d. Late Autumn

4. The fruit basket of Jhuma's grandfather was full of-

i. Mango

ii. Orange

iii. Jackfruit

Which one of the following is correct?

a. i & ii b. ii & iii

c. i & iii d. i, ii & iii

Creative Questions

1. Rafiq, a small businessman came back to his village from town after suffering a loss in his business. It was very tough for him to meet the daily requirements of his 6 member family. Besides a small house in the village, he owned a medium sized pond and 50 decimals of crop land. Eventually, as he was advised by his uncle Altaf Master, he began to work on one of his rural assets. Soon, besides meeting the family demand for animal protein he made a handsome profit. Later, he started engaging his other agricultural assets.

a. In how many ways did men collect food before they started agriculture?

b. Explain the reasons why banana is called a season neutral fruit.

c. Describe how Rafiq started earning profit by engaging his agricultural wealth.

d. Evaluate the ways Rafiq employed his agricultural assets in the context of our demand for food.

2. Rahim Miah has cultivated several kinds of field and horticultural crops in his fields. All the members of his family started celebrating the harvest festival.

a. When did men learn how to use and control fire?

b. Write down the characteristics of a family.

c. Explain how the activities of Rahim Miah help to meet up the demand for food.

d. Analyse the relationship of the agricultural activities of Rahim Miah with the festival mentioned above.

Short Answer Questions

1. What are horticultural crops? Explain.
2. What is the Navanna festival? When is it held?
3. How many agricultural seasons are there, and what are they?

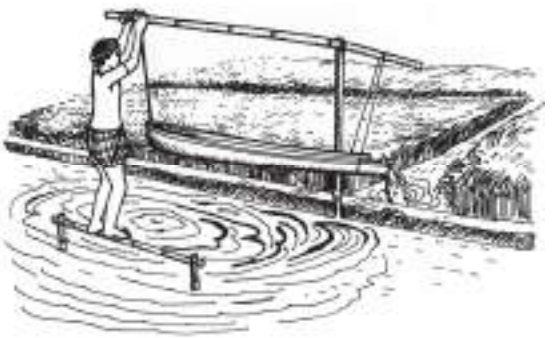
Assignment: Submit a description to the teacher about the role of agriculture in the revolution of human society.

Inquiry based work: Collecting the sample of different field and horticulture seeds.

Chapter Two

Agricultural Technology

We live in an era of technology. We are using modern technologies in every walk of our lives. Agriculture is a scientific work . Many techniques have been developed to make agricultural practices easy. The farmers are using these techniques, as appropriate, in their crop field as well as in the multiplication of plants and animals. Again, technology is being used in fish farming as in managing poultry and dairy. Innovation of sustainable agricultural techniques are increasing with continuous research.





At the end of this chapter we will be able to -

- explain the field techniques being employed in agriculture.
- analyse the use of technology in the reproduction and multiplication of plants and animals.

Field Techniques Used In Agriculture

Lesson-1: Necessity of Irrigation and Enhancing Its Effectiveness

Necessity of Irrigation

We know that without irrigation or if there is shortage of water, growing of crops is not possible. But this irrigation water has also been wasted. The source of water is either underground or above ground, water needs to be drawn by the use of a technique. Farmers need extra labour and money to compensate the cost of wastage of irrigation water. Therefore, care must be taken so that irrigation water is not wasted in any form. By reducing the waste, effectiveness of irrigation can be maximized. Water loss may be caused by: 1. evaporation, 2. trickling down of irrigated water and 3. leaking.

Evaporation: Irrigated water from the crop fields get evaporated in the same way as the water of pond, lake, canal and other reservoir is being evaporated because of radiation and heat from the sun. It is very difficult to check or stop this process. However, just adequate irrigation at proper time should be the strategy.

Trickling down of irrigation water: Irrigation water passes through the air pockets of porous soil and trickle down through the soil layers. It is called trickling down of irrigation water. Such loss occurs if there is no impervious layer of soil which can stop trickling down of water. Creation of a hard layer under the surface soil of crop field or irrigation channel can minimize such loss.

Leaking of water: This is almost similar to the trickling down process. However, the difference is that through trickling down water goes downward deep into the soil of the same land while through leakage water passes to another plot or land where irrigation is not intended. Sometimes rats create holes in the alleys of the crop field through which water may pass and reach the neighbouring plot. Therefore the alleys between plots must be checked regularly and should be mended.

Increasing the effectiveness of irrigation

Sufficient and timely irrigation in a crop field maximizes the utility of irrigation. Some techniques for increasing the benefit of irrigation are listed below-

1. Supply of required amount of water.
2. Irrigation at a proper time.
3. Strong alleys are to be raised around the crop field.
4. Irrigate in the afternoon or in the evening.

5. If the plants are planted in lines, irrigation should be applied in furrows between the lines.
6. Texture of the soil of the crop field should be taken into account as well, while estimating the need for the water to be supplied.
7. Before supplying water through the channel, the channel itself should be checked and secured or permanent irrigation channel should be made.
8. Right method of irrigation should be practiced.
9. Slope of the irrigation channel should be given towards the crop field.
10. Rat should be controlled.
11. Sufficient organic matter should be added to soil of the crop field.

Large Irrigation Project in Bangladesh

For better irrigation of farmlands, the government has undertaken many irrigation projects. Most of these irrigation projects are controlled and managed by the Water Development Board of Bangladesh. In such project areas the farmers can grow crops like aus, amon and boro rice, jute, wheat, potatoes, vegetables and fruits round the year. They could go for crop diversification as well. The names of some of these irrigation projects are listed below:

1. The Ganges- Kopotaksha irrigation project (G-K project)
2. Barisal Irrigation Project (BIP)
3. Bhola Irrigation Project
4. Thakurgaon Deep Tube well Project
5. Chandpur Irrigation Project (CIP)
6. Muhuri Irrigation Project (MIP)
7. Pabna Irrigation and Rural Development Project (PIRDP)
8. Meghna-Dhonagoda Irrigation Project
9. Karnafuli Irrigation Project (KIP)

Activity: Visit crop fields to observe the wastage of irrigation water if any. And also observe the measures taken to minimize such loss. Write a report and present in the class.

New words: field techniques, evaporation, trickle down, leakage.

Lesson-2: Irrigation Methods

Crop fields can be irrigated in different ways. Choice of irrigation method depends on the type of land, nature of soil, source of water, kind of crop cultivated etc. Some methods of irrigation are mentioned below-

1. flood irrigation, 2. furrow irrigation, 3. border irrigation, 4. circular irrigation, and 5. sprinkler irrigation

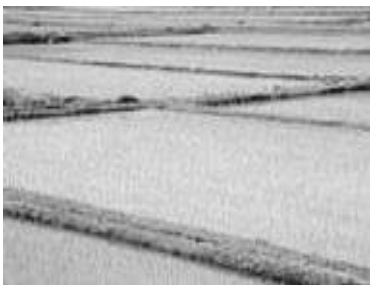


Fig-2.1: Flood Irrigation

Flood Irrigation: This type of irrigation is suitable for flat land with the water drawn from nearby ponds, canals, and other water reservoirs, and then flown through a channel to the crop field. To avoid leaking of water to the neighbouring fields strong alleys are raised around the crop field. This method is suitable for the following reasons:

1. A large area of crop field can be irrigated in a short time.
2. Channels and furrows are not needed within a crop field.
3. Flood irrigation is effective for plain land.
4. Requires less labour and time.
5. In the fields where crops are grown in broadcast method, this irrigation is effective.
6. In case of crop fields having a slope, water must be retained by making strong and sufficiently high alleys.



Fig-2.2: Furrow irrigation

Furrow Irrigation: This is very suitable for crops being raised in lines. Furrows are dug in between the plant lines towards the slope of the plot. Then water is allowed to flow along these furrows, usually one after the other. Depth and length of these furrows depend on the length and the topography of the plot. Where the plot is flat, the length of the furrows will be longer and where the plot is slope, the length of the furrows will be shorter. In this method:

1. Delivery of water can be regulated easily and there is no possibility of water logging.

2. The whole crop field can be systematically irrigated.
3. Water loss can be minimized.
4. Erosion of soil is also minimized.
5. Same amount of water can be distributed to a larger area compared to flood irrigation.

Border Irrigation: In this method the crop field is divided into small blocks taking into consideration the topography of the crop field. Water is supplied to the blocks from the main channel. Each block is connected with a main irrigation channel which is usually situated on a higher ground. Water is allowed to flow to one block after another. In this system, an arrangement is created to drain out excess water through another outlet along the slope. In this method:

1. water management is easy.
2. less wastage of water occurs.
3. Less soil erosion is caused.

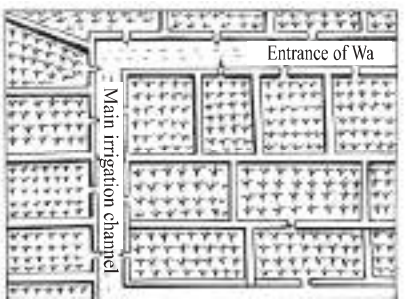


Fig-2.3:Border irrigation

Circular Irrigation: In this method, water is not supplied to the whole field. Only the soil around a tree is irrigated. This method is suitable for fruit orchards and social forest. Here a main water channel is dug in the middle of two tree lines. A circular furrow is dug keeping the foot of the tree at the center. This circle is connected with the main water channel. In this method-

1. Wastage of water is minimum.
2. Management of water is very easy.

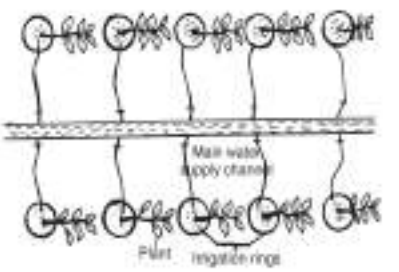


Fig-2.4: Circular irrigation

Sprinkler Irrigation: Sprinkling water, similar to rainfall, on the plants is done in this method of irrigation. This method is suitable for watering seedbeds, potted plants, grass-lawns, ornamental plants and leafy vegetables. The method of watering the seedbeds or plants by using watering cans in our country belongs to sprinkler irrigation.


Fig-2.5: Sprinkler irrigation

Activities: Visit a crop of vegetable field and observe how the farmers are irrigating their field. Prepare report on the irrigation system and present it in the class.

New words: irrigation, flood irrigation, furrow irrigation, border irrigation, and circular irrigation.

Lesson-3: Concept and Purpose of Drainage

Adequate amount of irrigation is good for the growing crops but excess water is harmful. Removal or withdrawal of excess water from the crop field is done through a drainage system. Stagnant water in the rice field may be beneficial for rice cultivation but for most of the other crops it may be even fatal. For example papayas cannot tolerate excess of water. Seeds cannot be sown until excess of water is drained out from the field or seed bed. When the soil is over saturated with water in a field, one cannot transplant vegetable or flower seedlings or fruit tree or social forest tree plantlets. Therefore water must be drained out when it is in excess. Draining out water from the crop field after a heavy rainfall is necessary.

Drawbacks of excess water

1. In the water saturated soil aeration is minimum. Air movement is hampered at the root zone area of soil. As a result, due to lack of water, root i.e, the growth of root is hampered.
2. As water stagnates for long, the closed parts of soil become filled with water. As a result the area becomes oxygen depleted and the roots of crop get rotten causing the death of trees.
3. Growth of beneficial microorganisms is seriously hampered.
4. Availability of some plant nutrients is reduced.

Purpose of Drainage

1. Increase aeration in soil.
2. Activate root functions.
3. Increase activities of beneficial soil microbes.
4. Balance soil temperature.
5. Restore perfect soil condition for sowing and transplanting.



Fig-2.6: Water drainage by furrow method

Drainage techniques

1. Digging temporary drainage channel.
2. Pumping out of excess water from the field.
3. Establishing a permanent drainage system.
4. Blocking excess water by making dam
5. Diverting the water supply channel.

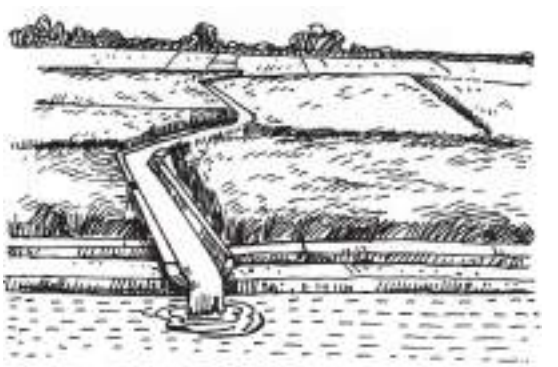


Fig-2.7: Water drainage by permanent furrow

Activities: Make a group discussion on the proper way of rapid drainage of rain water lay stagnant on a papaya field and present it in the class.

New words: drainage, colonization, microbes, soil aeration.

Lesson-4: Water Treatment in a Fish Pond

Culturing fishes in ponds is a very familiar agricultural technology. Successful use of this technology is possible when the environment in and around the pond supports healthy and fast growth of fishes. It is very important to retain the quality of the pond water for profitable cultivation of fishes.

The water in the pond may be spoiled in different ways. Pond water may not be able to retain sufficient oxygen in dissolved state. Due to unavailability of oxygen fishes may suffocate and eventually die. Besides causing economic loss to the fish farmers it further deteriorates the environment by rotten fishes. For this reason, pond water should be treated to supply fish adequate oxygen and save them from intoxication and other microbial infections. This situation can be managed in the following ways:

1. Lack of dissolved oxygen in water: This is a common problem in ponds specially in rainy days. It may occur in the morning or in the evening or any time in a day. It may also happen in a cloudy day, sometime after rainfall. The visible symptom of oxygen deficiency is that the fishes come up at the surface of water and gobble to draw oxygen from the air. Soon some of the fishes die. The following measures should be taken to avoid such deterioration of pond environment.

A. Swimming in the pond: Usually the water in the pond is quiet and without any current.Water from one area of the pond can hardly be transported to another area. Therefore oxygen does not get dissolved in sufficient quantity. Swimming in the pond allows the water to be re-oxygenated. Young people can be encouraged to swim in the pond.



Fig2.8.: Swimming in the pond

B. Pounding pond water with bamboo: Hitting or pounding pond water with the help of a bamboo for an hour or two will stir and mix pond water very well. Pounding can start from one side and end on the other side of the pond. During this process oxygen from the air gets dissolved in pond water making it healthy again.

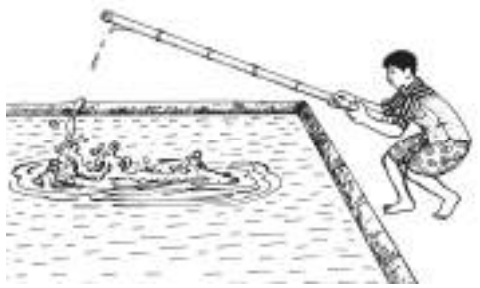


Fig2.9: Pounding pond water with bamboo

2. Opaqueness of pond water: This may be caused by several reasons, such as suspension of soil make the water in the pond muddy and non transparent. If it rains continuously for a few days rain water may cause erosion to the bank of the pond and add mud in the pond water, making it opaque. Following techniques may be used to make the pond water clean and transparent:

A. Adding quick lime at the rate of 1 to 2 kg per decimal in pond area for making pond water clean through sedimentation.

B. Adding 240 grams of alum per decimal of a 30 centimeter deep pond to clear the water through sedimentation.

C. The easiest and less costly technique is to dip 12 kg straw per decimal in the muddy water.

3. Acidity and alkalinity (pH) of pond water: Determining the pH, acidity and alkalinity of pond water can be understood. It is determined by pH metre . The acceptable range of acidity or alkalinity of a fish pond is between 6.5 and 8.5. Problem arises if the acidity or alkalinity becomes more or less than the acceptable range. As for example, if it is below 6.5 fish gills rot, if it is above 8, fishes get less hungry for food, become weak. As a result, they easily become vulnerable to diseases.

The following procedures can be used to adjust the pH of pond water to normal level.

A. Application of lime: If the water is too acidic (pH below 6.5), it can be treated through application of 1 to 2 kg of lime per decimal.

B. Dipping branches of tamarind or drumstick (shajna) tree: This may be practiced where the pond water is too alkaline (pH-above 8.0). The branches should be kept as such for 3-4 days.

4. Green algae layer at the surface of pond water: The quality of water in a fish pond may be affected when a greenish algal layer covers the surface of water. The water of the pond turns deep green. This hampers normal movement of fishes and they reach the surface for oxygen. For water treatment, one of the following measures can be taken depending on the pH level of water.

A. Use of Copper Sulphate: 12 to 15 gram copper sulfate dissolved in 2 to 3 liters of water may be mixed with the pond water.

B. Use of lime: Application of 1 kg lime per decimal may be enough to clean the pond water.

Activity: Visit some fish ponds to observe if they are polluted. Notice the measures taken by the fish farmers. Prepare a report and present it in the class.

New words: Oxygen, acidity, alkalinity, pH, susceptible, vulnerable, copper sulphate, lime, algae, algal layer.

Agricultural Technology in the Reproduction of Plants and animals

Lesson-5: Seed Multiplication Technology in Agriculture

The foremost technology to be cited for plant multiplication is the production of seeds of high yielding varieties. The Bangladesh Agricultural Research Institute is engaged in breeding seeds of high yielding varieties for vegetables, wheat, mustard, potato etc. Among the vegetables are tomato, brinjal, bottle-gourd, cauliflower, cabbage, broccoli, chili etc. These high yielding varieties, reach the farmers and they grow better crops, and earn profits. For example they can even grow tomato in summer, brinjal and bottle-gourd throughout the year and many more.

The Bangladesh Rice Research Institute has so far developed and released 121 high yielding varieties of rice. Bangladesh Institute of Nuclear Agriculture (BINA) has added some more rich varieties. As contributions of the high-yielding varieties, Bangladesh has attained almost self-sufficiency in food.The number is growing almost every year. Among the high yielding rice varieties some are mentioned below.

Aus: BR9 (Shufola), BR14 (Gazi), BR16 (Shahi Balam) etc.

Amon: BR11, Mukta, BRRI dhan30, BRRI dhan33, BRRI dhan 40, BRRI dhan44 etc.

Boro: BRRI dhan28, BRRI dhan29, BRRI dhan36, BRRI dhan 50 (Bangla moti), BRRI hybrid-1, etc.

Seed multiplication is a highly technical job. The prime objective of this job is to restore the qualities of seeds. Agriculturists are relentlessly working on the seed multiplication of the different crops preserving and blending their desirable characters. For that matter they are employing new techniques and procedures, thus seed multiplication technology refers to production of standard quality seed, management of seed quality and storage of seed. The seed scientists suggest the following measures to be taken to produce standard quality seeds.

1. **Preservation of purity of seed:** The identity of a seed is provided by its origin. Therefore during seed multiplication strict care must be taken so that seeds from different origin do not get mixed with the working seed.
2. **Isolation of seed crop from commercial or normal crops:** In this case the isolation means growing the seed crop keeping a safe distance from commercial crops of the same species. In many cases, keeping a safe distance become difficult. In such case a borderline of the same variety of the seed crop must be raised around the designated seed crop. This will lessen possibility of cross pollination and genetic mix up.
3. **Treatment of Seed:** Seeds may bear diseases as being infected or as contaminated with seed-borne pathogens. That is why seed should be treated before sowing. There are several chemicals that can be used to treat seeds. For example Granosan-m, Vitavex-200, etc.
4. **Seed sowing method:** Timely sowing is important. The soil in which seed has been sown should have adequate moisture. Line sowing is preferred and for that matter a seed dispenser could be used.
5. **Rouging:** This is an important procedure for keeping purity of multiplied seed. In this process seedlings of unwanted origin are uprooted and destroyed along with the weeds. Rouging should be done also in case of the appearance of any disease symptoms. Rouging for maintenance of purity should be done before flowering.

6. Intercultural operations:

i. Seed plot must be kept free from weeds.

ii. Insects should be controlled at proper time.

iii. Adequate irrigation and drainage should be done.

7. Harvest of seed crop: Seed crop should be harvested as soon as they have been mature and ripen. Delay may expose the crop to rain, hailstorm, and contamination with seed-borne pathogens. Extra care should be taken that the seed crop may not suffer from injury during harvest and post harvest operations.

8. Drying of seeds and storage: The seeds should be adequately dried. For example, right seed moisture level of grains like rice and wheat is 12% and this seed moisture level should be maintained for storage. Too much of drying may make seeds brittle that is not desirable. Seeds to be preferably stored in air tight earthen or metallic containers which should be dry and clean. Malathion may be sprayed to protect seeds from insects.

Production of Quality Seeds

Quality seeds are produced in three steps:

1. Basic seed
2. Foundation seed
3. Certified seed

Farmers should not use any seed other than certified seed. If anyone uses the seeds without core instead of certified seeds, he may not get good crop. The Seed Certification Authority (SCA) certifies seeds after completing required seed testing procedures. The steps of quality seed production are described below-

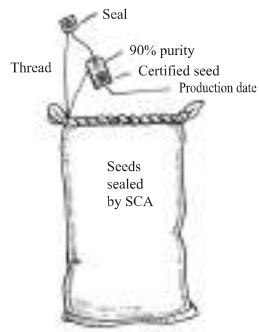


Fig-2.10: Certified seeds

1. Basic seed: The seed having high genetic character is produced in the research institute with intensive supervision by the plant breeding scientists and it is called basic seed. Usually basic seeds are produced in small quantity. These seeds are not for sale.

2. Foundation seed: The seed which is produced in a controlled environment from basic seed in the farm of the seed production institute is called foundation seed. This foundation seed is also not for sale.

3. **Certified seed:** Seeds produced by the seed certification authority in a controlled atmosphere are called certified seeds. This may also be called the release of a cultivable variety. The SCA issues a certificate in this respect. These seeds are sold to the farmers.

Activity-1: Visit a farm enlisted with Bangladesh Agriculture Development Corporation (BADC) and observe whether the conditions are followed in multiplying certified seeds. Report your findings to your class teacher.

Activity-2: After making arrangement with your class teacher visit an agricultural research organization and observe how the basic seeds are produced.

New words: purity of seeds, isolation basic, foundation and certified- seeds, treatment of seed rouging, seed moisture.

Lesson- 6 : Raising Seedlings from Seeds

Seedbed must be prepared to produce seedlings. For winter vegetable seedlings the seedbeds should be prepared in the months of Ashwin and Kartik and for Summer vegetables seedbeds are to be prepared within the month of Falgun and Chaitra. For early varieties of crops seedbed can be made one month earlier.

The seedlings of fruits, vegetables, seasonal flowers and agro-social forest plants are usually raised in the seedbeds. Among these are tomato, cauliflower, cabbage, brinjal, chili, capsicum, papaya, and Indian spinach, etc.The seedlings are transplanted to the main field when they are 30 to 35 days old. The size of an ideal seedbed is usually 3 meter x 1 meter. In a standard size seedbed usually 10-12 gm seeds can be sown as per varieties.

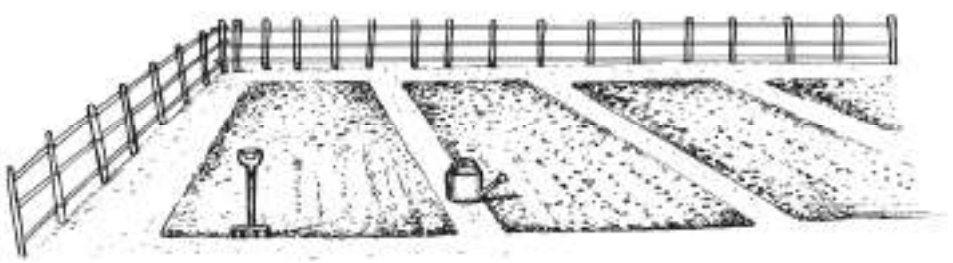


Fig-2.11: An ideal seedbed area

Seedbed should be prepared in sunny, airy, fertile, high land near a source of water. It should be noted that the seedbed is at least 10 centimeters above the main land. There should have a 30 cm wide alley in between two adjacent seedbeds. Rotten cow-dung and Urea should be mixed with soil of the seedbed.

Then seeds should be spread in the bed and covered with loose, fine soil. The seedbed should be leveled with a wooden plate. Seedbed should be watered daily. It is better to water seedbed with a handheld sprinkler so that water is sprinkled like rain drops. Seedlings grow in 3-4 days. Care should be taken so that seedbeds do not get dry. The seeds having thick seed coats may take some more time to sprout. Such seeds should be dipped in water for 24-48 hours before sowing for quicker germination. Arrangement should be there to cover the seedbeds to save seedlings from scorching sun and rain.

As the age of seedlings increases, their heat tolerance increases as well. However, water should be applied with sprinklers, preferably in the afternoon. The soil should be loosened with a hoe.

Seedbeds may be attacked by insects and diseases. Appropriate measures need to be taken in consultation with agriculture officers. Usually 10 liter of water mixed with 4 teaspoonfuls of malathion-57 EC can be spread in the seedbed Infected and diseased seedlings should be uprooted carefully and be burnt down or buried deep into the soil.

Seedlings of cauliflower, cabbage etc. are better to be transferred to a second seedbed before planting in the main field. When the seedlings grow faster, 10 gram Urea may be dissolved in water and be sprinkled in seedling beds. Straws may be placed on seedbed to preserve moisture. When seedlings reach the age of 4-5 weeks, these can be transplanted to the main field.

Before uprooting the seedlings to transplant, the seedling bed should be moistened by sprinkling water. The best time for uprooting seedlings is the afternoon. Seedlings should be uprooted carefully with a sickle so that the root system is not injured much. The seedlings need to be carried in a basket for transplantation. For transplantation of a seedling, a pit should be prepared in the field with a sickle and the seedling should be placed in the pit just as it was in the seedling bed.

Activity : Select a suitable site around your house where 3m X 1m seedbed can be made.

1. Produce seedlings in the seedbed,
2. With a spade loosen the soil of the selected space,
3. Seedbed should be at least 10 cm high from the ground level,
4. Mix up 10 gm urea with rotten cowdung and spread and mix it with the soil of the seedbed. Sow seeds 2cm below the surface of the seedbed,
5. Everyday give sprinkler irrigation to the seedbed. The seedlings will start emerging within 3 to 4 days,
6. Take care of the seedbeds according to the instructions of this lesson until the seedlings get fit for planting in the main land.

New word: Seedlings, seedbeds, sprinkler, brick chips, second seedbed, shade, thick cover, seed, malathion 57.

Lesson 7: Asexual Multiplication of Plants

Technology plays a vital role in the asexual multiplication of plants. We cannot deny the importance of such multiplication techniques whether it is old or recently developed. The contribution of technology in plant multiplication has been described below.

Plantlets developed from plant organs: Almost all the plants reproduce sexually through true seeds however plantlets can be produced asexually using a plant organ for multiplication. Techniques for developing plantlets using organs of a mother-plant have brought forward revolutionary changes in agriculture, creating a scope of great benefit for the farmers. Among the popular techniques cutting, layer grafting, gooti grafting, side grafting, veneer grafting, paired grafting etc are noticeable . The main characteristic of the asexually produced plantlet is that they keep the characters of the mother plant unchanged. Besides, asexually produced plantlets bear all the characters of the mother-plant.

1. Cutting: In this technique branches, roots and leaves of a mother plant is cut and transplanted in a tub or in a nursery bed situated in a shady place. Plantlets will grow there within fifteen days. Afterwards the plantlets are transplanted in the actual land. Multiplication through this technique is quite easy and mass production is possible. Roses and lemons are commonly multiplied through this method.

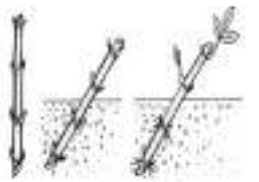


Fig-2.12.: Cutting

2. Ground layering: The basal branches of the mother-plant are pulled carefully down near soil.Then the lowergreen part of the bark is to be ground with the blunt side of a knife. But the space between two axils is barked off with a sharp knife and then this injured part of the branch is dug or covered with soil and secured in a way that it stays dug under the soil while still connected to the mother-plant. After some days, roots develop at the scratched area and give rise to a new plantlet.The plantlet is severed from the mother-plant and kept it as it is for a few more days allowing it to grow independent of its mother-plant. This plantlet is then removed with its root-system along with some soil. Then the plantlet is transferred to an already prepared pit in the designated orchard. Ground layering is used in lemon, guava, rose etc.



Fig-2.13: Ground layering

3. Grafting: There are two parts of grafting. 1. Root Stalk, 2. Scion. There are some more names of this grafting technique, like bud grafting, veneer grafting, T-grafting, side grafting and so on. The underdeveloped plant on which grafting is done is called the root stalk. The improved plant part (epical stem, foliar bud) which will be transferred and allowed to grow on the stalk is the scion. Graftings are of two kinds: joint grafting and disjoined grafting



Fig-2.14: Grafting

Multiplication of mangoes, tejpata, sofeda etc. is being done through this grafting nowadays.

Activity-1: Make a rose plantlet cutting a branch of a rose through cutting.

2: Transplant a plantlet in a tub of rangan through gooti grafting.

New words: cutting, graft, gooti, transplant, stalk, scion, pruning.

Lesson-8: Reproduction Technology in Animals

Poultry birds and ducks are our main animal resources. Therefore in this lesson, the production of chicks and ducklings through hatching eggs will be discussed. For hatching, fertilized eggs are needed. For selection of good eggs following points should be considered:

1. Smooth, thick and hard shells of egg.
2. Normal coloured eggs.
3. Medium size eggs.
4. Clean Egg surface.
5. Eggs weighing between 50-60gm.
6. In summer the age of the eggs should be between 3 to 4 days, while in winter 7-10 days.

Hatching of Eggs: There are two kinds of procedures of hatching eggs. They are Natural process and Artificial process. In the natural process,eggs are hatched by hens and ducks. Natural process is used in the households of villages. This process does not need any investment. On the other hand, chicks and ducklings can be produced through hatching eggs artificially by husk and incubator process.



Fig-2.15.: Natural process of hatching egg

Natural process of hatching eggs: Hatching fertilized eggs using the body heat of a hen is natural. We might have seen this in our house. A layer hen after finishing her laying of eggs becomes naturally interested in hatching.

We may have observed this process in our own house. Such hens are engaged in hatching 10-12 eggs in an artificial nest of straw. Such a nest should be 35 cm in diameter and about 10 cm thick. The hatching hen must be fed well before she starts hatching. Grain feed and water should be placed near her nest and after 8 to 10 days the eggs may be examined against light. A blackish spot will develop inside the eggs in which embryo starts developing. Chicks will come out within 21 days of hatching. The chicks remain under the supervision of the mother about two months and then move independently.

Hatching eggs by Incubator: Same period of time is needed for hatching eggs by natural process and by an incubator. The advantage of this incubator process is that many more chicks can be produced at a time hatching many eggs. In this process healthy chicks are produced controlling diseases during hatching eggs. In this process as the hens do not hatch eggs, they can lay eggs, as a result, the production of eggs of the farm increases. So this process, commercially, is very much popular to the farm holders.

Incubator is a temperature, humidity, and movement of air controlled electric machine. In this machine one hundred to one lac eggs can be hatched at a time. During hatching eggs through incubator the following rules have to be followed with emphasis.

1. Temperature : The temperature inside an incubator is controlled within 99.5-100.5 ^{0}F. It is mentionable that cell division of the embryo will not occur and embryo will disintegrate if it does not get optimum temperature.

2. Humidity : In an incubator the optimum humidity is controlled within the range of 65-70%. If the humidity inside the incubator is less than the range water from the eggs will be vapourised which will harm the embryo.

3. Circulation of air: Circulation of air plays an important role for taking oxygen of the embryo and coming out of carbon dioxide from the eggs. So there is a process of

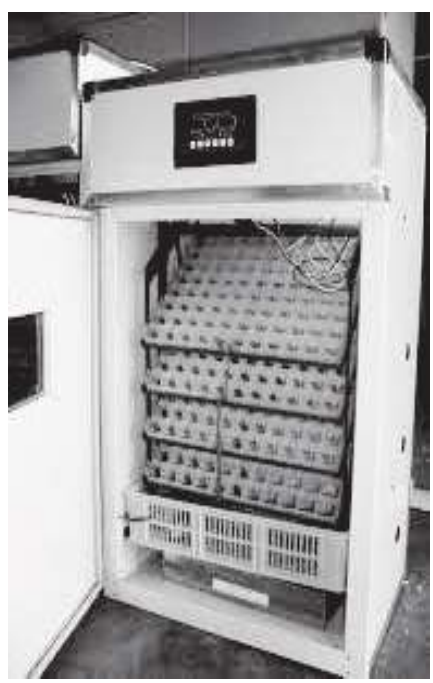


Fig-2.16: An Incubator

entrance of oxygen and removal of carbon dioxide through the circulation of air in the incubator. Embryo may disintegrate if there is no circulation of air.

4. Placing Eggs in the Setting Tray: Eggs weighing 55-60 gm are placed in the setting tray. The oval part of the eggs is kept at upper side and the narrow part at the lower side. During the incubation period the eggs are adjusted at 45^0 angle.

5. Movement of Eggs : The eggs are moved 3-8 times per day for getting temperature, humidity and air circulation at all sides of the eggs equally and it is done automatically.

6. Replacement of Eggs to Hatchery Tray : Eggs are replaced from setting tray to hatching tray after 18 days in case of eggs of hens. But in case of eggs of ducks the eggs are replaced from setting tray to hatching tray at 25th day. Noteworthy that there is no scope of hatching of eggs in the setting tray. The temperature has to be reduced 1-2^0F in the hatching tray.

7. Candling of Eggs : Watching the inner part of eggs with light is called candling. After seven days of placing the eggs in the setting tray, all the eggs are candled for differentiating the unfertile eggs and the eggs with deformed embryo. Again at the 14th day, eggs with deformed embryo are separated by candling in the same way. If eggs with deformed embryo, rotten eggs are not separated, the healthy eggs in the incubator are attacked with germs.

8. Fumigation : It is a process of destroying germs by using chemicals. In this case 70 ml formalin and 35 gm potassium per manganate mixture is used for every 100 cft area. This mixture is used after being kept in an earthen pot. This mixture destroys germs by producing very poisonous fume. So all should leave the house immediately keeping the doors and windows closed during using this mixture.

Activity: The class teacher along with his learners will visit a poultry farm nearby. After visiting the farm,they will prepare a group-wise report and submit it.

New words: hatching, incubator, setting tray, hatching tray, candling, fumigation.

Exercise

Multiple Choice Questions

1. How long can eggs for hatching be preserved during winter?

a. 3-4 days b. 4-5 days

c. 7-10 days d. 10-12 days

2. Sprinkler irrigation is provided on-

i. seedbed

ii. vegetable field

iii. perennial fruit trees

Which one is correct?

a. i b. ii

c. i & ii d. ii & iii

Read the following passage and answer questions 3 and 4

Razia's father wanted to utilize his 5 decimal fallow pond with fish farming and started the job. After some days, Razia noticed that the water in the pond had turned into deep green. She also marked a few dead fishes floating here and there in the pond. Razia, a student of class VII, advised her father to treat the pond with Copper Sulphate.

3. What amount of Copper Sulfphate did Razia's father procure?

a. 12-15g b. 24-30g

c. 48-60g d. 60-75g

4. What are the reasons behind the problems which arose in the pond of Razia's father?

a. Infestation of an algal layer on the pond

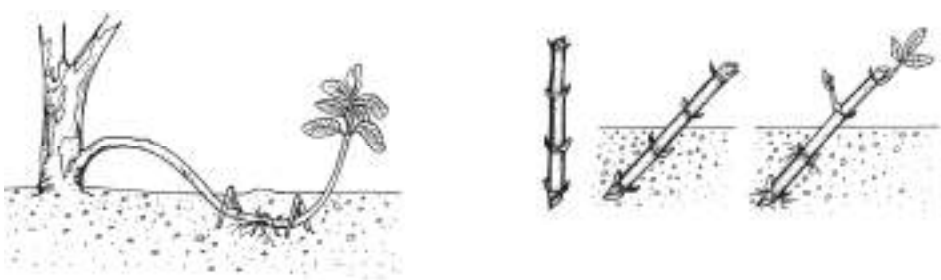
b. The pond water becoming opaque

c. Addition of excess lime in the pond water

d. Changing pH of the pond water

Creative Questions

1.



A B

a. What do you understand by asexual propagation of plants by grafting?

b. Explain an advantage of asexual propagation by grafting.

c. Which technique of the above figures is suitable for propagation of roses? Explain.

d. Analyse the ways how the above grafting procedures can help in having a good plantlet, and eventually a good crop.

2. To fulfill family demands, Tanvir Ahmed started growing cauliflowers and tomatoes near his homestead. He has a 5 year old mango orchard too. Tanvir Ahmed was successful with an irrigation method in mango orchard and he applied this same method for his vegetable garden and faced some problems in the vegetable garden.

a. Why is irrigation applied?

b. Explain a technology to increase effectivity of water management.

c. Explain the irrigation method that Tanvir Ahmed successfully employed in his mango orchard.

d. Analyse how Tanvir Ahmed could solve the irrigation problem in his vegetable garden.

Short Answer Questions

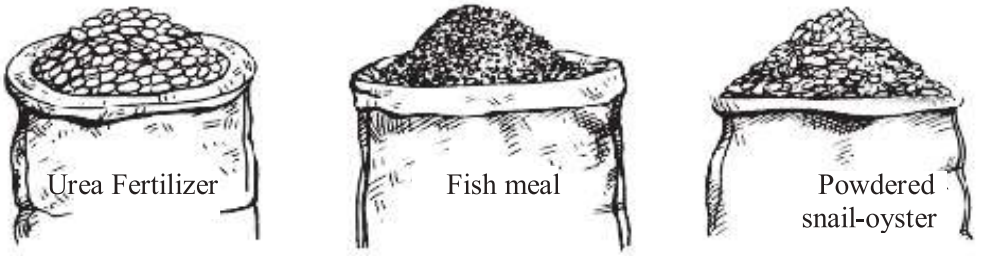
1. What is cutting? How is the cutting done?
2. What is water treatment? Why is pond water treated?
3. What is set in the setting tray and how?

Assignment: Students will visit crop fields to observe how farmers drain excess water from the land. After the visit, they will prepare a group report and submit it to the teacher.

Chapter Three

Agricultural Equipments

In the previous class it was mentioned that soil provides physical support and nutrients to the plants. What is the role of fertilizer? It supplements nutrition for the plants. In case of animals carbohydrates, proteins, fat, vitamins and mineral salts are the sources of nutrients. On the other hand, for cultured fishes and domestic animals, the food supplements called feeds are important to have the expected production. Similarly, enriching soil with organic manure improves the productivity of the soil. So it is important to know about the production process and use of organic manure.



At the end of this chapter we will be able to -

- explain the importance of animal and plant nutrition.
- describe the procedure of production of supplementary feeds for fishes and domestic animals .
- describe production processes of organic manures using easily available organic wastes (like homestead wastes).
- describe the importance of using pesticide (organic and non-chemical)

Lesson-1: Elements of Plant Nutrition

Plants draw some elements from soil, air and water for nutrition and growth. These are called essential elements. In want of any of these basic elements, plants cannot live well. Therefore, these elements are supplied as manure/fertilizer to satisfy needs for profitable production of crops. these elements are called plant nutrients. The deficiency symptoms of one nutrient cannot be fulfilled by another nutrient. The classification of nutrient elements, their functions and the respective deficiency symptoms are described below.

Classification of Essential Nutrient Elements

There are 17 essential nutrient elements for plants. On the basis of amount needed, these may be divided into two classes: Macro and Micro nutrients.

A. **Macro nutrients:** There are 9 macro nutrients. These are Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and Sulphur. These nutrients are used in large quantities for natural growth of the plants.

B. **Micro nutrients:** 8 essential elements are needed in trace amounts, these are called micro nutrients. These are Iron, Manganese, Molybdenum, Copper, Zinc, Boron, Chlorine and Cobalt. Though they are applied in small quantities, these are essential for the completion of their life cycle.

Sources of Essential Elements: There are two major sources to obtain these 17 essential elements for plants. These are: (a) Natural Sources and (b) Artificial sources.

A. **Natural sources:** soil, water and air are natural sources.

   Soil: Except Carbon, Oxygen and Hydrogen, all the rest 14 essential elements are supplied by soil or soil organic matter.

   Air: Carbon and oxygen are available from the air.

   Water: Hydrogen and Oxygen are available from the water. Plants get its minerals dissolved in water through roots from soil.

B. **Artificial sources:** Chemical fertilizers and Organic manures are artificial sources.

Organic manure: All the nutrients of the plants are available in the organic manure. Decomposed cow-dung, compost, wastes, straw, and weeds are used for making organic manure.

Chemical fertilizer: Nitrogen can be obtained from Urea. Triple Superphosphates (TSP) provide Phosphorus and the Murate of Potash (MoP) provides Potassium. Gypsum provides Calcium and sulphur. Besides, zinc sulphate contains Zinc and sulphur.

Activity: Students in four groups receive samples of Urea, TSP, MoP and Gypsum from the class teacher, and prepare a report on the essential elements these respective fertilizers provide, and also mention 3 functions of each fertilizer, and present to the class for discussion.

Lesson-2: Functions of Essential Elements

Different essential elements are required for certain definite functions in plant life cycle.

Nitrogen (N): 1. Keeps the plants green. 2. Plays role in the development and growth of leaves, stems and branches. 3. Helps in the formation of tillers. 4. Helps to expand roots.

Phosphorus (P): 1. Makes the root of the plants firm. 2. Helps timely flowering and ripening crop. 3. Increases the quality of the crop.

Potassium (K): 1. Helps in developing and strengthening the stem. 2. Increases disease resistance in plants. 3. Regulates the growth of leaves, stem and fruits of plants. 4. Increases growth of roots. 5. Helps develop grain in the grain-crops.

Calcium (Ca): 1. Helps in the development of roots and growth of plants. 2. Gives energy to plant cells. 3. Increases production in the pulse crops. 4. Strengthens the stems of fruit crops. 5. Increases Calcium deposit in the crops.

Magnesium (Mg): 1. Helps in the photosynthesis. 2. Increases absorption of phosphorus in plants. 3. Helps in the production of carbohydrates and fat in plants. 4. Helps in retaining green colour in plants.

Sulphur (S): 1. Increases production of oil crops. 2. Helps in the development of nodules in the leguminous crops. 3. Helps to develop roots and production of seeds. 4. Helps in the growth of vegetative body in plants.

Zinc (Zn): 1. Helps in the production of flowers & fruits. 2. Helps in the development of chlorophyll. 3. Increases production of fruit and cereal crops. 4. Takes part in the seed development. 5. Increases production of onion and peas.

Iron (Fe): 1. Takes part in the production of chlorophyll in plants. 2. Helps in seed production. 3. Increases quality of crops. 4. Increases production in crops like Cabbage, Cauliflower, Broccoli, Knolkhol and Radish. 5. Helps in the growth of roots.

Activity: The class teacher divides the class into four groups and names them with N, P, S, and Ca. Each group will consult among themselves to write report about the designated essential element, and their source and functions. The groups prepare the report and present in the class for general discussion.

New words: chlorophyll

Lesson-3: Deficiency Symptoms of Plant Nutrients

Plants suffering from nutrient deficiency express discernible symptoms. Such symptoms for the major elements are described below –

Element	Deficiency Symptoms
Nitrogen(N)	1. Leaves become light green to yellow. 2. Reduces crop production. 3. Seeds remain undeveloped. 4. Less tillers are produced. 5. Reduces the expansion of root. 6. Leaves fall early. 7. Seeds become smaller.
Phosphorus(P)	1. Normal development of canopy and the root zone is hampered 2. Cell division is hampered. 3. Plant growth is retarded. 4. Small number of leaves develop. 5. Protein content is less. 6. Less flower production. 7. Causes fruit falls and size reduction of fruits.
Potassium(K)	1. Reduces disease resistance. 2. Reduces resistance against insects and mites. 3. The rate of photosynthesis decreases. 4. Plant growth is hampered. 5. Leaves become copper coloured. 6. Reduces drought tolerance.
Sulphur (S)	1. Plants become dwarf. 2. Leaves become small and discoloured. 3. Crop maturity is delayed. 4. Stem dries up and becomes thin. 5. Production of oil crop decreases, 6. New leaves of rice plants become yellow, 7. Growth of the plant and tillers decreases.
Zinc(Zn)	1. Bases of young paddy leaves turn whitish. 2. Flowering and fruiting delayed 3. Discolouration appears between leave veins of maize, cotton, and oranges. 4. Leaf development is hampered. 5. Leaf-curl occurs in lemon 6. Uneven growth of rice seedlings. 7. Tips of roots and stems dry up.
Iron(Fe)	1. Green young leaves become dull, 2. Discoloration first appears in leave veins and then spread over the entire leaves. 3. Plants become dwarf. 4. Rot develops in the leaves of orange, soya beans, and leafy vegetables. 5. The leaves of rice seedlings on the seedbed become yellow.
Calcium (Ca)	1. The tips of the newly developed leaves get deformed. 2. The colour of the leaves get faded and yellow. 3. Edges and middle part of leaves become yellow and brown. 4. Leaves remain small in size. 5. Plants become dwarf-ish. 6. Buds of flowers and fruits fall. 7. Growth of legumes is hampered.
Magnesium (Mg)	1. Space between veins getting yellow. 2. Leaves dry up early 3. Branches and petioles remain thin. 4. Newly developed leaves remain dwarf, thin and light green. 5. Leaves of country beans become yellow. 6. Development of chlorophyl is hampered. 7. The branch and the petioles of leaves become narrow.

Activity: With the help of specimens, still photographs or video pictures the teacher demonstrates the deficiency symptoms in plants. The students take note and discuss among themselves.

Lesson-4: Essential Nutrient Elements for Domestic Animals

Animals need nutrition for survival very similarly to human beings. Their feed must contain all the essential nutrient elements to support their body growth, repair of losses and development of resistance to diseases. Feed on domestic animals should contain six nutrient elements.

Names, sources and functions of the nutrients are given in the following table.

Nutrient	Source	Functions of nutrient
Protein	Pulses, oil cakes, dried fish, blood meal.	1. Develop resistance against infection to keep the animal healthy and fit. 2. Growth and repair of loss.
Carbohydrate	Wheat, maize, rice straw, rice bran, molasses.	1. Increases body energy and generates and restores temperature. 2. Increases the growth and the activity of the body. 3. Reduces constipation.
Fat & Oily substances	Oil cake, soyabean, ground nut, sun flower, fish oil and milk.	1. Restores body temperature, energy. 2. Restores skin smoothness and protect from skin diseases.
Vitamins	Green grasses, peels of fruits and vegetables, tree leaves.	1. Vitamin D supports generation of new tissues, bones and tooth. 2. Vitamin A increases disease resistance and supports quick recovery from sickness.
Minerals(Phosphorus, Sodium, Calcium, Manganese, Copper Cobalt, Magnesium, Zinc, iron)	Green grass, salt, treated feeds of plant origin.	1. Helps generation of new tissues. 2. Help growth and strengthening of tooth and bones 3. Helps of clotting blood.
Water	Ponds, canals, bil, rivers, underground sources drawn by deep and shallow tube-well, juicy green grass.	1. Regulates body temperature. 2. Helps desolving and digesting of food materials. 3. Reduces constipation. 4. Expels metabolic toxins from animal body through urine and sweat.

Balanced Feed for domestic animals

A Feed in which all the nutrient elements are present in due proportion is called a balanced feed. Such a feed is highly required by the animals. The feed should be tasteful and easily digestible, and should contain fiber and grain in adequate proportions.

Fiber rich feed : A. Dry: Rice & wheat straw, silage, grasses. **B. Wet:** Green grasses, sweet potatoes, radish, carrot etc **C. Grains:** Smashed rice wheat and maize grain. Bran from wheat, rice, and pulses, oil-cakes.

Activity: The class teacher may demonstrate healthy and diseased domestic animals with still pictures and video clips, and ask the students to distinguish between the healthy and diseased animals. For this, teacher may engage students in groups.

Lesson-5: Nutrition of Domestic Birds

Like the wild animals, the domestic birds and animals also need six kinds of nutrients. The sources and roles of these nutrients are described below:

1. Carbohydrate

Sources: The sources of carbohydrate for birds are paddy, crushed rice, wheat and maize, rice and wheat bran etc.

Functions:(1) Feeding crushed maize grains makes the egg yolks yellow. (2) The birds need carbohydrate for the increase of body energy, production and storage of heat. 3. It increases the growth and work activity of body. 4. It also removes constipation.

2. Protein

Sources: The sources of proteins are oil cakes, broken pulses and soyabean, powdered dry fish, animal guts, blood, snail, oyster, small fish etc .

Functions: Protein repairs damaged tissues and maintain body organs to keep the birds healthy and lively.

3. Fat/Oil

Sources: The sources are grains of oil crops, oil cakes etc.

Functions:(i) Fat keeps constant body temperature and boosts energy.

(ii) Restores softness of skin and brightness of feathers. Fat protects the skin from infection and diseases.

4. Vitamins

Sources: The Sources are spinach, Indian spinach, lettuce, radish, cabbage, cauliflower, carrot, green grass and by-products of fish.

Functions: (i) Vitamins increase egg production and fertility (ii) vitamin D restores fertility of fertilized eggs and also keeps the skin, bones and beak strong and healthy (iii) Vitamin A protects the body from diseases.

5. Minerals

Sources: The sources are fish wastes, crushed dry fish and shells of mollusks, bone meals, salt etc.

Functions: (i) It develops egg shells (ii) Helps in the development of new tissues(iii) It keeps bones and teeth strong and gives nutrients (iv) It also helps to clot the blood.

6. Water

Sources: Sources are natural or supplied water, vegetables and green grasses.

Functions: (i) Water helps control of temperature and food digestion (ii) It helps make food soluble (iii) removes constipation (iv) Water helps discharge the waste products as stool, urine and sweat.

It is said that snail, oyster, small fish, crab, earth-worm insects, aquatic plant etc. are favourite food for ducks.

Balanced diet or nutrition for domestic birds: Every living being needs food for the sustenance of life. Presence of only one kind of nutrient in the daily diet will fail to ensure proper growth and body function. In the food or feed, all the essential elements must be present in adequate quantities. So a diet should be adequately balanced to support the completion of life cycle perfectly. Deficiency of one essential element in diet cannot be compensated by another. We can get quality meat, and eggs from our domestic animals when we provide them with a balanced diet. All the nutrients mentioned above are present in the balanced diet of fowls in exact proportion. So this diet is very necessary for fowls.

Lesson-6: Supplementary Food

We already know that plants receive their nutritional requirements from soil, water and air. If there is lack of these elements we use fertilizer in the field. What about fishes and other domestic animals? From where they obtain the essential nutrients? The answer may be, daily ration which

includes fibrous food and food grains. But this might not be sufficient to have maximum profitable production from them. Therefore, to have a high production from our fishes, domesticated birds and animals, some extra nutritional materials are to be supplemented with their ration. This is called supplementary feed.

Supplementary Food for Fishes: Fish production will not be satisfactory with naturally available food in the pond. Availability of natural food can be increased by adding fertilizer in the pond. But that also is not sufficient. To have a profitable production within a short time, supplementary feed has to be supplied. To estimate the amount of supplementary food for the fishes in the pond, it is required to net 30-40 fishes and weigh them, and the required amount of supplementary feeds have to be calculated on the basis of their age and average weight. On the basis of total weight of the fishes in that pond 3-5% supplementary feed can be supplied every day. That means if all the fishes of a pond weigh 100 kg in that pond 3-5 kg supplementary feed can be supplied every day. On the other hand, supplementary feed should be supplied to fish fries at the rate of 5-10% for body weight.

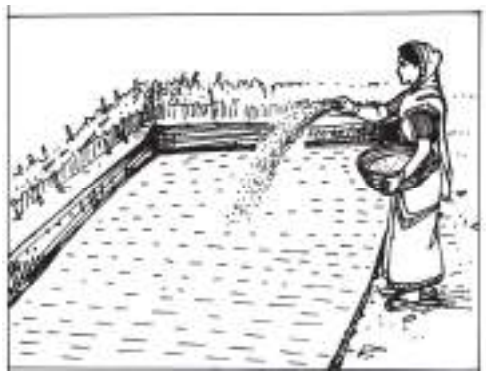


Fig-3.1: Substitute feed being supplied in a fish pond

For Carps: Fishmeal, rice bran, mustard oil cake, flour and vitamin- mineral are mixed to prepare supplementary feed for carp fishes such as rohu, catla, mrigal, silver carp, common carp etc. Oil cake should be soaked in water for 12 hour prior to mixing. Soaked oil cake, fishmeal, rice bran and flour are mixed together and made into small balls. The total required feed is divided into two parts and one parts is supplied to the pond in the morning and the rest in the evening.

Food should be supplied daily at the same time at the fixed place so that the fishes can take food easily.

The elements with the amount for adult and fries are shown in the following chart

Supplementary feed list for carp fishes

Ingredients	adult Fish	Fish Fries
Fish meal	10 kg	21 kg
Rice bran	53 kg	28 kg
Mustard oil-cake	30 kg	45 kg
Flour	6 kg	5 kg
Mixture of vitamins and mineral	1 kg	1 kg
Total	100 kg	100 kg

List of supplementary food for prawns :

For Shrimps and prawns: For 1 kg of supplementary feed following ingredients are to be used according to the quantity indicated-

Ingredients	gm (dry weight)
Rice or wheat bran	500
Mustard oil cake	150
Dried fish meal	250
Snail or oyster (mollusk shell)	95
Salt	3
Vitamins	2
Total	1000

Activity: Students in groups write posters on supplementary feed for carps, fish-lings, and prawn, and present in the class.

Lesson-7: Supplementary Foods for Domestic Animals

In our country straws, brans of rice and wheat, oil cakes, grasses, and weeds are usually used as animal feed. But these food are not fed in the balanced way. So we do not get expected production from domestic animals. Therefore domestic animals are served with supplementary feed.

Supplementary feed is prepared with all the six elements including carbohydrate, proteins, fat, minerals, and vitamins and of course water are seriously considered. Some locally produced grasses like Napier, Para, German, Guinea, lpil ipil and Black gram, Cowpea, maize etc. are fed to the animals. For each milking cow, supplementary feed at the following rate per day should be served.

Materials	**Amount**
Green grass	15-20 kg
Straw	3-5kg
Mixed grains	2-3 kg
Salt	55-60gm

For the first time to get 3 liters of milk 2kg of mixed grains should be served. For every extra 3 liters of milk 1kg of mixed grain must be added. When only green grass and straw are fed, for each 100 kg body weight of the animal, 3 kg green grass and 1 kg straw are to be given. If the animal is fed only green grass, 6 kg of green grass and while only straw 3 kg of straw/100kg body weight has to be fed with plenty of water and full ration of salt.

Mixed grains for supplementary feed-

Materials	**Amount**
Rice bran	2 kg
Wheat bran	5 kg
Crushed maize	1.8 kg
Linseed or ground nut oil cake	1 kg
Salt	100 gm
Mixed minerals	100 gm
Total	10 kg

Activity: The students in groups will prepare the list of materials and amounts needed to prepare 2.0,kg of mixed grains as supplementary foods for milking cows, and present in poster paper.

Lesson 8: Supplementary Feed for Poultry Birds

The poultry birds get domesticated in the rural household move freely and find their food. In some cases these birds are supplied with only rice bran. As this is not sufficient birds may suffer from malnutrition. Similarly if the birds kept in the poultry farms are not fed adequately with proper amount of feed, they may suffer from malnutrition as well. As a result , production of egg, meat and feather is reduced. Therefore, supplementary feed has to contain the 6 nutrients (carbohydrate, protein, fat, vitamins, minerals and water). This may be termed as the supplementary feed for the domestic birds. Lists of such food for growing poultry birds are given below.

For growing poultry birds of 8-16 weeks of age:

Materials	Quantity (%)
Crushed wheat grain	50
Wheat bran	10
Rice bran	16
Powdered dry fish	9
Oil cake of sesame	12
Powdered oyster shell	2.5
Salt	0.5
Total	**100**

Activity: Students in two groups will make two posters on supplementary feed for growing poultry birds.

Lesson-9: Organic Manure

We have been informed about different type of fertilizer and organic manures in class six . Now we will know the procedures of producing manures and their use.

Benefits of application of organic matter to the soil

1. Organic matter content of the soil is increased. 2. The physical, chemical and

organic status of the soil is improved. 3. Increases the activity of the soil microorganisms. 4. Increases the water holding capacity of the soil. 5. Nutrient loss from the soil becomes less. 6. Fertility of the soil is enhanced. 7. Soil texture is improved. 8. Production of crop and its quality is improved. 9. Environment of soil is improved.

Activity: As per instruction of the class teacher, the students prepare a poster by adding points one after another about the usefulness of organic matter application in the soil and present it in groups.

Now we will discuss the preparation of compost, green manures and oil cake.

Prepartion of Compost: It is produced by microorganisms associated with the filth and urine of domestic animals through decomposition.

Different agricultural waste, straw and rubbles, weeds, water hyacinth, kitchen waste etc. are also used to produce compost. Usually one or several components are used to prepare compost. There are two methods. One is mass method and another is trench method.

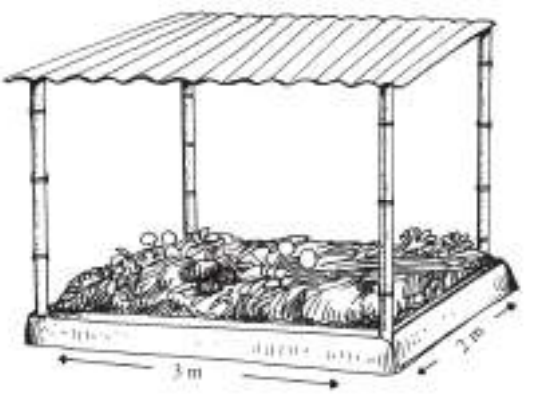


Fig-3.2: Preparation of compost through trench method

Preparing compost in trench method:

Compost can be produced round the year with trench method, and the process is described below-

1.(a)Selection of a relatively high ground where rain water does not stand. (b). Trenches measuring 1.2 meter deep, 3 meter long, and 2 meter wide has to be dug. (c). Six such trenches need to be dug side by side. (d). A roof should be erected over the trenches. (e). Five of the trenches should be filled with materials stated in the heap method leaving 1 trench vacant. (f). Heap of each trench should be filled up to 30 cm higher than the ground. (g). After 4 weeks the materials from the neighbouring trench should be transferred to the empty one. (h) This way the components of the compost should be turned upside down so that these rot quickly.

2.After two to three months all the materials get decomposed and turn into compost.

Benefit from compost: Adding compost to a crop field-

(1). Improves the fertility and productivity of soil. (2). Adds extra nutrients to the soil. (3).The soil nutrients being conserved. (4). Improves the soil texture. (5). Increases the water holding capacity and aeration of soil. (6) Activates soil microbes especially the beneficial ones.

Lesson-10: Preparation of Green Manures

Green manure is prepared by growing green plants and ploughing down when the plants are still young and succulent. After decomposition these plants become green manure. Usually leguminous crops like dhaincha, cowpea, long beans, khesari, etc. are preferred.

1. At first any of such crops are to be cultivated in the field. It is to be smashed before the blooming of flowers.
2. This is followed by 3-4 times repeated ploughing and laddering to fairly mix the plants with the soil.
3. Green manure process completes after two weeks through decomposing the ploughed-down crops.
4. Green manure is used at the place where it has been produced.

Growing and using dhaincha for green manure

1. The plot where a commercial crop has been planned to be cultivated, should be ploughed 2-3 times to raise dhaincha for green manure.
2. Broadcast 70 gm of TSP and 50 gm of MoP per decimal over the plot.
3. Broadcast 200 gm of dhaincha seeds per decimal on the plot.
4. After 8-10 weeks the plants may start flowering.
5. They are to be cut down or chopped into small pieces and ploughed down under soil. A light irrigation is given. After 2-4 weeks, the ploughed down plants will turn into green manures and the plot is ready for cropping.

Benefits from green manure

1. The soil becomes fertile and productive.
2. Huge amount of organic matters are added to the soil.
3. The soil is enriched with nitrogen.
4. Microbial activity in the soil gets encouraged.



Fig-3.3 Cultivation of Dhaincha

5. Soil nutrient is conserved
6. Bio environment in the soil is improved

Preparation of oil cakes for use: The bi-products produced during/after extraction of oil from oil seeds are called oil cake. Oil cakes are used as manures and feed for cows. Oil cakes can be produced from cotton seeds, mustard oil seeds, ground nut , neem, sesame, linseed etc. These oil cakes contain lots of nitrogen and protein. The cakes should be powdered before spreading on the soil.

Activity-1 : In groups, students will apply compost, supplied by the class teacher, to plants raised in the pots in the school campus as per instruction given by the teacher. The students will observe and make notes on the difference in the growth of the plants.

Activity-2 : In groups the students will draw pictures of trench system of compost production, and write the steps of compost production, and submit in the class. Teacher will evaluate these.

Lesson-11: Introduction to Organic and non-chemical pesticides

The chemical pesticides are called silent killers. Pesticides are of three kinds organic, chemical and non-chemical. All the pesticides are more or less harmful. Chemical pesticides are the most harmful as pollutant of environment while the physical and biological pesticides are environment friendly. So we should use organic and non-chemical pesticide for saving of environment and the production of poison free fruits. These are described below with examples:

A. Organic Pesticides

1. Allamanda leaf extract: effective against fungi.
2. Garlic extract: effective against fungi and bacteria.
3. The extract of neem (bark, leaf, fruit, and flower) is used as pesticide. Powdered dry leaves of neem mixed with stored crop can be used to protect from attack of pest. Oil and oil cake of neem are used to destroy the worms of crop roots.

4. Extracts of Tobacco "Nicotine Sulphate" is effective against insects of foliage and growing branches.
5. Decomposed excreta of poultry birds: against soil borne plant parasitic nematodes.
6. Limo bacteria extracted from the root-zone of sugarbeets can be used for efficiently controlling the 'damping' of seedling in the seedbed. These bacteria form a protective layer at the root-zone of sugarbeets and spinach, and excrete microbicidal antibiotics and protect them from soil-borne fungi and bacteria.
7. *Trichoderma* species are very effective bacteria and fungi exterminators which are soil borne.
8. By applying microbes as manure, crops can get rid of fungi and bacteria.

B. Non-chemical pesticides

1. Hot water treatment is very effective in controlling bacteria borne seed diseases. For this treatment, the rice seeds are dipped (in muslin bags) for about 15 mins in hot water at 54 degree Celsius temperature to free seeds from fungi, bacteria, and viruses.
2. Lady bird beetle can be multiplied to control insects and mites damaging crop.
3. Praying mantids can be multiplied to control insect pests.
4. Pomegranates can be saved from insect damage when young fruits are wrapped with fine cloth.
5. Balanced fertilization of soil reduces diseases and insect damage of crops.
6. Routine weeding operation in the crop field reduces insect damage.
7. Insects can be trapped and killed using light traps in the field.
8. Insect population can be reduced by sweeping nets over a crop field.
9. Resting places can be created in the crop field where insect eating birds can rest to look for insects.
10. Culturing fishes in the rice field.
11. Burning or ploughing down of crop residue after harvest.
12. Grafting tomatoes and eggplants (brinjals) on wild species as stalk to save these crops from bacterial wilt.

13. Insect can be reduced drastically using traps of pheromone and pumpkin / sweet gourd.
14. Extracts from mahogany and neem seeds can be used as bio-pesticide.
15. Carnivorous insects like grasshoppers, damselflies, bugs and spiders can be multiplied.
16. Number of frogs should be increased.

Activity: In groups, students will create a list of advantage and disadvantages of the non-chemical control of insects and the bio pesticide in poster papers to present in the class.

Lesson-12: Disadvantages of Using Chemical Pesticide

Disadvantages are more than that of advantages in using chemical pesticide in the crop field. These are –

1. Prolonged use of chemical pesticide, year after year induces resistance in the pests reducing its effectiveness as pesticides.
2. Most of the chemical pesticides indiscriminately kill the beneficial flora and fauna and deprive the crop from natural protection.
3. Only a small fragment of the chemical pesticide, 1% or less, can reach the targeted pests.
4. Applied chemical pesticide easily pollutes soil, air and water on the surface and at the underground to affect the food-chain and the ecosystem.
5. Chemical pesticide hampers formation of soil and reduces soil productivity.
6. Chemical pesticides destroy biodiversity.
7. In general chemical pesticide pollutes the environment and destabilizes the ecosystem.

Activity-1: If possible the class teacher will demonstrate how carnivorous insects and spiders, pheromones trap, light trap, chemical pesticides can be used to control insects through using video clips, still pictures, poster etc.

Activity-2: The class teacher will instruct students to create poster or present a write up on "The bad effects of using chemical pesticides."

or

Activity-1: The class teacher will ask students to make a list of crop damaging insects, carnivorous insects and birds. The teacher will arrange group participation for this task.

Activity-2: The teacher will form student group and ask to submit specimens of non-chemical pesticides.

Exercise

Multiple Choice Questions

1. **How many essential elements are there for plant nutrition?**

   a. 11 b.14

   c. 17 d.20

2. **To fulfill carbon and hydrogen requirements plants need-**

   i. Water

   ii. Soil

   iii. Air

   Which one of the following is correct?

   a. i & ii b. i & iii

   c. ii & iii d. i, ii, & iii

Read the following text and answer questions no. 3 & 4

Salma has started poultry farming. She procured 18 layers and 6 kg of poultry feeds, and fed the birds. After 2 days she noticed that the eggshells are rather soft. She became anxious.

3. **Feeding at a minimum rate, how many days can Salma feed her birds with the amount of feed she procured?**

   a. 1 b. 2

   c. 3 d. 4

4. **To manage the problem Salma noted in her poultry farm what element she should add to the poultry feed.**

   a. Oil cake b. Smashed pulses

   c. Corn flower d. Salt

Creative Questions

1. Mr. Hafeez, a farmer from Sardarpara village managed 20 decimal of lands through a lease agreement and observed that in his rice crop tillers are not coming out as expected. The crop-field is infested with insects and mites too. People suggested Hafeez to apply chemical fertilizers and pesticides. Hafeez ignored the suggestions and was a looser. But in the next year, from the very beginning to the end of cropping he applied bio-management and was successful.

a. What do you understand by nutrient elements for plants?

b. Explain the usefulness of keeping a trench vacant while producing compost through trench method.

c. Describe what kind of organic management practice Hafeez could adopt in the first-year crop?

d. Evaluate the fact that the crop management practice Hafeez adopted in the second year not only fulfilled the nutrition requirements but also protected his crop from pests and diseases.

2. Monira Begum for the second time transplanted brinjal seedlings on his field near his homestead. These plants flowered and produced fruits in due time. This time Mr. Ahad noticed infestation of insect pests in stems and twigs of brinjal plants. He also noticed small black pores on some fruits. Last year also he faced similar problems and applied chemical insecticides which were of no use-only wastage of money. Therefore this time he consulted the local agriculture officer for the alternative treatment.

a. What kind of pesticides can be used to conserve nature?

b. For what reason; chemical pesticides are called silent killers? Explain.

c. Describe the appropriate measure to solve the problem Monira Begum is facing?

d. Evaluate the measures Monira Begum took for his brinjal crop in the previous year.

Short Answer Questions

1. How many and what are the sources of plant nutrients?
2. What is meant by supplementary food? Why is this food necessary?
3. What is green manure? How is this fertilizer made?

Assignment: Write the sources and functions of nutrients in domestic animals and birds in the form of a table on poster paper and present it in groups.

Inquiary based work: Collecting the sample of different types of fertilizer.

Chapter Four

Agriculture and Climate

In this chapter agricultural season, features of agricultural seasons, Rabi harvest, Kharif crops, season neutral harvest, and the characteristics of these crops have been discussed first. Later the impact of weather and climate on harvest has been described. Besides these, the idea on adverse weather and climate i.e. excessive rainfall, hails, drought, flood, and waterlogging has been provided with. Harms caused by such environmental odds have also been discussed.







At the end of this chapter we will be able to –

- describe the characteristics of agricultural seasons ;
- identify Rabi and Kharif harvests ;
- identify season neutral harvests ;
- explain the influence of weather and climate on agricultural production ;
- locate major areas of Bangladesh in consideration to agricultural production and agro-environment.

Lesson-1: Agricultural Season

From our reading of chapter 4 in class six we learned about the significance of weather and climate for the harvests. What crops will grow in which area depends on the climate of that particular region. So to know about the types of harvests of an area or a country we should be aware of the climate of that region or country. Temperature, rainfall, wind flow, sunlight, air pressure, humidity, etc. are the elements of weather and climate. These are the elements that impacts harvests.

If we consider the geographical location of Bangladesh, sea level and distance from the sea, temperature, humidity, and rainfall, it becomes noticeable that the climate of Bangladesh is a subtropical monsoon type . Moderate rainfalls, mild winter, moist summer are the main aspects of the climate of Bangladesh. This type of climate is very much favourable for agricultural production.

The cropping period taken from seed sowing to maturity of the crop, through its physical growth, production of flowers and fruits is considered as cropping season for that particular crop. That is, time range between seedling and reaping is known as the season of harvest. Growth of different types of crops in different areas of Bangladesh depends on the climate of Bangladesh. For growing crops a calendar year has been divided into two seasons; viz.–

A. Rabi season
B. Kharif season

A. Rabi season: Period between Ashwin and Falgun is called the Rabi season. At the onset of this season Bangladesh experiences rainfall, but it rains very little. During this season the temperature, humidity in air, and rain all are in less amount.

B. Kharif season: Spell between Choitra and Bhadra is known as Kharif season. This season is divided into two phases, viz. 1. Kharif–1 or summer, and 2. Kharif–2 or rainy season.

Kharif – 1: Timespan from Chaitra to Jaistha is called Kharif – 1 season or summer. During this season the temperature tends to be high, and storms and hailstorms occur sporadically.

Kharif – 2: The time from Asharh to Bhadra is known as Kharif – 2 or rainy season. During this time it rains heavily, air contains high humidity, and the temperature tends to be moderate.

The crops that are affected by temperature, rain, humidity, duration of day length etc. are categorized on the basis of seasons. This classification is not that much applicable to perennial trees like fruit trees, social forest trees and medicinal crops.

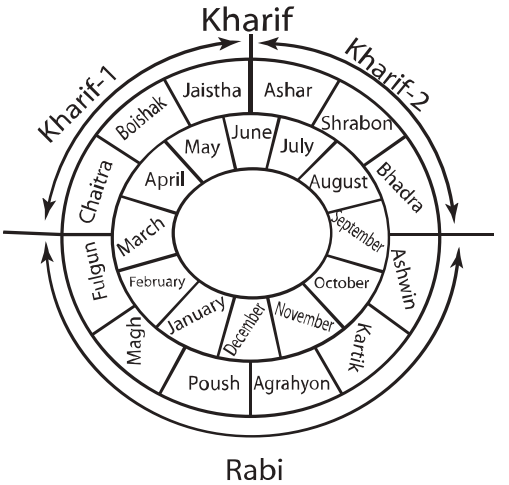


Fig-4.1 : Agricultural season

Activity: Write the characteristics of agricultural seasons individually and present them in the class.

New words: agricultural season, rabi season, kharif – 1, kharif – 2.

Lesson-2: Crops of Rabi Season

Rabicrop

If any crops spend the entire or most of the Rabi season for their physical growth, blossom and fructification, they are known as Rabi crops. They are also called winter crops. If we want to learn about the characteristics of the Rabi crops we should know about the aspects of the Rabi season. The aspects of the Rabi season are –

1. low temperature.
2. insufficient rainfall.
3. low humidity.
4. less possibility of storms.



Fig-4.2 : Collection of juice from Date tree

5. less fear of hailstorms.
6. less threat of flood.
7. fewer attacks of disease and pests.
8. needs irrigation.
9. Night time is longer or equal to daytime.

From the characteristics of the Rabi season we can understand what types of crops grow in this season. The crops that need low temperature are cultivated during Rabi season. Horticultural crops like potatoes, cauliflower, cabbage, carrot, radish, gourd, bean, knolkhal (olkopi), broccoli, turnip, spinach, onion, garlic, etc. are cultivated in this season. Field crops that are cultivated at this time include boro rice, wheat, mustard, linseed, lentil, chick-pea, blackgram (kheshari), etc. Date juice is collected during this season.

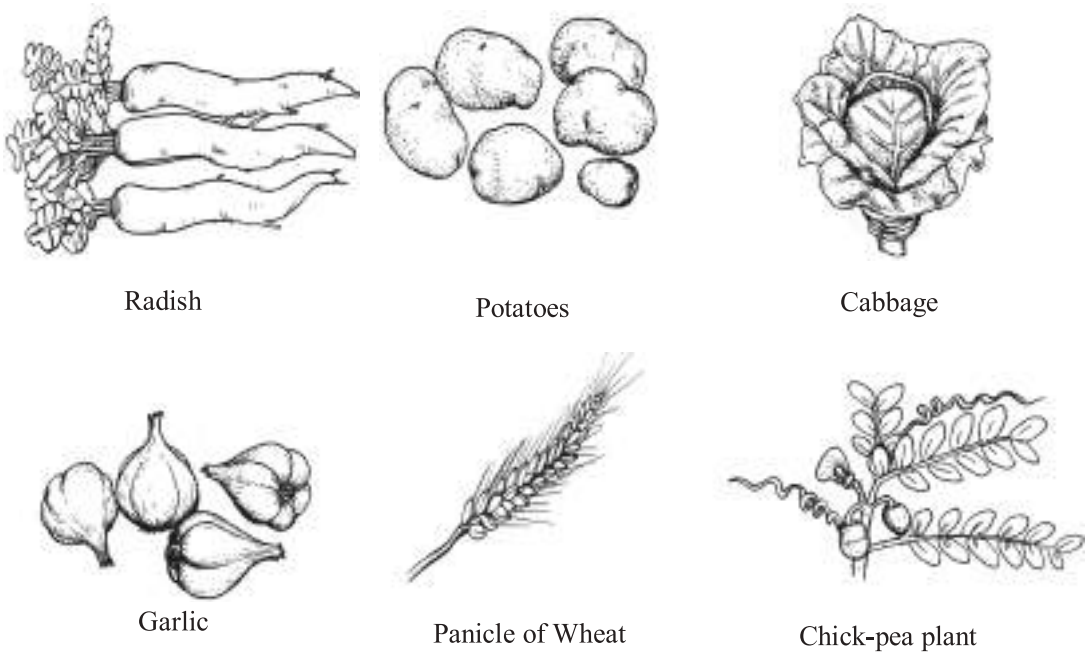


Fig-4.3 : Various types of Rabi crops

New words : rabi crops, characteristics of rabi crops, aspects of rabi season.

Lesson-3: Crops of Kharif Season

If any crops spend the whole or most of the Kharif season for their physical growth, blossom and fructification, they are known as Kharif crops. If we want to learn about the characteristics of the Kharif crops we should know about the aspects of the kharif season. The aspects of the Kharif season are-

1. high temperature.
2. heavy rainfall.
3. high relative humidity.
4. more possibility of storms.
5. more fear of hailstorms.
6. more attacks of flood.
7. more hazards from diseases and pest.
8. irrigation almost not needed.
9. day length is longer or equal to nighttime.



Fig-4.4: Cloudy sky

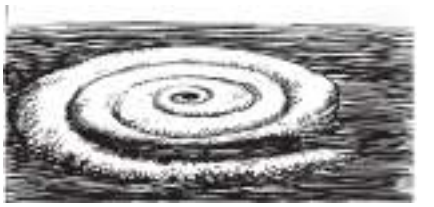


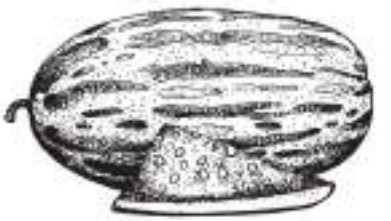
Fig-4.5: Cyclone

The crops that require high temperature are cultivated in Kharif season. This season is divided into two phases, viz. –

Kharif-1: It rains moderately in this season and shower starts at the end of the season. Threat of Nor'-westers and hailstorms is higher in this season. Many parts of the country are seen to be vulnerable to sudden river swelling floods. High temperature and moderate humidity are experienced in this season. Diseases and insects attack crops in medium scale. Moderate irrigation is needed for growing crops. Main crops in this season are – jute, sesame,



Sweet gourd



Water melon

Fig-4.6: The crops of Kharif-1 season

amaranth (danta), taro (mukhikachu), okra, snake gourd (chichinga), and ribbed gourd (jhinga), bitter gourd (karala), pointed gourd (patal), pumpkin, etc. Mango, black berries, jackfruit, papaya, water melon, melon all these fruits ripe during this time.

Kharif-2: It rains heavily in this season. There is less threat of gust and hailstorms, but flood is quite alarming this time. Excessive heat prevails and air contains humidity profusely in this season. Diseases and insects attack crops moderately. Artificial irrigation is not required that much for growing crops. Chief crops in this season are – aman rice, aquatic sprout (panikachu), ash gourd (chalkumra),okra (dherosh), snake gourd (chichinga), ribbed gourd (jhinga), and sponge gourd (dhundul), etc. Palm, amloki (*Myrobalan*), pine apple, hog plum (amra), guava, late-maturing mangoes, jackfruit, and pomelo (jambura) - these fruits ripe during this time.



Ribbed gourd (Jhinga)



Ash gourd (Chalkumra)

Fig-4.7: The crops of kharif-2 season

Activity : Rearrange crops or fruits according to seasons.

Name of Crops/Fruits	Rabi	Kharif-1	Kharif-2
Jute, transplanted aman, potato, sesame, okra, cauliflower, jackfruit, pineapple, onion, watermelon, Ashgourd, mustard, Taro (mukhikachu), palm and lentil.			

New words : kharif crops, characteristics of kharif-1 and kharif-2

Lesson-4: Season neutral Crops

In the previous lesson, we learned about the identity and characteristics of different seasonal crops. For these, the crops of one season cannot be cultivated in another season. But there are some crops that are grown profitably throughout the year. Can you name a few of such crops?

The crops that are grown throughout the year for profit are all season neutral or Baromashi crops. All season neutral crops are also day length neutral (diba niropekkha) because these crops can blossom and produce fruits irrespective of day length. We will learn in details about the influence of day length in blossoming and producing fruits in the next chapter. In our country the season neutral horticultural crops include red amaranth (lalshak), egg plants or brinjal, chili, papaya, banana, etc. On the other hand season neutral field crops include maize, ground-nut, etc.

In our country many crops cannot be cultivated throughout the year because of meteorological conditions and limitations. Import of some high value crops like tomato and onion could be avoided if they could be grown here throughout the year. For the solution of this problem research work is in progress. Some summer varieties of tomato and onion have already been released.

Doesn't this question arise in your mind why some crops grow throughout the year? To get the answer to this question we must think about the climatic needs of a crop. We already know that one kind of climate is required to grow Rabi crops while the need is different for the Kharif crops. Season neutral crops can be cultivated during both Rabi and Kharif. It can be assumed from this that the extent of the climatic need of the season neutral crop is rather wide. As a result these crops can be cultivated during both the seasons or throughout the year. So we can say that the season neutral crops –

1. can be grown in both low and high temperatures.
2. can be grown in both less and heavy rains.
3. can be grown under low as well as high humidity.
4. can produce flowers and fruits under both short and long day lengths.

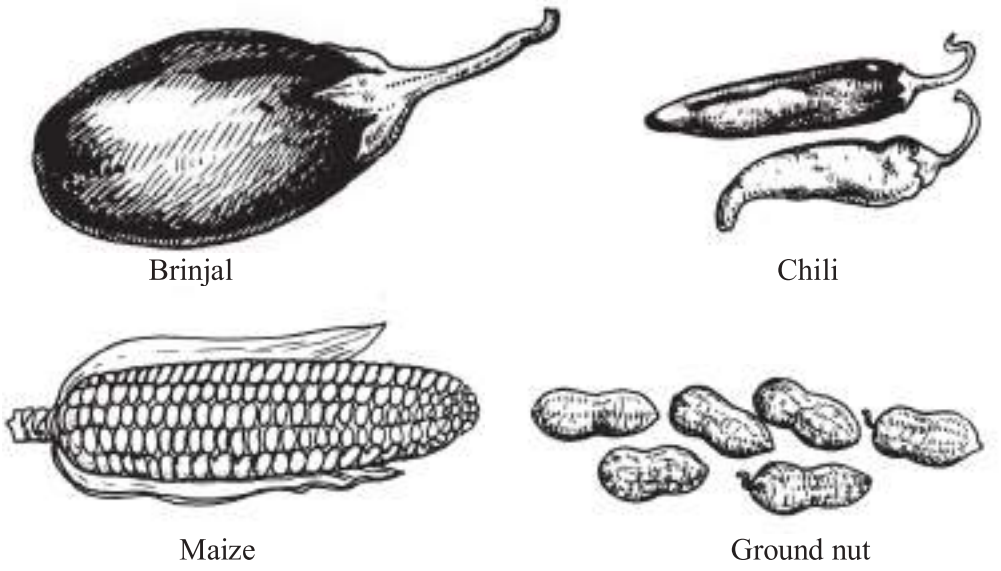


Fig-4.8: Season nutral crops

Activity: Get into four groups. Now from your displayed chart of the mixed crops make a list of season neutral crops and present it in the class.

New words : season neutral crops.

Lesson-5: Influence of Weather and Climate on Crop Production

What crops will grow in which area depends on the weather and climate of that area. The elements of weather and climate have impact on crop production. Now we will discuss how these elements influence crop production-

1. Sunlight: Sunlight has its impacts on crop production in many ways. We know that plants produce their food through photosynthesis. In this process the presence of sunlight is essential. In the presence of sunlight, water combined with carbon dioxide to produce carbohydrate in the leaf of a green plant. As per the need of the sunlight plants are divided chiefly in two types, viz. (a) light loving plants and (b) shadow loving plants. Maize and sugarcane grow well in full sunlight while tea and coffee prefer shade. The day length to which plants are exposed influence production of flowers and fruits. On the basis of the sensitivity to day length plants are divided into three kinds, viz.-

A. Long day plant: For the production of the flowers and fruits, these plants need at least 12 hours of day length, namely – aus rice, jute, ash gourd, snake gourd, sponge gourd, etc.

B. Short day plant: For the production of the flowers and fruits, these plants need less than 12 hours of day length, e.g.–wheat, mustard, aman rice, gimakolmi, Indian spinach (puishak).

C. Day neutral plant: These plants can produce flowers and fruits under any day-length, e.g. -ground nut, banana, tomato, cotton, etc.

2. Heat: Heat influences growth and survival of the plants. For this plants choose minimum, optimum and maximum temperatures. These three temperature points are known as cardinal temperatures. Cardinal temperatures will be different for a given plant depending on its species and variety. The distribution of crops in a given area is controlled by the cardinal temperatures. On the basis of the need of the temperature, cultivable crops can be divided into two categories, namely – Cool season crops and Hot season crops.

A. Cool season crops: These crops prefer to grow in low temperatures e.g. wheat, potato, chick-pea, lentil, cauliflower, knolkhol, etc. For growth, these plants require minimum 0-5°C , optimum 25-31°C and maximum 31-37°C temperature .

B. Hot season crops: These crops grow in high temperatures e.g. jute, rubber, kasava, etc. For growth, these plants require minimum 15-18°C optimum 31-37°C and maximum 44 - 50°C temperature .

3. Rainfall: Water is very important for plants. They depend on water retained in soil. Rain is the key source of soil moisture. For this the amount, hour and fall of rain is very significant for crop production. Because of rainfall variance, different types of crops grow better in different areas of the world.

4. Air current: Respiration, photosynthesis, pollination of flowers, etc. are controlled by air current.

5. Relative humidity (RH) in the air: High humidity is favourable for the crops in their initial growth phase. At the granulation stage low humidity may cause shrinkage of the grains. Too much humidity in air props up the spread of diseases and insects.

6. Dew and fog: Sometimes dew and fog can create a favourable environment for the spread of diseases in the crops.

Activity: Work in four groups to make a list of elements that affect weather and climate on crops production to present it in the class.

New words: short day plant, long day plant, light loving plants, day neutral plant, shadow loving plants, cardinal temperatures, day-neutral plant.

Lesson-6: Influence of Adverse Weather and Climate on Crop Production

Crop production increases when the weather and climate are in favour. But in adverse weather and climate crop production decreases or it may cause total crop loss. In this chapter, we will discuss different types of adverse weather. And we will learn about the damages caused by such weather.

1. Heavy rainfall: When it rains more than usually it does, we call it heavy rainfall. Heavy downpour in the rainy season impedes the production of vegetables. Vegetable plants lean on the ground because of excessive rain and their leaves, flowers and fruits get damaged. Heavy rain may cause flash flood and waterlogging. Flood and waterlogging result in oxygen deficiency in the soil. In this situation the growth of plants and their production suffer from damages. Various plants like papaya, jackfruit, etc. even die in such condition. So water stagnated due to heavy rainfall, must be drained out.

2. Hailstorm: When the rain drops in the shape of ice balls it is called hailstorm. In Bangladesh hailstorms occur in the months of Chaitra and Boishakh almost every year. Downpour of hail in the south-eastern part is more than that in the northern part. In most of the cases hail accompanies Nor'-westers. Hailstorms cause huge damage to the crops. Especially leaves, flowers, and fruit suffer extreme injury due to hailstorm. Hailstorm active for a few minutes can totally damage a crop like Boro rice, jute, mango, banana, onion, and garlic in our country.

3. Drought: When there is not enough rain for a long period, it is called drought. In our country when it does not rain continuously for twenty days or more during the months of Chaitra and Kartik it is called drought. Soil gradually suffers from moisture shortage because of the dearth of downpour. The amount of water that plants release through transpiration is more than the amount they can absorb from the soil. During drought the condition of water

deficiency continuously hinder growth and development of the plants. This state is known as drought afflicted situation. Crops wilt away because of drought and if the drought is acute, plants may dry up and die. As a result the production reduces drastically. Drought is divided into three forms on the basis of damage caused to crops, viz. severe drought, moderate drought and ordinary drought. We suffer from 70-90 percent harvest deficit during severe drought. The deficit is 40-70 percent in moderate drought and 15- 40 percent in ordinary drought. Crops suffer from drought in almost all seasons in Bangladesh. Rajshahi, Chapainawabgonj, Natore, Dinajpur, Rangpur, Bogura, Kushtia, Jashore, and Madhupur regions experience severe to moderate drought almost every year.

4. Flood: Damage and loss of crops depend on flood water level, flow of flood water, and prolongation. Flood water inundates low and mid-low land areas. For this, fields of crops especially paddy fields go under water. Usually at the time of sowing or post-sowing period aman rice suffers damage because of flood.But boro rice sustains loss from floods caused by overflow of rivers during the period it matures.



Fig-4.9 : Flood

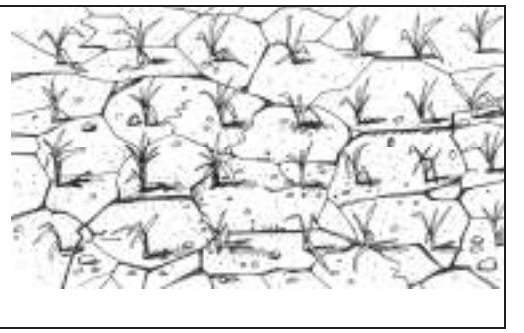


Fig-4.10 : Drought stricken paddy field

Activity: Get into two groups. One group will make a list of harms caused to crops for heavy rain and the other group will make the list of damages due to hailstorm. Then display both the lists on the board.

New words: heavy rain, hailstorm, severe drought, moderate drought, ordinary drought.

Lesson-7: Agro Ecological Zones (AEZ)

Bangladesh is predominantly a land of agriculture. Almost all types of crops grow in Bangladesh. But all crops do not grow in all areas of Bangladesh. Cultivation of crops depends on the environment of a given area. So it is necessary to know area wise agro environment to design agricultural activities. That means agro ecological zone is an important aspect in agricultural activities.

We know that in some parts of Bangladesh it rains heavily while the other parts receive light rain or no rain. Somewhere temperature is high and in other places it is low. Soil is also different in different areas. All these constitute the agro environment. For favourable agro environment mango grows well in Rajshahi, lichi in Dinajpur, tea and oranges in Sreemongol, and date grows well in Jessore. So, on the basis of soil and climate, Bangladesh has been divided into 30 agro ecological zones.

Activity: Teacher will hang a map of Bangladesh on the wall. Forming groups of students he will ask them to write the names of the well grown crops and the district in a piece of paper and tag it at the right place in the map. Finally the teacher will explain the areas in the map marked with crops growth.

Video show: Teacher will show a video on area wise crops in Bangladesh to present the country at a glance.

Agro ecological zones in Bangladesh

Lastly, in 1988-1989 Bangladesh has been divided into 30 agro ecological zones. For agricultural production crop selections, intercultural operation, control and management of diseases and pests the agro ecological zone is taken into consideration.

To determine agro ecological zones certain things like land, agro weather, soil, and water situation are taken into consideration. Each of these factors can be classified again e.g. land is classified in five categories – high land, mid-high land, mid-low land, low land, and extreme low land.

Agro weather may be divided into pre Kharif, Kharif-1, Kharif-2, Rabi, and extremely hot weather.

Availability of water and moisture is given priority while demarcating agro ecological zones. Besides these, the river basins and other natural water reservoirs are taken into account.

Considerable factors for soil classification are sandy, clayey, loamy and their combinations like sandy loam, clayey loam and so on besides the pH of soil.

Lesson-8 : Crop Variety as Per Agro Ecological Zones (AEZ)

Due to agro climatic environment, we notice the dominance of a particular crop in some areas though rice, jute, wheat, potato, etc. are grown in almost all agro climatic regions.

AEZ 1 consists of Dinajpur, Panchagarh, and Thakurgaon districts. Particular crops in this region are litchi and mango. Nowadays tea is being cultivated and cultivation of oranges has also started.

AEZ 2 includes the shoals in Tista area. This area includes some areas of Nilphamari, Lalmonirhat and Kurigram. The specific crops of this region are gound-nut and Foxtail millet (a kind of cereal).

AEZ 3 and 4 are in Rangpur and part of Bogra. Characteristic of this region is that tobacco and vegetables are grown here.

AEZ 5 and 6 include the Chalanbil area, some low lands of Atrai and Punarvaba river. This is situated in the district of Naogaon, Natore and Chapainawabganj. The plants are used to manufacture Paati, and cane products are the specific crops of these zones. Water melon and garlic are being cultivated widely nowadays.

AEZ 7 is located in the shoals of the river Brahmaputra in the district of Kurigram, Gaibandha and Sirajganj. Particular crops in this region are ground-nut and pumpkin.

AEZ 8 covers the riverside areas of the Brahmaputra. These include some area as of Sherpur and Jamalpur. AEZ 9 encompasses Sherpur, Jamalpur, Tangail and Mymensingh area. Special crop in AEZ 8 region is Water chestnut (Paanifal). Almost all kinds of crops grow in AEZ 9 region.

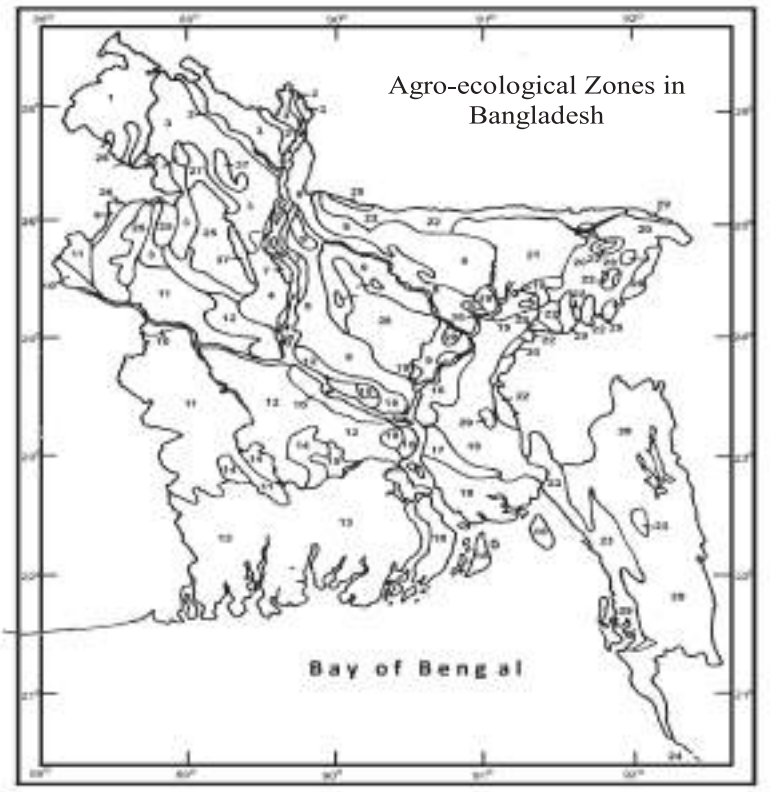
AEZ 10 extends over the shoals of the Padma. Ground nut is the main crop here. AEZ 11 is the waterfed areas by the old Brahmaputra. Cotton is the characteristic crop of this region. AEZ 12 covers the riverbanks of the Padma. This region produces the crops like broadcast aman and palm. The coastal area of Khulna forms the AEZ 13.The Sunderbans belongs to this region. AEZ 14

includes the sides of low lands in Gopalganj. Palm and date trees are the specialities of this region. AEZ 15 covers the Arial quagmire area. Broadcast aman (buna aman) is main type of crop in this region.

AEZ 16 stretches over the middle Meghna area. Land is mid-high here. Crops including potato and banana grow in this region. AEZ 17 encompasses the border areas of Noakhali and Cumilla. General crops including ground nuts, maize etc. grow here. AEZ 18 covers low areas of Bhola. Coconut and betel leaf are the special crops here. Eastern Meghna area comprises the AEZ 19. Broadcast aman is the particular crop that grows in this region. Tanguar Haor belongs to AEZ 20. Boro rice production and fish cultivation areas are situated here. AEZ 21 includes the banks of Surma and Kushiara. This zone includes many areas of Sunamganj. These are the production areas of boro rice, fish and vegetables. Foot of the North-Eastern hills belongs to AEZ 22. This zone includes some parts of Netrokona, Sunamganj, Moulovibazar and Sylhet. Areca palm, lemons, oranges, and Khasia betel leaves are the specific crops in this region. Nowadays agar is being cultivated in these areas.AEZ 23 stretches over the coastal areas of Chattogram and Cox's Bazar. Betel leaves exhibit the characteristics of this region. Coral island of St. Martin's belongs to AEZ 24. Coconut is the main crop here.

AEZ 25, 26, and 27 encompass the Barind Tract area of Rajshahi, Bogura and Dinajpur. Almost all crops grow in the high lands of these areas. AEZ 28 stretches over the red-soil zone from Madhupur to Tejgaon of Dhaka. Sal tree (*Shorea robusta*) grows here. Jackfruit and Pineapple are also the crops here. AEZ 29 includes all the other hilly areas. This zone includes the hill areas of Rangamati, Bandarban, Khagrachari, Chattogram, Moulovibazar and other district . The special crop here is tea. The red-soil area of Akhaura belongs to AEZ 30. Major crops in this region are teasle gourd (kakrol) and Mukundapuri guava.

The main purpose of giving the details is to inform that Bangladesh has immense diversification in agriculture though it is a small country. However, AEZ 3, 9, 11 and partially 16 are open AEZs. Because of the various crops like rice and jute grow in these zones, Bangladesh is called 'Golden Bengal'.



1. Old Himalayan Piedmont Plain Land Area. 2. Active Tista-flooded or inundated Land Area. 3. Tista meander flooded Land Area. 4. Korotoya-Bangali flooded Land Area. 5. Lower Atrai basin Area. 6. Lower Punarvabha flooded Land Area. 7. Active Bramhaputra - Jamuna flooded Land Area. 8. New Bramhaputra and Jamuna flooded Land Area. 9. Old Bramhaputra flooded Land Area. 10. Active Ganges flooded Land Area. 11. High Ganges river flooded Land Area. 12. Low Ganges river flooded Land Area. 13. Ganges tidal flooded land area. 14. Bil areas of Gopalganj-Khulna. 15. Arial bil Area 16. Middle Meghna river flooded Land Area. 17. Lower Meghna river flooded Land Area. 18. New Meghna estuarine flooded Land Area. 19. Old Meghna estuarine flooded Land Area. 20. Eastern Surma-Kushiara flooded Land Area. 21. Sylhet Basin Area. 22. Northern and Eastern Piedmont Plain Areas. 23. Chattogram Coastal Plain Land areas. 24. St. Martins Coral Island Area. 25. Plain Barind Tract. 26. High Barind Tract. 27. North-eastern Barind Tract. 28. Madhupur Tract. 29. Northern and Eastern Hilly Area 30. Akhawara Terrace.

Activity: Make a list of crops grow in your region and present it in the class.

Exercise

Multiple Choice Questions

1. Hailstorm occurs in Bangladesh-

a. In Boishakh and Jaistha b. In Ashar and Shraban

c. In Falgun and Chaitra d. In Chaitra and Boishakh

2. Day neutral (dıbanırapakkha) crops are –

i. ground-nut, tomato, papaya

ii. aus rice, egg plants, banana

iii. maize, cauliflower, potato

Which one of the following is correct?

a. i b. ii

c. i and ii d. ii and iii

Read the following paragraph and answer questions 3 and 4.

Amena Begum has decided to grow vegetables in the empty space beside her house. She currently grows tomatoes, beans, and gourds. By the end of this season, she plans to plant red vegetables, eggplants, and chilies.

3. Which are the crops of the Rabi season (Grown in Winter and harveste d in Spring) –

A. Beans, bitter gourd B. Beans, gourd

C. Bitter gourd D. Papaya, banana

4. The characteristics of the season mentioned in the paragraph are –

i. Rainfall is less

ii. The temperature is high

iii. Water irrigation is required

Which of the following is correct?

A.i and ii B.i and iii

C.ii and iii D.i,ii and iii

Creative Questions

1. Though Sadiq's home is situated in the area where it rains lightly. Still a lot of vegetables grow there. Once Sadiq accompanied his mother to his uncle's house at Tilatol in Chattogram and carried some fresh vegetables with them. One day he noticed that the sky suddenly got covered with deep dark clouds and stormy wind started blowing, and then it began to rain.

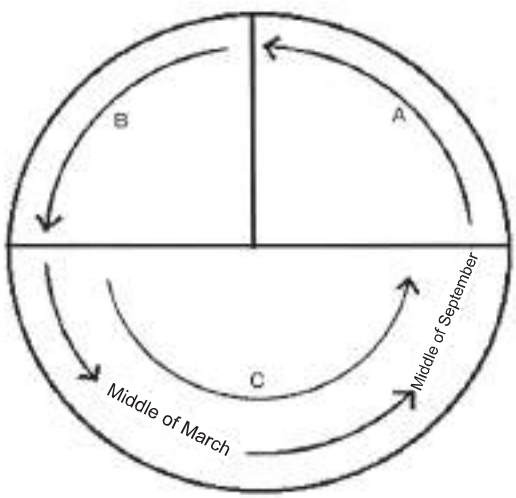
   a. What do you understand by season of crops?

   b. Explain the reason of calling potato a vegetable of cardinal temperatures.

   c. In light of the above stem, describe the seasonal characteristics of the crops in the agro area where Sadiq lives.

   d. Compare the weather types of Sadiq's area with that of his uncle's precinct.

2.



Graph of agricultural season on the basis of 12 months

a. In how many regions has Bangladesh been demarcated on the basis of the weather and climate?

b. Explain under what circumstances, infection of diseases spreads during winter.

c. Identify and explain in which agricultural season in the graph, irrigation is not much required.

d. Evaluate the impact of temperature on the crops of agricultural seasons marked as 'C' in the figure.

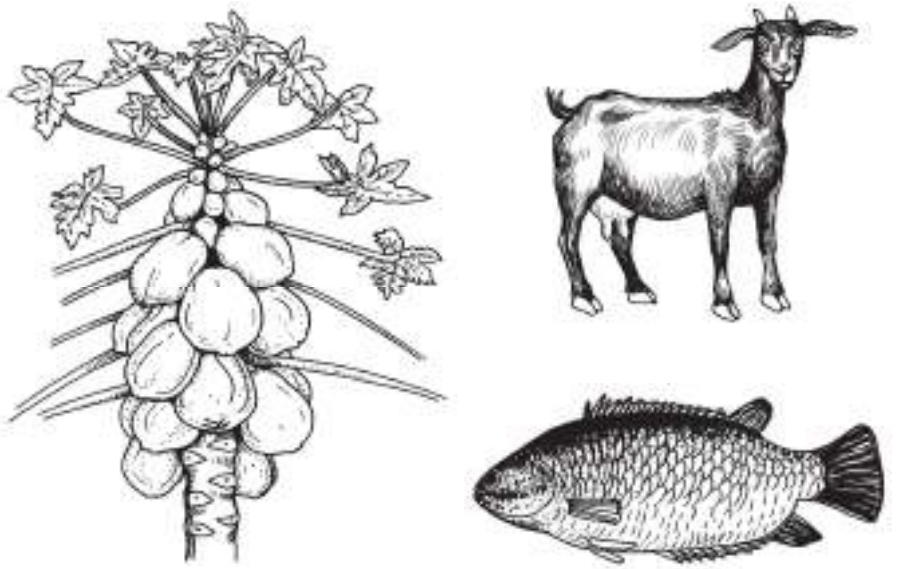
Short Answer Questions

1. What is drought, and what damage does drought cause to plants?
2. What are short-day plants? Give examples.
3. What is hail? What kind of damage does hail cause to crops?
4. Write two reasons for dividing Bangladesh into agricultural production zones.

Assignment: Why can some crops be cultivated all year round? Students will write an individual report and submit it to the teacher.

Chapter Five
Agricultural Production

Agricultural production means the production of crops, domestic animals and fish. In this chapter, there will be discussion on grains (maize/corn), floriculture (tube rose and marigold) and fruit cultivation (guava and papaya) among agrobased production; disease management; and harvesting crops. Later pisciculture and disease management (climbing fish), poultry rearing and disease management (chickens) and livestock production system and disease management (goat) have been discussed. Finally ideas on how to maintain income and expenditure (debit-credit) records of the agrobased production have been conveyed.



At the end of this chapter we will be able to –

- describe the cultivation process of grains (maize/corn).
- describe the cultivation process of different types of flowers and fruit.
- describe fish cultivation process.
- analyse the ways of preventing diseases in fishes and disease management.
- describe poultry rearing procedure.
- describe livestock and poultry diseases management and analyse them.
- maintain the records of income and expenditure of agrobased production.

Lesson-1: The process of maize (Corn) Cultivation

Maize is a high yielding and a diversely usable granular crop. Maize cultivation in Bangladesh is expanding. Maize is a perennial shrub. Both male and female flowers grow in the same plant. The male flower sprouts arraying like a tassel in the head of the plant. The female flower comes out in the form of mocha from the axis point of the stem and leaf at the mid height of the plant. A granular structure takes form in the *mocha* (ear) when the female flower is fertilized. Nutrition value of the maize grains is more than that of rice and wheat. Maize grains are used as human food and its sappy plants and green leaves are used as high quality food for the cows. There is a widespread need of the maize grains as the livestock, poultry and fish feeds.

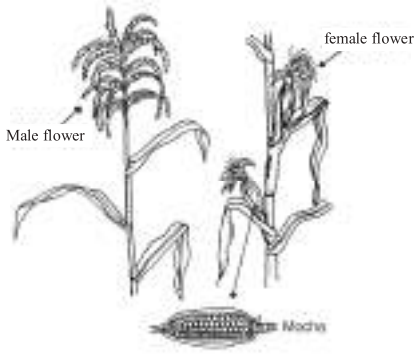


Fig-5.1: Maize plant

Variety: Bangladesh Agricultural Research Institute has produced some high yielding and hybrid varieties. Among these varieties Barnali, Shuvra, Mohor, BARI maize – 5, BARI maize – 6, BARI maize – 7, BARI hybrid maize – 1, BARI hybrid maize – 2, BARI hybrid maize – 3 are important. Besides for *khoi* (popcorn), popcorn maize and to eat when it is tender BARI sweet maize –1 have been released. Apart from this, various seed companies import seeds of hybrid maize from foreign countries.

Soil: Sandy loamy and loamy soil are the best for the maize cultivation. But it should be monitored that the soil does not get waterlogged.

Sowing time: It is the proper time to sow maize seed between October and November in the Rabi season and between mid-February and March in the Kharif season.

Seed ratio and sowing process: For BARI maize variety 25 – 30 kg and for popcorn maize 15 – 20 kg per every hectare should be sown in rows. Distance in between rows should be 75 cm and there should be one plant after every 25 cm or two plants after every 50 cm in each row.

Land preparation and application of fertilizer: In our country maize is cultivated amply during Rabi season. Land must be prepared by ploughing deeply 4-5 times and by harrowing. Use of fertilizer in maize cultivation has been given below:

Name of the fertilizer	Amount of fertilizer (kg/hectare)
Urea	172 – 312
TSP	168 – 216
MoP	96 – 144
Gypsum	144 – 168

At the ending phase of the preparation, the land must be tilled after spraying one-third of total urea and the whole of other fertilizers on it. Besides maize yields well if for each hectare of land 10 – 15 kg zinc sulphate, 5 – 7 kg boron and 5 ton cow–dung manure are used at this time. The remaining urea should be divided in two halves and the first installment should be sprayed 25 – 30 days after seed germination, whereas the second installment should be sprayed in a 'use over' way 40 – 50 days after germination of the seed. In 30 days after the seedling grow, extra saplings must be weeded out. The land must be kept free from weeds until the seedlings become one month old. During spraying the second installment of urea, soil in between two rows must be heaved up to the bottom of the seedling.

Activity: Make a list of food grains as an individual work.

New words: use over, maize mocha.

Lesson-2: Intercultural Management in Maize Cultivation and Crop Yield

Use of irrigation: To get the production of high yielding maize variety up to the expectation level 3-4 times irrigation is required. The first irrigation should be given at the five leaves stage and the second one is recommended at ten leaves stage. The third one is ensured at the time of budding out of the mocha and the fourth one should be given at the phase of taking granular shape. It should be observed that the soil in the maize field does not get waterlogged.



Fig-5.2: Maize plant of different stages

Pest control management: The maize crop suffers less pest attack. But at the seedling stage larva of cutworm cuts the bottom of the tender plant. This insect hides at day time and comes out at night. This larva should be dug out of the soil around the just cut plant sand destroyed. If the attack is massive, furadan or dursban should be applied in prescribed amount and the land should be irrigated again.

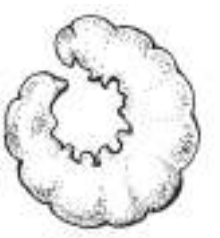


Fig-5.3: Larva of Cutworm

Diseases of maize: Maize may be affected by considerable number of diseases, e.g. seed rot disease and plant decaying disease (Chara mora rog), leaf blight disease, stem rot, ear rot and grain rot disease. Attacks of these diseases get through various types of seeds and soil-borne fungi. Seed rot and plant decaying diseases outbreak in maize field if there is excess water in soil and the temperature is low. A long grey mark is seen in the lower part of the plant when attacked by leaf blight disease. This mark later spread to the upper part of the plant. If the attack is massive the plant dries up in advance and dies away.

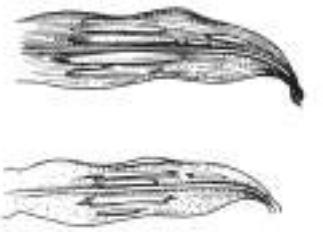


Fig-5.4: Singed leaf disease

Pest control procedure

1. Pest preventive variety should be used.
2. Seeds should be treated before sowing.
3. The remains of maize plant should be burnt down after harvesting.
4. Cultivation of maize in the same field over and over again should be stopped.

Collection and threshing of corns: When the maize flower gets the colour of shiny straw, stalk leaves become slightly yellowish, maize crop becomes worthy of collecting ears. When the maize flower ripes 75-80%, corns can be collected. Maize ear should be dried up in the sun for 4-5 days after collection of them. Then corns should be separated by a hand driven thresher or a threshing machine and preserved after sifting.



Fig-5.5: Hand driven thresher

Lifespan: Lifetime of maize is 135-155 days during Rabi season and 90-110 days during Kharif season.

Production: In Bangladesh maize yields well during Rabi season and it does less in Kharif season. Maize production varies between 3.5 – 8.5 ton / hectare depending on its variety and season.

Activity: Get into two groups. Note down the ways of corn collection in the notebook and present the lists in the class.

New words: Cutworm, corn threshing machine.

Lesson-3: Cultivation Process of Tuberose

White and sweet-scented tuberose is a favourite flower of us all. It is called rajanigandha as it diffuses fragrance at night time. In festivals and celebrations, home decorations, bouquets, garland and ornamentation tuberose is widely used. According to the arraying of petals, tuberoses are of two types. The variety that holds petals in a single row is called single and the other variety that holds petals in two or more rows is called double.



Fig-5.6: A tuberose plant with flowers

Reproduction: The reproduction of tuberose takes place from bulb in Bangladesh. These bulbs have the same look as onions. They stay hidden under ground in winter. When the winter is over the bulb is segregated from the thickets. For planting 2-3 cm long root is a sufficient size.

Plantation of bulb: For tuberose cultivation the land that gets plenty of light and air should be selected. Tuberose grows well in loamy and sandy-loamy field. Bulb is planted between February and April. This is planted at 25–30 cm distance in between rows, 10–15 cm from one plant to another plant and 4 -5 cm deep in the ground. 3– 4 months after plantation, a bulb blossoms.



Fig-5.7: Bulb

Application of Fertilizer: Soil has to be made granular by ploughing 3 – 4 times and by harrowing. While tiling, in each hectare of land 10 ton decomposed cow-dung manure, 200 kg urea, 300 kg TSP, 350 kg MoP should be mixed with soil. After 30 – 45 days of planting bulb, 125 kg urea should be sprayed again in a 'use over' way and should be irrigated.

Nursing : The land for tuberose cultivation should always contain adequate moisture in it. But there should not be any water-logging. In that case bulb could get rotten. Irrigation should be ensured immediately after planting bulb, again after the plant shoot, and once again when the plant reaches to the height of 10 – 15 cm. Besides, when blossoming starts, 1-2 irrigation helps the plant flower much and lessens falling of flowers. If it favours, soil beads should be broken apart after irrigation every time.

Harmful insects are not seen in tuberose plants. But fungal rot disease at the bottom of the plant sometimes causes a great loss. Because of this disease the

bottom of the plant which is close to the ground gets rotten and the plant dries up to die away. To prevent this, it should be monitored closely so that water cannot stagnate in the field. Mixture of 250 EC tilt with water at the ratio of 0.5 ml / 1 liter water per decimal of land should be sprayed at the bottom of the afflicted plant.

Flower plucking: Tuberose is mainly sold as the long stem or flowers with stalk or fallen flowers without stalk. Fallen flowers are used for making garlands. Flowers are collected along with the stalks before they bloom. It is good to pick flowers either in the morning or in the evening. After procuring flowers, the lower part of the stem should be dipped into water. Because of it flowers can maintain their freshness and brightness. Flowers with stalks should be sent to the market after being tied together in a stack and wrapped in black polythene.



Fig-5.8: Tuberose

Activity: Display the poster-paper drawing of collecting and marketing of tuberose.

New words: single tuberose, double tuberose, bulb.

Lesson-4: Cultivation Process of Marigold

Marigold is very popular in our country. Cultivation of marigold is easy. This flower can be grown in the yard, park and in the tub in a veranda. Marigold is used in festivals, celebrations, home decor and for making garlands. Colour, structural variety, and gracefulness of this flower attract people of all class. Bleeding from the wound stops if the fluid from the leaves of marigold flowers is used on the wound of body.

Variety identification: Two species of marigold are grown in Bangladesh viz. a) African marigold – plant of this species grows about 100 cm tall and blossoms mono coloured large flowers. According to the variety, flowers take the colours of yellow, golden, light-orange, etc. b) French marigold – plant of this species grows 15-30 cm tall, sturdy, bushy and flowers bloom in small size and take the red colour.



Fig-5.9: Marigold in a tub with flower

Seedling production: Plant of marigold can be developed from seed and through grafting a branch

from the stem. During the rainy season seeds are sown thinly and thus the seedling is produced. Seedbed of marigold should be made as the vegetables seedbed. One month old seedling is suitable for plantation. For developing plants through branch grafting healthy plants should be selected after they blossom. From the branch 2.5 cm wide and 5-10 cm long part should be cut off. These cut-off branches should be implanted in the mixture of sand and loamy soil in a shady place. It should be implanted in such a way that at least a node of the branch remains under the ground. Numerous roots, boughs and branches will grow out of it, if it is nurtured regularly. In the rainy season the branches should be cut off from the implanted branch and should be rooted again in the same way. In a month when countless roots grow in them, they should be planted.

Activity: As an individual work, students will write down the process of developing branch grafting of the marigold flower along with a sketch in their notebooks.

Land preparation and plantation: High and loamy field is the best for marigold cultivation. Soil has to be made granular by ploughing 4–5 times and by harrowing. It is better to plant sapling at the ending part of the rainy season. In the main field distance in between rows should be 60 cm and one plant should be 45 cm far from another plant. In case of the plantation in tubs, short type marigold is selected.

Application of Fertilizer: During last tilling for every decimal of land 40 kg decomposed cow-dung manure, 1 kg urea, 0.80 kg TSP, 0.70 kg MoP should be mixed well. 1 – 1.5 months after plantation only urea at a rate of 0.70 / decimal should be applied. After mixing the fertilizer properly, the land should be irrigated. In the case of planting in tubs, tubs should be prepared well by mixing 250gm decomposed cow-dung manure with urea, TSP and MoP 1 tea spoon each properly for each tub.1- $1\frac{1}{2}$ months after plantation one teaspoon urea should be applied again.

Inter-nurturing: When the plants are young, weeds should be cleared out regularly. Considering the fluid situation of the soil 1–2 irrigation is enough. But it is better to irrigate after blossoming. To get more flowers, the tip of the plant should be cut off when the plant grows a little bigger. For this, boughs and branches grow more resulting in more flowering. A bamboo post should be fixed with the plant so that the storm wind, irrigation and the weight of the flowers cannot tip the plant over.

Disease-pest management : Harmful insects are not seen to attack marigold flower plants that much. But bacterial wilt disease can cause the plant dry up

from the top gradually and at one stage the whole plant dries up to die away. To prevent this, the afflicted plant should be picked out and burnt down.

Flower plucking : Marigold flowers should be plucked along with its peduncle with a scissor. If the peduncle is little longer the flowers remain fresh for a longer period. After procuring flowers, water should be sprinkled on and the flowers should be sent to the market after being wrapped in black polythene.

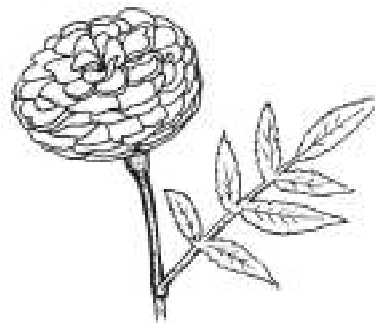


Fig-5.10: Marigold flower

New words: African marigold, French marigold, Branch grafting.

Lesson-5: Cultivation Process of guava

Guava is a popular fruit in Bangladesh. It is a vital source of vitamin C. This fruit grows more or less almost everywhere in the country. But it is cultivated commercially in Barishal, Pirojpur, Jhalokathi, Chattogram, Cumilla, etc. areas. In Bangladesh,we get many types of guavas. Among them Kanchannagar, Swarupkathi, Mukundapuri, kazi peyara, BARI peyara–2, BARI peyara–3 varieties are important.



Fig-5.11: Guava

Soil: Guava is a drought tolerant plant and it can grow in various types of soil. It can bear with slight salinity in the field. Fertile and deep loamy soil is good for commercial production.

Pit making : Guava saplings are chiefly planted between June and September. For planting seedlings 60 cm x 60 cm x 60 cm holes are dug at 4mx4m distances. Soil from the upper 30 cm part of the hole is kept on one side and the soil from the lower 30 cm part of the hole is kept on the other side. Then the soil of the upper part is put at the bottom, and the hole is filled up with the lower part soil after being properly mixed with 5-7 kg decomposed cow-dung manure, 200 gm TSP and 150 gm MoP. It is kept in this condition for 10-15 days.

Plantation of saplings : Seedlings are made from seeds and gooti grafting. Saplings from seeds and gooti grafting are planted in middle of the hole. The plant should be tied to a bamboo post to avoid tilting. To protect it from the cattle, bamboo made cage or fence should be set around the plant.

Application of fertilizer: If fertilizer is used in three equal installments in February, May and September, guava yields very well. It is not that the fertilizer should be given just at the root of the plant, rather it should be mixed properly with the soil and should be extended up to the area where the boughs and branches spread. Irrigation is required after the use of the fertilizer.

Amount of fertilizer according to the age of each plant:

Name of the fertilizer	1 – 3 years
Cow-dung/compost	10 – 20 kg
Urea	150 – 300 gm
TSP	150 – 300 gm
MoP	150 – 300 gm

Nurturing: After collecting fruits from the adult tree, branches should be amputated in August – September. If the branches are cut off, new branches grow and produce more fruits. To keep the tree, fruit yielding should always continue and to get quality fruits, 25 – 50 % fruits should be ripped at the tender state. At the time of bearing fruits if irrigated intermittently after every 7-10 days during the months of April to June, the fruit production increases.



Fig-5.12: Affected guava

Disease-Pest management: Sometimes guava plants are attacked by fungal diseases. For this disease tiny spots are seen on the body of the fruit and later they become bigger creating sore in guavas. At this the fruits get cracks on them and may get rotten. To prevent this disease fallen leaves and fruits should be collected from beneath the tree and be burnt down. After fruitage, mixture of 250 EC tilt with water at the ratio of 0.5 ml / 1 liter water should be sprayed 3-4 times after every fifteen days. at the bottom of the afflicted plant.

Fruit collection : Kazi and BARI types of guava produce fruits twice a year. When it is time for the fruits to ripen, its green color gradually turns to yellowish green. Fruit production varies depending on the age and species. A 4-5 years old tree yields 15- 20 kg fruits.

Activity: Draw the plantation process of guava sapling on a poster paper and present it in the class.

New words: amputated, fungal disease.

Lesson-6: Cultivation Process of Papaya

Papaya is a very delicious, nutritious fruit and it is enriched in medicinal qualities. Papaya is eaten as a vegetable when it is green and is eaten as a fruit when it ripens. Papaya is available throughout the year.

Papaya variety: Shahi, Ranchi, Washington, Honeydew, Pusha varieties of papaya and different hybrid varieties imported from abroad are cultivated in our country.

Land selection and preparation : High and mid-high loamy or sandy loamy soil is good for papaya cultivation. But by doing proper nursing papaya can be cultivated in all types of soil. For this the land must be tilled well 3/4 times. Papaya cannot tolerate waterlogging.

Seedling production : Collecting seeds from a good and sweet papaya the white covering of them should be taken off and then should be sown afresh in the seedbed or in the soil in a polybag. After sowing the seeds, necessary amount of irrigation must be given. Seedlings grow in 15-20 days.

Plantation process: Papaya can be cultivated throughout the year. But for commercial cultivation the months of Ashwin - Kartik or Falgun - Chaitra are suitable. Two months before the selected time, seeds should be sown for production of seedling. Seedlings of 1½ - 2 months old should be planted. After making 60 cm x 60 cm x 60 cm size 'Seedling bed' at 2 m distances, saplings should be planted in it. 15 days before plantation, fertilizers need to be mixed with the soil of 'mada'.

Procedure of applying fertilizer: 500 gm TSP, 250 gm Gypsum, 25 gm Borax, 20 gm Zinc sulphate, 15 kg organic or compost for each seedling bed must be mixed properly with the soil. After plantation when new leaves sprout, urea and MoP 50 gm each must be applied after every one month. The amount is made double when the tree blossoms. Even one month before the plucking of last fruit, MoP and urea fertilizers should be applied.

Intercultural management: In the case of the plant of mono-sex type 3 saplings are planted in one bed. When blossoms only one female plant must be kept and the others must be culled. For the benefit of pollination 10% male plants are kept. If it is certain that fruitage will happen from the flowers, one fruit should be preserved in one footstalk and the rest should be ripped off. The plant should be tied to a bamboo post to avoid being tilted or being uprooted by storm.

Disease-pest and remedy : If the soil of the seedbed or the polybag is marshy, the plant may tilt and if there is any lack of proper drainage system in the field,

the adult tree may get infected with stem rot disease in the rainy season. To prevent this fungal disease, proper drainage system must be ensured and the infected tree must be cut off and burnt down. Papaya tree may get infected by mosaic virus and leaf wrinkling virus. Mosaic virus infected leaf gets yellowish colour and it looks like mosaic. Because of these diseases the leaf blade becomes thick and fragile. If the virus affects any tree in the garden, the infected trees must be culled and interred.

Fruit collection: When the astringent juice of fruit gets the watery state, papaya can be collected as a vegetable. When the peel of the fruit takes light yellowish colour, it can be collected as a ripe fruit. Production of fruit varies according to its varieties. But shahi papaya grows 40-50 tons in a hectare.

Activity: Write down the process of producing papaya saplings and the procedure of planting them, and then present it in the class.

New words: borax, fertilizer, viral disease, preparation of seedbed.

Lesson-7: Method of Keeping Agricultural Accounts (Crop Production)

Many people take crop production as a business. So they calculate the expenditure in crop production and income by selling the products. If the income is more at its expected level than the production cost, it will be worth going for producing that crop. Income and expenditure in crop production may vary in consideration to place, time and person. To calculate the returns and costs in crop production, we should know about the heads of income and expenditure first. We find three heads of expenditure in the crop production viz. (a) ingredients cost, (b) supplementary cost, and (c) total production cost.

Ingredients cost: Ingredient cost may be of two types e.g. –

Material ingredient cost: The expense for seed, fertilizer, irrigation, etc. for crop production is called materialistic ingredient cost. Materialistic ingredient cost can be calculated by using the table below–

Serial no.	Ingredient	Per hectare required ingredient (kg)	Rate of ingredient (taka)	Cost per hectare (taka)

Other ingredient cost: The expense required for necessary labourer and animal or machinery strength for producing crops is called other ingredient cost, e.g. - labourer for planting saplings, land tilling cost etc. extraneous ingredient cost can be calculated by using the table below -

Serial no.	Description of work	No. of labourer or no. of tilling	Per day wage or per tilling cost	Cost per hectare (taka)

Supplementary cost: Interest on the total ingredient cost and land value during crop production is called supplementary cost.

Total production cost: Sum total of total ingredient cost and total supplementary cost is called the total production cost.

Total production cost = Total ingredient cost + Total supplementary cost

In crop production, income is divided into two types, viz. total income and net income. Total income includes the total income of the produced crops and the byproducts, as in the case of rice cultivation. As for example the income after selling rice and straws. The residue amount after deduction of the total production cost from the total income is called net income.

Net income = Total income – Total production cost

Will you be able to calculate the net income in papaya cultivation in a given land? To calculate the net income from papaya cultivation, we will have to calculate the income and expenditure as described below:

Material ingredient cost

Seed, fertilizer, insecticide, fungus spray , bamboo, thread, irrigation costs.

Extraneous ingredient cost

1. Number of labourers and expenses for making seedbed, sowing seeds, nursing saplings, and plucking saplings.
2. Expenses for 3 times land tilling and harrowing.
3. Number of labours and costs for seedbed preparation, fertilizer mixing, planting saplings.
4. Expenses for using fertilizer and nursing, and collecting crops.

Supplementary cost

1. Calculated interest on the total ingredient cost at the rate of 12.50% during crop production.
2. Calculated interest on the market value of land at the rate of 12.50% during crop production.

Total production cost: Add the total ingredient cost and supplementary cost.

Total income: Multiply the probable production by the market price.

Net income: Deduct the total production cost from the total income.

Activity: Get into two groups and calculate the income and expenses of papaya cultivation in 1200 sqm field.

New words: material ingredient cost, extraneous cost, supplementary cost, total production cost, total income, net income.

Lesson-8: Cultivation Process of Climbing fish (Koi)

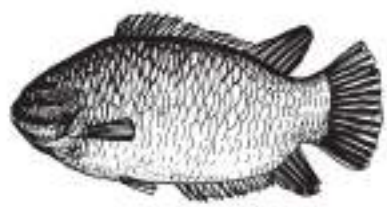


Fig-5.13: Climbing fish

Climbing fish is a delicious fish. It is very popular among the people of Bangladesh. Climbing fish is found in different water reservoirs like haor, canal, bils, and ditches. The species which is cultivated in Bangladesh has been imported from Thailand. Thai Climbing fish is fast growing than the local species. Like other fishes Climbing fish inhales oxygen in water through its gill. But when it comes up from water it can survive in an adverse situation by taking oxygen through its special organ lying under its skin. Climbing fish cultivation is profitable nowadays.

Importance of Climbing fish cultivation: This fish is delicious and nutritious. There is a great demand of Climbing fish in the market and the market price is also very high. It can be cultivated very densely in a shallow pond. By cultivating this fish, it is possible to fulfill the needs of the animal protein in a family.

Characteristics of a cultivable pond : The pond should be in an open area. It will be good if the pond is in silt loam or clay loam soil. The pond should be with strong and cleanbanks and it should be in a flood free area. The pond should have the water retention capacity for at least 5-6 months.

Preparing the pond for cultivation: For cultivating Climbing fish in the pond the following steps should be taken –

Bank repair: In case of broken condition, the banks of the pond must be repaired properly. To ensure adequate light in the pond the branches and boughs of the big trees on the banks should be shortened.

Control of aquatic weeds: Aquatic weeds should be cleaned from the pond to make sure that the pond gets enough sunlight. Besides weeds free pond helps producing natural feed for fishes in the pond.

Removal of predatory and unwanted fishes: Predatory and unwanted fishes must be removed from the pond because the predatory fish eats up the young fishes and the unwanted fish finishes the food for the Climbing fish. These fishes can be removed from the pond by hauling net repeatedly or by drying up the pond or by using 20-30 gm rotenone for every decimal of the pond.

Application of lime : Lime removes acidity from the water and soil. Lime also eradicates the turbidity of water and helps Climbing fish prevent its diseases. So 1-2 kg lime should be used for per decimal of the pond.



Fig5.14: Young climbing fishes

Application of fertilizer : Cultivation of climbing fish largely depends on supplementary feed. Seven days after using lime in the pond,100 gm urea and 50 gm TSP should be doused in water for each decimal area should be applied in sunlight.

Release of Climbing fish fry: Slanting to one side, Climbing fish is capable of moving from one place to another by using its fin to walk. For this all the sides of the pond should be enclosed by nylon net before the release of climbing fish fry. The young fishes should be carried cautiously to prevent injuries to them. Before releasing them to the pond it should be ensured that the fry gets adjusted to the pond water. 400-500 young fishes can be stocked up in every decimal area of the pond. In such a stocking density prepared fish feed must be provided.

Feeding system : Fish meal, mustard oil-cake, rice bran and wheat bran are doused in water and from this mixture balls are made as a food for Climbing fish and then these balls are dropped in some specific places of the pond. Besides commercially produced fish feed can be collected from the market and given to the Climbing fishes. Food should be supplied daily at the rate of 5% to 10% of the body weight of a fish. The food should be divided into two halves daily; one half should be given in the morning and the other in the afternoon.



Fig-5.15: Prepared food for climbing fish

Activity: Work in groups and write down the characteristics of Climbing fish cultivation process and present in the class.

New words: Adverse situation, Supplementary feed.

Lesson-9: Control of Diseases in Climbing fish

Control of diseases among fishes means preventive and remedial steps taken against the diseases. Preventive measures are taken before being infected and remedial steps are adopted after being affected. In the case of climbing fish, importance must be given on the prevention than treatment . Climbing fish is vulnerable mainly to bacterial and parasitic diseases. But for the great stocking density of fishes and nutritional deficiency in food, fishes can be affected by the diseases caused by malnutrition.

Steps to prevent diseases among climbing fishes are mentioned below –

1. There should be net hauling at least once in a month.
2. Fish feed enriched in nutrition should be supplied in accordance with the average weight of the fish.
3. Water must be changed if the water gets deep green colour or gets polluted.
4. If a red layer is seen on water, bleaching powder at 50 gm / decimal should be applied.
5. In the pond of climbing fish a lot of plankton is created and it pollutes the pond water. To control plankton 12 Tilapia and 4 Silver carp in every decimal area can be released.
6. If there is any scarcity of oxygen in the pond, steps should be taken for the arrangement of bamboo beating and swimming.
7. To prevent diseases 0.5–1.0 kg lime or 200–250 gm zeolites for each decimal area should be applied for one metre of deep water at the beginning of winter. Besides 250 gm salt per decimal can be applied in every two months.

Activity: In groups students will discuss the preventive measures for diseases among climbing fish, write in their note books and present them in the class.

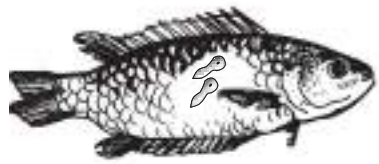
If climbing fish is infected by any disease, the following remedial steps should be taken –

1. If the fish is affected by bacterial disease or fins rot disease, 6 – 8 gm copper sulphate per decimal area should be applied.

2. If the fish is infested with louse, for 30 cm depth of water 3-6 gm dipterex for every 100 once a week should be applied three times successively.



A fish with parasitic disease



A fish affected by bacterial disease

Fig-5.16: diseased climbing fish.

3. If the fish is affected by ulcerated disease, copper sulphate treatment along with the seven days use of oxytetracycline at a ratio of 3 – 5 gm per kg feed can control the disease. In addition, 0.5 kg-1.0 kg edible salt can be applied for 30 cm depth of water for every 100 decimal.

New words: remedial steps, red layer in the pond, fin rot disease.

Lesson-10: Rearing Process of poultry (Fowl)

You must have observed how poultry is reared in the villages. In rural Bangladesh fowls are reared in a fully open or free state. But in commercial farms poultry is reared in a confined state. Besides these, some people raise chickens in a penned area. Poultry rearing processes are discussed below:

Poultry rearing in open or free process: In this process chickens are raised in a fully open or free state. This process is very easy and popular for rearing small number of chickens. In rural areas of Bangladesh poultry is reared at homes in this process. Chicken roams around the homesteads whole day long to collect its own food. Leftover food at homes is also given to them. They return to their houses in the evening. It does not cost much for their abode. Expenditure in poultry rearing is meagre as it does not require any feed and labourer. This process is not applied to rear chickens on commercial basis. Raising local chickens in this process is profitable.



Fig-5.17: Poultry rearing at home in an open process



Fig-5.18: Poultry rearing in half-confined process

Poultry rearing in half-confined process : In this process there is a specific pen for the chickens. A wide area around the pen is surrounded by a wall or fence. It is called run. Throughout the day chickens go about this area. They take shelter in that pen during rain and storm. Besides this, they stay in that pen at night. As they are confined to a restricted area, they do not get adequate food and water. So they should be supplied with food and water. Because of supplying food, the production cost gets higher in this process. In a half-confined process the high quality chicken breed variety of Fayoumi, Australorp or Rhode Island Red are better to be reared instead of hybrid fowls.



Fig-5.19: Poultry rearing on the floor in a confined process



Fig-5.20: Poultry rearing in cages in a confined process

Activity: Students will get into four groups and write down the advantages of different processes of poultry rearing to present them in the class.

Poultry rearing in confined process: In this process many chickens are reared in a totally confined state in a house. The pen built in this process is suitable for fowl-raising. This is called chicken farm. Generally in the confined process chickens are reared on the floor. Apart from this, many a people raise chickens in cages too. When the floor of the pen gets damp, chicks can be nurtured in a bamboo made platform. In commercial poultry rearing this process has

become a standard. In this process chickens are supplied with food and water. Because of this, the management cost is higher and the profit is also higher in this process. Highbreed layer, broiler and layer hybrid chicks are reared in confined process. In this process, a large number of fowls can be reared together in a small area.

New words: commercial, leftover, management, hybrid, broiler and layer.

Lesson-11: Poultry Feed and Water Management

Poultry feed management is an important factor in chicken rearing. In homesteads chickens live on the waste, fallen crops, insects, vegetables, etc. in an open or free process of poultry rearing. So, they do not get adequate and balanced feed. The desired number of eggs and amount of chicken meat will not be in hand if balanced feed is not ensured when nurturing high breed chickens at homesteads. 70% of the total poultry rearing cost is spent on poultry feed. Chickens drink a lot of water. So poultry feed and water management is important in a poultry farm.

Nutrition of poultry and food ingredients: The essential nutrients for poultry are sugar, protein, fat, mineral salts, vitamin and water. The necessary nutrients for poultry are present in a balanced feed. Different food ingredients that the source of nutrients for poultry are given below –

Serial no.	Nutrients	Food ingredients
1	Carbohydrate	Wheat, maize, rice grains, rice bran, wheat bran etc.
2	Protein	Dry fish powder, soyabean meal, sesame oil-cake, mustard oil-cake etc.
3	Fat	Soyabean oil, mustard oil, sesame oil etc.
4	Mineral	Common salt, bone powder, oyster-snail powder, vitamin-mineral mix
5	Vitamin	Vegetables, vitamin mix etc.
6	Water	Pure water from tube-well, well

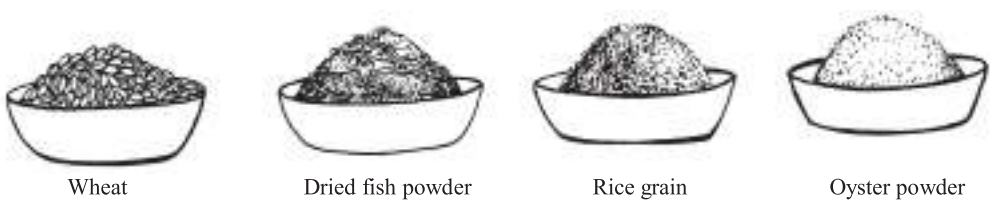


Fig-5.21: Different types of food ingredients

Poultry ration: Three types of commercial poultry feed is available in the market. Layered chicks ration, broiler grower ration and finisher ration are available. So rations should be prepared or bought from the market to feed fowls according to their age and purpose.

Preparation of poultry ration: A balanced poultry ration is prepared by granular food ingredients. About 45-55% wheat and maize, split 15-20% rice and wheat grains, 10-15% soyabean meal and sesame oil-cake, 6-10% dried fish powder, 2-6% bone powder or oyster-snail powder are used in ration preparation. Besides this, common salt and vitamin mix should be added to the ration. After preparing ration, food ingredients should be mixed properly. Following is the sample ration preparation for the layers –

Serial no	Food ingredients	Percentage (%)
1	wheat and maize grains	47.00
2	rice and wheat bran	16.00
3	soyabean meal	10.00
4	sesame oil-cake	10.00
5	dry fish powder	10.00
6	oyster-snail powder	6.00
7	common salt	0.50
8	vitamin-mineral mix	0.50
	Total	**100.00**

Activity: In groups, students will prepare 2 kg ration maintaining the ratio shown in the sample ration and present it in the class.

Supply of food and water : Each chick consumes 10-15 gm food daily. Amount of food supply must be increased as the chicks grow. A fowl consumes 100-120 gm food daily and it should be supplied with 200 ml germ free pure water. Feed pot and water pot must be used after cleaning every day.



Feed pot Water pot

Fig-5.22 : Feed pot and water pot for chick

New words: ration, finisher ration.

Lesson-12: Management of Poultry Disease

Birds, as well as human beings also suffer from various diseases. Nonconformity with the normal health factors of human beings and birds and animals is called disease. An unnatural symptom in a body is considered as the manifestation of a disease. Disease management means prevention, identification and medication of this disease. Primarily infected chickens can be identified by observing the external symptoms. The symptoms of a sick chicken are given below –

1. A sick chicken gets separated from the flock.
2. It dozes sitting on the ground.
3. Food or water intake decreases or stops.
4. Feathers of the chicken look messy.
5. Abnormal defecation.



Fig-5.23: External symptoms of a sick chicken

Birds are infected by diseases for various reasons. Main cause of the diseases is germs. Viral and bacterial diseases of fowls are very critical. There is no treatment for viral diseases. So, if the disease breaks out, the poultry cannot be saved. Besides this, parasitic disease causes great harm to the chickens. To prevent viral and bacterial diseases fowls should be vaccinated regularly. Preventive power in chicken's body develops after vaccination. This is why all the chickens in the farm or homestead should be vaccinated at a time.
Few names of diseases are given below –

1. **Viral disease:** ranikhet, gumboro, bird flu etc.

2. **Bacterial disease:** fowl cholera, fowl typhoid, pullorum, tuberculosis, botulism etc.

3. Parasitic disease: Two types of parasites are seen both inside and outside the body of the chicken. Outside body parasites like louse, atali and mite develops under the feathers. Chickens are mostly attacked inside their body by the parasites like round worm and tape-worm. These worms take a share in the nutritious food of the chickens. Many worms suck blood from the body of the chicken. Besides, chickens suffer from blood dysentery quite often. Protozoa is the cause of this disease. Domestic animals stay in the farm house for a long time. If they are infected by diseases, they can be cured by giving treatment



Fig-5.24: Treatment for an infected chicken

and brought back to production again. But this is not possible in a commercial poultry farm. So, the following steps should be taken to prevent diseases in the poultry farm –

1. Pen and adjacent areas should be kept clean.
2. Predatory birds or animals should be barred from entry to the farm.
3. Vaccination should be given timely.
4. Chickens should be provided with fresh food.
5. Chickens should be supplied with pure water.
6. Balanced food should be given to the chickens.
7. Arrangement should be made to keep the poultry bed dry.
8. Poultry excreta should be preserved at a distance from the farm.

Activity: In groups, students will present a list of common poultry disease in the class.

If any disease breaks out in the poultry farm, a veterinarian should be contacted without getting panicked and the following steps should be taken –

1. Isolate the sick fowl and keep it under observation.
2. Arrange pathological test of the feces and urine if required.
3. In case of severe viral disease, all the chickens must be destroyed.
4. Dead bird must be put deep in the ground.
5. Infected chicken should not be sold out in the market.
6. Treatment should be provided on advice of the veterinarian.



Fig-5.25: A fowl attacked by fowl pox

New words: virus, bacteria, parasite, prevention, protozoa.

Lesson-13: Process of Goat Rearing

Goat is an important domestic animal in Bangladesh. A she-goat gets the ability to conceive in 7-8 months. It is very popular among farmers because it can give birth to 2-3 kids at a time. A castrated goat weighs 15-20 kg in 12-15 months. The goat meat (chevon/mutton) is very delicious. So there is a great demand of goats in the market.

Goat rearing in a traditional method: In the villages goats are reared by letting them free or by tying them up in the field, in the garden and in the roadside spaces. Generally no additional food is supplied to them. During the rainy season the farmers cut off the leaves of different trees and give them to the goats to eat. They allow their goats to take shelter at night time in their room or in another room of their house.

Scientific method should be followed if the goats are reared for commercial purpose. In this method the importance is given on the housing for the goat, its food and health management. In a scientific method goats are reared in confined or half-confined processes. If there is no grazing field or any space for tying up the goats, confined process is adopted for goat rearing.

Goat rearing in confined process: Goats are reared in a fully confined process in this method. A high and dry land is selected for building a house for the goats. In this process, the house for the goats can be built in a cost effective way by using wood, bamboo, tin, thatch, golpata etc. While making the house it should be remembered that an adult goat requires 1 sqm (10 sqft) area for itself. If the floor is damp, a platform must be built in the house for the goats. In this process green grass, granular food and water are supplied to the goats in a fully confined state. But the goats enjoy better health if they are taken out to graze for several hours. If a farm is started with fresh goats, they should not be kept in a confined state at the beginning. Gradually their grazing time should be reduced. There will be no trouble in food intake once the goats get adjusted to the new environment.



Fig-5.26: A room for goats in confined process



Fig-5.27: Granular food mix for goat in confined process

Goat rearing in half-confined process: At the time of goat rearing in this method, a blend of confined and free processes is followed. While confined to the farmhouse, the goats are supplied with the granular food. While grazing in the field, they eat the green grass. If it is not possible to take them to the field in the rainy season, they must be supplied with the green grass too.

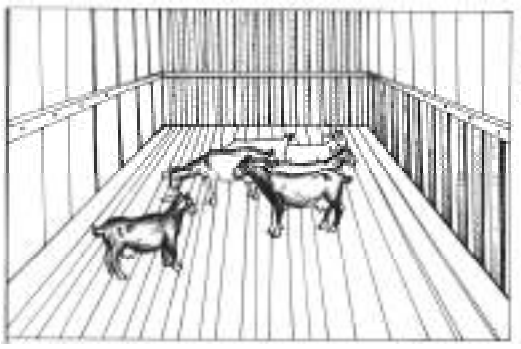


Fig-5.28: A Goat house in the platform in half confined

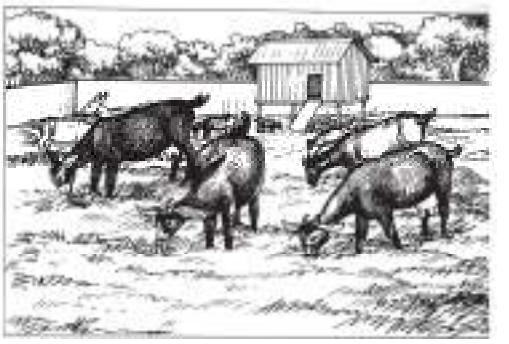


Fig-5.29: Goat eating green grass in half-confined Process

Activity: In groups students will discuss and note down the advantages and disadvantages of different processes in goat rearing to present them in the class.

New words: confined, half-confined, granular food.

Lesson-14: Management of Goat Feeding

Feeding management is one of the important factors in goat rearing. Goats live on green grass and granular food. Besides this, the goats can be fed the mixture of jaggery (chitagur) and the small slices of the fine rice straw. The matter of goat kids should be considered at the very onset of feed management. Goat kids wean mother's milk in 2-3 months. When they cross one month of age they should be made accustomed to tender green grass and granular food.

Green grass : Ipil ipil, leaves of jackfruit, khesari, mashkolai, bent grass (durba), baksa etc. are nutritious grasses for the goats. If there is scarcity of local grass, high quality Napier, para, german grass can be cultivated for the goats. Goats can be fed cultivated grass after cutting or by grazing.

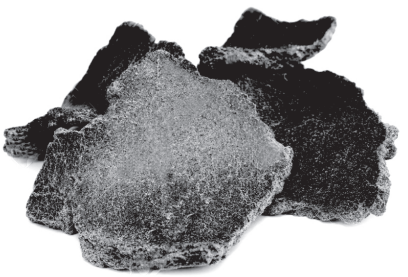


Fig-5.30: Goat is eating cut green grass

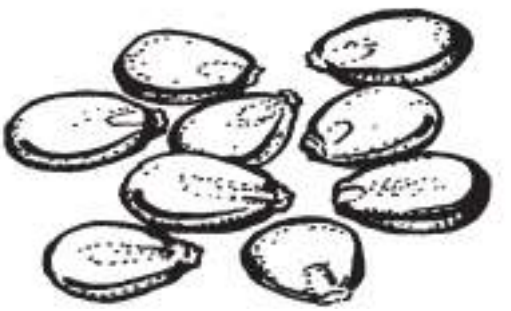


Fig-5.31: Prepared granular food for goat

Granular food : To meet the nutritional need of the goats, they should be provided with requisite crushed food mixed with green grass. Wheat, maize, wheat and rice bran, chaff of various pulses, dry fish powder etc. are used as granular food mix. Common salt and vitamin mineral mix should be added to the granular food.1-2 liter water should be supplied according to the age of the goats.



Oil-cake of mustard



Maize

Fig-5.32: Granular food

Activity: In groups, students will accomplish any of the following works and present it in the class.

1. Make a list of the types of green grass and creepers and herbs that the goats in your village eat.
2 Make a list of food which is supplied to the goats as granular foods.

Water: Like human beings all the birds and animals need water. Goats are to be provided with pure water according to their ages. So water should be kept within the reach of the goats.

A granular food mix for the goat is given below -

Food ingredient	Percentage (%)
Wheat crush/ maize crush	10
Wheat bran/rice bran	48
Chaff of pulses	17
Oil-cake of soyabean/mustard/sesame	20
Dry fish powder	1.5
Bone powder	2
Common salt	1
Vitamin-mineral mix	0.5
Total	100

Amount of green grass and granular food required to be supplied to the goats according to their ages is given below –

Weight of the goat (kg)	Daily green grass (kg)	Daily granular food mix (kg)
4	0.4	100
6	0.6	150
8	0.8	200
10	1.5	250
12	2.0	300
14	2.5	350

New words: vitamin-mineral mix

Lesson-15: Prevention of Goat Diseases

Goats like to stay in a neat and clean place. There should be the arrangement of light and air in their houses. Goats always like dry and high land. It needs to be observed that the goats do not catch cold. Because of cold, goats get infected by complicated diseases including pneumonia. This is why a bed of hay or straw should be made to use on the floor in winter. During winter gunny sacks should be hung on the walls of the goat house to protect them from cold. Causes of diseases in goats are mentioned below –

1.Virus-related disease: P.P.R, pneumonia etc. 2. Bacteria-related disease: goiter, diarrhoea etc.

3. Parasite-related disease: Two types of parasites are seen inside and outside the body of the goats. Outside body parasites like louse, atali and mite develop in the skin. Goats are greatly susceptible to inside body parasites like round worm, tape-worm and leaf worm. These worms take a share in the nutritious food of the goats. Many worms suck blood from the body of the goat. Besides, goats suffer from blood dysentery quite often. Protozoa is the cause of this disease. When goats are infected by any serious disease, the following common symptoms become visible–



Fig-5.33: A goat infected by P.P.R disease

1. Body temperature increases.
2. Bristles look straight.
3. Food intake and rumination cease.
4. It dozes and reclines on the floor.
5. Tear and saliva from mouth comes out.



Fig-5.34: A sick goat

Virus-related disease may cause death of goats. Treatment of virus infected goats does not help. Goats infected by bacteria may also die. But in this matter treatment can cure goats in most cases. So, the following steps should be taken to prevent diseases in the farmhouse for goats –

1. Pen and adjacent areas should be kept clean.
2. Vaccination and helminticide should be given timely.
3. Goats should be provided with fresh food.
4. Goats should be supplied with balanced food and pure water.
5. Arrangement should be made to keep the floor of the goat house dry.
6. Goat excreta should be preserved at a distance from the farm.



Fig-5.35: A healthy goat being vaccinated

If any disease breaks out in the farmhouse of goats, the following steps should be taken in consultation with a veterinarian –

1. Observe the sick goat after isolating from other goats and provide medication.
2. Arrange pathological test of the feces and urine if required.
3. Dead goat must be buried deep in the ground.

Activity: Students will get into four groups and write down the diseases that the goats suffer from. Then they will present it in the class.

New words : worm-killer, helminticide.

Lesson-16: Method of Keeping Agricultural Accounts (Poultry Rearing)

The requirement of egg and meat can be satisfied if poultry is reared as a family effort. Besides, a small amount of income is possible by selling extra eggs in the market. Following is the sample approximate debit-credit accounts of rearing 100 layers.

There are two heads of expenditure in poultry rearing –

a. Permanent expenditure
b. Rolling expenditure

Permanent expenditure: Initial expenditure before starting the poultry farm is called permanent expenditure. This cost includes land, poultry pen, brooder, food pot, water pot, drum and pitcher, box for laying eggs etc. A table for calculating approximate expenses for rearing 100 layers is given below.

Land	Making poultry house	Brooder	Food and water pots	Drum and pitcher	Box for laying eggs	Total permanent expenditure
Own	15,000/-	2,000/-	2,000/-	1,000/-	2,000/-	22,000/-

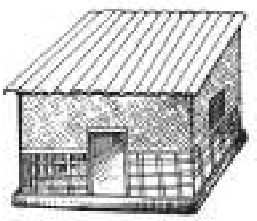


Fig-5.36: One roofed poultry house

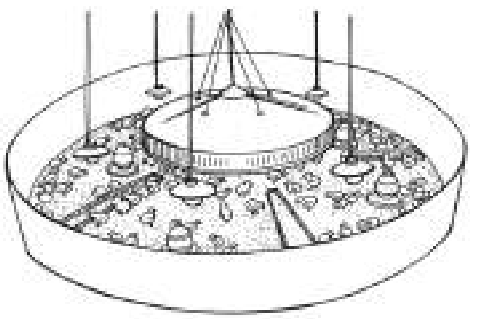


Fig-5.37: Brooder

Rolling expenditure: All the costs starting from chick purchase to other daily expenses is called rolling expenditure. At the time of nurturing 12 out of 100 goat-kids may die. So 112 kids should be purchased while buying chicks. Major heads of rolling expenditure includes chick price, food purchase, utility bills, vaccination and medication, litter (poultry bed), labourer and transportation costs etc. Layers stay in the farm for 18 months. A table for calculating approximate expenses for rearing 100 layers in a family farm is given below.

Chick price (40/- each)	Food purchase 50 kg for each @ 35/- per kg	Utility bill (monthly 300/-)	Vaccination and medication	Litter	Labourer	Transportation cost	Total rolling expenditure
4,480/-	1,75,000/-	5,400/-	2,000/-	1,000/-	Own	1,000/-	1,88,880/-

Total expenditure = Total permanent expenditure + Total rolling expenditure
= 22,000/- + 1,88,880/- = 2,10,880/-

Income: Earning is possible by selling eggs, adult chickens, litters and food sacks from the poultry farm. Adult chickens can be sold out in the market after completion of egg-laying. Litters can be used as the organic manure in the field and in fish feed making. A table for calculating approximate income for rearing 100 layers in a family farm is given below.

Eggs selling (daily 80 pcs, 52 weeks, 8/- each)	Chicken selling (200/- each)	Litter selling	Food sack selling (100 sacks, 10/- each)	Total income
2,32,960/-	20,000/-	500/-	1,000/-	2,54,460/-

Total profit= Total income – Total expenditure=2,54,460/ - 2,10,880/= 43,580/

Activity: Students will calculate individually and submit the income and expenditure accounts for rearing 10 chickens**.**

New words: permanent expenditure, rolling expenditure, litter.

Exercise

Multiple Choice Questions

1. Which one is the high yielding variety of maize?

a. Mukundapuri b. Mohor

c. Pusha d. Ranchi

2. Medicinal plant is –

i. papaya and marigold

ii. papaya and guava

iii. maize and tuberose

Which one of the following is correct?

a. i b. ii

c. i and ii d. i and iii

Read the following paragraph and answer questions no 3 and 4

Fahim cultivates maize in 2.5 hectare of land. For every hectare of land he uses 172 kg urea and adequate amount of other fertilizers at the final stage of land preparation . He fixes the space between rows 75 cm and sows seeds at every 25 cm distance in a row. But he does not get expected harvests.

3. What amount of urea does Fahim require for his land?

a. 344 kg b. 430 kg

c. 312 kg d. 860 kg

4. What is the reason for not getting good harvest by Fahim?

a. For not using urea in installments

b. For incorrect sowing space

c. For not using right amount of urea

d. For the failure to select the right variety

Creative Questions

1. Abida is the daughter of a poor farmer family. After receiving training from Youth Training Center, Abida decides to go for poultry rearing. With that view in mind, she buys 10 layers and starts rearing them in the open environment of her home. In a few days the chickens start laying eggs and Abida's family makes fortune. Being inspired, Abida's neighbour Sheuli also buys 20 chicks of fayoumi breed and starts rearing them as Abida did. But in a few days 3 of Sheuli's chicks die and some of them starts dozing.

a. What do you understand by disease?

b. Why are chickens vaccinated? Explain.

c. Explain the reasons of Abida's success in poultry rearing.

d. Analyse the causes of Sheuli's failure and give your opinion.

2. Momin Miah decides to grow two different varieties of papaya in the high land to the south of his house and in the low land to the east of his house. For this he completes all nurturing works including land preparation, fertilizer use, and sapling planting properly. After a few days he notices that some saplings in the eastern side are slanting and their leaves are getting yellowish. But the papaya plants in the southern part are in normal state.

a. What do you understand by material ingredient cost?

b. Why does heavy rainfall mount the risk in tuberose cultivation? Explain.

c. Explain the reason why the papaya plants in Momin Miah's southern part of the land are in normal state.

d. Analyse the remedial procedures for the problems developed among the plants in the land to eastern part of the house.

Short Answer Questions

1. What do you mean by overhead charge? Why is this expense necessary?
2. Mention two uses of corn.
3. What is the cause of guava tree disease? What measures should be taken to control this disease?

Assignment: Students will write individually about the preventive measures taken when raising goats and submit them to the teacher.

Inquiary based work: Collecting the sample of food grains for poultry and goats.

Chapter Six
Afforestation

Afforestation means scientific planting, nurturing and conserving trees in the forest. If afforestation can be done properly, the forest-grown materials will be produced. These forest-grown products are timber, firewood, wild medicinal plant, fruits, honey, wax etc. For afforestation we should know well about forest-grown trees, fruit-bearing trees, construction materials and medicinal plants. In this chapter we will gain knowledge, skills and attitude about identity of these trees, cultivation process and significance of these trees. We will know about the value of agricultural construction materials like timber and bamboo. We will be able to produce sapling from the stem. We will discuss about the use of medicinal plants in our daily lives. We will be able to take part in creating social awareness about this.



At the end of this chapter we will be able to –

- explain the characteristics of various trees.
- explain the economic values of different trees.

- describe the cultivation process of fruit bearing, forest-grown, construction materials, and medicinal plants.
- describe the fresh sapling producing method from stems.
- describe the use of forest-grown trees as construction materials.

Lesson- 1 : Identity, Significance and Cultivation Process of Fruit Bearing Tree- Jackfruit

Identity: Jackfruit is our national fruit. It is very delicious and nutritious. Jackfruit is bigger than any other fruits. The scientific name of jackfruit is *Artocarpus heterophyllus*. Jackfruit tree is a dicotyledonous, timber yielding ever green tree. It can grow up to almost 21 m tall. Its timber is hard and of yellow colour. Seeds are white and flowers are green in colour. Leaves are plain, oval and green. The saplings are planted after being produced from seeds or through grafting method. Shraban and Bhadra are the perfect time for planting the saplings of jackfruit.



Fig-6.1: Jackfruit tree

Jackfruit is cultivated in almost all of the districts in Bangladesh. Jackfruit orchards are grown in Gazipur, Tangail and in the Bhawal area of Mymensingh. It is cultivated in Sylhet, Chattogram and Rangpur regions. It grows well in the red soil of the highlands. The timber and fruits from this tree have a great economic value.

Variety: The certified variety of jackfruit is few in Bangladesh. There are only some variety and lines produced at BARI. It gives fruits once a year. On the basis of the quality of its kernel, Jackfruits can be divided into three types viz. –

1. Khawaja jackfruit – kernel of this type is hard.

2. Half-juicy jackfruit – kernel of this type is hard at its opening and soft at the back.

3. Soft jackfruit – kernel of this type is soft and dissolves quickly when put into the mouth.

Significance : Jackfruit is a tree suitable for diversified uses. Juicy kernel of a ripe jackfruit is very sweet. There is no match for ripe jackfruit to fulfill the lack of sugar and vitamin. Green jackfruit and jackfruit seeds are used as vegetables. Jackfruit tree has a very high quality timber. Its colour is deep yellow. This wood is long lasting and it takes polishing nicely. This wood is used in making the doors and windows of a house. Jackfruit timber can be used in making home furniture. From economic point of view jackfruit timber and for nutrition its fruits are very significant. Leaves of jackfruit trees are used as cattle feed during emergency period.

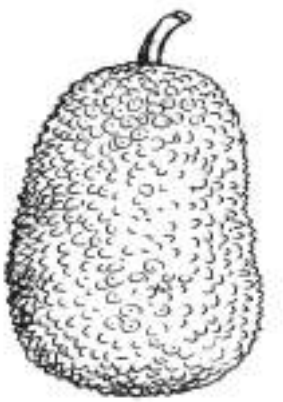


Fig-6.2: Jackfruit

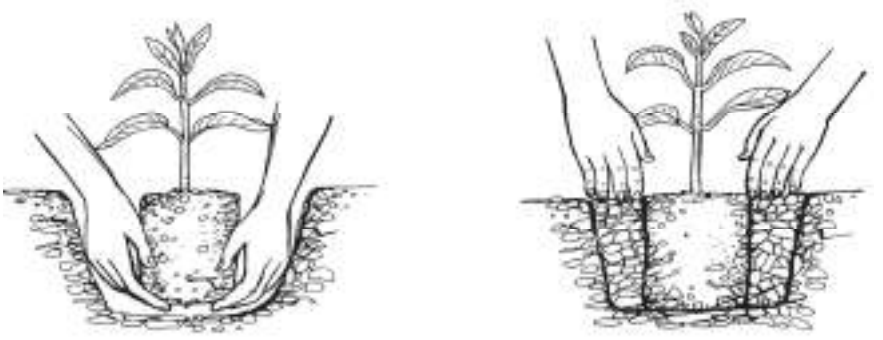
Cultivation Process

Selection and preparation of field: Jackfruit is cultivated in all types of flood free soil. But silt loam or a bit red soil of highland is good for jackfruit cultivation. Land should be prepared well by ploughing and harrowing several times. Pits of 1m x 1m x 1m size should be dug in the field at 10 m distances before a month of planting saplings. During digging the soil of the upper part and the soil of the lower part should be kept separate. Now accumulated soil of upper part of the pit is to put at the bottom of pit and the soil of bottom will have to be mixed with manure to fill up the pit. Amount of fertilizer will be 20 kg decomposed cow-dung manure,400 gm bone powder or 150 gm TSP, 2kg ash or 150 gm MoP.

Plantation and post-plantation nursing: Seedlings are planted after having produced from seeds or through grafting method. Shraban and Bhadra are the

perfect time for planting the saplings of jackfruit. The soil at the bottom should be heaved after being planted. The land should be irrigated in case of drought. Soil at the bottom of the plant should be loosened by pricking regurlarly.

Application of Fertilizer: Fertilizer should be used for the jackfruit tree throughout the year. 30 kg cow-dung manure, 200 gm urea, 150 gm TSP and 100 gm MoP should be given to a 2-5 year old plant. 50 kg cow-dung manure, 800 gm urea, 500 gm TSP and 800 gm MoP should be applied to a tree when it bears fruits.



A sapling is being implanted Soil around the sapling is being pressed

Fig-6.3 : Plantation of seedling

Fruit collection: A Jack fruit tree bears flowers and fruits within the month of December to March on the basis of variety. In three months after fruiting jackfruit gets maturity. When the jackfruit becomes mature it's thorns become blunt and the juice of leaf-stalk becomes thin. Besides, if it is striken a bluring sound is produced.

Activity: Observing jackfruit tree (group work)
Observe the sapling of jackfruit, sample stem with leaves, fruit, flower and seed. Write down the characteristics of jackfruit on poster paper through group discussion and present them.

New words: ever green tree, simple leaf.

Lesson- 2: Identity, Significance and Cultivation Process of Forest Grown Tree- Mahogany

Identity : The original abode of mahogany is Jamaica and Central America. Two names are available as the species of mahogany. Of them, *Swietenia macrophylla* species is leading in Bangladesh. Mahogany is abundantly available in the districts of Jashore, Khulna, Chattogram and Chattogram hill tracts. Currently as a part of afforestation with government and non-government initiatives this tree is being planted countrywide extensively. At roadsides, dams, homesteads, office premises, social forests and private forests cultivation of this tree is increasing.



Fig-6.4: Mahogany tree

It is a dicotyledonous timber tree. The trunk of this tree is long, hard and brown coloured. Its leaves are compound. Flowers are greenish white. Fruits are brown coloured, oval shaped and big in size. All the leaves fall off the tree in winter. This is why it is called deciduous tree. Saplings produced from seeds are mainly planted for mahogany. Seeds are sown in the seedbed of the nursery after they are collected between March and April. Mahogany seedlings are planted starting from the month of June till August. This tree grows well in high and mid-high land. Mahogany is familiar as a high quality timber producing tree. There is a great demand of the timber of this tree in making doors and windows of the houses and furniture. Fiber of this timber is very fine and its colour is blackish dark-tan. It receives polishing very nicely.



Fig-6.5: Leaf, flower and fruit of Mahogany

Significance : Mahogany timber is very hard and long-lasting. The colour is reddish brown. When the tree gets more maturity, the wood looks dark black reddish . Fiber of this timber is very fine. This wood takes good polishing. This wood is abundantly used in making all types of furniture. Besides, mahogany timber is good for making doors and window frames. Mahogany timber is used to make various types of fancy industrial materials.

Cultivation Process

Seed collection and plantation: Mainly the sapling produced from the seed is planted for mahogany tree. But stumps can also be planted. Seeds are sown in the seedbed of the nursery or in the polybag after they are collected during February to April. For sowing seed in the polybag, loamy soil should be mixed with organic manure at the ratio of 2 parts of loamy soil and 1 part of organic manure. Two seeds should be sown in one polybag. In the seedbed seeds should be sown at 8-10 cm distances. The seed is implanted at 3-4 cm deep in the ground. Seed should be implanted in a slanting state so that the fan of the seed is kept upward. After sowing seed light irrigation in the land should be arranged. When the plant is tender it should be covered by a shade to protect the seedbed from the midday sunlight and also from rain. A seed takes 20-30 days for germination. It is good to plant saplings at 9-10 m distances.

Soil preparation: Mahogany grows well in high and mid-high land. Loamy and silt loam soil is good for mahogany. Before planting saplings, the selected land should be cleaned and leveled. According to the size of the sapling the length, width and depth of the pit should be 60-80cm. After digging pits, the soil should be mixed with fertilizers. The pit should be covered with fertilizer mixed soil and left for 15 days. Then the soil mixed with the fertilizer and the pit should be dried up in the sun for 15 days. The seedling should be planted after making the soil granular by turning it up again by a spade.

Application of Fertilizer and nursing: At the time of preparing the land, 10-15 kg organic manure, 1-2 kg ash, 200-300 gm urea, 100-150 gm TSP and 50-100 gm MoP should be given. Arrangement for irrigation should be made in case of drought. The land should be weeded out regularly. When the plant is young, some side-buds that grow beside the main plant must be pruned. A stick should be tied to the young plant and it should be fenced around. After

irrigation, mulching may be done at the base of the plant for retaining moisture in the soil. As the plant grows older, its boughs and branches should be trimmed to make a canopy.

Activity – 1: Observe a mahogany sapling, trunk with leaves, fruit and seed. In groups discuss and fill up the following table to present it in the class.

Observable topic	Characteristics of a mahogany tree
1. Type of the plant	
2. Stem	
3. Seed	
4. Flower	
5. Where cultivated	
6. Grown in what kind of soil	
7. Major significances	

Activity -2 : Observe to identify the sample of different fertilizers used for planting Mahogany sapling.

New Words : deciduous tree, compound leaf, mulching.

Lesson– 3: Identity, Significance and Cultivation Process of Construction Materials Plant- Bamboo


Fig-6.6: Bamboo bush

Identity : Bamboo is known as building material. It is an indispensable material in building the hut of the poor or constructing the high rise mansions. Bamboo is cultivated everywhere in our country. It is usually cultivated from motha or rhizomes. It is grown from the seeds also. Bamboo generally grows 5 to 7 meter tall. It is very strong. Tender bamboo is green and the matured bamboo is of biscuit colour. The thin offset of bamboo are known as '*konchi*'. Bamboo leaf is thin and long. Flower and seed grow in bamboo trees once in hundred years. Bamboo bush is grown naturally too.

In Bangladesh 23 types of bamboos are found. Bamboos are of two origins, e.g. –

Forest-grown bamboo: e.g. Muli, mitinga, dalu and nolitalla, betua makla. These bamboos have thin stem walls.

Bamboos grown in the rural homesteads: e.g. ura, borak, barua, moral. These bamboos have thick stem walls.


Fig-6.7: Borak Bamboo

Significance : Bamboo is called the timber of the poor. In rural economy bamboo plays a great role. In a rustic setting the use of bamboo from home making to all other affairs of everyday use is very common. Bamboo is the principal raw material in rural cottage industry. Basket, winnower, polo, hat etc. are made of bamboo. To cross over the canals in the village, bamboo made bridges are used. Flute made of bamboo is the musical instrument of village children. Use of bamboo in the agricultural items like plough, yoke, rake and spade is noticeable.

For conservation of crops and plants bamboo fence is used. In industrial mills and factories it is used as the raw material in producing paper and rayon.

Cultivation Process

Bamboo is an essential construction material. It is cultivated everywhere in Bangladesh. Bamboo is cultivated in three ways viz. motha and offset method, pre-twig shoot grafting method, node grafting method.



Fig-6.8: Bamboo motha

1. Method of Bamboo cultivation by motha or offset: For bamboo cultivation 1-3 years old motha or offset should be collected. At the bottom of the bamboo, motha with 3-4 nodes under the ground is called offset. For offset the selected bamboo must be fresh. The month of Chaitra is the suitable time for collecting offset. It is necessary to plant the collected offset in the sandy bed in a temporary nursery till the rainy season starts. In 15-25 days new leaf and bud sprout from most of the offsets. This offset is transplanted in the pit filled with a mixture of soil and cow-dung at 3:1 ratio.

2. Method of Pre-root twig grafting: Roots develop at the bottom of many bamboo twigs naturally. This type of twig with the roots and motha is called pre-root twig. The twig graft should be cut along with the roots and motha from the bamboo aged less than one year with a saw very carefully from the month of Falgun to Awshin.The collected twig graft after being cut at the size of one and a half hand length must be transplanted straight in the depth of 7-10 cm of temporary made nursery. If it is watered for 2-3 times in a day regularly new tender sapling will be produced just after a month.

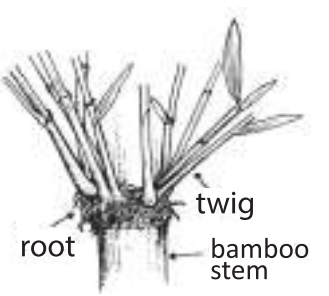


Fig. 6.9: Pre-root twig grafting

These saplings must be planted in the polybags with soil and cow-dung mixed at 3:1 ratio. The twig grafts should be planted during the month of Baisakh-Jaistha after being kept in this state for a year.

3.Method of Node grafting: The process of producing saplings by cutting the bamboo stem into pieces is called node grafting method. For this 1-3 year old strong bamboo should be selected. Newly cut bamboo should be sliced into node long pieces. These slices must be planted in the temporary nursery bed without delay in the months of Chaitra and Boishakh in parallel. Irrigation of water should be regular, Make sure that the node bud in every slice is fresh and uninjured. Roots will grow in most of the node grafts during Ashar and Shraban. The node graft along with its roots should be taken out of the temporary bed to be planted in the field before the rainy season is over.

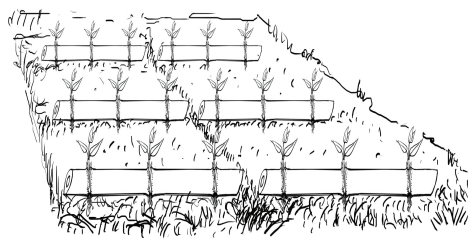


Fig-6.10: Node graft in the temporary bed

Nursing of Bamboo

The new bamboo clump should be watered during drought. The soil at the bottom of the plant should be loosened with a spade. The place must be weeded out. Infected trees must be taken out along with its motha and burnt down. In the months of Falgun- Chaitra new strong and healthy bamboo can be got if bamboo clump is provided with soil.

Collection of Bamboos : A bamboo takes 3 years to be matured. For this reason 3 year old bamboos should be collected from bamboo – clump. Bamboo should never be cut during bamboo planting time. Besides, it is not wise to cut all matured bamboo from the bamboo clump at a time.

Activity: Get into three groups and discuss the bamboo cultivation process in motha method, pre-root twig method and node graft method. Then present the findings of your discussion in the class. (Time: 15 min)

New Words : offset, pre-root twig grafting method, node grafting method.

Lesson- 4 : Identity, Significance and Cultivation Process of medicinal plant-Neem

Identity: Human beings sometimes depend on trees for recovery from diseases. What are these plants called? Tell the names of few medicinal plants that you know. Observe the specimen trees of arjun, haritaki, amloki (*Myro balan*) etc.or their pictures. Now watch a video on your device or observe the specimens or the

pictures of the herbal plants like tulsi, thankuni, basok, marigold (ganda) etc. In groups discuss whether there are any medicinal trees or herbal plants in your homesteads or school.



Fig-6.11: Neem tree

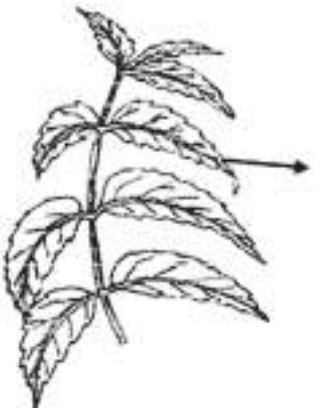


Fig 6.12: Hilly Neem leaf

Neem tree is seen in every region of Bangladesh. There are at least two varieties of neem viz. *Melia azedarach* and *Azadirachta indica*. Neem is a deciduous tree of medium to big size. It grows 10 - 20 m tall. New leaf grows between the months of February and March. Leaf is compound and there are 9-15 leaf blades from one petiole. The leaf blades are long, slanting and spear shaped. The margins of the blades are serrated. Flowers are white and sweet scented. Fruits are oval shaped. The fruit gets light yellow colour when it ripens.

Reproduction : Reproducing of neem trees is done through seeds. Its reproduction can be done by root and stem cutting as well.

Seed collecting time: Seeds are collected during the months of June to July.

Significance : The use of the neem tree takes place in various ways. But its medicinal quality does a lot of good to human beings. Extract of neem leaf works excellent as an insecticide for crops. Use of the sap extracted from neem leaf and the neem oil are beneficial for controlling skin diseases. Neem leaf extract reduces the irritation that the worms cause. Dry leaf of neem is used to prevent insects in cloths and rice. Neem twig is used for tooth brushing. Oil-cake

of neem is used as germicide. The bark of neem tree is used for healing health problems like rheumatic fever, ringworm, eczema, periodontal diseases that cause bleeding and releasing of pus, pyorrhea and jaundice. Neem bark extract makes the gum strong.

Cultivation Process

Preparation of land : The soil and weather of our country are very much suitable for the cultivation of Neem. Neem grows well in well drainaged loamy soil. At first we have to plough the land for making it clean and weedfree.

Producing Saplings : The month of June-July is the proper time to collect neem seeds. The seeds are sowed in polybags for producing seedlings within a week. The seeds are collected from mature fruits and after peeling of the outer covering the seeds are kept open. Then the seeds are washed in clean water . The seeds are then dried in the shade. Later on the dried seeds are sowed in polybags for producing seedlings within a week. The produced seedlings are to be planted in the land in May-June next year.

Making pits and planting seedlings: For planting neem seedlings pits of 1m x 1m x 1m size at 7m x 7m distance should be dug in the field. Soil of the upper part of the pits has to be kept on one side and soil of the lower part (has to be kept) on another side. Then both the pits and the soil of the pits have to be dried in the sun for 15 days. The soil of lower part of the pit is to be mixed with decomposed cow-dung or compost then the pit is to be filled up giving the soil of the upper part in the lower part of the pit.

After 15 days, one year old seedlings have to be planted in the middle of the pits. The soil of the bottom has to be irrigated after being heaved.

Nursing: Sticks should be tied to the young plant and be fenced around. The land has to be irrigated in the dry season if needs. The soil of the bottom of the plants has to be loosened by pricking at times. If weeds are seen in the land, it has to be weeded out. Generally neem tree is attacked less by disease or insects.

Harvesting and Yeild : The flowers, leaves, fruits, seeds, and oil of neem tree are used in various medicines. Leaves, bark, fruits, and seeds can be collected after 8-10 years of planting the seedling.

Activity: Plant sapling of neem in your school ground (group work).

New words : extract of leaf, germicide.

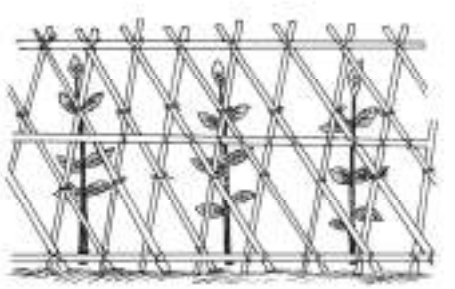
Lesson-5: Conservation of Trees and Forest

Conservation of various trees and forest

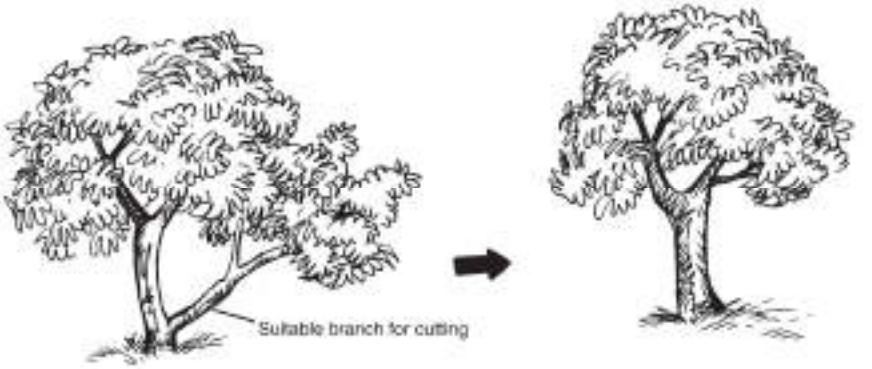
We have 17% forest resources in our country. The existing resource is also on the verge of destruction for various reasons. We need afforestation to protect what we have and to expand the resources. It is essential for us to preserve the new saplings planted around us and the forest we have.



Watering the sapling



Fencing around the sapling



Pruning of woody plant (Before pruning) Pruning of woody plant (After Pruning)

Fig-6.13: Preservation of sapling and trees

Activity: Preserving planted sapling and tree

1. Observe the illustrations given above and write the ways of preserving planted saplings.
2. Write down the importance of preserving timber plant by pruning.

Removing unimportant boughs and branches to make the timber tree valuable is called pruning. If the tree is pruned at the regular interval of the specific time both the quality and quantity of the timber are ensured. Nowhere in the road, dam or homestead the trees will grow well if they are not nurtured properly. If trees are affected in large scale with insets and fungi, these should be controlled by insecticides and fungicides. It is better to prevent diseases naturally.



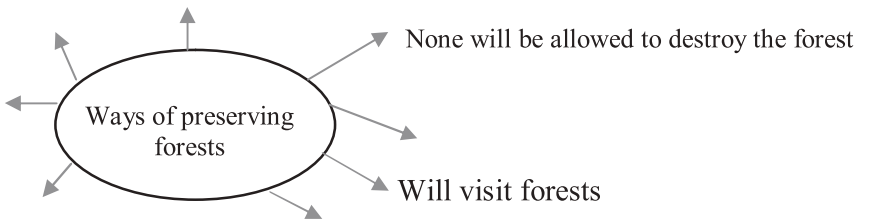
Fig-6.14: Endangered Salban

Conservation of forest : The Story of Anu –

Anu likes the pleasing bowery environment very much. During winter vacation she went to visit the salban with her father. She was delighted to see the sal and garjan trees. But the view of the desolation because of cutting trees in an outstretched area pained her very much. She saw that people had grabbed the forest area to set up their homesteads. Besides, the grabbers were always in action to seize more lands through different plots causing destruction to the forest in various ways. His father told him that forest was stretched to more widespread areas. Many kinds of animals and birds were seen in the forest. She further learned from her father that forest marauders were selling out the axed trees secretly. Anu thought over the ways of maintaining the forests in our country. In her notebook she wrote down some ways of preserving forests, which are as the following –

1. Forest marauders must be resisted.
2. People must be briefed about the importance of the forest.
3. Everyone must take part in making social forests.
4. Birds and animals in the forest must not be killed.
5. There should not be any hindrances on creating forests in its natural process.
6. Know and let others know and advise to follow the forest conservation rules and regulations.
7. Make people aware of preserving forests.

Activity: Listen carefully to the story of Anu's forest visit. Think in groups about other steps that can be practiced in preserving the forests. Complete the following chart in a poster paper and present it in the class.



Lesson- 6: Process of Producing New Saplings from the Stem

The process of developing new plant from a stem cutting is called artificial vegetative reproduction method. We have known about it in the second chapter. We will know about some more vegetative reproduction methods in detail in this lesson.

Activity: Producing new plant from stem cutting (pair work).

Observe the branch grafting, gooti grafting and separated paired grafting in the chart. Identify the types of artificial vegetative reproduction method in each process.

1. Branch grafting or cutting

When a grafting is produced cutting from the branch of a tree, it is called branch grafting or cutting. In this process a branch after being cut from a mature tree is dipped into drenched water soil. Afterwards the branch grows bigger naturally and becomes a mature tree, such as Shimul and Mander.

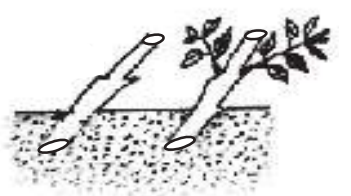


Fig-6.15: Branch grafting

2. Gooti grafting: In this process a new plant is produced through grafting from a mother tree variety of high quality. Gooti graft is a very popular and easy process. Graft is developed in trees like lemon, guava, sapodilla, litchi, ixora etc. For gooti graft a fresh one year old twig should be selected. A paste must be made by mixing water with three shares of loamy soil and one share of decomposed cow-dung manure. Like the illustration 5 cm area at 60 cm below the tip of the branch should be barked off in a rounded shape. Bark free part should be scrubbed with the blunt side of a knife to pull the greenish slippery outer covering. Then the paste should be applied around the bark free part of the branch and both sides should be tied by a thread after being twisted round by polythene as it is shown in the illustration. In 3-4 weeks white root developed in the bark free part will be visible from outside the polythene. When the roots grow properly and get the brown colour, the branch should be cut off and planted in a pot. It should be kept in a shady place for few days. Soil of the pot must be watered time-to-time. New leaves will develop in few days if it is kept in the sunlight.

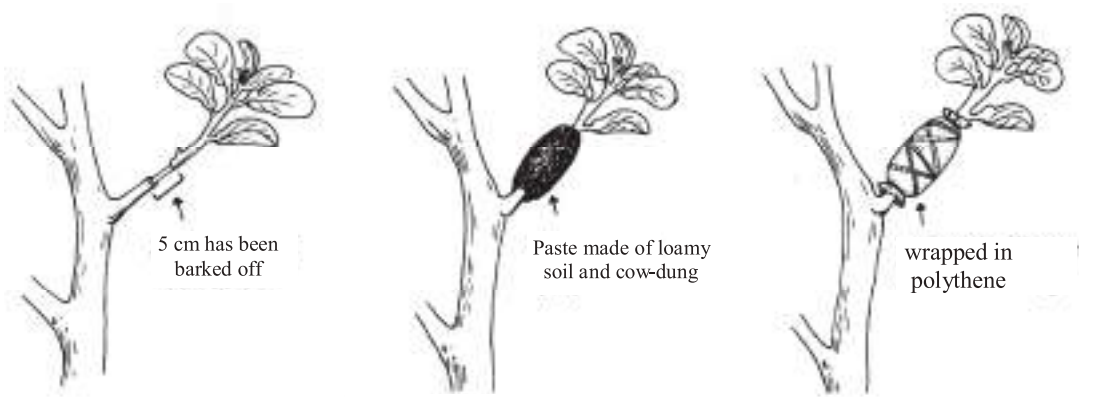


Fig-6.16: Gooti grafting

3. Separated paired grafting

A best example of paired grafting is cleft grafting

Cleft Grafting

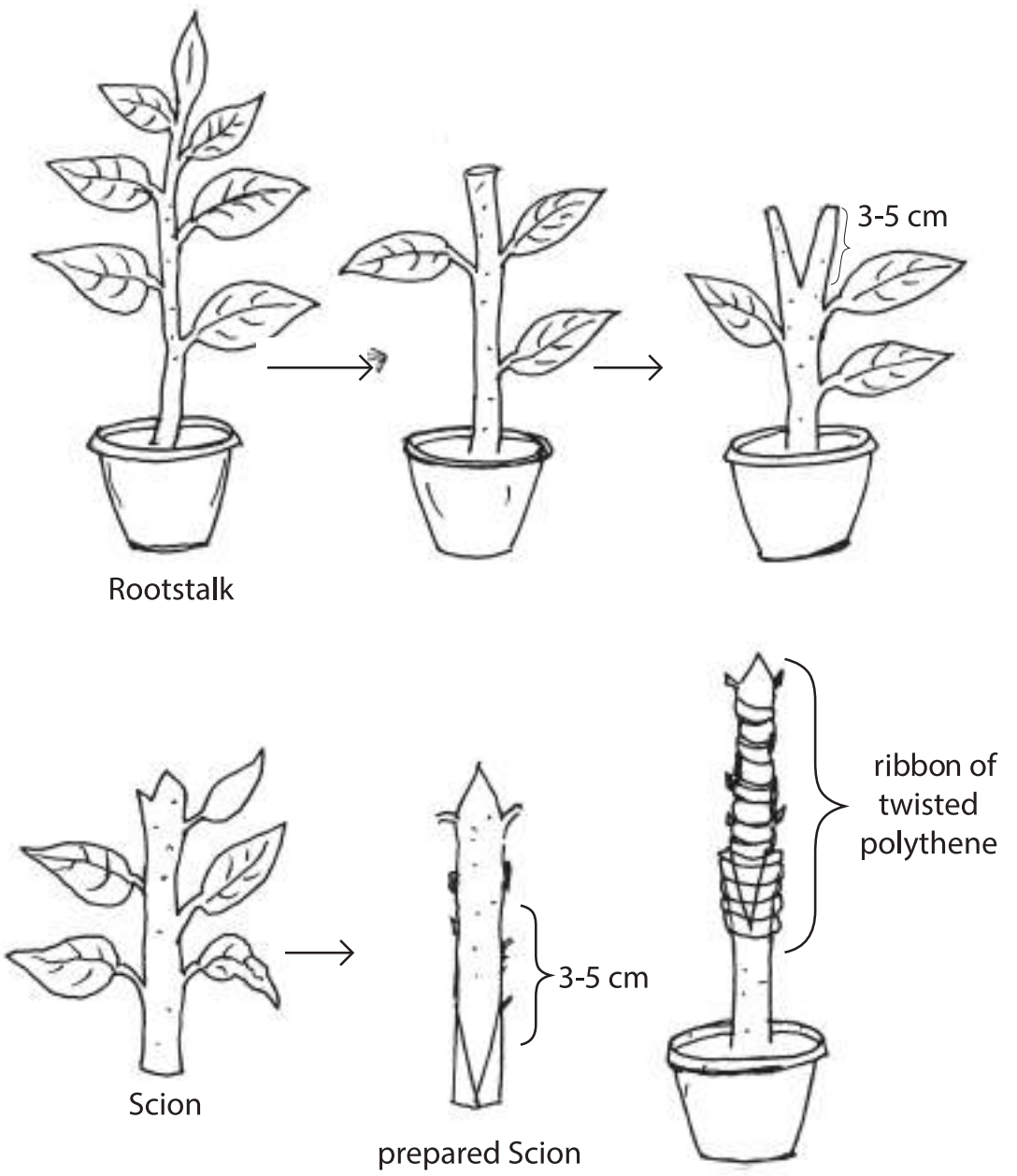


Fig-6.17 steps of cleft grafting method in mango

Separated paired grafting

Veneer grafting and cleft grafting are important among the separated paired grafting. But cleft grafting is being used more at present. Because the method of cleft grafting is easy and the rate of success is also high. Mango, jackfruit, star fruit/carambola, olive, sapodilla, rose berry, berry, etc are produced by this cleft grafting. We will know about the process of producing improved variety of mango by cleft grafting method.

We know that in paired grafting, the sapling from store of fruit is called root stalk and the branches of improved class of tree are called scion. Cleft grafting of mango is produced twice in a year. It is done from the month of March to May before rainy season and in the months of September-October after the rainy season. 3-15 month old rootstalk is better. The branches with fresh bud at the top should be selected as scion so that it can bloom within some days. 10-15 cm scion with deep green leaves should be preferred. Now the leaves are to be separated from scion with a sharp knife. Then from lower part of the scion 3-5 cm obliquely 'V' shape is to be cut. Then 40-45 cm steam above the bottom of the root stalk is to be cut in rounded shape so that there are 3-4 leaves below the cut part.

Now with the help of a sharp knife the cut part across the middle is to be splited up to 3-5 cm from top to bottom. After that the scion should be placed into that splited part and then the scion up to bud is to be coiled with a polythene tape strongly. If it is in equal diameter, any part of the scion is to be tightened with any part of the root stalk to match . After that, it is to keep in mind that no branches can grow from the root stalk . Separated paired grafting may attach within 1 ½ - 3 months. When the paired grafting is attached perfectly, it is to put of cutting the polythene tie. Unless it is cut, polythene gets into in the scion and the scion then breaks.

Activity : Discuss in groups different grafting e.g., branch graft, gooti graft, paired graft. Each group will draw the grafts in poster papers and present in the class.

New words : branch graft, gooti graft, veneer graft, scion.

Lesson- 7 Use of agro construction material: Timber

We have many uses of timber in our everyday life. Timber is used in building a house and making furniture. Think about the contexts of your house and school. In these places what things are made of wood? What are the different uses of the timber of different trees? Let us learn about the detailed use of timber now.

1. Preparation of home building materials: Timber is used in making pole, bar, platform, mat etc. Besides, frames of doors and windows. Timber of sal, teak, sundori, rendikoroi (koroi),deodar, etc. is used in these works.

2. Making furniture: Chair, table, sofa, bedstead, cupboard, chest of drawers, etc. are made of wood. Timber of mahogany, teak, rain tree, jackfruit, shilkoroi, etc. are used to make these products.

3. Manufacturing Vehicles: Timber is used in making boat, launch, steamer, bus, truck etc. besides cart, rickshaw, van, rail line slippers, etc. Timber of sal, teak, jarul, babla, pitraj etc. is used in making these vehicles.

4. Manufacturing tools: Plough, yoke, rake, electric switch boards etc. are made of wood. Various types of sports materials are also made of timber. Wood is used in making education materials like pencil, paper etc. these products are made of the wood of the trees like palm tree, babla, gaab, latkan and geywa etc.

5. Firewood: Timber of the trees like mango, mandar, pitraj, or the waste of other trees is used as firewood. Apart from this match-sticks are made from the wood of geywa, shimul, kadam and chhatim trees. In producing plywood timber of mango, pitraj, kadam, trees is used. Packaging boxes are made of kerosene wood.

Activity: Timber producing plant and its uses (group work)

Area of timber use	Two examples of works where wood is used	Two names of wood producing tree
1. Construction of house		
2. Making furniture		
3. Making vehicles		
4. Making equipment		
5. Firewood		

Lesson-8 Use of agro construction material: Bamboo

Bamboo is essential in our lives from the starting to the end. Each of you give an example of the use of bamboo. Now let us learn thoroughly about the use of bamboo.

1. Bamboo in construction work: Low income people of the village depend on bamboo to build their houses. Strong bamboos, borak in particular, are used for constructing houses.

2. Bamboo in furniture: Furniture is made of mainly mooli, maral and talla bamboos. These bamboos are used in making bookshelf, sofa, stool, chair etc.

3. Bamboo in decoration: Decoration work is done with maral, talla and bamboos with fine fiber. In home and office decorations these bamboos are used greatly.

4. Bamboo in making equipment: Equipment is made from stronger type of bamboo like borak.This type of bamboo is used in making plough, yoke, spade, ladder, rake etc.

5. Bamboo in transport and as firewood : Stronger type of bamboo like borak is used in making transports. Bamboo is used in making rickshaw, boat, cart pulled by horses or cows. All types of bamboos, bamboo leaves and other parts are used as firewood.

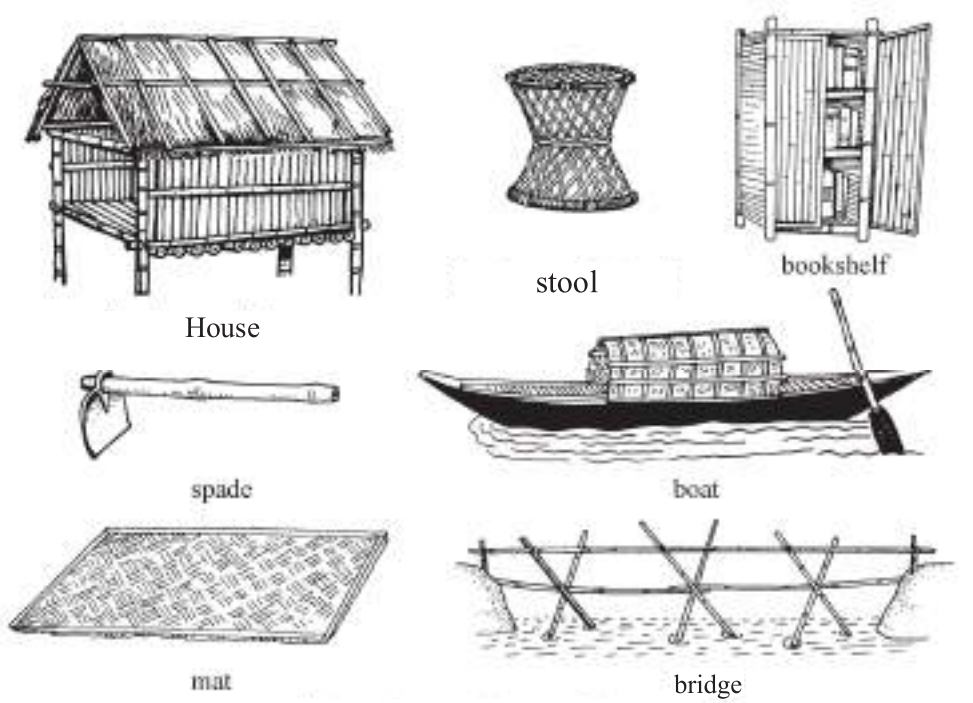


Fig-6.20: Bamboo made materials

Exercise

Multiple Choice Questions

1. What type of wood is used in making packaging boxes?

a. Kadam b. shimul

c. kerosene d. chhatim

2. Leaf-blades of neem tree are –

i. long

ii. oval

iii. spear-shaped

Which one of the following is correct?

a. i and ii b. i and iii

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

Read the following paragraph and answer the questions no 3 and 4

Hasan and Jamil are two friends. To make furniture they bought two different logs of the same type of tree with fine fiber. The same carpenter made their furniture. When polishing was done, though Jamil's furniture got the desired dark blackish colour, Hasan's furniture got reddish brown colour and it made Hasan upset.

3.The tree that Hasan bought was –

a. teak b. jackfruit

c. mahogany d. akashmoni

4. Jamil's furniture was of high quality because the log of the tree was –

i. well matured

ii. fine fibered

iii. polished well

Which one of the following is correct?

a. i and ii b. i and iii

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

Creative Questions

1. Sajid, a student of class five always suffers from stomach ailments and skin diseases. When he went to his village in summer vacation, his grandfather made extract from the leaves and bark of a tree in his garden. Sajid's grandfather made him drink some of the extract and applied some of it on his body. Sajid got cured at this. Apart from this, his grandfather showed him a garden of a special fruit. His grandfather gave him the idea about the fruit which is the biggest in size and has special qualities.

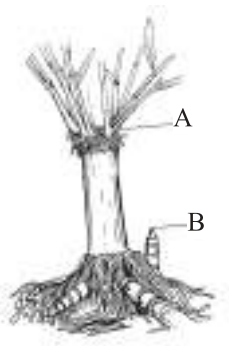
   a. Write the name of a variety of mahogany tree.

   b. Explain the reasons of describing bamboo as a construction material.

   c. Explain the reason why the fruit in the garden in Sajid's grandfather is of special quality.

   d. In the perspective of rural health and environment friendly agriculture, analyse the utility of the tree that Sajid used.

2.



a. Which tree is called deciduous tree?
b. Explain why jackfruit tree has to be planted in the land that does not get inundated.
c. Explain the process used in artificial propagation shown at A, B in above Picture.
d. Evaluate the role of the tree illustrated above, in agro material construction.

Short Answer Questions

1. What is a herbaceous plant? Give an example.
2. In which soil does mahogany grow well? How do you prepare the soil for mahogany cultivation?
3. What is pruning, and why is a hardwood tree pruned?

Project-based work: Students will individually graft a guava tree bud and show the graft to the teacher by placing it in a pot.

End

2026 Academic Year

Seven-Agriculture Studies

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