

UNIT

7

Economic Biology

Learning Objectives

At the end of this lesson, students will be able to

- know about horticulture and floriculture.
- classify bio manures and know their importance.
- know the steps involved in mushroom cultivation.
- differentiate between hydroponics, aquaponics and aeroponics.
- know the importance of dairy farming and cattle breeds.
- gain knowledge on the aspects of aquaculture and pisciculture.
- understand the culture practices of economically important fishes and crustaceans.
- gain awareness on vermicomposting methods and the benefits of vermicompost.
- identify the commercial products obtained from apiculture.



Introduction

The gift of nature is almost unlimited and thus a variety of useful products are obtained from plants. Economic plants are numerous and have a variety of uses. Many of them occur in nature, particularly in hills and forests while a number of them are cultivated for food and industry. Economic uses of plants are varied and therefore the scope for improvement and their cultivation is immense to meet our ever growing demands with the advancement of civilization. Floriculture and Horticulture have created considerable public awareness. Several drug yielding plants are known and utilised as medicinal herbs in crude form (indigenous way) from ancient days. Edible mushrooms

are valuable source of supplementary protein, hence their cultivation is gaining importance.

In recent scenario more emphasis is given to the progress of economic aspects of zoology like aquaculture (culture of fish, prawn, crabs, pearl and edible oysters), vermiculture, apiculture and dairy farming which are gaining more importance as animal-based farming due to their economic and commercial values. Attention is now given to find out ways and means to get more food to meet the demand of the growing population without depleting the environment and natural resources. Animal farming has now become an agro based entrepreneurship and is beneficial to rural farmers. The yield of animal food products has increased to satisfy the increasing demand of food for the

growing population. Bee keeping (Apiculture) and vermiculture are also progressing and in future they may be considered as important commercial trade.

7.1 Horticulture

Horticulture is a branch of agriculture that deals with cultivation of fruits, vegetables, and ornamental plants. The word horticulture is derived from the latin words 'hortus' meaning garden and 'colere' meaning to cultivate. Horticulture is both a science and an art of growing plants with improved growth, quality, yield, and with resistance to diseases, insects, stress etc. There are four main classes of horticulture: (i) Pomology (fruit farming), (ii) Olericulture (vegetable farming), (iii) Floriculture (flowers farming), (iv) Landscape gardening.

7.1.1 Pomology or Fruit farming

The term pomology is derived from the latin word 'pomum' means fruit and 'logy' means study. It deals with development, enhancement of fruit quality, cultivation techniques, regulation of production periods and reduction of production cost of fruits.

More to Know

- More than 10 million tonnes of Bananas are produced worldwide.
- India is the largest producer of guava, litchi and mango, and the second largest producer of sapota.

7.1.2 Olericulture or Vegetable farming

Olericulture is the science of growing vegetables. Vegetable farming can be classified into: i) Kitchen or Nutrition gardening ii) Commercial gardening iii) Vegetable forcing.

Kitchen gardening

Kitchen gardening is growing of vegetables in small scale at household. e.g. Beans, Cabbage, Lady's finger, Tomato, Brinjal, Carrot, Spinach etc.



Figure 7.1 Kitchen gardening

Commercial gardening

It is the production of vegetables in large scale to be sold in markets.



Figure 7.2 Commercial gardening



INFO BIT

UZHAVAN APP

Government of Tamil Nadu has launched Uzhavan (farmer) mobile application. It can be used by farmers to gather information on farm subsidies, farm equipments, crop insurance and weather conditions. It also provides information on available stock of seeds and fertilizers in local government and private stores.



Activity 1

Discuss in your class room about the importance of crop insurance to farmers.

Vegetable forcing

It is the method of growing vegetables in buildings, green houses, cold farms or under other artificial growing conditions. It is the most intensive type of vegetable growing. e.g. Cabbage, Tomato, Brinjal etc.



Figure 7.3 Vegetable forcing



- India is the second largest producer of vegetables next to China.
- India stands first in the world in the production of potato and lady's finger, second in the production of brinjal, cabbage, peas, onion, cauliflower and tomato.

Green House or Poly House

It is a framed structure covered with transparent material to grow crops under partialiy or fully controlled environmental conditions to get optimum growth and productivity. It is the fastest growing sector in the agriculture worldwide.

Advantages of Green House

1. Disease-free plants can be produced continuously.
2. Water requirement of crops is very low.
3. Yield is very high compared to outdoor cultivation.
4. Limited pesticide is needed.
5. It protects plants from uncertain weather.



Figure 7.4 Green House

INFO BIT

Pradhan Mantri Fasal BimaYojana (PMFBY)

It is an agricultural crops insurance scheme of Indian government. Under this scheme the central government provides insurance cover and financial assistance to farmers. It was launched on 18th February 2016.

7.1.3 Floriculture or Flower farming

Floriculture is the art of cultivation of flowering and ornamental plants in garden for beauty or floristry. It is concerned with growing traditional flowers, cut flowers, bedding plants, foliage potted plants, arboriculture trees, turf grass for beautification and value added products like essential oils, pharmaceutical and nutraceutical compounds. Examples: Geraniums (*Pelargonium*), Busy lizzies (*Impatiens*), *Chrysanthemum* and *Petunia*.



Figure 7.5 Flower Farming

More to Know

Floriculture Zones of Tamil Nadu

Zones	Flowers
Hosur Zone	Jasmine, Marigold, <i>Chrysanthemum</i> , Rose
Chennai Zone	Jasmine, <i>Crossandra</i> , Marigold
Madurai Zone	Jasmine, Marigold, Scented rose, <i>Nerium</i> , <i>Crossandra</i>
Trichy Zone	Jasmine, Rose, Scented rose
Coimbatore Zone	Jasmine, Tuber rose, <i>Celosia</i> , Scented rose
Kanyakumari Zone	Jasmine, Scented rose
Hill area Zone	<i>Chrysanthemum</i> , Marigold.

Uses of flowers

1. Flowers are used for decoration purpose.
2. They are also used for personal needs and, religious and ceremonial offerings.
3. They impart colour and beauty to the garden.
4. They increase country's economy.



Cultivation and growing of loose flowers mostly for worship, garland making and decoration is the domestic industry of India with an annual growth rate of about 30%. It is a business of approximately 10,000 crore rupees.

7.1.4 Landscape gardening

Landscape horticulture is the study of designing and constructing landscapes in homes, business firms and public areas.



Figure 7.6 Landscape gardening

7.2 Manuring (Biomanuring)

Organic manures are predominantly derived from plant debris, animal faeces and microbes. They make the soil fertile by adding nutrients like nitrogen. Few of them are listed below.

7.2.1 Animal manure

It consists of faeces and urine from livestock like cattle, horses, pigs, sheep, chickens, turkeys, rabbits, etc. Manures from different animals have different qualities and different applications.

a. Farmyard manure

It is a mixture of cattle dung, urine, litter material and other dairy wastes. On an average well decomposed farm yard manure contains 0.5% Nitrogen, 0.2% available phosphate and 0.5% available potash.

b. Sheep and Goat manure

It contains higher nutrients than farm yard manure. It contains 3% Nitrogen, 1% phosphorus pentoxide and 2% potassium oxide.

7.2.2 Compost

Compost is a soil conditioner as well as a fertilizer, which is rich in nutrients. It is produced by natural decomposition of organic matter such as crop residues, animal wastes, food wastes, industrial and municipal wastes by microorganisms under controlled conditions.

Vermicompost is the method of making compost with the use of earthworms, which generally live in soil. They eat biomass and excrete it in digested form. This compost is generally called vermicompost.



Figure 7.7 Earthworms

7.2.3 Green manure

Green manure is obtained by collection and decomposition of green leaves, twigs of trees, shrubs and herbs growing in wastelands, field bunds etc. Green manure improves soil structure, increases water holding capacity and decreases soil loss by erosion. It also helps in reclamation of alkaline soils and reduces weed proliferation. It is a manure obtained from undecomposed green material derived from leguminous plants e.g. Sunhemp (*Crotalaria juncea*), Dhaincha (*Sesbania aculeata*), Sesbania (*Sesbania speciosa*).

7.3 Biofertilizers

Biofertilizers are substances that contain living microorganisms which, when applied to seeds, plant surfaces, or soil, colonize the rhizosphere or the interior of the plant and promote growth by increasing the supply or availability of primary nutrients to the host plant.

7.3.1 Types of Biofertilizers

Rhizobium

Rhizobium is a soil bacterium that colonize the roots of leguminous plants to form root nodules. The bacteria fix atmospheric nitrogen and convert them to ammonia.



Figure 7.8 *Rhizobium* biofertilizer

Azospirillum

Azospirillum has the ability to use atmospheric nitrogen and transport this nutrient to the crop plants. It is inoculated on maize, barley, oats and sorghum crops. It increases productivity of cereals by 5 - 20%, of millets by 30% and fodder by over 50%.



Figure 7.9 *Azospirillum* biofertilizer

Azotobacter

Application of *Azotobacter* has been found to increase yield of wheat, rice, maize and sorghum. Apart from nitrogen fixation, these organisms are capable of producing antifungal and antibacterial compounds.



Figure 7.10 *Azotobacter* biofertilizer

Mycorrhizae

These fungi have symbiotic association with the roots of vascular plants. They increase the uptake of phosphorus. e.g. Citrus, Papaya.



Figure 7.11 *Mycorrhizae* biofertilizer

Azolla

Azolla is a free floating, aquatic fern found on water surfaces having a cyanobacterial symbiotic association with *Anabaena*. It is a live floating nitrogen factory using energy from photosynthesis to fix atmospheric nitrogen.

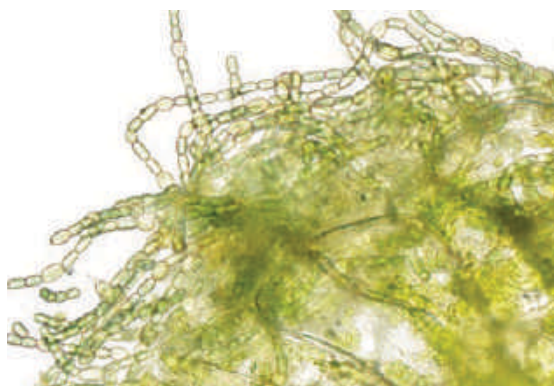


Figure 7.12 *Azolla* biofertilizers

Info bits

Biofertilizer Scheme

Tamil Nadu Government has recently launched '**Biofertiliser Scheme**'. It is aimed at better management of natural farming and helps to boost and maintain soil fertility.

7.4 Medicinal Plants

The history of the medicinal plants is as old as the history of human beings. Most medicines are obtained either directly or indirectly from plants. All the major system of medicines such as Ayurveda, Yoga, Unani, Siddha, Homeopathy (AYUSH) use drugs obtained from plants and animals. These drugs from medicinal plants are called secondary metabolites. Plants produce primary metabolites for their own living e.g. carbohydrates, amino acids etc., and secondary metabolites for protection, competition and species interaction. e.g. alkaloids, terpenoids, flavonoids etc. Phytochemistry is the study of phytochemicals which are chemical substances derived from various parts of the plant. Few plant derived drugs are described in (Table 7.1).

Activity 2

Collect at least five medicinal plants from your locality. Identify the plant and try to find out its medicinal value.

Table 7.1 Drugs derived from Medicinal plants

S. No.	Tamil Name	Botanical Name	Drug	Parts used	Disease cured
1	Katralai	<i>Aloe vera</i>	Anthraquinones	Leaves	Heal wounds, Skin disease, Cancer.
2	Tulsi	<i>Ocimum sanctum</i>	Essential oil	Leaves	Cold, Fever, Skin disease
3	Nannari	<i>Hemidesmus indicus</i>	Terpene	Roots	Bacterial infections, Diarrhoea
4	Nilavembu	<i>Andrographis paniculata</i>	Terpenoids	All parts	Dengue fever, Diabetes, Chikungunya
5	Vepalai	<i>Wrightia tinctoria</i>	Flavonoids	Latex, Leaves	Psoriasis, Diarrhoea, Swellings
6	Cinjona maram	<i>Cinchona officinalis</i>	Quinine	Bark	Malaria, Pneumonia
7	Chivan Amalpodi (Sarpagandha)	<i>Rauwolfia serpentina</i>	Reserpine	Root	Blood pressure, Antidote for Snake bite
8	Thaila maram	<i>Eucalyptus globulus</i>	Essential oil	Leaves	Fever, Headache
9	Pappali	<i>Carica papaya</i>	Papain	Leaf, Seed	Dengue
10	Nithya kalyani	<i>Cathyranthus roseus</i>	Alkaloids	All parts	Leukemia, Cancer

More to Know

Father of Indian Medicines

Ayurveda	Charaka Samhita
Yoga	Patanjali
Unani	Hippocrates (BUKRATH)
Siddha	Agasthya
Homeopathy	Samuel Hahnemann

Info bits

The Council of Scientific and Industrial Research (CSIR) and National Botanical Research Institute (NBRI) and Central Institute for Medicinal and Aromatic Plants (CIMAP) have jointly launched India's first anti diabetic ayurvedic drug **BGR -34** (BGR-Blood Glucose Regulator). It contains 34 identified active phytoconstituents from herbal resources. It works by controlling blood sugar levels.

7.5 Mushroom Cultivation

Mushroom cultivation is a technology of growing mushrooms using plant, animal and industrial waste. In short it is wealth out of waste technology. This technology has gained importance worldwide because of its dietary fibres and proteins value. Mushroom is a fungi belonging to basidiomycetes. It is rich in proteins, fibres, vitamins and minerals. There are more than 3000 types of mushrooms. e.g. Button mushroom (*Agaricus bisporus*), Oyster mushroom (*Pleurotus* spp.), Paddy straw mushroom (*Volvariella volvacea*). The cultivation takes one to three months. Major stages of mushroom cultivation are explained below.

Composting

Compost is prepared by mixing paddy straw with number of organic materials like cow dung and inorganic fertilizers. It is kept at about 50°C for one week.



Ganoderma lucidum, is commonly known as lingzhi mushroom which produces triterpenes, similar to steroids.

It has the following benefits for human:

- Oxygenates the body and boosts stamina.
- Provides more energy and vigour.
- Increases brain power.
- Improves quality of sleep and blood circulation.
- Reduces blood pressure.

Spawning

Spawn is the mushroom seed. It is prepared by growing fungal mycelium in grains under sterile conditions. Spawn is sown on compost.

Casing

Compost is covered with a thin layer of soil. It gives support to the growing mushroom, provides humidity and helps regulate the temperature.

Pinning

Mycelium starts to form little bud, which will develop into mushroom. Those little white buds are called pins.

Harvesting

Mushroom grow better in 15°C - 23°C. They grow 3 cm in a week which is the normal size for harvesting. In the third week the first flush mushroom can be harvested.



Fig 7.13 Mushrooms

Preservation

Discolouration, weight, and flavour loss are the main problems of harvesting stage of mushrooms.

The following methods are used to increase their life.

- (i) Freezing (ii) Drying
- (iii) Canning (iv) Vacuum Cooling
- (v) Gamma radiation and storing at 15°C.

7.6 Hydroponics

Hydroponics is the method of growing plants without soil, using mineral nutrient solutions in water. The containers are made of glass, metal or plastic. They range in size from small pots for individual plants to huge tank for large scale growing. It was demonstrated by a German Botanist Julius Von Sachs in 1980. Hydroponics is successfully employed for the commercial production of seedless cucumber and tomato. Plants are suspended with their roots submerged in water that contain plant nutrients. The roots absorb water and nutrients, but do not perform the anchoring function. Therefore, the plants must be mechanically supported from above.

Importance of hydroponics

- (i) Conservation of water and nutrients.
- (ii) Controlled plant growth.
- (iii) In deserts and Arctic regions hydroponics can be an effective alternative method.

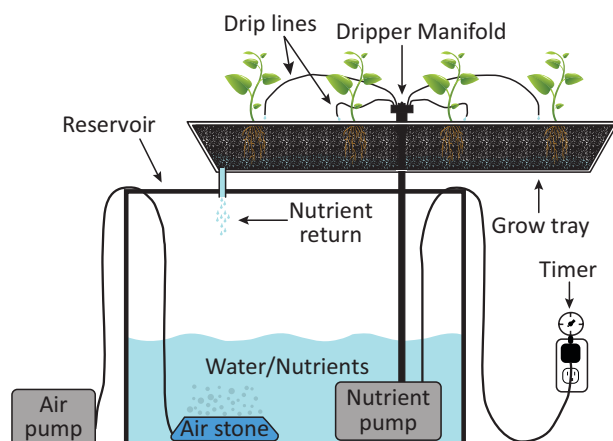


Figure 7.14 Hydroponics

7.7 Aeroponics

The aeroponic system is the high-tech type of hydroponic gardening. The growth medium in this type is primarily air. The roots hang in the air and are misted with nutrient solution. The misting is usually done for every few minutes, as roots will dry out rapidly if the misting cycles are interrupted. A timer controls the nutrient pump much like other types of hydroponic systems, except the aeroponic system needs a short cycle timer that runs the pump for a few seconds every couple of minutes.

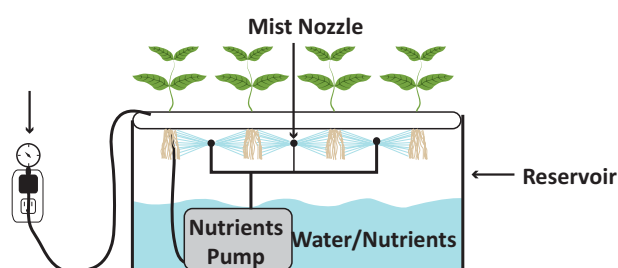


Figure 7.15 Aeroponics

7.8 Aquaponics

Aquaponics is a system of a combination of conventional aquaculture with hydroponics in a symbiotic environment, in which plants are fed with the aquatic animals' excreta or wastes. These wastes are broken down by nitrifying bacteria initially into nitrites and later into nitrates that are utilized by the plants as their nutrients. Thus the wastes are utilized and water is recirculated back to the aquaculture system.

Aquaponics consists of two main parts, aquaculture- for raising aquatic animals like fish and hydroponics-for raising plants. Green leafy vegetables like chinese cabbage, lettuce, basil, coriander, parsley, spinach and vegetables like tomatoes, capsicum, chillies, bell peppers, sweet potato, cauliflower, broccoli and egg plant can be grown in aquaponics.





Figure 7.16 Aquaponics

7.9 Dairy Farming

Dairy farming involves rising of cattle for milk production. It involves the proper maintenance of cattle along with, collection and processing of milk and milk products which are useful to man. Dairying is the production and marketing of milk and its products.

7.9.1 Cattle breeds

The Indian cattle include cows and buffaloes. They are domesticated for milk, meat, leather and transportation. They belong to two different species, *Bos indicus* (Indian cows and bulls) and

Bos bubalis (buffaloes). These cattle animals are reared for milk and farm labour.

They are classified into three types:

- (i) Dairy breeds
- (ii) Draught (or) Draft breeds
- (iii) Dual purpose breeds.

Dairy breeds

Dairy animals are domesticated for obtaining milk. The cows (milk producing females) are high milk yielders (**milch animals**). The dairy breeds may be indigenous breeds (or) exotic breeds.

Indigenous breeds are native of India. They include **Sahiwal**, **Red Sindhi**, **Deoni** and **Gir**. These cattle are well built with strong limbs, prominent hump and loose skin. Milk production depends on the duration of the lactation period (the period of milk production after the birth of a calf). These local breed animals show excellent resistant to diseases.

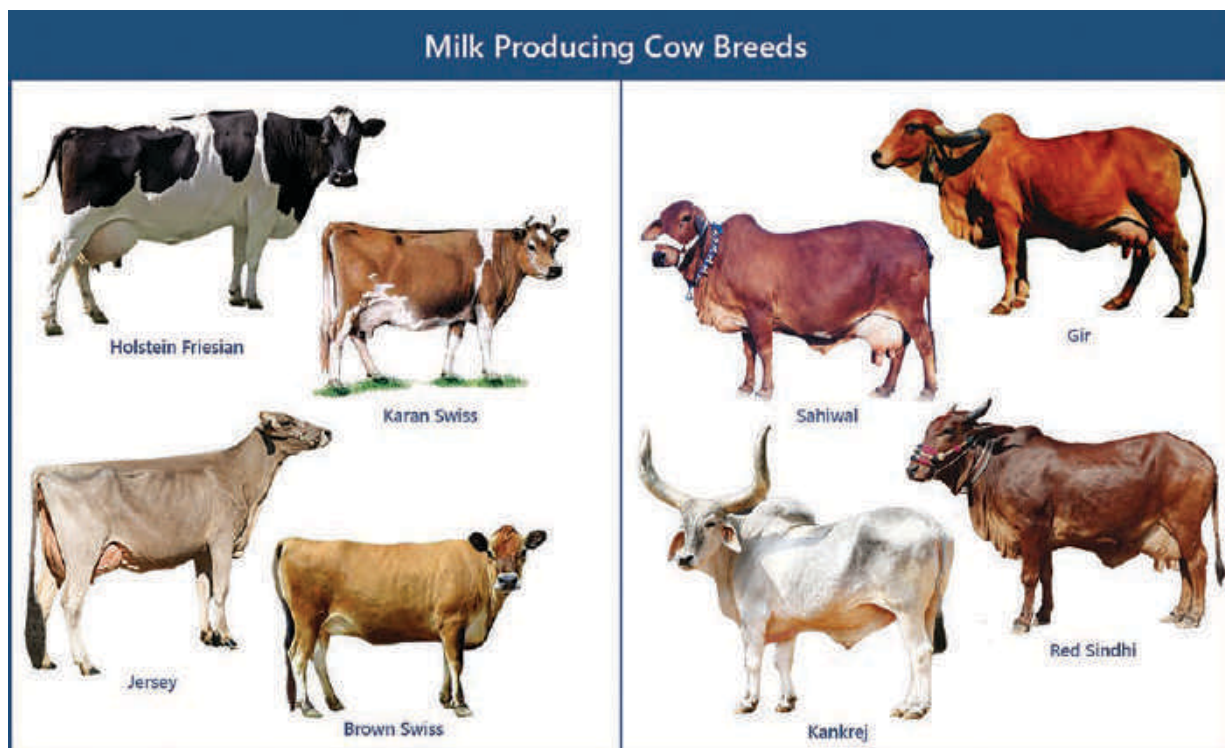


Figure 7.17 Cattle breeds



The **exotic breeds** (*Bos taurus*) are imported from foreign countries. They include **Jersey, Brown Swiss and Holstein-Friesian** etc. These foreign breeds are selected for long lactation periods.

The Indian (local) breeds and foreign breeds can be cross bred to produce animals with both desired qualities.

Info bits

Indigenous Draught breeds - Native to Tamil Nadu

Kangayam It is also known as kongu and konganad. It originated in Kangayam and is observed in Dharapuram, Perundurai, Erode, Bhavani and part of Gobichettipalayam taluk of Erode and Coimbatore district. The Kangayam breed was developed by the efforts of the late Pattogar of Palayamkottai, Sri N. Nallathambi Sarkari Manradia.

Bargur It is found around Bargur hills in Bhavani taluk of Erode district. It is developed for work in uneven hilly terrains.

Umblachery It is otherwise called as Jathi madu, Mottai madu, Molai madu, Therkathi madu. It originated in Thanjavur, Thiruvarur and Nagappattinam districts of Tamil Nadu and is suitable for wet ploughing and known for their strength and sturdiness.

Pulikulam This breed is commonly seen in Cumbum valley of Madurai district in Tamil Nadu. It is also known as Jallikattu madu, Kidai madu, Senthurai. They are mainly used for penning in the field and useful for ploughing. They have the typical backward curving horns of Mysore type cattle.

Draught (or) Draft breeds

They are used for agricultural work, such as tilling, irrigation and carting. These include **Amritmahal, Kangayam, Umblachery, Malvi, Siri and Hallikar** breeds. Bullocks are good draft animals while the cows are poor milk yielders.

Dual purpose breeds

These breeds provide milk and they are useful for farm work. In India these breeds are favoured by farmers as the cows are fairly good milk yielders and bullocks are good for draught work. They include **Haryana, Ongole, Kankrej and Tharparkar**.

Buffalo breeds

In India buffaloes are domesticated in great number. They are the main milk producers. The milk production of buffaloes is more than that of cows. **Murrah, Mehsana and Surti** are indigenous buffalo breeds which are good milk yielders.

More to Know

- Young female calf is called a Heifer (Until she has her first calf). Young male is called bull calf.
- Two months before giving birth, a dairy cow takes rest from giving milk in order to grow her calf.
- Holstein cow produces maximum quantity of milk than other breeds
- Cow spends upto 6 hours a day in eating, over 8 hours a day in chewing their cud which is regurgitated (partially digested food).





Activity 3

Can you identify the indigenous cattle breeds which belong to Tamil Nadu. Name them and write any two distinguishing characters for each.



7.9.2 Composition of cattle feed and its requirements

The food requirement for cattle should support healthy life of the animal and milk producing requirement. The feed for dairy cattle is broadly classified into two:

- Roughages
- Concentrates

Roughage is a coarse and fibrous fodder. It consists of succulent feed (cultivated grass, fodder and root crops) and dry fodder (hay, straw and chaff).

Concentrates are low in fibre and contain high level of carbohydrates, protein and other nutrients. A variety of raw materials such as cholam (jowar), kambu (pearl millet), ragi (finger millet), rice bran, wheat bran, cotton seed cake, mustard cake, linseed cake, groundnut cake, mango seed, neem cake and yellu (sesame) cake can be used to make concentrate feed. They should also be fed on green fodder (maize, lucerne, berseem, millet, and elephant grass).

When green fodder is not available, cattle can be fed with silage. Silage can be defined as fermented high moisture stored food which can be fed to cows. It is prepared from green grass, sorghum, cereals and weeds by using the entire green plant.

7.9.3 Feed Management

Dairy cattle need balanced rations containing all nutrients in proportional amounts and food additives which contain minerals, vitamins, antibiotics and hormones to promote the growth of animals, good yield of milk and to protect from diseases. The daily average feed ratio of a milking cow is:

- 15-25 kg of roughage (dry grass and green fodder)
- 4-5 kg of grain mixture
- 100-150 litres of water



The concentrates are fed at the time of milking. This helps in 'let down' of milk.

For a cow that gives above 2.5 kg milk yield per day, 1 kg of concentrate feed should be given for every additional milk yield.

Table 7.2 Nutritional Information of Cow's Milk

Composition of Milk	Average Quantity per 100ml
Energy	266 kJ
Total Protein	3.4g
Casein	0.7g
Total Fat	0.4g
Saturated Fat	3.4g
Total Carbohydrate	2.3g
Sodium	44mg
Calcium	128mg

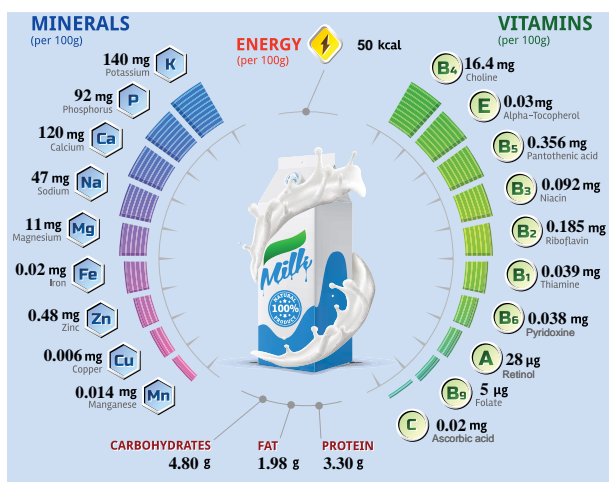


Figure 7.18 Nutrient contents of milk

7.9.4 Improvement of Livestock development in India

Several policies have been adopted by the Government to increase the livestock development in India. Improved breeding techniques in cattle have tremendously increased the production of new breeds with high capacities.

Intensive Cattle Development Programme

It is based on cross breeding of indigenous cows with exotic European breeds to increase milk production. New methods and modern equipments are made available for machine – milking of cows.

Operation Flood Programme

It is based on dairy commodity aid to increase milk supply in urban areas.



Dr. Verghese Kurein, was the founder of National Dairy Development Board (NDDB) and was called the **Architect of India's Modern Dairy Industry** and the **Father of White Revolution**. NDDB designed and implemented the world's largest dairy development programme called **OPERATION FLOOD**.

More to Know

Panchagavya is an organic liquid fertilizer. This product has the potential to play the role of promoting growth and providing immunity to plant system. Panchagavya consists of various products viz. Cow dung (25%), Cow urine (25%), Fresh milk (15%), Curd (10%), Ghee (5%), Banana (5%), Tender coconut water (5%) and jaggery (10%).

Activity 4

Visit a nearby livestock farm. Make a chart of different breeds of cattle in the farm and collect the information about the following.

Number of cattle, number of different breeds, amount of daily intake of fodder and water, amount of daily milk production.

7.10 Aquaculture

Aquaculture is the rearing of economically important aquatic organisms like fishes, prawns, shrimps, crabs, lobsters, edible oysters, pearl oysters and sea weeds under controlled and confined environmental conditions using advanced technologies.



Figure 7.19 Aquatic organisms used for rearing

Info bits

Tamil Nadu is a leading state endowed with rich fishery resources from Marine, Inland and Coastal Aquaculture. The marine fisheries potential of the state is estimated at 0.719 million tonnes. The inland fishery resources have a potential to yield 4.5 lakh metric tonnes of fishes. Tamilnadu ranks sixth among the maritime states in coastal farming.

7.10.1 Types of Aquaculture

Aquaculture is classified into:

1. Freshwater aquaculture
2. Brackish water aquaculture
3. Marine water aquaculture (Mariculture)

The classification is made based on the salinity of the respective culture system.

Freshwater aquaculture

The rearing of aquatic organisms in freshwater is called freshwater aquaculture. The salinity of this water is less than 0.5 ppt (parts per thousand). Culture of organisms is carried out in pond, river, dam, lake and cold water. These freshwater resources remain within the land. Tilapia, carps (Catla, Rohu, Mrigal), catfishes, and air breathing fishes are cultured in freshwater.



Figure 7.20 Freshwater aquaculture

Marine water aquaculture

The cultivation of aquatic organisms is in sea water. This is also referred as Mariculture or Sea farming. The salinity of water ranges from 30 to 35 ppt. Culture of organisms is carried out along the sea coast (inshore area) and in deep sea. Organisms like shrimps (marine prawns), pearl oysters, edible oysters, mussels and fin fishes like salmons, trouts, sea bass, murels, milk fishes and mullets are cultured in marine water.



Figure 7.21 Marine water aquaculture

Brackish water aquaculture

Brackish water is where sea water and freshwater mix together such as estuaries, lagoons and backwaters. The organisms are cultured in water where the salinity is more than 1 and less than 32 ppt. The important organisms cultured are Tilapia, spiny lobsters, crabs, marine prawns and milk fishes.

Info bits

The Central Marine Fisheries Research Institute (CMFRI) was established by the Government of India in 1947 at Cochin, Kerala State. Its main focus is on marine fisheries landings, research on taxonomy and bioeconomic characteristics of marine organisms.

The Central Institute of Brackish Water Aquaculture (CIBA) was established in 1987 with its headquarters at Chennai. The objective of CIBA is management of sustainable culture system for fin fish and shell fish in brackish water. CIBA assists small aquafarmers in fin fish and shrimp farming by providing sustainable modern technologies.

7.10.2 Prospects of Aquaculture

Aquaculture has become the fastest growing food producing sector to meet the demand of food and nutrition to the growing population through increased production from aquatic food resources. It aims at blue revolution. It is a major source of export and foreign exchange earnings for the country. It generates employment through fish farming in rural and under developed area.

It increases food supply and enhances nutritional status of people who rely on freshwater and marine water edible food resources. These cultured organisms are a valuable source of animal protein and also rich in vitamins and minerals.



FISH PRODUCTION IN INDIA

Aquaculture production – 2nd in South East Asian countries.

Total fish production- 7th position in the world.

Marine fish production – 10th position in the world.

7.11 Pisciculture

Pisciculture or Fish culture is the process of breeding and rearing of fishes in ponds, reservoirs (dams), lakes, rivers and paddy fields. It is the farming of economically important fishes under controlled conditions. Pisciculture helps in integrated rural development by generating employment and income to fishing community and fish farmers.

7.11.1 Types of fish culture practices

- a) **Extensive fish culture:** Culture of fishes in large areas with low stocking density and natural feeding.
- b) **Intensive fish culture:** Culture of fishes in small areas with high stocking density and providing artificial feed to increase production.
- c) **Pond culture:** Rearing of fishes in pond water.
- d) **Riverine fish culture:** Rearing of fishes in lotic water.
- e) **Dam culture (Culture in Reservoir):** Culture of fishes in artificial man made constructed reservoirs.
- f) **Lake culture (Culture in Lake):** Rearing of fishes in lakes which are natural standing water bodies.
- g) **Monoculture:** Culture of single type of fish in a water body. It is also called mono species culture.
- h) **Polyculture:** Culture of more than one type of fish in a water body. It is also called composite fish culture.
- i) **Integrated fish farming:** It is the culture of fishes along with agricultural crops or animal husbandry farming. Rearing of fish along with paddy, poultry, cattle, pig and ducks.

7.11.2 Types of ponds for fish culture

Fish farm requires different types of pond for the various developmental stages of fish growth. They are:

- a) **Breeding pond:** Healthy and sexually mature male and female fishes are collected and introduced in this pond for breeding. The eggs released by the female are fertilized by the sperm and fertilized eggs float in water as frothy mass.

- b) **Hatchling pits:** The fertilized eggs are transferred to hatching pits for hatching. Two types of hatching pits are hatcheries and hatching hapas.



Figure 7.22 Spawn production (Fish Seed) and Stocking of fingerlings in hapas

- c) **Nursery ponds:** The hatchlings are transferred from hatching pits after 2 to 7 days. The hatchlings grow into fry and are cultured in these ponds for about 60 days with proper feeding till they reach 2 - 2.5 cm in length.
- d) **Rearing ponds:** Rearing ponds are used to culture the fry. The fish fry are transferred from nursery pond to rearing ponds and are maintained for about three months

till they reach 10 to 15 cm in length. In these rearing ponds the fry develops into fingerlings.

- e) **Stocking pond:** The stocking pond is also called as culture pond or production pond. These ponds are used to rear fingerlings upto the marketable size. Before releasing the fingerlings, the pond is manured with organic manure and inorganic fertilizers.



Figure 7.23 Stocking pond

7.11.3 Cultivable food fishes in India

Freshwater cultivable fishes: Indian major carps (Kendai) – Catla, Rohu, Mrigal, catfishes (Keluthi), Murrels (Veral) and Tilapia (Jilebi kendai) are cultured in freshwater.

Marine water cultivable fishes: Sea bass (Koduva), Grey mullet (Madavai) and *Chanos chanos* (Milk fish) are the fishes cultured in marine water.

Freshwater fishes



Catla - *Catla catla*



Rohu - *Labeo rohita*



Mrigal - *Cirrhinus mrigala*

Marine water fishes



Sea Bass



Grey Mullet



Milk Fish

Figure 7.24 Freshwater and Marine water fishes

7.11.4 Nutritional value of fishes

Cultivable freshwater and marine food fishes are highly nutritious, rich source of animal proteins and are easily digestible. They are rich in essential amino acids such as lysine and methionine, minerals like calcium, phosphorus, iron, sodium, potassium and magnesium. Fat soluble vitamins A, D and water soluble B-complex vitamins like pyridoxine, cyanocobalamine and niacin are found in fishes. Polyunsaturated fatty acid (PUFA) which are helpful in regulation of cholesterol are present in plenty in fishes and thus promote cardiac health.

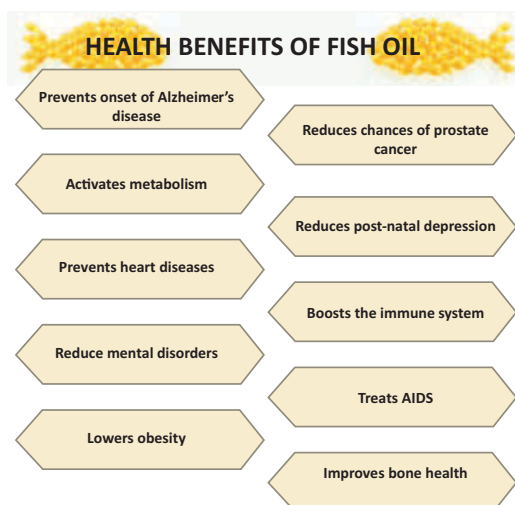
7.11.5 Fishery by-products

In addition to providing food, most of the fishing industries yield a number of by-products of commercial importance. These processed byproducts are used for human consumption and also for other purposes. These include:

a. Fish oil: It comprises of liver oil and body oil.

Liver oil of Cod, Tuna, Halibut and Shark are of great medicinal value and are rich in vitamin A, D and E.

Body oil is extracted from Sardines, Herrings, Salmons, Mackerels and Anchovies. They are used in industries for the preparation of lubricants, paints, varnishes and cosmetics.



b. Fish Meal

It is prepared from the wastes of fish oil or from whole fish and contains nutrients like protein, fat, minerals and vitamins. It is used as feed for cattle and poultry farming animals.

Other by-products obtained from fishing industry are fish flour, fish manure, fish silage, fish guano, fish sausage, fish glue, fish leather and isinglass.



Activity 5

Visit a fish farm during the breeding season near your locality and collect information about the following:

- Different types of pond you see.
- Different varieties of fishes in the pond.
- Type of feed and their ingredients used to prepare feed.
- The sources from where the fish seeds are procured.
- The annual production of the pond.

7.12 Prawn Culture

One of the most economically important shell fish resources of India are prawns. They are crustaceans which inhabit freshwater, marine water, estuaries, backwaters and shallow waters of temperate and tropical countries. They are of great demand both in the local and international market. Due to their great taste, they are a cherished delicacy to be served as food.

In view of their popularity and marketing avenues in foreign countries there is a need for developing advanced technology and intensify prawn culture in India. The export earning from prawn and prawn products has increased tremendously during the last 25 years.

7.12.1 Commercially important prawns of India

Marine prawns

They occur in coastal waters. *Penaeus indicus* (Indian prawn) and *Penaeus monodon* (Giant tiger prawn) are the important species of Indian coast. The marine penaeid prawns are also called as shrimps. The mature shrimp breeds in deep sea. Most of the developmental stages are spent in estuaries and backwaters.



Figure 7.25 Marine water prawn

Freshwater prawns

They inhabit rivers and lakes. They migrate to brackish water for breeding. *Macrobrachium rosenbergii* (Giant river prawn) and *Macrobrachium malcomsonii* (small prawns) are the common freshwater prawns.



Figure 7.26 Freshwater prawn

Info bits

Penaeid prawns are called shrimps (e.g. *Penaeus indicus*)

Non - penaeid prawns are called prawns (e.g. *Palaemon* spp, *Macrobrachium* spp)

7.12.2 Types of Prawn culture

A number of species of prawns of different sizes are found distributed in water resources. Only those prawns which are good in size, weight, available in plenty and easily cultivable are commonly selected for prawn culture on commercial basis.

Marine water prawn culture

The rearing of marine penaeid prawn is called marine prawn culture or shrimp culture. *Penaeus indicus* can attain a maximum length of upto 20 cms and *Penaeus monodon* upto 30 cms when fully grown.

Freshwater prawn culture

The rearing of freshwater prawn is called fresh water prawn culture. *Macrobrachium rosenbergii* and *Macrobrachium malcomsonii* can attain a maximum length of 20 and 15 cms respectively when fully grown.

7.12.3 Methods of prawn culture

In our country different localized methods of prawn culture are being followed. The methods employed for prawn culture are given below.

- Seed collection and hatchery method
- Paddy cum prawn culture method

Seed collection and hatchery method

The larvae and juveniles obtained by collection from natural resources (estuaries, lagoons and backwaters) or by hatchery methods (controlled breeding) are reared and grown into adults with supplementary feeding.



Figure 7.27 Post larvae (Prawn seed)

Paddy cum prawn culture

It is also called Pokkali culture. It is the oldest and traditional method of prawn culture practiced in Kerala. The low lying paddy fields along the coastal areas serve as suitable grounds for prawn culture. It is the practice of rearing prawns as 'secondary crop' in paddy fields. Prawns are cultured in these fields after the harvest of paddy. Both freshwater and marine prawns are cultured by this method based on their required salinity conditions.



Figure 7.28 Paddy cum prawn/fish culture

7.12.4 Nutritional value of prawns

Apart from being a delicacy, prawns are a rich nutritive source of protein, vitamin A and D, glycogen and amino acids. They contain less amount of fat. Cultured prawns also provide polyunsaturated fatty acid (PUFA) which plays an important role in health and weight maintenance.

7.13 Vermitechnology

The awareness of organic matter and concept of sustainable agriculture is gaining importance among our farmers in the recent years to produce good quality crops. Maintenance of soil organic matter is very important for sustainable productivity. Biowaste, especially the organic fraction of solid waste, can be reused for soil conditioning after composting. Recycling of available biowastes from different sources is helpful and can reduce environmental pollution.



The Egyptian Pharaoh, Cleopatra said, "Earthworms are sacred."

She recognized the important role the worms played in fertilizing the Nile Valley croplands after annual floods. Charles Darwin was intrigued by the worms and studied them for 39 years. Referring to an earthworm, Darwin said, "It may be doubted whether there are any other animals in the world which have played so important a part in the history of the world." The earthworm is a natural resource of fertility and life.

7.13.1 Vermiculture

Vermiculture involves the artificial rearing or cultivation of earthworms and using them for the production of compost from natural organic wastes. These wastes are degraded into nutrient rich manure that can be used as vermicompost.

INFO BIT

NUTRITION FACTS AND HEALTH BENEFITS OF SHRIMP

- Shrimp is merely water
- Shrimp lack carbohydrates
- Shrimp is low in calories and excellent source of protein
- An abundant source of minerals such as iron, sodium, zinc and phosphorus
- Rich source of vitamins such as thiamin and niacin



- Helps to prevent hair loss
- Helps maintain healthy bones
- Helps improve memory performance
- Beneficial in eliminating bad cholesterol
- Reduces risk of lung and prostate cancer



Earthworm is one of the nature's pinnacle. It turns common soil into superior quality compost. In one acre land there can be more than one million earthworm. Slime, a secretion of earthworm contains nitrogen, which is an important nutrient for plants.

7.13.2 Earthworm species used for vermiculture

Different types of earthworm are living in our soil. Among the vast community of earthworms only very few species can be used for vermicompost production. They are *Perionyx excavatus* (Indian blueworm), *Eisenia fetida* (Red worms), *Eudrilus eugeniae* (African night crawler).



Perionyx excavatus



Eisenia fetida



Eudrilus eugeniae

Figure 7.29 Earthworm species for vermicomposting

Info bits

Vermiwash : During earthworm culture, water is sprinkled over the feed and the excess water and the excretory content of earthworm is slowly drained out which is known as Vermiwash. It is a liquid plant growth regulator which contains high amount of enzymes along with macro and micronutrients.

7.13.3 Vermicomposting

It is an important component of organic farming which can convert bio-wastes into nutrient rich organic manure by using earthworms. The burrowing and soil feeding habits of earthworms make the soil porous which permits both aeration and quick absorption of water. It feeds on the organic wastes and excrete it in digested form known as castings. The compost is generally called vermicompost.



7.13.4 Vermicompost

Vermicompost is the excreta (worm castings) which is a fine, granular organic matter formed by the decomposition of organic materials by the earthworm. It improves physical, chemical and biological properties of the soil and makes it an ideal fertilizer for the soil.

7.13.5 Materials required for vermicomposting

Biologically degradable organic wastes are used as potential organic resources for vermicomposting. They are:

- Agricultural wastes (crop residue, vegetables waste, sugarcane trash)
- Crop residues (rice straw, tea wastes, cereal and pulse residues, rice husk, tobacco wastes, coir wastes)
- Leaf litter
- Fruit and vegetable wastes
- Animal wastes (cattle dung, poultry droppings, pig slurry, goat and sheep droppings)
- Biogas slurry

7.13.6 Methods of vermicomposting

Vermicomposting methods can range from a wormbin in the kitchen for household scraps to large mechanized systems, which can be able to accommodate tons of organic material. In general these methods are of the following types:

- Bin (or) Container method
- Vermicomposting of organic wastes in field pits
- Vermicomposting of organic wastes on ground heaps

Let us now study how vermicompost is obtained by bin method.

Vermicomposting by bin method

It is the rearing of earthworms in a container or bin. The container is half filled with bedding materials such as shredded cardboard, leaves, paddy husk, chopped straw, saw dust and manure. Small quantity of soil and sand is added to provide necessary grit for the worms. The bedding material should be moistened by adding water that enables free movements of the worms. The worms are gently placed and spread evenly on the bedding.

Organic wastes (kitchen wastes, vegetable and fruit wastes) are added which are fed by the earthworms. The bin is covered with coconut leaves or gunny bags to conserve moisture, provide darkness and keep out of pests. After a period of 60 days the wastes are completely transformed into nutrient rich materials that are excreted by earthworms known as **worm castings**. These castings are harvested and used as organic manure.

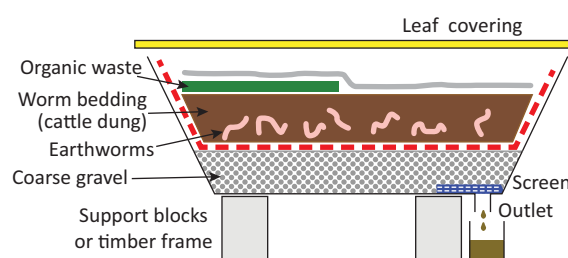


Figure 7.30 Vermicomposting bin

7.13.7 Advantages of Vermicompost

Vermicompost is dark brown in colour and similar to farmyard manure in colour and appearance.

- It is a rich source of nutrients essential for plant growth. It makes the soil fertile.
- It improves soil structure, texture, aeration and water holding capacity and helps to prevent soil erosion.
- It contains valuable vitamins, enzymes and growth regulator substances for increasing growth, vigour and yield of plants.
- It enhances decomposition of organic matter in soil.
- Vermicompost is free from pathogens and toxic elements.
- Vermicompost is rich in beneficial microflora.



Figure 7.31 Vermicompost



Activity 6

Prepare vermicompost from organic waste materials present in your school surroundings and garden. The above activity can be done in a circular container/bin and kept in shady place with optimal temperature and light.

7.14 Apiculture

Apiculture is the rearing of honey bee for honey. It is also called Bee keeping. It is a profitable rural based industry and it is developed as an agro-based cottage industry. Apiculture provides employment to rural people and honey bee is domesticated by farmers to produce honey.

Honey bees are social insects. The nest of honey bee is known as the bee hive. They live in colonies and show division of labour.

7.14.1 Types Honey Bee

There are three types of individuals in a colony namely the Queen bee, the drones and the worker bees.

- a. **Queen Bee:** The queen is the largest member and the fertile female of the colony. They are formed from fertile eggs. The queen is responsible for laying eggs in a colony. The life span of the queen bee is 3-4 years.
- b. **Drones:** They are the fertile males. They develop from unfertilized eggs. They are larger than the workers and smaller than the queens. Their main function is to fertilize the eggs produced by the queen.
- c. **Worker Bees:** They are sterile female bees and are the smallest members of the colony. Their function is to collect

honey, look after the young ones, clean the comb, defend the hive and maintain the temperature of the bee hive.



Figure 7.32 Types of Honey bee

7.14.2 Indigenous and Exotic varieties of Honey Bee

a) Indigenous varieties

- i) *Apis dorsata* (Rock bee or Wild bee)
- ii) *Apis florea* (Little bee)
- iii) *Apis indica* (Indian bee)

b) Exotic varieties

- iv) *Apis mellifera* (Italian bee)
- v) *Apis adamsoni* (African bee)

7.14.3 Structure of Bee Comb

The comb of the bees is formed mainly by the secretion of the wax glands present in the abdomen of the worker bee. A comb is a vertical sheet of wax with double layer of hexagonal cells. The cells of the comb are of various types.

The **storage cells** contain honey and pollen. They are built in the margin and at the top of the comb.

The **brood cells** contain the young stages of the honey bees and they are built in the centre and the lower part of the comb. The **brood chamber** is divided into three types **Worker chamber**, **Drone chamber** and **Queen chamber** where the larvae developing into worker, drone and queen are reared.

Formation of Honey: The honey bees suck the nectar from various flowers. The nectar passes to the honey sac. In the honey sac,



Figure 7.33 Bee Comb

sucrose present in the nectar mixes with acidic secretion and by enzymatic action it is converted into honey which is stored in the special chambers of the hive.

7.14.4 Useful products from Honey Bee

Honey bees are used in the production of honey and bee wax. Honey is the aromatic sweet material and its quality depends upon the flowers available to the bees for nectar and pollen collection.



- Honey bee visits 50 to 100 flowers during a collection trip.
- Average bee will make only $1/12^{\text{th}}$ of a teaspoon of honey in its lifetime.
- One kilogram of honey contains 3200 calories and is an energy rich food.

a. Honey

Honey is a sweet, viscous, edible natural food product. Dextrose and sucrose gives sweet taste to the honey. It also contains protein, free amino acids, vitamins like ascorbic acid, niacin, riboflavin and thiamine. Minerals like calcium, iron, phosphorus and manganese are present. Acids such as citric acid, gluconic acid and formic acid are found in honey. Formic acid is a preservative in honey. Invertase is an enzyme present in honey.

Uses of Honey

- Honey has an antiseptic and antibacterial property. It is a blood purifier.
- It helps in building up of haemoglobin content in the blood.
- It is used in Ayurvedic and Unani system of medicines.
- It prevents cough, cold, fever and relieves sore throat.
- It is a remedy for ulcers of tongue, stomach and intestine.
- It enhances digestion and appetite.

b. Bee wax

Bee wax is the natural by product secreted by the wax glands of worker bee to construct the combs of bee hive. It is widely used in cosmetic and pharmaceutical industries.

Other useful products obtained from honey bees are bee pollen, royal jelly, propolis and bee venom.

More to Know

Bee-keeping industry is one of the important activities of Khadi and Village Industries Commission (KVIC). Honey manufactured by the Khadi Board has good patronage from the public. The Board's honey processing unit at Amsi in Kanyakumari district is producing "A" Grade honey. The raw honey is procured mostly from Jamunamaruthur in Thiruvannamalai district and Marthandam in Kanyakumari district. This raw honey is 100% tested before packing for sales.

Points to Remember

- ❖ Horticulture, is a branch of agriculture that deals with cultivation of fruits, vegetables, and ornamental plants.
- ❖ The four main classes of horticulture are pomology (fruit farming), olericulture (vegetable farming), floriculture (flowers farming) and landscape gardening.

- ❖ Floriculture is the art of cultivation of flowering and ornamental plants for gardens and floristry.
- ❖ The organic manures are predominantly derived from plant debris, animal faeces, microbes. They make the soil fertile by adding nutrients like nitrogen.
- ❖ A biofertilizer is a substance which contains living microorganisms which, when applied to seeds, plant surfaces, or soil, colonize the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant.
- ❖ All the major system of medicines such as Ayurvedic, Yoga, Unani, siddha, Homeopathy (AYUSH) use drugs obtained from plants.
- ❖ Mushroom cultivation is a technology of growing mushrooms using plant, animal and industrial waste.
- ❖ Hydroponics is the method of growing plants without soil, using mineral nutrient solutions in water.
- ❖ The aeroponic system is high-tech type of hydroponic gardening and the growth medium is primarily air.
- ❖ Aquaponics is a system of a combination of conventional aquaculture with hydroponics in a symbiotic environment in which plants are fed with the aquatic animals' excreta or wastes.
- ❖ Dairy farming involves raising of cattle for milk production.
- ❖ Aquaculture is the rearing of economically important aquatic organisms like fishes, prawns, shrimps, crabs, lobsters, edible oysters, pearl oysters and sea weeds under controlled and confined environmental conditions using advanced technologies.
- ❖ Pisciculture or fish culture is the process of breeding and rearing of fishes in ponds, reservoirs (dams), lakes, rivers and paddy fields.
- ❖ The most economically important shell fish resources of India are prawns.
- ❖ Vermiculture involves the artificial rearing or cultivation of earthworms and using them for the production of compost from natural organic wastes.
- ❖ Apiculture is the rearing of honey bee for honey.

A-Z GLOSSARY

Aquaculture	Culture of fishes, prawns, shrimp, oysters and crabs in either sea water or freshwater.
Aquaponics	Combination of conventional aquaculture with hydroponics in a symbiotic environment in which plants are fed with the aquatic animals' excreta or wastes.
Compost	Soil conditioner, fertilizer, natural pesticide, a decomposed organic matter which is rich in nutrients.
Floriculture	Production of ornamental plants.
Green manure	Undecomposed green material derived mostly from leguminous plants.
Hydroponics	Soil less growing system in which plants grow in water.

Mariculture	Culture of fishes and other aquatic organism in marine water near the sea coast.
Nectar	It is a sweet viscous secretion secreted by the flower of plants.
Olericulture	Production of vegetables.
Pasturage	The availability of flowers to bees for nectar and pollen collection.
Pisciculture	It is the culture and rearing of fishes under controlled conditions.
Polyculture	Culture of more than one species of fish in a pond.
Pomology	Production of fruits.
Silage	Fermented high moisture stored food which can be fed to cows.
Vermicompost	Vermicompost is the excreta of earthworm which is a natural rich organic soil formed by the decomposition of organic material by the earthworm.
Vermicomposting	Earthworms degrade organic waste materials into useful product which can be used as a nutrient rich fertilizer.
Vermiculture	The artificial rearing or cultivation of earthworms for the production of vermicompost.



TEXTBOOK EVALUATION



I . Choose the correct answer.

- The production and management of fish is called
 - Pisciculture
 - Sericulture
 - Aquaculture
 - Monoculture
- Which one of the following is not an exotic breed of cow?
 - Jersey
 - Holstein-Friesian
 - Sahiwal
 - Brown Swiss
- Which one of the following is an Italian species of honey bee?
 - Apis mellifera*
 - Apis dorsata*
 - Apis florea*
 - Apis cerana*
- Which of the following are Indian cattle?
 - Bos indicus*
 - Bos domesticus*
 - Bos bubalis*
 - Bos vulgaris*
 - i and ii
 - i and iii
 - ii and iii
 - iii and iv
- Which one of the following is not an Indian major carp?
 - Rohu
 - Catla
 - Mrigal
 - Singhara
- Drones in the honey bee colony are formed from
 - unfertilized egg
 - fertilized egg
 - parthenogenesis
 - both b and c

7. Which of the following is an high milk yielding variety of cow?

- a. Holstein- Friesan b. Dorset
c. Sahiwal d. Red Sindhi

8. Which one of the following is referred as red worms?

- a. *Eudrilus fetida*
b. *Eudrilus eugeniae*
c. *Perionyx excavatus*
d. *Lampito mauritii*.

9. Which Indian variety of honey bee is commonly used for apiculture?

- a. *Apis dorsata* b. *Apis florea*
c. *Apis mellifera* d. *Apis indica*

10. Mehsana is a breed of

- a. Cow b. Buffalo c. Goat d. Sheep

11. Binomial name of Nilavembu is

- a. *Leucas aspera*
b. *Andrographis paniculata*
c. *Crotolaria juncea*
d. *Cassia fistula*

12. _____ is the method of growing plants without soil.

- a) Horticulture b) Hydroponics
c) Pomology d) None of these.

13. The symbiotic association of fungi and vascular plants is

- a) Lichen b) *Rhizobium*
c) Mycorrhizae d) *Azotobacter*

14. The plant body of mushroom is

- a) Spawn b) Mycelium
c) Leaf d) All of these

II. Fill in the blanks.

1. _____ is a nodulating type of micro organism associating symbiotically with the root of legume plants.

2. Quinine drug is obtained from _____.

3. *Carica papaya* leaf can cure _____ disease.

4. *Ganoderma lucidum*, is commonly known as _____ mushroom.

5. _____ is the maintenance of bee colonies in modern hives.

6. Vermicompost is a type of soil made by _____ and microorganisms.

7. _____ refers to the culture of prawns, pearl and edible oysters.

8. The fertile female in a honey bee hive is _____.

9. _____ is a preservative in honey.

10. _____ is the method of culturing different variety of fish in a water body.

11. Pasturage is related to _____.

III. State whether true or false, If false, correct the given statement.

1. Medicinal plants contain compounds that can be used for therapeutic purposes.

2. Anthraquinones is obtained from *Ocimum sanctum*.

3. Mycorrhiza is an algae.

4. Aquaponics is a technique of growing plants with their root supplied with moisture present in the air.

5. Milch animals are used in agriculture and transport.

6. *Apis florea* is a rock bee.

7. Ongole is an exotic breed of cattle.

8. Sheep manure contains high nutrients than farm yard manure.

IV. Match the following.

Column A	Column B
Lobsters	Marine fish
Catla	Pearl
Sea bass	Shell fish
Oysters	Paddy
Pokkali	Fin fish
<i>Pleurotus sps</i>	Psoriasis
Sarpagandha	Oyster mushroom
Olericulture	Reserpine
<i>Wrightia tinctoria</i>	Vegetable farming

V. Define the following.

- | | |
|-----------------|-----------------|
| a. Pisciculture | e. Floriculture |
| b. Apiculture | f. Compost |
| c. Vermiculture | g. Pomiculture |
| d. Mariculture | h. Pinning |

VI. Differentiate the following.

- Exotic breed and Indigenous breed
- Pollen and Nectar
- Shrimp and Prawn
- Fin fish and Shell fish
- Farmyard manure and Sheep manure

VII. Answer in brief.

- What are secondary metabolites?
- What do you know about AYUSH?
- What are the types of vegetable garden?
- Mention any two mushroom preservation methods.

- Why do we call Haryana and Kankrej breed of cattle as dual purpose breeds?
- How is division of labour observed in honey bees?
- What is the nutritional importance of fish liver oils? Name any two marine fishes which yield these oils.
- Enumerate the advantages of vermicompost over chemical fertiliser.
- What are the species of earthworm used for vermiculture?
- List the medicinal importance of honey.

VIII. Answer in detail.

- Enumerate the advantage of hydroponics.
- Give an account on medicinal plants.
- What are biofertilisers? Give examples. Why are biofertilisers better than other fertilizers.
- Define Mushroom culture. Explain the mushroom cultivation methods.
- Write short notes on;
 - Importance of green houses
 - Uzahavan mobile Application
 - Major floriculture zones
 - Azospirillum*
- What are the sources of organic resources for vermicomposting?
- Give an account of different types of fish ponds used for rearing fishes.
- Explain the feeding management of dairy cattle.
- Classify the different breeds of the cattle with suitable examples.

IX. Assertion and Reason.

Direction: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Of the statements given below, mark the correct answer as

- If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- If both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
- If Assertion is true but Reason is false.
- If both Assertion and Reason are false.

1. Assertion: Hydroponics can be defined as a soilless growing system in which plants grow in water.

Reason: If a plant is provided with water, minerals and required nutrients, it will grow well and yield more even in the absence of soil.

2. Assertion: Fish and other varieties of aquatic animals are used as food.

Reason: Fish and other varieties of sea food constitute good source of nutrition.

3. Assertion: The production of food from animal sources has increased greatly in the last few decades.

Reason: Operation flood and blue revolution production has increased in the recent years.

X. Thinking Skills

- Biomanuring plays an important role in agriculture. Justify

- Arun and Akash were given fertilisers and earthworm compost both to be used in the fields. Akash preferred to use earthworm compost. Why he did not select the fertilizers?
- What is pasturage and how is it related to honey production?
- Each bee hive consists of hexagonal cells. Name the material in which the cell is formed and mention the significance of the hexagonal cells.



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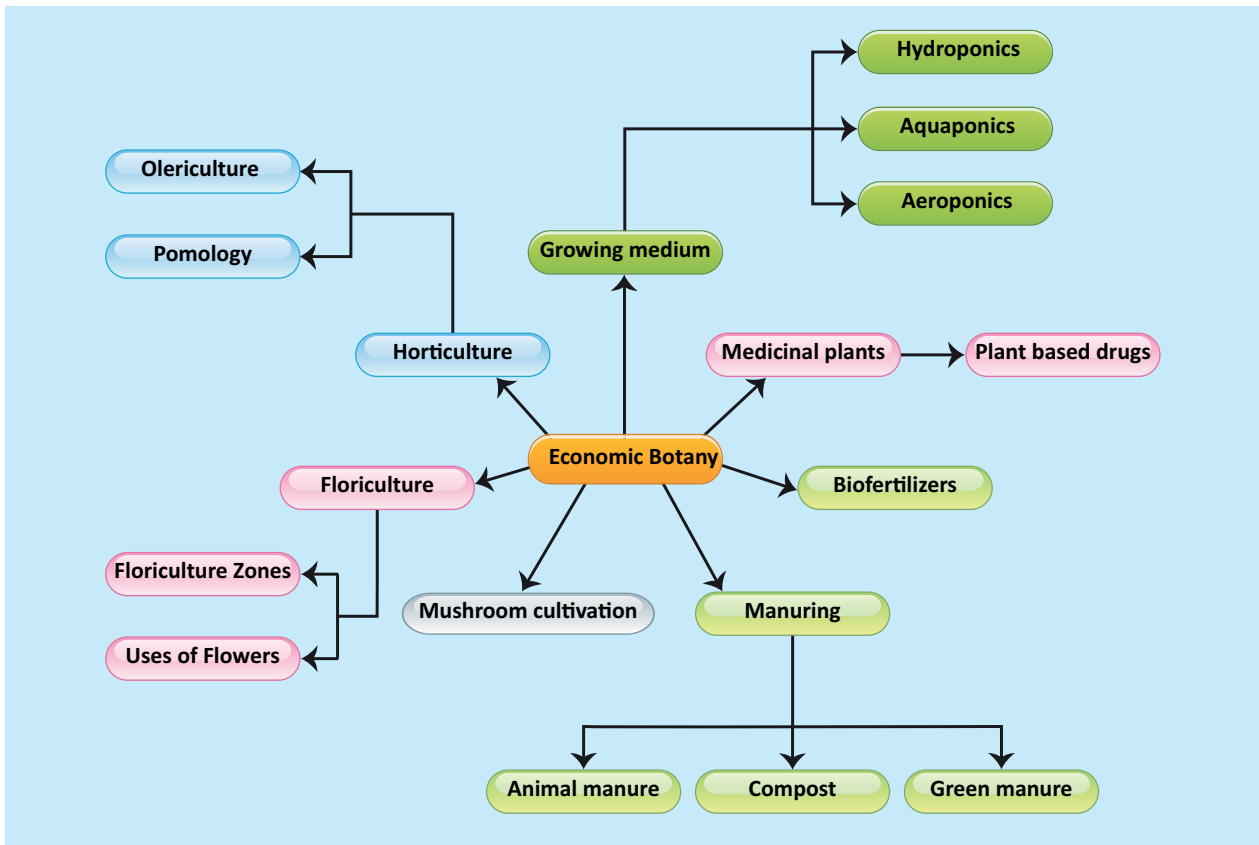


INTERNET RESOURCES

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Concept Map

Economic Botany



Economic Zoology

