

IMPROVEMENT IN FOOD RESOURCES

The population on this planet is constantly growing. The world population, according to the United States Census Bureau, was 6 billion in 1999 and has grown alarmingly to 7 billion in 2012. This would put pressure on the supply of food to mankind. The area available for plant cultivation is shrinking but the amount of food required is increasing. We must meet the demand for food by increasing the food produce from agriculture and animal farming.



Thus, we clearly understand the reasons for the scarcity of food.

The problem of food scarcity can be overcome by:

- i) increasing the yield of crops.
- ii) preventing cultivable lands from being used for other purposes.
- iii) optimizing water resources for cultivation.
- iv) improving the system of preservation and distribution of food materials.

1.1 IMPROVEMENT IN CROP YIELDS

Majority of the world's population depends on agriculture. We have to think of smart ways to increase food production. Agricultural scientists are working to increase the quality and quantity of food that we produce from plants.

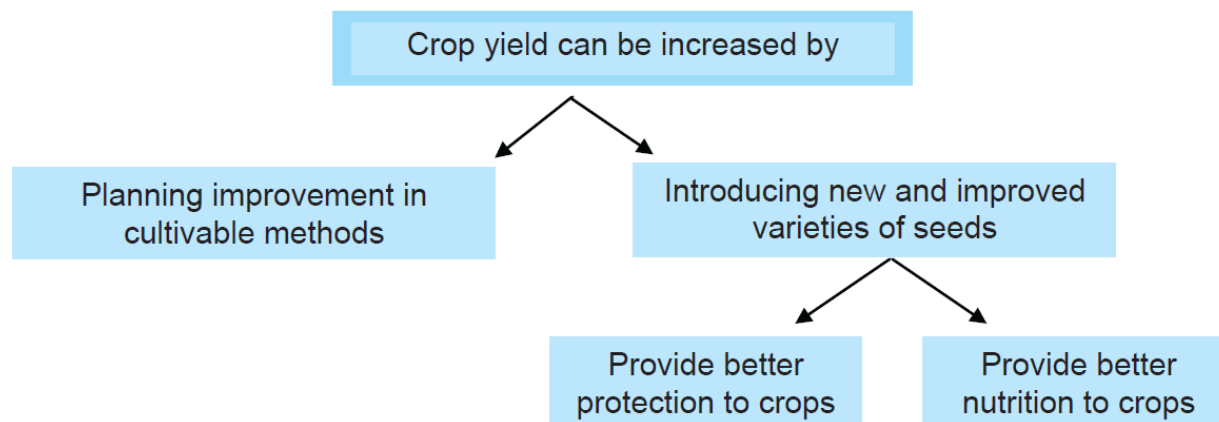
Plants that are cultivated in farms and harvested for food are called crops. There are a large variety of crops. Here are some examples:

Crops grown for cereals: Rice, Wheat, Maize, Millet

Crops grown for pulses : Pea, Greengram, Blackgram

Crops grown for oilseeds: Groundnut, Sunflower, Mustard, Sesame

Crops grown for animal fodder: Oats, Sudan grass, Elephant grass, Alfalfa.



Introduction of new and improved varieties

Improved varieties or strains of crops are produced by selective breeding for various important characteristics such as disease resistance, response to fertilizers, product quality and higher yield.

Common factors for crop improvement

Higher Yield	To increase the productivity of the crop per acre
Improved Quality	Quality of crop products vary from crop to crop. e.g. baking quality in wheat, protein quality in pulses, oil quality in oil seeds.
Biotic and abiotic resistance	Crop production is decreased due to biotic (diseases, insects and pests) and abiotic factors (heat, cold, salinity and drought). Resistance to these stress factors can improve crop production.
Change in maturity pattern	Shorter maturity period; Uniform maturity makes the harvesting process easy and reduces losses during harvesting.
Wider Adaptability	One variety can be grown under different climatic conditions in different areas. Developing varieties of wider adaptability helps in stabilizing crop production.
Desirable agronomic characters	Tallness and profuse branching are desirable characters for fodder crops. Dwarfness is desired in cereals. Developing varieties of desired agronomic characters give higher productivity.

Selecting good varieties of crops, planning improvement in crop production and ensuring crop protection will result in increased crop yield.

Some improved varieties of crops and fruits

Fodder crop, Paddy, Wheat, Baby corn, Maize, Sunflower, Mango, Grapes

1.2 NUTRIENT MANAGEMENT

Plants take in carbon, hydrogen and oxygen from air or water, and absorb many other nutrients from the soil. Scientists have identified sixteen elements that are important for the growth and reproduction of plants.

Nitrogen is needed for plants to prepare proteins, nucleic acids, chlorophyll and other important organic molecules. Deficiency of nitrogen causes chlorosis in plants. Phosphorus is needed for the process of converting light energy from the sun into chemical energy. Similarly, different elements are needed for important activities in the life cycle of a plant.

MACRO-NUTRIENTS

Elements which are essential in large quantities for the growth of plants are called Macro-nutrients. They are carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, potassium, calcium, magnesium and iron.

MICRO-NUTRIENTS

Elements that are needed for the growth of plants in very small quantities are called Micro-nutrients. They are manganese, copper, molybdenum, zinc, boron and chlorine.

Just as in humans, plants too are affected by nutrition deficiencies. It can affect the process of growth and reproduction resulting in low yield or no yield.

1.3 USES OF MANURE AND FERTILIZERS

During farming and harvesting of crops, a large amount of nutrients are extracted by plants from the soil. This deficiency is compensated with the addition of chemicals in the form of fertilizers and manure.

Manure is an organic substance prepared by the decomposition of plant and animal waste.

Based on the kind of biological material used, manure can be classified as follows:

i) Compost & Vermi Compost:

Vermicompost is manure prepared by using earthworms to speed up the process of decomposition of plant and animal waste.

ii) Green Manure : Green manure is prepared by using leguminous plants like sunhemp and soyabean. These are grown for a specific period of time and then ploughed back into the soil. Green plants add nutrients and organic matters like nitrogen and phosphorus to the soil.

USES OF MANURE

- f Manure enhances the water holding capacity of the soil.
- f It increases the number of friendly microbes.

- *f* It improves the soil texture.

FERTILIZERS

Fertilizers are chemicals like nitrogen, phosphorous and potassium that are commercially produced in factories and used as plant nutrients.

When there is a specific nutrient missing in a plant, it is recommended to use a fertilizer. Small or micro doses of fertilizers can result in dramatic improvements in the health of a plant.

Types of Fertilizers	Examples
Nitrogenous Fertilizers	Urea, Ammonium Sulphate, Ammonium Nitrate
Phosphatic Fertilizers	Single Super Phosphate, Triple Super Phosphate
Potassic Fertilizers	Potassium Nitrate, Potassium Chloride
Complex Fertilizers	Nitrophosphate, Ammonium Phosphate, Diammonium Phosphate (DAP)

Usage of fertilizers has its own disadvantages. Fertilizers account for additional expenses for farmers. Moreover, these chemicals being water-soluble can get washed away and contaminate the natural water-supply. Farmers also have to take meticulous care with the dosage, as excess chemicals can destroy soil fertility. Excess fertilizers that are washed away into the ponds, lakes, canals and rivers can also result in the growth of unwanted plants like Water Hyacinth and Algae.

These plants grow in excess amounts. They deprive the water-body of oxygen and stop the flow of water. As a result, fishes and other living organisms do not get sufficient sunlight and oxygen and they die. The excessive richness of nutrients in water that causes dense growth of algae on the surface and causes death of other organisms living in the water is called eutrophication.

Differences between Manure and Fertilizers

Manure	Fertilizers
1. Manure is a natural substance obtained from the decomposition of cattle dung, human waste and plant waste.	1. Fertilizer is a mineral or chemical compound containing nutrients like sulphur, phosphorous and nitrogen.
2. Manure contains organic substances.	2. Fertilizers are inorganic compounds.
3. Manure can be prepared in fields.	3. Fertilizers are manufactured in factories.
4. Manure contains all nutrients but in small quantities.	4. Fertilizers contain more quantities of one specific nutrient or more.
5. Manure adds plenty of humus to soil and improves the texture of the soil.	5. Fertilizers do not contribute to the addition of humus to the soil.
6. Manure is not easily absorbed because it is less soluble in nature.	6. Fertilizers are soluble in water and it is easily absorbed.
7. Manure is less soluble; it is not easily washed away from the soil and hence its effect is long lasting.	7. Fertilizers are easily washed away by water and hence their effect is of shorter duration and require repeated application.

Farmers must efficiently balance the use of fertilizers and manure.

Some agriculturists practice organic farming. This method makes use of manure like recycled farm waste to nourish the crops. This avoids the use of insecticides and fertilizers.

Fertilizers which are produced from living organisms are called Bio-fertilizers. The main source of bio-fertilizers are bacteria, cyanobacteria and fungi. Bio-fertilizers are renewable and non-polluting sources of plant nutrients. They also improve the soil nutrients. Rhizobium and Cyanobacteria such as Anabaena and Nostoc are some common bio-fertilizers.

1.4 PROTECTION FROM PESTS AND DISEASES

Organisms that attack or destroy crops, food or farm animals are called pests. They damage cultivated crops and plant products in storage. Crop yield is affected due to pests during the process of sowing, harvesting, storing and consumption. This causes a great loss to the national economy.

1.4.1 INSECT PESTS

Insects attack plants in all stages of their growth. Based on the mode of attack, insect pests are classified into three types:

i) Chewing Insects: They cut and chew the root, stem and leaves of the plants.

e.g. grasshoppers and caterpillars.

ii) Sucking Insects: They suck the cell sap from different parts of the plants.

e.g. leaf hoppers and aphids.

iii) Borer Insects: They make holes and enter different parts and feed on plant tissues.

e.g. sugarcane borer.

Some common Indian Insects and Pests of Crop Plants

Sugarcane Top-borer, Gundhi Bug, Sugarcane Stem-borer, Pyrilla (Sugarcane Leaf Hopper), Mustard Aphid, Painted Bug

1.4.2 DISEASES OF CROP PLANTS

A wide variety of plant pathogens such as bacteria, virus and fungi exist in our environment. When conditions become favourable, they spread and infect crop plants causing diseases. Based on the mode of transmission, plant diseases are classified into four types.

1	Seed borne diseases	They spread through seeds. e.g. Leaf spot of rice, Loose smut of wheat.
2	Soil borne diseases	They spread through the soil. They affect roots and stems in plants. e.g. Tikka disease of groundnut.
3	Air borne diseases	These diseases are transmitted through air. They attack all aerial parts of plants like leaves, flowers and fruits. e.g. Blast of rice, Rust of wheat .
4	Water borne diseases	The diseases which are transmitted through water are called water-borne diseases. e.g. Bacterial blight of rice.

Pesticides are toxic chemicals that destroy pests.

i) Insecticides: Chemical substances which are used to kill insects are called insecticides. e.g. DDT (Dichloro diphenyl trichloro ethane), Malathion.

ii) Fungicides: Chemicals used to kill fungi are called fungicides.

e.g. Bordeaux mixture.

iii) Weedicides: Chemical substances which are used to kill weeds are called weedicides. e.g. 2, 4-D. (2, 4 - Dichloro phenoxy acetic acid)

iv) Rodenticides: Chemicals used to kill rodents like rats, mice and squirrels are called rodenticides, e.g. Zinc Phosphate, Arsenic.

1.4.3 METHODS OF INSECT PEST CONTROL

The infestation of different types of insect pests can be controlled by the following methods:

- Root-cutting insects are controlled by mixing insecticides in soil.
e.g. Chloropyrriphos.
- Stem and leaf cutting insects and boring insects are controlled by dusting or spraying insecticides.
e.g. Malathion, Lindane and Thiodan.
- The sap-sucking insects can be controlled by spraying insecticides.
e.g. Dimethoate and Metasystox.

1.4.4 PRECAUTIONS FOR APPLYING PESTICIDES

- Do not touch the pesticide with bare hands; use rubber gloves while handling it.
- Do not blow, suck or apply mouth to any sprinkler, nozzle or other parts of the spraying equipment.
- Do not spray pesticides against the direction of wind in the open field.
- Use only the prescribed dose of pesticides for spraying.

1.4.5 STORAGE OF GRAINS

Most crops are harvested once a year. In order to get a supply of food items regularly throughout the year, they are stored in safe storage.

Cereals or food grains are stored by the farmers, traders and the Food Corporation of India (FCI).

During storage, grains and seeds are subjected to spoilage by various agencies. Factors responsible for such damages are:

- i) Biotic factors** (insects, rodents like squirrel and rat, birds, fungi, mites and bacteria)
- ii) Abiotic factors** (moisture and temperature)

These factors cause,

- infestation of insects
- degradation in quality
- loss in weight
- poor germinability
- discolouration of product
- poor marketability.

Therefore, it is essential to protect the produce from any kind of loss during storage.

Preventive and Control Measures are used when the produce is stored for future use. They include strict cleaning of the produce before storage, proper drying of the produce in sunlight and then in shade and fumigation using chemicals that kill pests.

1.5 HYBRIDIZATION IN PLANTS AND ANIMALS

1.5.1 HYBRIDIZATION IN PLANTS

Improved varieties of seeds and plants can be introduced by the process of hybridization.

Hybridization is the method of producing improved varieties by crossing the genes of two or more dissimilar and specially selected parent animals or plants. The parents with desirable qualities are selected and the best characters are brought together in a single variety.

Hybridization can be:

- i) Intervarietal** (cross between two different varieties)
- ii) Interspecific** (cross between two species of the same genus)
- iii) Intergeneric** (cross between different genera)

Of the above three types, intervarietal hybridization is widely adopted in plant breeding.

In maize, hybrids are grown because they produce good yield. Modern varieties of maize, wheat and rice that we consume are all products of hybridization.

1.5.2 HYBRIDISATION IN ANIMALS

Hybridisation is a method of breeding, where the offspring is formed by the union of two genetically dissimilar parents. It involves the application of the principles of genetics and physiology of reproduction.

Hybridization has long been used for commercial production of cattle, sheep and poultry. Black Rock chicken is a hybrid of Rhode Island Red and Barred Plymouth Rock chicken. These are examples of two normal breeds that are combined to form an extraordinary breed. Scientists however, proceed with much caution in their efforts to identify better breeds and hybrids.

Some of the characteristics that farmers look for when selecting parent crops or farm animals for hybridization are:

1. Resistance to diseases
2. Tolerance to climatic conditions
3. General appearance
4. Size and configuration
5. Productivity
6. Good health
7. Proper age of reproduction

The different methods of animal hybridisation are as follows :

Inbreeding

Breeding between closely related individuals within the same breed is known as inbreeding.

The importance of inbreeding are:

1. It is used as a tool primarily to build desirable genotype and to promote pure breeds with desirable characteristics.
2. To identify undesirable recessive genes. This enables the breeder to separate them from the stock.
3. Inbreeding promotes uniformity.
4. Inbreeding associated with selection can produce improved stocks.

Selection

It is a process of selecting productive individuals for further breeding. Modern approach of selection is based on records of performance.

Outbreeding

It involves breeding of animals that are not closely related.

a) Outcrossing: It involves breeding from the crossing of animals of the same breed (without a common ancestor).

b) Cross breeding: In this method, superior males of one breed are mated with superior females of another breed. It involves the fusion of two different breeds in order to combine the desirable qualities of both.

c) Interspecific Hybridisation: In this method, male and female animals of two different species are mated. In some cases, the progeny may combine desirable features of both the parents. For example, mule is produced from a cross between female horse (mare) and male donkey. Mules are sturdier and harder than their parental species and are well suited for hard work in different terrains like mountainous regions. There are two methods of interspecific hybridisation.

i) Natural Method: In this method crossing of indigenous and exotic breeds takes place in order to improve the yield significantly.

ii) Artificial insemination: It is a method used in hybridization in which stored semen of a desired male animal is introduced into the genital tract of a selected female animal using suitable instruments in order to obtain a better breed of the animal.

Advantages of artificial insemination

1. Ensures progeny with desirable qualities.
2. It is an economical method wherein semen from one animal is used to impregnate many females.
3. It provides high yielding animals with increased production of milk, eggs and meat.
4. Frozen semen can be stored for a long period and it can be transported even to remote areas.

1.6. ANIMAL HUSBANDRY

The branch of agriculture which deals with the feeding, sheltering, nurturing and breeding of domestic animals such as cattle, pigs, horses and fowls is called animal husbandry.

The various elements of animal husbandry are :

1. Proper feeding of animals.
2. Provision of clean drinking water for animals.
3. Proper shelter for animals.
4. Prevention and cure of animal diseases.
5. Proper breeding of animals.

Different animals are bred for different purposes.

Some examples are:

Dairy animals: Those that are used as

Farm animals	Purpose
Cow	Meat and Milk
Buffalo	Meat and Milk
Duck	Egg and Meat
Chicken	Egg and Meat
Sheep	Wool, Meat and Milk

Silkworm	Silk
Bees	Honey and Wax

Meat producing animals: Animals that are reared for their meat, **e.g.** Cow, Pig.

Poultry animals: Birds that are source of egg and meat, **e.g.** Chicken, Turkey.

Animal Product	Fat %	Protein %	Sugar %	Minerals %	Water %
Milk	3.60	4.00	4.50	0.70	87.20
Egg	12.00	13.00	Trace	1.00	74.00
Meat	3.60	21.10	Trace	1.10	74.20
Fish	2.50	19.00	Trace	1.30	77.20

Cattle: Cows, bulls and oxen are together called cattle. They are raised for milk, meat or labour (draught / draft animals).

Shahiwal, Red Sindhi, Gir and Deoni are examples of Indian cattle breed that are used for their milk.

Holstein Freisian is an exotic breed from Holland and Friesland in the Netherlands. It is distinctive with large black and white colour markings. These cattle have been in use as dairy animals for more than 2,000 years. They are known as a breed that gives very high yield of milk. Murrah and Jersey are examples of cattle that are selected for milk-yielding purposes.

Strong animals that are used for pulling heavy loads for transportation or ploughing fields are called draught (draft) animals. Kangayam, Umblacherry, Amritmahal and Hallikar are popular breeds of draught cattle. These animals can walk long distances carrying heavy loads.

Some breeds like Ongole, Khankrej and Tharparkar are used for both milk and work.

Cattle feed or fodder:

Cattle feed or dry fodder is made of roughage and concentrates. Roughage is a coarse and fibrous substance having low nutrient content. A variety of raw material such as sorghum (jowar or Cholam), cumbu (pearl millet or bajra), tamarind seed, rice bran, tapioca residue, ragi (finger millet) husk, sunflower meal, groundnut oilcake, gingelly oilcake, cotton seedcake and neem cake can be used to make concentrate feed.

On an average, a milch cow (a breed that is used for milk production) will consume concentrate feed equivalent to 2.5% - 3% of its bodyweight. About two-thirds of this dry feed should be in the form of crude fibres and the rest one-third should be concentrates. They should also feed on forage or grass varieties like Hybrid Napier, Sudan grass, Berseem and millets. These are also called as green fodder.

When there is a demand for more milk production or stronger draught animals, it directly reflects on an improvement on their feed. Silage is a feed that is highly nutritious. When green fodder is not available, cattle can be fed with silage. Silage can be defined as fermented highmoisture stored fodder, which can be fed to cows, sheep and goats. It is made from ordinary green grass, maize, sorghum or other cereals and other weeds using the entire green plant.

The crops are shredded into small pieces and packed inside bags and sealed to allow fermentation. After two weeks the silage is ready to be fed to cattle.

Cattle can suffer from diseases and parasitic infections. Vaccinations are given to protect them against bacterial and viral infections.

1.7. POULTRY FARMING

Poultry farming is defined as rearing and breeding of avian species for the purpose of egg and meat. Chicken occupy 90% of the total poultry.

The term poultry includes chicken, ducks, geese, turkeys, pigeons and guinea fowls. The poultry industry with its production in the form of eggs and meat is of particular importance in providing a balanced diet for the human population. Proper management of poultry includes methods of hatching, rearing, housing, sanitation, prevention of diseases and a sound marketing system.

Dr. V. Kurien is considered as the Father of White Revolution. White Revolution refers to a time when there was tremendous increase in milk production with the use of new improved breeds of cattle. Dr. V. Kurien is the founder chairman of National Dairy Development Board (NDDB). This board designed and implemented the world's largest dairy development programme called OPERATION FLOOD.

Silver revolution

The increase in egg production brought about the 'Silver Revolution' in the area of animal husbandry.

NUTRITIONAL VALUE OF MILK

Constituents	Functions
Calcium	Builds and maintains bone mass
Vitamin D	Promotes calcium metabolism
Protein	Builds and repairs Muscles
Potassium	Maintenance of bloodpressure.
Vitamin B2	Cellular metabolism
Vitamin B4	Functioning of enzymes
Vitamin B12	Maturation of red bloodcells.

There are more than hundred breeds of fowls. The fowls are classified on the basis of their utility to man. They are: 1. meat type 2. egg type 3. dual type.

Examples for cross breeds of Poultry are: HH-260, IBL-80, B-77, IIS-82

Advantages of Cross breeds

1. Cross breeds lay more number of eggs.
2. The eggs produced are larger in size.

3. They yield more meat.

Nutritional value

Eggs and meat are good sources of protein. Eggs also contain calcium, phosphorus, sodium, vitamins B1, B12 and D.

Housing of Birds

In free-range farming, the poultry are allowed to roam around freely during the day. They are confined in a cage only in the nights. This is a semi-intensive method.

- White leghorn is the most high egg yielding breed in the world.
- India ranks fifth in the world poultry production.

Vegetarian eggs: Fertile eggs rot more rapidly than infertile eggs. Hence the production of infertile eggs is desired. Hens are capable of laying eggs without the presence of cock and the eggs obtained are infertile. Such eggs are called vegetarian eggs.



Intensive farming involves growing birds in small cages that are just large enough for them to feed and lay eggs. Animal welfare activists discourage this method as this does not provide sufficient space for the bird to move or spread its wings.

Birds that are reared for meat are also grown in large coops or houses that protect them from predators.

Aseel, Chittagong and Karaknath are examples of Indian varieties of poultry. Broilers are young chicken that are grown only for their meat.

Poultry feed

Poultry diets are composed of a mixture of cereal grains, soya bean meal, fish meal, bone meal, wheat bran, groundnut cake, barley, oats, maize, animal by-product meals etc. Trace minerals such as zinc, iron, copper iodine, manganese and selenium must be included in the poultry feed.

Poultry disease and control

Poultry are often affected by diseases and attacked by predators like cats, dogs and foxes. Some of the common diseases found in Indian fowls are tick fever (Spirochaetosis), tuberculosis, fowl cholera, fowl pox and flu.

Disease control

Poultry diseases can be controlled by vaccination, isolation of affected birds, improving the sanitary conditions, removing dampness through exposure to sunlight. Feeding poultry with a wellbalanced diet will prevent them from developing deficiency diseases.

Poultry industry in Tamilnadu

The Tamilnadu Government is giving great importance to poultry industry. Namakkal, Palladam and Chennai are well-known for poultry industries. Every student studying in schools of Tamilnadu is served with an egg, as a part of nutritious meal on all working days.

1.8. PISCICULTURE

The process of rearing and breeding of fishes in rivers, streams, ponds, irrigation canals and paddy fields is known as pisciculture. Pisciculture plays an important role in Indian economy. It provides employment and income to millions of fishermen and farmers, particularly in the coastal areas. Factors to be considered for pisciculture:

1. Topography or location of pond.
2. Water resources and quality of water.
3. Quality of soil (Nutrients).
4. Temperature of water.

Types of pisciculture

- a. Extensive pisciculture: growing fish on natural feed.
- b. Intensive pisciculture: Growing fish on artificial feed to maximize production.
- c. Monoculture: Growing a single type of fish in a water body.
- d. Polyculture: Growing one type of fish or more types of fishes with different feeding habits together in a waterbody.
- e. Integrated pisciculture: Growing fish along with agricultural crops or other animals.

Types of fishing ponds

Fish culture requires different types of ponds for the various stages of the growth of fish. The types of ponds are as follows:

1. Breeding ponds: Sexually mature males and females are collected and left in these ponds for breeding.
2. Hatchery ponds: The seeds collected from breeding ponds are delivered here in order to hatch young fishes called fish fries.
3. Nursery pond: 3 to 5 day old fish fries are retained here for about 20 days and fed well.

4. Rearing ponds: These are deeper ponds where fish fries from the nursery ponds are transferred and maintained for about three months. The fish fries grow to a size of about 125 mm in length and are now called fish fingerlings.

5. Stocking ponds: These are larger ponds and the fingerlings are fed with artificial feed. Organic and inorganic fertilizers are used to increase their size. Antibiotics are used to prevent infectious diseases. When the fishes attain the required growth, they are harvested.

1.9. AQUACULTURE

Aquaculture is a business that involves the production and marketing of aquatic organisms, both plants and animals, under controlled conditions. Aquaculture includes culture of prawn, lobsters, fish, pearl oysters, mussels and crabs.

Nutritional value of fishery products

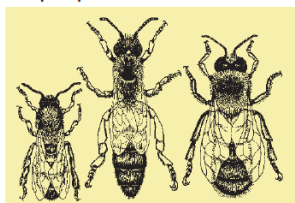
Fishes are rich in animal protein, vitamins and minerals. The vitamin A content of fish liver helps for good vision. Vitamins such as B6, B12, D, Biotin, Niacin and minerals such as phosphorus, potassium and iron promote normal growth of the human body. Fish meal for cattle and poultry is prepared from the non-edible parts of fishes.

1.10. APICULTURE

The scientific method of rearing honeybees for honey and wax is called 'Apiculture' or 'Bee keeping'. Honey bees are social insects. They live in colonies. They exhibit teamwork and division of labour.

They feed on the pollen and nectar of flowers. The honey bees collect nectar from various flowers. The nectar is swallowed by the bees. In the stomach, the nectar is converted into honey by enzymatic action and stored in the honeycombs. There are three types of bees in a colony.

- a. Queen:** It is the only fertile female in the hive. The work of the queen bee is to lay eggs.
- b. Drones:** These are fertile male bees and its function is to mate with the queen bee and fertilize eggs.
- c. Workers:** These are sterile females. They take care of the queen bee and the young bees, collect nectar, build honeycombs and protect the beehive.



Worker Queen Drone

Facts about Indian Fisheries(both capture and culture)

1. Total fish production– 2nd position in the world.
2. Marine fish production– 7th position in the world.
3. Aquaculture production– 2nd position in the world.
4. Fish industry contribution -Rs.53,000 crores as foreign exchange annually.

Honey bee varieties**a. Indigenous varieties**

- i. *Apis indica* (Common Indian honey bee)
- ii. *Apis dorsata* (Rock bee)
- iii. *Apis florea* (Little bee)

b. Exotic varieties

- i. *Apis mellifera* (Italian bee)
- ii. *Apis adamsoni* (South African bee)

Economic importance of honey bees

Honey bees are used in the production of honey and bee wax.

Uses of honey

1. Honey is an energy-rich food. For example, 1 Kg of honey contains 3,200 calories of energy.
2. Honey contains sugar, minerals, vitamins, enzymes and pollen.
3. Honey is an antiseptic and contains formic acid as the preservative.
4. Honey is a blood purifier, a cure against cough, cold, sore throat, ulcers of tongue, stomach and intestine.
5. Honey is helpful in building up the haemoglobin content of the blood.
6. Honey is used in the preparation of bread, cakes and biscuits.

Bee wax

It is utilized in the manufacture of cosmetics, lubricants, cold creams, shaving creams, polishes, candles, ointments and in medical preparations.

HONEY BEE COMMUNICATION (Dance forms)

Round dance indicates that the source of nectar is within 100 mts. Waggle dance signifies a long distance. The dance patterns specify the direction of nectar with respect to the sun. In 1973, KARL VON FRISCH received the Nobel Prize for deciphering this dance language.



Round dance

Waggle dance