PRE-MEDICAL

ZOOLOGY

ENTHUSIAST | LEADER | ACHIEVER

STUDY MATERIAL

Strategies for enhancement in food production (Animal Husbandry)

ENGLISH MEDIUM

Copyright Statement

VERGHESE KURIEN

Born – 26 November, 1921
Calicut, Madras Presidency, British India
(Now Kozhikode, Kerala)
Died – 9 September, 2012
Nadiad, Gujarat, India
Known for – White revolution in India
Co-founder AMUL
Award – World Food Prize (1989)
Padma Vibushan (1999)
Padma Bhushan (1966)
Padma Shri (1965)
Ramon Magsaysay Award (1963)

Verghese Kurien was an Indian social entrepreneur, who is known as the Father of White Revolution in India for his operation food, the world's largest agricultural development programme. This transformed India from a milk - deficient nation to the world's largest milk producer.

The Prime Minister Lal Bahadur Shastri to appoint him the founder - chairman of National Dairy Development Board (NDDB) in 1965.

BANDA VASUDEV RAO

Born – 1935
Chanchalguda, Hyderabad, Andhra Pradesh, India
Year Active – 1970 – 2004
Known as – Father of poultry farming in India
Founder chairman of National Egg Coordination Committee (NECC)
Award – Padma Shri

Dr. B.V. Rao gathered farmers together and founded the National Egg Coordination Committee in 1982 and was its founder chairman. He was also association with the world poultry science association (WPSA). He was one of the key figures in the organisation of the world Poultry Conference in New Delhi in 1996.

He also founded a higher education institution, Dr. B.V. Rao institute of Poultry Management and Technology. Which conducts higher courses in the subject.

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

01. ANIMAL HUSBANDRY

- **Animal Husbandry**
- **Dairy farm management**
- **Animal breeding**
- **Poultry**
- **Apiculture/Bee keeping**
- **Fisheries**
- **Seri culture**
- **Lac culture**

- **Animal husbandry** is the agricultural practice of breeding and raising livestock. As such it is a vital skill for farmers and is as much science as it is art.
- Animal husbandry deals with the care and breeding of livestock like buffaloes, cows, pigs, horses, cattle, sheep, camels, goats, etc., that are useful to humans. Extended, it includes poultry farming and fisheries.
- Fisheries include rearing, catching, selling, etc., of fish, molluscs (shell-fish) and crustaceans (prawns, crabs, etc.).
- Since time immemorial, animals like bees, silk-worm, prawns, crabs, fishes, birds, pigs, cattle, sheep and camels have been used by humans for products like milk, eggs, meat, wool, silk, honey, etc.
- It is estimated that **more then 70 per cent of the world livestock population is in India and China.** However, it is surprising to note that the contribution to the world farm produce is only **25 per cent,** i.e., the productivity per unit is very low.
- Hence, in addition to conventional practices of animal breeding and care, newer technologies also have to be applied to achieve improvement in quality and productivity.

02. DAIRY FARM MANAGEMENT

- Dairying is the management of animals for milk and its products for human consumption.
- In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk.
- Milk yield is primarily dependent on the quality of breeds in the farm. Selection of good breeds having high yielding potential (under the climatic conditions of the area), combined with resistance to diseases is very important.
- For the yield potential to be realised the cattle have to be well looked after – they have to be housed well, should have adequate water and be maintained disease free.
- The feeding of cattle should be carried out in a scientific manner – with special emphasis on the quality and quantity of fodder.
- Besides, stringent cleanliness and hygiene (both of the cattle and the handlers) are of paramount importance while milking, storage and transport of the milk and its products.
- Nowadays, of course, much of these processes have become mechanised, which reduces chance of direct contact of the produce with the handler.
- Ensuring these stringent measures would of course, require regular inspections, with proper record keeping. It would also help to identify and rectify the problems as early as possible.
- Regular visits by a veterinary doctor would be mandatory.

(1) LIVESTOCK

Domesticated animals, especially the farm animals, kept for profit are collectively called as **livestock**.

eg. Cattle, Buffaloes, Sheep, Goat, Pigs, Horses, Camel etc.

(2) BREED

A group of animals related by descent and similar in most characters like general appearance, features, size, configuration, etc., are said to belong to a breed.

Some animals and their breeds-

Animal	Breeds
Cattle (Cow)	• Sahiwal – Best milch breed in India • Holstein Friesian –Best milch breed in world • Jersey – Exotic breed of cattle
Buffalo	Murrah, Nagpuri
Sheep	Merino, Bikaneri, Hisardale, Patanwadi
Goat	Kashmiri Pashmina
Hen	Aseel, White leghorn

Jersey
NCERT XII Page No. 167, Figure No. 9.1(a)

03. ANIMAL BREEDING

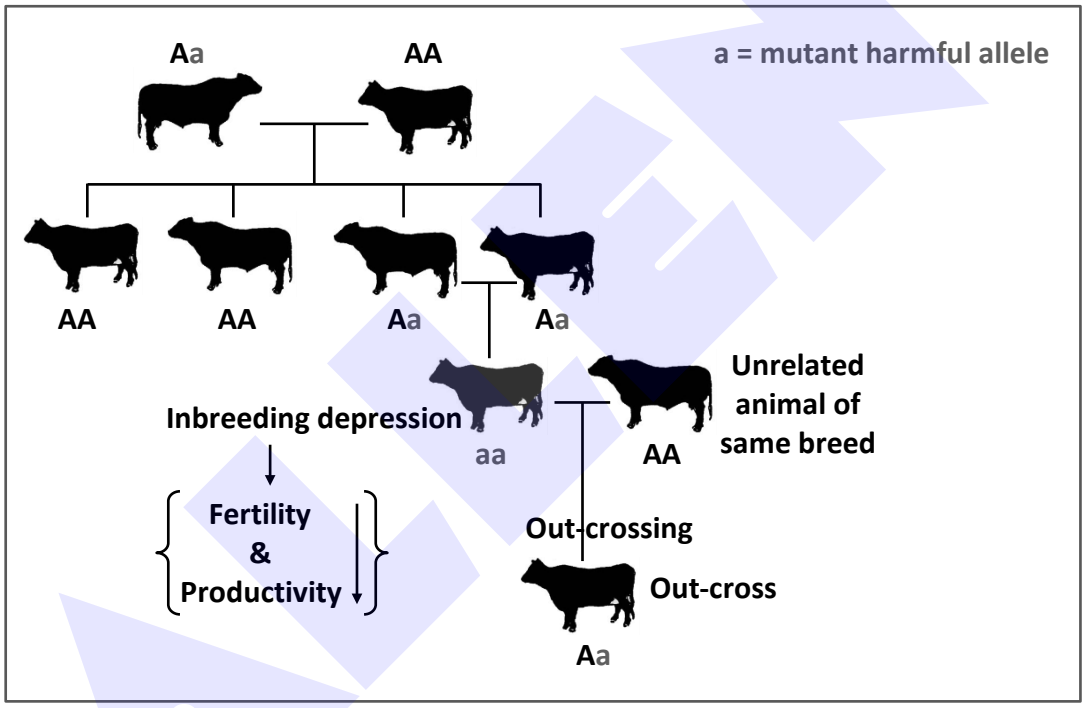
- Breeding of animals is an important aspect of animal husbandry. Animal breeding aims at increasing the yield of animals and improving the desirable qualities of the produce.
- For what kind of characters would we breed animals? Would the selection of characters differ with the choice of animals?
- When breeding is between animals of the same breed it is called **inbreeding**, while crosses between different breeds are called **outbreeding**.

(1) INBREEDING

Inbreeding refers to the mating of more closely related individuals within the **same breed for 4-6 generations.**

- The breeding strategy is as follows – superior males and superior females of the same breed are identified and mated in pairs.
- The progeny obtained from such matings are evaluated and superior males and females among them are identified for further mating.
- A superior female, in the case of cattle, is the cow or buffalo that produces more milk per lactation. On the other hand, a superior male is the bull, which gives rise to superior progeny as compared to those of other males.

- Try to recollect the homozygous purelines developed by Mendel. A similar strategy is used for developing purelines in cattle as was used in case of peas.
- Inbreeding **increases homozygosity.** Thus inbreeding is necessary if we want to **evolve a pureline** in any animal.
- Inbreeding **exposes harmful recessive genes** that are eliminated by selection.
- It also helps in **accumulation of superior genes** and **elimination of less desirable genes.**
- Therefore, this approach, where there is selection at each step, increases the productivity of inbreed population. However, **continued inbreeding,** especially **close inbreeding, usually reduces fertility and even productivity.** This is called **inbreeding depression.**
- Whenever this becomes a problem, selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This usually helps restore fertility and yield.



(2) OUT-BREEDING

Out-breeding is the breeding of the unrelated animals, which may be between individuals of the same breed (but having no common ancestors), or between different breeds (cross-breeding) or different species (inter-specific hybridisation).

(A) Out-crossing :

This is the practice of mating of animals within the **same breed,** but having **no common ancestors on either side of their pedigree upto 4-6 generations.** The offspring of such a mating is known as an out-cross. It is the best breeding method for animals that are below average in productivity in milk production, growth rate in beef cattle, etc. A single outcross often helps to overcome inbreeding depression.

(B) Cross-breeding :

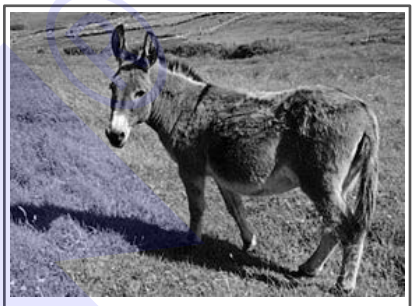
In this method, superior males of one breed are mated with superior females of another breed. Cross-breeding allows the desirable qualities of two different breeds to be combined. The progeny hybrid animals may themselves be used for commercial production. Alternatively, they may be subjected to some form of inbreeding and selection to develop new stable breeds that may be superior to the existing breeds. Many new animal breeds have been developed by this approach. **Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Merino rams.**

(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, and may be of considerable economic value, e.g., Mules are sturdier and hardier than their parental species, that are well suited for hard work in difficult terrains like mountainous regions.

Female Horse × Male Donkey = Mule (Sterile)

Male Horse × Female Donkey = Hinny (Sterile)

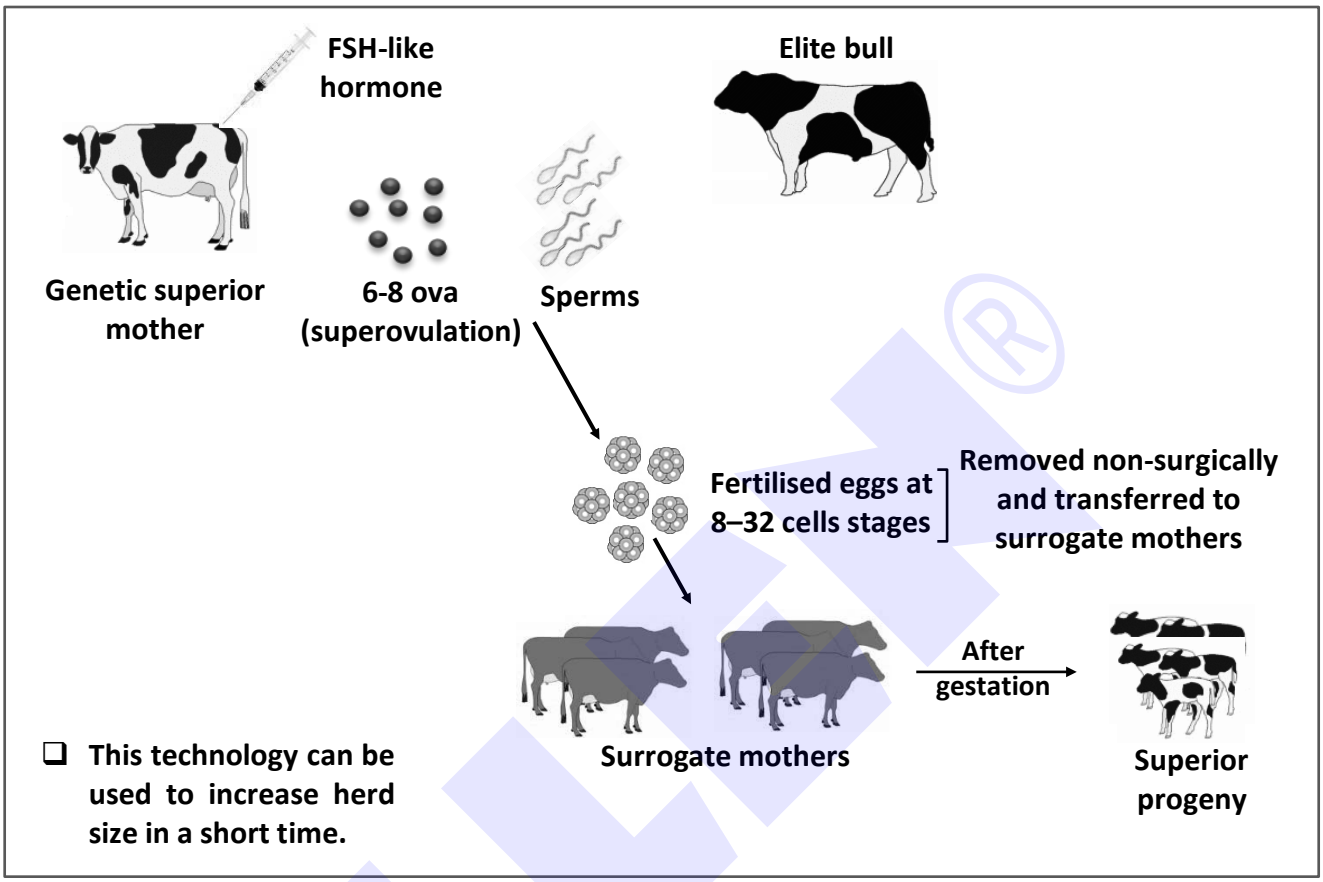


Mule
NCERT XII Page No. 168
Figure No. 9.2

- **Controlled breeding experiments** are carried out using **artificial insemination.**
- The semen is collected from the male that is choosen as a parent and injected into the reproductive tract of the selected female by the breeder.
- The semen may be used immediately or can be frozen and used at a later date. It can also be transported in a frozen form to where the female is housed. In this way desirable matings are carried.
- **Artificial insemination helps us overcome several problems of normal matings.** Can you discuss and list some of them?

  Often, the success rate of crossing mature male and female animals is fairly low even though artificial insemination is carried out.
- To improve chances of successful production of hybrids, other means are also used.
- **Multiple Ovulation Embryo Transfer Technology (MOET)** is one such programme for herd improvement. In this method, a cow is administered hormones, with **FSH-like** activity, to induce follicular maturation and super ovulation instead of one egg, which they normally yield per cycle, they produce **6-8 eggs.**
- The animal is either mated with an elite bull or artificially inseminated. The fertilised eggs at **8–32 cells stages,** are recovered **non surgically** and transferred to **surrogate mothers.**
- The genetic mother is available for another round of super ovulation.

- This technology has been demonstrated for cattle, sheep, rabbits, buffaloes, mares, etc. High milk yielding breeds of females and high quality (lean meat with less lipid) meat-yielding bulls have been breed successfully to increase herd size in a short time.



04. POULTRY

- Poultry is the class of domesticated fowl (birds) used for food or for their eggs. They typically include **chicken** and **ducks**, and sometimes **turkey** and **geese**. Turkey is recently domesticated bird. The word poultry is often used to refer to the meat of only these birds, but in a more general sense it may refer to the meat of other birds too.
- Selection of disease free and suitable breeds, proper and safe farm conditions, proper feed and water, and hygiene and health care are important components of poultry farm management.

(1) BREEDS OF HEN (*Gallus gallus*)

Indigenous (Desi) or Indian breeds	Exotic Breeds
Aseel, Ghagus, Karaknath, Brahma, Bursa etc.	**White leghorn,** Rhode island red, Plymoth rock etc.

- Aseel is best game bird, it is used in **cock fighting**.
- Poultry birds exclusively **grown for meat** are called **broilers** (e.g. Plymoth rocks).
- Poultry birds exclusively **grown for eggs** are called **layers** (e.g. White leghorn).
- Indian breeds are slow growing, less efficient converters and produce fewer eggs (60 eggs/years).
- The broilers with high nutritive value have been produced by cross breeding **(heterosis)**

Leghorn
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Figure No. 9.1(b)

(2) COMMON DISEASES OF POULTRY

Fowlpox, Bird flu (H_5N_1–Virus), Ranikhet (New castle diseases) are common viral diseases of poultry.

How can we prevent the spread of the flu in case some chicken are infected?
If any of the infectious disease has affected a mass proportion of the chicken and hens, then the best and safer decision, to avoid the fatal consequence, is to destroy the affected individuals. A poultry keeper must be aware about the common diseases so as to ensure the well being of hens and also of man.

05. APICULTURE / BEE KEEPING

- Bee-keeping or **apiculture** is the maintenance of hives of honeybees for the production of honey. It has been an age-old cottage industry.
- Bees are the **pollinators** of many of our crop species such as **sunflower, Brassica, apple** and **pear.** Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the yield–beneficial both from the point of view of crop yield and honey yield.
- Although bees are active throughout the year but in winter they become sluggish and are very active in spring.

(1) IMPORTANT SPECIES OF HONEYBEES

(A) ***Apis dorsata*** **(Rock bee)**- It is also named as saarang bee. It is of largest size and yields highest amount of honey. However, It is of highly aggressive nature and migratory species, which is not suitable for rearing by man.

(B) ***Apis indica*** **(Indian Mona bee)**- It lives across the whole country and is most common bee. It is mild in nature, so that it is easily manageable during rearing.

(C) ***Apis florea*** **(Bhringa bee)**- This bee is smallest in size and of timid nature.

(D) ***Apis mellifera*** **(European bee)**- This bee is of mild nature. It is the most useful bee for commercial purpose.

(2) ORGANISATION

- Honey bees include specialized non reproductive group of worker bees so also called as **Eusocial insect.**
- They show **polymorphism** and **good division of labour.**
- Each colony has more than 40,000 to 50,000 insects consisting of 3 castes -

(A) Queen :- It is about 15-20 mm long. Its body is about three times larger and 3 times heavier than a worker bee.

Only one queen develops from fertilized egg (i.e., it has 32 chromosomes). It feeds on **Royal jelly.**

Its sole function is laying eggs.

(B) Drones :- About 100 male bees are present in one hive. Salivary glands, wax secreting glands and stings are absent in drones.

Their sole duty is to fertilize the queen. Drones are developed from unfertilized eggs (**parthenogenetically**) so there are only 16 chromosomes present in them.

(C) Worker :- Their number is maximum in a hive. These are the smallest individuals.

Worker bees are sterile females. These are developed from fertilized eggs (32 chromosomes). Life span of a worker bee is short (about 6-8 weeks).

(3) LIFE HISTORY OF HONEY BEE

- After fertilization the queen lays about 2000/eggs/ days, one egg in each brood cell.
- After hatching a white larva **(Grub)** emerges which is feed by workers (Nurse bees)**.**
- The worker bees provide food which consists of pollen & honey to all larvae.
- The egg hatched in royal chamber is looked after by workers & fed with **royal jelly** so that it convert into queen.

(4) NECTAR COLLECTION & HONEY PREPARATION

- Sucrose of nectar $\xrightarrow{\text{Invertase}}$ Glucose + fructose
- Nectar is stored in the crop
- Extra amount of water is evaporated by the **fanners bees.**
- This concentrated product is called Honey.

(5) MODERN METHOD OF APICULTURE

- Modern method of apiculture makes use of artificial bee hive. They are more convenient as these may be reused and can be shifted easily to safer place in adverse weather conditions. In addition to above, these are easy to handle and can be carried in a simple and easy manner.

(6) PROCUREMENT AND REARING OF HONEY-BEES

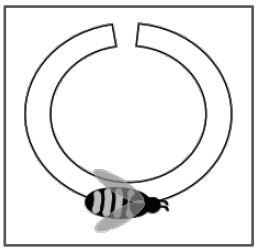
- The increased demand of honey has led to large-scale beekeeping practices; it has become an established income generating industry, whether practiced on a small or on a large scale.
- Bee-keeping can be practiced in any area where there are sufficient bee pastures of some wild shrubs, fruit orchards and cultivated crops.
- There are several species of honeybees which can be reared. Of these, the **most common species** is ***Apis indica***.

- Beehives can be kept in one's courtyard, on the verandah of the house or even on the roof. Bee-keeping is not labour-intensive.
- Bee-keeping though relatively easy does require some specialised knowledge and there are several organisations that teach bee-keeping. The following points are important for successful bee-keeping:
  - Knowledge of the nature and habits of bees,
  - Selection of suitable location for keeping the beehives,
  - Catching and hiving of **swarms** (group of bees),
  - Management of beehives during different seasons and
  - Handling and collection of honey and of beeswax.

(7) COMMUNICATION BY DANCE

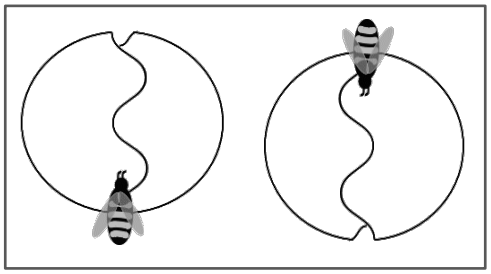
- **Karl Von Frish** discovered communication in bees and shared Nobel prize in medicine (1973) with N.Tinbgergen and K.Lorenz for this discovery.
- The following type of dances can be seen in honey bees.

(A) Round Dance :-



This dance indicates that the food source is about **less than 75 m** from a hive. The direction of food source can be identify with the help of smell of flowers which is present on the body of a scout honey bee.

(B) Tail wagging Dance :-



With the help of this dance bees give the information of that food source at a very far distance **(more than 75 m).** In it direction and distance of food source are indicated according to the position of sun. When the honey bee is flying in a straight line it wagging its tail and wings to produce the sound.

Distance of a food source can be identified with the help of speed of dance, speed of wagging tail and speed of sound.

(i) If the motion is in upper side of a straight line with wagging tail then food source will in the same direction of sun.

(ii) If the motion is in lower side of a straight line then food source will be in opposite direction of sun.

(8) HONEY

- Honey is a food of high nutritive value and also finds use in the indigenous systems of medicine. **It is the secondary product of apiculture.**
- Fructose, Glucose and water are main component of honey. Sucrose, enzymes, pigments, minerals and vitamins are also present in less amount.

(9) BEE WAX

- Honeybee also produces beeswax, which finds many uses in industry, such as in the preparation of cosmetics and polishes of various kinds.
- **Wax is the real and primary product of apiculture.**
- It is obtained from bee hives.
- This is a secretion of abdominal glands (wax glands) of worker bees.

(10) PROPOLIS

- It is prepared from a plant substance (pollen) called 'PROPOLIS'
- The propolis gives the wax a hardly nature.
- Propolis is a gum like substance which is used by bees to repair the old & destructed parts of hive.

BEGINNER'S BOX — ANIMAL BREEDING, POULTRY, APICULTURE

1. Super ovulation and embryo transplantation are meant for improving:
(1) Human race (2) Live stock (3) Poultry (4) Plants

2. Murrah and Nagpuri are breeds of:
(1) Cow (2) Buffalo (3) Goat (4) Sheep

3. Best milch breed of cattle is:
(1) Red Sindhi (2) Deoni (3) Sahiwal (4) Holstein-Friesian

4. The contribution of India and China in the world farm production is:
(1) 10% (2) 70% (3) 50% (4) 25%

5. Which is an exotic breed of cattle?
(1) Jersey (2) Rathi (3) Sahiwal (4) Gir

6. What is the result of mating between male horse and female donkey?
(1) Donkey (2) Horse (3) Hinny (4) Mule

7. Which are fertile individuals in the colony of honey bees?
(1) Queen (2) Drones (3) Workers (4) Both 1& 2

8. Caring and management of beehives for the production of honey is called as:
(1) Apiculture (2) Poultry (3) Piggery (4) Sericulture

06. FISHERIES

- Fishery is an industry devoted to the catching, processing or selling of fish, shellfish or other aquatic animals.
- A large number of our population is dependent on fish, fish products and other aquatic animals such as prawn, crab, lobster, edible oyster, etc., for food.
- Some of the freshwater fishes which are very common include ***Catla***, ***Rohu*** **and common carp.** Some of the marine fishes that are eaten include ***Hilsa*****, Sardines, Mackerel and Pomfrets.**
- **Pisciculture** is rearing catching & management of fishes.
- **Aquaculture** is rearing and management of useful aquatic plants and animals like fishes, oyster, prawns mussel etc.
- Fisheries has an important place in Indian economy. It provides income and employment to millions of fishermen and farmers, particularly in the coastal states. For many, it is the only source of their livelihood.
- In order to meet the increasing demands on fisheries, different techniques have been employed to increase production. For example, through aquaculture and pisciculture we have been able to increase the production of aquatic plants and animals, both fresh-water and marine.
- This has led to the development and flourishing of the fishery industry, and it has brought a lot of income to the farmers in particular and the country in general. We now talk about **'Blue Revolution'** as being implemented along the same lines as 'Green Revolution'.

(1) CULTIVABLE SPECIES OF FRESH WATER FISHES

Indigenous species-

(i) ***Catla catla*** (Catla)

(ii) ***Labeo rohita*** (Rohu) – Most common carp

(iii) ***Labeo calbasu*** (Calbasu)

(iv) ***Cirrhinus mrigala*** (Mrigal)

(v) ***Clarius batrachus*** (Magur)

(2) EXOTIC SPECIES

(B) Exotic species-

(i) ***Cyprinus carpio*** (Common carp)

(ii) ***Ctenopharyngodon idella*** (grass carp)

(iii) ***Hypopthalmicthys molitrix*** (chinese carp/silver carp)

(3) MARINE FISHES - ARE GENERALLY RICH IN OMEGA-3-FATTY ACIDS

(i) ***Hilsa*** (Hilsa)

(ii) ***Salmo*** (Salmon)

(iii) ***Sardinella*** (Sardine)

(iv) ***Harpodon*** (Bombay duck)

(v) ***Stomaleous*** (Pomfret) - Introduced in Indian sea by foreigners

(vi) ***Rastrelliger*** (Mackerel)

(4) IMPORTANT STEPS OF FISH CULTURE

- The major steps followed in the fish culture practice are briefly described in following lines-

(i) To obtain pure seed of the desirable fish species, healthy males and females of a superior fish species are selected.

(ii) These are then induced to breed artificially by **(Hypophysation)** giving in them the injections of pituitary extract (containing FSH or LH) or a synthetic hormone like human chorionic gonadotropins (hCG).

(iii) This stimulates females for spawning (egg production) and the males to emit milt (containing sperms) on the ova to fertilize them.

(5) BY-PRODUCT OF FISHING INDUSTRY

- Isinglass is a high grade collagen produced from air bladder or swim bladder of certain fishes like cat fishes & carps. The isinglass prepared in Russia is of best quality.
- Isinglass is used to clarify wine.
- Shark Liver oil and Cod liver oil are very good source of vitamin A and D.

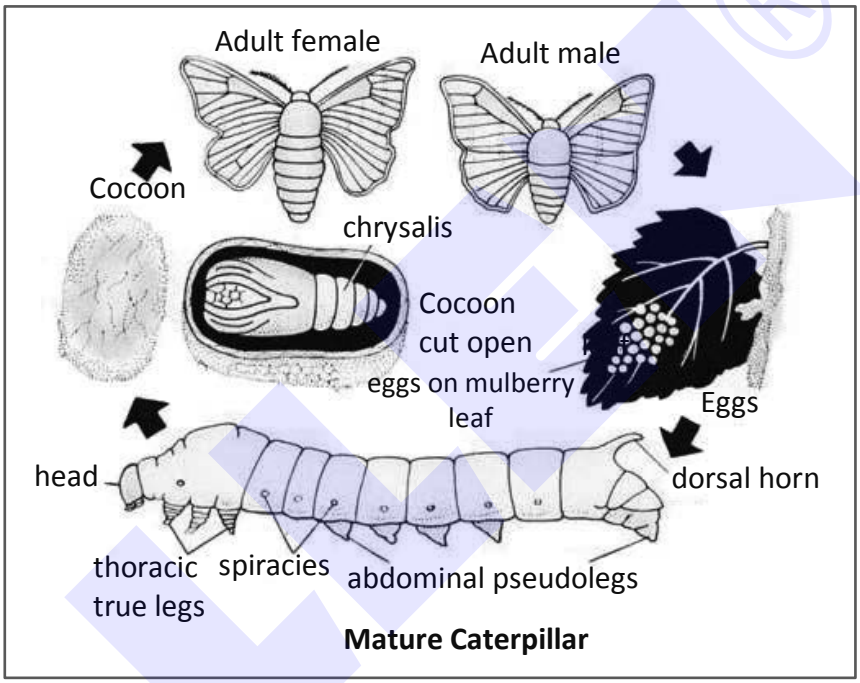
  Liver oil contains vit A, D, E & C.
- **DHA** (Docosa hexanoic acid) is also obtained from fish flour used as a supplement in baby food. (Certain algae are also source of DHA) essential for brain functioning.
- Skin of some fishes like shark (Shagreen) & rays are used for covering card cases, jewel boxes.
- Skin of some fishes like cod & salmon are used for the formation of leather.

Common diseases in carps –

- Fungal diseases – Gill rot
- Bacterial diseases – Fin rot, Tail rot, Dropsy etc.

07. SERICULTURE

- The production of silk from the silk worm by rearing practices on commercial scale is called sericulture.
- **Mysore (Karnataka)** is the leading silk producer state in India.
- Silk fibre is a protein produced from silk glands of silkworm.
- Silk glands are modified **salivary gland** of the caterpillar larva of the insect ***Bombyx mori*** (Mulberry silk moth).
- Silk is composed of **fibroin (80%)** and **sericin (20%)** protein.
- Most common and best quality silk is obtained from Mulberry silkworm (*Bombyx mori*).
- **Pebrine** is the protozoan disease in silkworm which is caused by *Nosema bombycis*.



Mature Caterpillar

08. LAC CULTURE

- Lac is resinous secretion of last segment of *Laccifer lacca /Tachardia lacca* or Lac insect.
- This **insect is a parasite** which lives and breeds on some host plants like Kusum, Ber, Palas etc.
- The lac is a secretory product of **lac glands (Dermal glands). Lac mainly composed of Resin (70-90%)**
- India produces **75%** of the total world production.
- **In India the largest lac producing state is Jharkhand**.
- **The quality of lac depends on the nature of host plant**. The best quality of lac is obtained by the lac insect which have been reared on ber and palas. This lac is named as **Kusumic lac**.
- **Lac is used in printing industry, preparation of gramophone records, electrical appliances, in varnish, polish, bangles, cosmetics, lacwax & lacdye.**

09. MAIN INFECTIOUS DISEASES OF DOMESTIC ANIMALS

Disease (s)	Pathogens
A. Bacterial diseases	
1. Anthrax	*Bacillus anthracis*
2. Hemorrhagic septicaemia	*Pasteurella multocida*
3. Black quarter	*Clostridium chauvoei*
4. Brucellosis	*Brucella abortus*
5. Bovine tuberculosis	*Mycobacterium bovis*
6. Botulism	*Clostridium botulinum*
7. Tetanus	*Clostridium tetani*
B. Viral diseases	
1. Rinderpest	Paramyxo virus
2. Foot and Mouth Disease **(FMD)**	Picorna virus
3. Cowpox	Orthropox virus
4. Rabies	Rhabdo virus
C. Protozoa born diseases	
1. **Babesiosis**	*Babesia* species
2. Trypanosomiasis	*Trypanosoma evansi*
3. Theileriosis	*Theileria* species
D. Helminth born diseases	
1. Ascariasis	*Neoascaris vitulorum*
2. Fasciolasis	*Fasciola* species
3. Trichuriasis	*Trichuris* species
E. Fungal diseases	
1. Ringworm	*Trichophyton* species
2. Aspergillosis	*Aspergillus* species
3. Aflatoxicosis	*Aspergillus flavus*
4. Blastomycosis	*Blastomyces* species

Golden Key Points

- **Angoora wool** is obtained from Angoora rabbit.
- **Shahtoosh** is obtained from **Chiru (*Panthelops hodgsonii*)** (Tibetan antelope) it, is an endangered species due to high poaching. (It is finest and lightest wool).
- Indian Milch breeds of cattle – Gir, Sahiwal, Red Sindhi, Deoni, Rathi etc.
- Exotic Milch breeds of cattle – Holstein Friesian, Jersey, Guernsey, Ayrshire, Brown Swiss, Red Dane.
- **India** ranks first in milk output in world.
- Cattle meat is also known as **Beef**.
- The fine soft wool called **PASHMINA** is the underfur of Kashmiri & Tibetan goat.
- Pig's meat is called PORK.
- The care & management of pigs is called PIGGERY.
- **Stilbestrol**

  – Synthetic estrogen.

  – used in the treatment of female animals for infertility.

  – Also induced lactation in sterile female.
- **NDRI (National Dairy Research Institute)** was establised during first five year plan at Karnal (Haryana).
- Certain premier institutes in India viz., **Central Inland Capture Fisheries Research Institute (CICFRI), Barrackpore (W.B.); Central Marine Fisheries Research institute (CMFRI), Kochi (Kerala); Central Institute of Fresh water Aquaculture (CIFA), Bhubaneshwar (Orissa)** and many other institutes, are continuously engaged in the research and extension studies in the field of fisheries to make it more beneficial.
- Silk is secreted by larva but silk is obtained from cocoon or pupa.
- Juvenile hormone maintains the larval stage in silk worm.
- Mulberry (*Morus alba*) specially grown for silkworm is called **moriculture**.
- *Gambusia* fish is used in biological control of mosquitoes.
- **River Dolphin** (mammal) is National aquatic animal of India.

BEGINNER'S BOX — FISHERIES, LAC CULTURE, SERI CULTURE

1. Which is a fresh water fish?
(1) Rohu (2) Sardines (3) Mackerel (4) Pomfret

2. Hypophysation technique is used in:
(1) Pisciculture (2) Sericulture (3) Apiculture (4) Lac culture

3. Which is fungal disease in fishes?
(1) Fin rot (2) Gill rot (3) Tail rot (4) Dropsy

4. Central Inland Capture Fisheries Research Institute is situated in:
(1) Kerala (2) Orrisa (3) Maharashtra (4) West Bengal

5. The lac is secretion of:
(1) Salivary gland (2) Dermal gland (3) Tear gland (4) Wax gland

6. The lac is mainly composed of:
(1) Dye (2) Wax (3) Sugar (4) Resin

7. The foot and mouth disease in domestic animals causes due to:
(1) Virus (2) Bacteria (3) Fungus (4) Protozoa

8. Cattle meat is also known as:
(1) Mutton (2) Buff (3) Pork (4) Beef

9. Rearing of silkworm for commercial silk production is known as:
(1) Apiculture (2) Pisciculture (3) Sericulture (4) Aqauculture

BEGINNER'S BOX — ANSWERS KEY

ANIMAL BREEDING, POULTRY, APICULTURE

Que.	1	2	3	4	5	6	7	8
Ans.	**2**	**2**	**4**	**4**	**1**	**3**	**4**	**1**

FISHERIES, LAC CULTURE, SERI CULTURE

Que.	1	2	3	4	5	6	7	8	9
Ans.	**1**	**1**	**2**	**4**	**2**	**4**	**1**	**4**	**3**

- More than 70% of the world livestock population is in India and China but their contribution to the world farm produce is only 25%.

Animal breeding :

It aims at increasing the yield of animals and improving the desirable qualities of produce.

Animal Breeding

Inbreeding	**Out-breeding**
Mating of more closely related individuals within the same breed for 4-6 generations.	Mating of the unrelated animals 3-Types i. Out-crossing ii. Cross-breeding iii. Interspecific hybridization

Artificial insemination :

Semen collected from male (chosen as parent) is injected into reproductive tract of selected female.

MOET (Multiple ovulation embryo transfer technology) :

This method is used to increase herd size in short time.

Bee keeping :

Wax is primary product whereas honey is secondary product.

Fisheries :

It is an industry devoted to catching, processing or selling of fish, shellfish or other aquatic animals.