

PISCICULTURE: - The scientific rearing of fish on scientific scale under controlled conditions for the purpose of food is fish culture or Pisciculture.

AQUA CULTURE: - The scientific rearing of aquatic organisms' like fishes, prawns, crabs, lobsters, etc., under controlled conditions for the purpose of food on scientific scale is fish culture.

Fish Culture: - The Indian fish is used for human consumption and is the subject of a sea and fresh water fishery, particularly in China, India, Indonesia, Vietnam and Thailand. It is also the subject of an aquaculture industry, the main countries involved in this being Saudi Arabia, Vietnam, Iran and India. Harvesting is done by drainage of the pond. The collected fishes are then subjected to marketing. After marketing they are processed by removing unwanted structures like gills, exoskeleton, digestive system etc., and finally preserved by many methods for future use.

FRESH WATER FISHERY is an aquaculture to raise and produce freshwater fishes for human consumption. Freshwater fish farming shares many characteristics with, and many of the same features like rearing fishes in ponds, rivers, lakes etc.,

MARINE WATER FISHERY is an aquaculture for the cultivation of fishes in marine waters. The conditions in marine waters are different from the fresh waters. Generally marine fisheries are done in the back waters of sea.

ESTUARINE FISHERY: - Estuary is place where fresh water meets the salt waters. This common estuarine fish was first discovered from Singapore in the mid-1800s. Mangrove inhabitants are mainly juveniles and adults are usually that of a similar looking but less common fishes. The fish production in India accounts for about 15% of the total world production of fish and shrimps. For marine fishes, the percentage of Indian production to the world production is about 20%.

FISH FARMING

INTRODUCTION OF FISH CULTURE: - Fish farming is the raising of fish for commercial purpose. Based on the environment in which culture is done, fish farming may be categorized as freshwater or brackish water or saltwater or marine fish farming. Fish culture is the oldest form of aqua culture known to the world.

Distinguishing characters of fishes

The distinguishing characters of fishes which make it most suitable for culture are,

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1. Eat low on the food chain.
2. Tolerate poor water quality.
3. Adapt to both alkaline and acidic water.

Characters of cultivable fish

The following criteria should be considered before selecting a fish for farming purpose.

Rate of growth: Fish which grow to a larger size in shorter period are suitable for culture. Ex. fishes.

Adaptation to climate: The cultured species of fish should be able to adapt to the local climatic conditions of the farm.

Tolerance: The fish should have the capacity to tolerate wide fluctuations in the physic-chemical conditions such as oxygen, salinity and temperature etc of the water.

Acceptance of artificial feed: When more number of fish is to be accommodated in a limited space, there is the need for supplementary feeding on compounded diets. The fish should show ready preference for these feeds.

Resistance: It is desirable that the cultured fish is hard enough to resist the common diseases and attack of parasites.

Friendliness and compatibility: The fishes proposed to be cultured together should be able to live together without interfering or attacking the other.

Conversion efficiency: The species of fish which give more edible flesh per unit of food consumed is preferred.

Consumer's preference: Food preference of people varies with the geographic regions. Hence, the species cultured should be easily marketable locally or to the targeted consumers.

Indian Fishes

Catlacatla (Catla)

Labeorohita (Rohu)

Cirrhinamrigala (Mrigal)

Exotic (Chinese)fishes

Cyprinusfishio (Common fish)

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Minor Fishes*Labeobata* (Bata)**Catfishes***Wallago attu* (freshwater shark)*Mystusaor* (Cat fish)*Clariasbatrachus***Murrels or snake heads***Channa striatus* (Striped snake head)*Tilapia**Oreochromismossambicus***STEPS INVOLVED IN FISH CULTURE**

Fish culture is the process of growing improved variety of fish having good taste under controlled conditions and management. This fish culture not only produces nutritious food but also helps in generating income and provides job opportunities to people. The following chart shows the steps included in fish culture,

Preparation of pond

Proper construction, preparation and maintenance of the fish pond are key parameters for a successful aquaculture practice. There are different pond components like nursery ponds, rearing ponds, production ponds, segregation ponds and breeding ponds or spawning ponds.

Nursery ponds are shallow, while the others are moderately deep. In larger production ponds, water can be maintained at a depth of 2 to 3 meters.

Preparation of pond involves making the pond weed and predator free. Also generation of adequate food to ensure the survival of good growth of the fishes is important part of preparation of pond. This includes two stages namely, conditioning and manuring.

Conditioning of pond: A layer of lime is spread over the bottom of the pond for two weeks. It removes the acidity of the soil and facilitates desirable geochemical cycles and also kills unwanted soil organisms. Water is let in slowly after two weeks and filled to the desired depth. The quality parameters such as temperature,

oxygen content, pH, turbidity, hardness, alkalinity and plankton growth should be checked for optimal levels, before stocking the fish.

Manuring of pond: After conditioning of the pond, organic or chemical manure is applied in order to develop the fish food organisms like phytoplankton and zooplankton. Organic manure may be urine or sewage rich in nitrogenous matter like cow dung, pig dung, poultry manure and plant manure such as green manure, compost, oil cake etc. Use of chemical fertilizers varies according to the concentration of phosphorus and nitrogen in the soil.

Culturing of fish

The culturing of fish includes all the following steps,

Spawning: Spawning can be either natural or artificially induced. The brood fish spawn naturally on the plants of the spawning pond. Artificially the brood fish are made to breed in the hatcheries by injecting them with the hormones.

Larval phase: In the pre-larval phase, the newly hatched fry come out of the eggs. During the larval phase, the fry swims up and now they are called hanging fry. These fry feed on rotifers as their first food.

Nursing phase: Fishes can be generally nursed both in ponds and in specially constructed tanks. If there are many predators in the area of the pond then tanks are best option. The tanks or ponds must contain dense populations of Paramecium and rotifers. The nursed fry enters adolescent phase and now they are called fingerlings. The fingerlings must be fed with artificial proteins as well as natural foods.

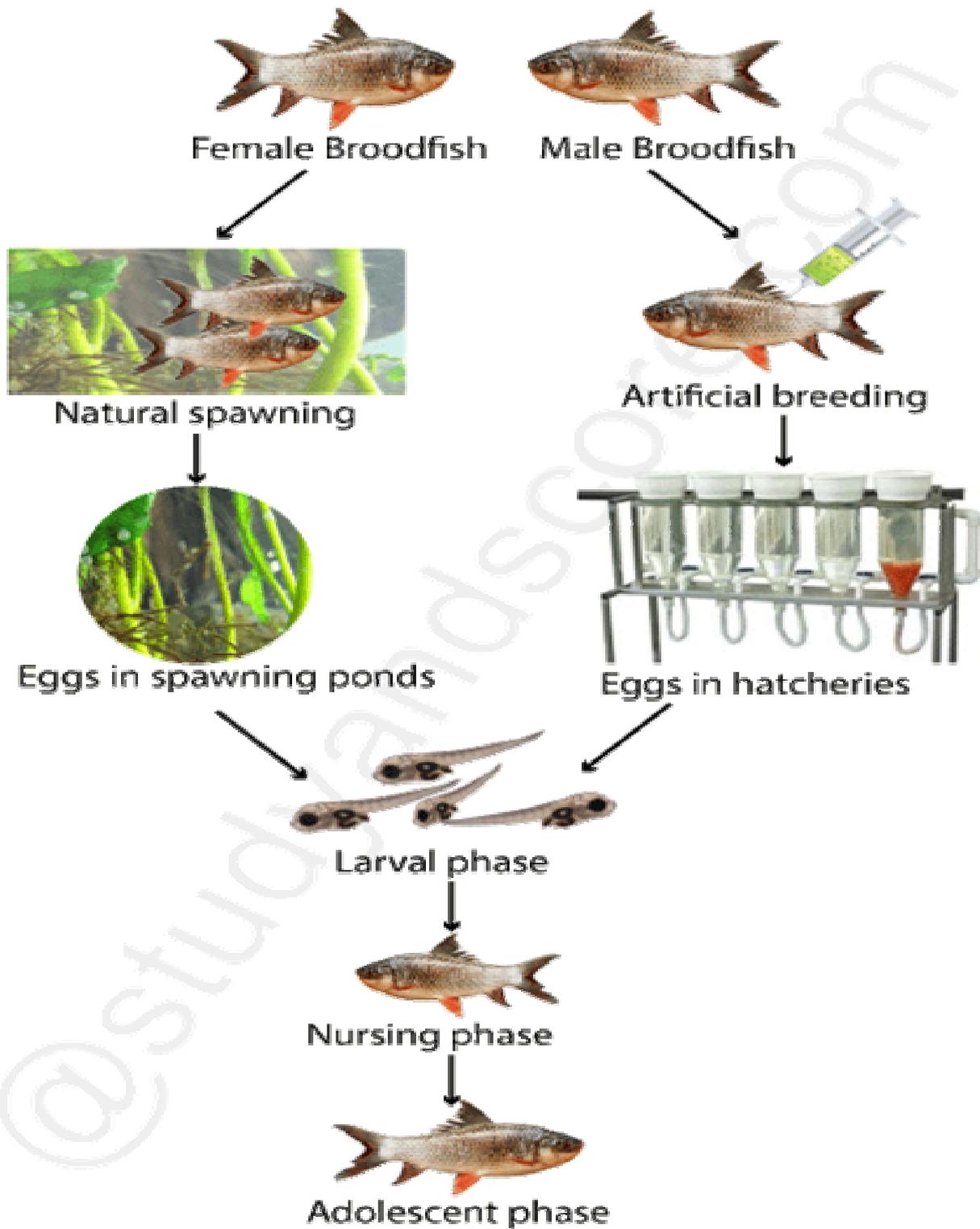
Management of fish pond

Feed and water qualities are the two major factors governing the productivity of the fish culture pond. Also seed quality, stocking and other management measures also determine the extent of fish production. Water quality involves the regulation of Temperature at 25-33°C, dissolved oxygen, pH around 6.5 – 9.0, hardness, alkalinity, turbidity and plankton culture etc.

Harvesting of fish

Generally, fishes are reared in both undrainable and drainable ponds with long harvesting ditches. During harvesting they must be drained slowly. Since fish tend to

swim towards incoming water, a small quantity of water is flowed into the pond near the drainage site to concentrate the fish.



When a large quantity of fish is concentrated in the harvesting pits aeration should be supplied. Finally, the fishes are harvested with drag nets.

Handling and processing

If harvesting is carried out in warm water, the fish are pre-conditioned by repeated stressing before netting. Harvested fish can be transferred live in aerated tanks for 3-5 hours. The density of fish in transport tanks and the duration of transport depend on fish size, temperature and the amount of aeration. The majority of fishes is transferred live to markets, and is sold either live or freshly dressed.

FISH DISEASES AND CONTROL

Analyzing water parameters, replenishment of water, aeration, regular feeding and observation for mortality and disease symptoms should be checked routinely in the management of aquaculture ponds. Diseases can be of viral or fungal or bacterial origin or may be due to ectoparasites and endoparasites.

PROCESSING OFFISH: -The collected fishes are then subjected to marketing. After marketing they are processed by removing unwanted structures like gills, exoskeleton, digestive system etc., and finally preserved by many methods for future use. This method is best when the fishes are processed that is digestive systems is removed and other unwanted parts like gills, exoskeleton, etc., are removed.

PRESERVATION OF FISHES: -**Preservation** is also a process that keeps fishes from decomposing. The use of preservation is especially from loss, injury, or danger. Preservation increase the shelf –life of the fishes and does not alter the taste and smell of these food items.

1. **FREEZING:** - Freezing means removal of heat from the body. To check the enzymes, bacterial action and putrefaction it is preferred to store the fish under lower temperatures. The fishes are chilled in ice when they are to be stored for a few days. The fishes are arranged in tiers in shelves or boxes and stacked, and should not be dumped in heaps in cold storage. It is preferred to store at a temperature **below 4.0 ° C** to prevent microbial spoilage of fish.
2. **DEEP FREEZING:** Preservation of fishes at the temperatures of **below zero degreescentigrade** termed as deep freezing. This method is best when the FISHES are

processed that is digestive systems is removed and other unwanted parts like gills, exoskeleton, etc., are removed.

3. **COLD STORAGE/REFRIGERATION:** Cold storage preservation of fishes is practiced at the places where storage facilities are available. The fishes are preserved overnight in cold storage at **4.0°C to 5.0 ° C** . Then marketed the next day and with the increase in availability of ice, fish is transported in ice by different modes of transport like rail, trucks, motor vehicles, etc.

The **West Coast** has a large number of freezing plants at places like Bombay, Mangalore, Cochin and Trivandrum where freezing of fishes, lobsters and fishes are undertaken.

4. **SALTING** Salting is a process where the common salt, sodium chloride, is used as a preservative which penetrates the tissues, thus checks the bacterial growth and inactivates the enzymes. Salting commences as soon as the fishes surface of the fishes comes in contact with common salt and the end product shall have the required salinity with taste and odour.
5. **DRY SALTING** is the process the fish is first rubbed in salt and packed in layers in the tubs and cemented tanks. The salt is applied in between the layers of fishes in the proportion of 1:3 to 1:8 salt to fish. The proportion of salt to fishes varies with the fishes.
6. **SMOKING:** - In this method, landed fish is cleaned and brined. It is then exposed to cold or hot smoke treatment. In cold smoking, first a temperature of 38°C is raised from a smokeless fire. After this heating, cold smoke at a temperature below 28°C is allowed to circulate past the fish.
7. **CANNING:** - It is the method of storing fishes in air-tight containers. But this method is costly. Empty cans should be packed carefully by employing the manual labor or through mechanical device. While packing, care should be taken to see that no air pockets are left which cannot be removed by exhausting.
8. **SUN DRYING:** - It is the method of fishes are exposed to sunlight for certain durations on the mats. But in this method, the taste of fishes may vary and also the enzymes of fishes get dried up and may be loss in the nutritive value offish
9. **PRICKLING'S:** -It is the method of fishes are given spices and chilly and salt treatment for certain durations. But in this method, the taste of fishes may vary and also not good for the blood pressure patients.

10. MIXED SALTING: - In this process, simultaneous use of salt and brine (salt water) is followed. The salting process is continued till the concentration of salt in the surrounding medium equalizes with the concentration of salt in the fish tissue. The salting process may affect the shape, structure and the mechanical features of muscle tissue.

11. PIT CURING: It is another process employed in South and South-East Coast of our country. In this process the fish treated with salt are buried in pits lined with leaves. After 2-3 days they are removed and marketed directly.

COMPOSITE FISH FARMING

Composite fish farming is rearing of two or more varieties of fishes in same plot of land. Composite fish farming is practiced in paddy fields of West Bengal and Andhra Pradesh. Generally, Composite fish farming is also called polyculture or mixed fish farming since two or more varieties of fishes in same plot of land.

Advantages of Composite fish farming: -

1. The fish Productivity is high.
2. Disease spread is minimum.
3. The economic returns of fish farmer are increased.
4. There is maximum usage of food resources.
5. The competition among fishes for food is greatly reduced.

POULTRY

The term **poultry** refers to the rearing and breeding of avian species such as chickens, ducks, turkeys, geese and guinea-fowls for the purpose of meat and eggs under controlled conditions is called poultry. They are the best converters of feed into animal protein compared to other livestock. Chickens are the most common poultry enterprises. Chickens alone occupy 90% of the total poultry.

Poultry Breeds: - There are more than hundred breeds and more varieties of fowls. The fowls are classified based on their utility to man. They are meat type, egg type, dual type and games and ornamental type. Based on their origin there are four major exotic breeds of fowls. They are American breeds, Asiatic breeds, English breeds and Mediterranean breeds. In addition to the above many of the indigenous breeds are also reared.

I. American breeds: -Most of the American breed of fowls are dual purpose forms giving meat and egg. These breeds are characterized by yellow feathers, red ear lobes and many of them lay brown-shelled eggs. Rhode Island reds,

Plymouth rock, New Hampshire and Wyandotte are some of the important breeds of American class.*a. Plymouth rock:* - Plymouth rock is the oldest and most popular breed of America. The birds are single combed with long and deep body. The breed produces good sized eggs. The plumage is generally greyish white. The female looks darker in colour than males. This colour feature is used to distinguish the sex of the birds. The females usually have black spots on the shanks.

b. White plymouth: The white plymouth rock has white plumage throughout the body and it is commonly used in broiler production. Standard weights of cock, 4.3kg; hen 3.4kg; cockerel, 3.6kg; pullet, 2.7kg.

II. English breeds: -All the breeds of this class originated from England. Presence of white plumage and pink coloured earlobes are the characters of the breed of this class. Most of them lay brown shelled eggs. Sussex, Orpington, Australorp and Cornish are some of the important breed of this class.

a) Sussex:

An old and common breed of England. High fecundity and have a good amount of meat also. Range from 3-4 kg in body weight, light, spotted or red in colour. Legs, beak and feathers are white, black ribs may occur on the neck. Beak small and curved. Legs small and without feathers.

b) Orpington:

Bird of English breed but common in India. They have high fecundity and good quality of meat, eggs are bigger in size, may lay about 200 eggs per annum. The body is oblong, and broad. Feathers are loosely arranged. Legs are without feathers. They cannot withstand extreme bad climatic conditions.

c) Australorp:

A bird of Australian origin but now very common and popular in India. Can withstand bad weathers and is successfully acclimatized in Indian climate. The birds are good all round breed. They range from 3-3.5 kg in body weight. The beak is dark or black colour and legs are black or brown coloured.

d) White Cornish and White Rock:

These are newly introduced English varieties in India and are gaining momentum day by day. These are particularly broiler type of breed and are ready in a few weeks only. They produce tasty and flavored quality of flesh. These are the only white skinned English breeds.

III. Mediterranean breeds: - Breeds of this class originated from European countries which are the side of Mediterranean Sea. The important breeds of this class, Leghorn and Ancona originated from Italy whereas Minorca originated from Spain. The breeds are light bodied with non-feathered shanks. The fowls of this class lay white shelled eggs and they are non-sitters.

Leghorn: - The white leghorns are the most popular and commercial breed in India, Colors of plumage may be white, brown or black. The fowls of this breed are small, compact with single comb and wattles. Though the leghorns are adapted to most of the climates, they are thriving well in dry areas. They mature early and they begin to lay eggs at the age of 5 or 6 months. Hence, the breed is economically important and preferred in commercial forms. The standard weight of the cock is 2.7kg; hen 2.0kg; cockerel 2.3kg; and pullets 1.8kg

V. Indigenous breeds of fowls: The common country hen of India is known as 'Desi' which is the best mother for hatching. Some of the Indian fowls resemble the leghorn, but have poor laying qualities. Chittagong, Aseel, Kadaknath and Busra are four breeds of indigenous fowl in India.

a. Aseel: - Aseel is noted for its pugnacity. The colour of the breed is white or black. The hens are not good egg layers but are excellent sitters. Aseel breed is found in almost all states of India, but abundant in Andhra Pradesh.

b. Chittagong: - Chittagong breed is largely found in West Bengal. The plumage colour varies, but the popular shade is golden or light yellow. The beak is long and yellow in colour, the ear lobes and wattles are small and red in colour. They are good egg layers and are delicious.

c. Kadaknath: - It is a fowl with black flesh. It is abundant in Madhya Pradesh and bred by tribals and the eggs are light brown in colour. The adult plumage varies from silver and gold-sprangled to bluish-black. The comb, wattles and tongue are purple in colour,

d. Busra: - This is a small to medium sized bird found in some parts of Gujarat and Maharashtra. They are light feathered with wide variation in body colour.

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COMMON VIRUS DISEASE OF POULTRY

Ranikhet disease, also known in the West as Newcastle disease is a contagious and highly fatal diseases of fowls. The disease occurs in almost all countries and usually assumes a server form affecting birds of all ages. Mortality in flows varies from 50 to 100 per cent.Ranikhet disease is largely a disease of fowls, but it also effects turkeys, pigeons, ducks, geese, pheasants, guinea-flows, partridges and doves. The disease is also suspected to cause conjunctivitis among laboratory workers and persons handling infected birds.

Symptoms: - The symptoms vary according to the age of the affected birds. The first symptoms usually observed in young birds are sneezing, gasping and often droopiness. It is in this stage of the disease that the manifestations rather closely resemble those of infections bronchitis. Within a short time after appearance of respiratory symptoms, deaths occur in a flock in quick succession and in increasing numbers from day to day.

Treatment and Prevention: -At present there is no effective treatment of any value. Proper housing and general good care are indicated in an effort to shorten the duration and severity of the infection.An early recognition of the disease and application of struck sanitary measures are of great value in the control of the disease. Some important measures for its prevention are ; slaughtering of all apparently ailing birds, segregating of in - contact in group of 10 to 15 each; removal of all infective materials such as droppings, residues of poultry cleanliness ; and provision of separate attendants for each group of birds.

Control: -Control of Ranikhet diseases can be effect with judicious application of sanitary and vaccination measures. The possibility of entry and spread of infection is considerably reduced through the maintenance of flock on deep little system and stopping all unauthorized entries, even of human beings, into the battery brooders. Disposal of fowl carcasses by burning or deep brutal to reduce the scope of carrion-eating birds like crows, kites and vultures perching near fowl pens or poultry farms helps to resume the hazards of this infection. Two types of vaccines are available in India, one for the adult birds an another for younger birds or body chicks. The virus strain for Ranikhet disease vaccine used for adult birds age over weeks was evolved at the Indian Veterinary Research Institute. The vaccine consists of freeze - dried virus grown in chick embryos. Vaccination of birds 6 weeks old and above confers immunity for 1 to 3 years.

Fowlcholera- (*Pasterullamultocida*) Important symptoms

In acute cases birds may die without showing any symptom. In less severe form breathing rapid-open beak, feather ruffled, comb and wattle become cyanotic. There may be yellowish diarrhea. In chronic form swollen comb and wattle, joints hot and painful. In duck acute hemorrhagic enteritis and oozing of blood from oral cavity noticed. Sudden death will be occurring.

Specimens to be collected

Blood smear from ailing bird, spleen, liver, lung etc. from sacrificed or dead bird in separate cover (on ice), long bones from putrefied carcass in charcoal packing.

Diagnosis

Demonstration of organism in blood smear, isolation of organism from internal organs, isolation of the organism from long bone, in chronic case it is difficult to demonstrate the organism in blood. Smear from wattle is used, biological method using pigeon.

Control / Treatment: Treatment: Sulpha drugs and TMP combination, Enrofloxacin are effective. Drugs like Flamequin, Ampicillin, Chloramphenicol, Chlortetracycline and Novobiocin are also used. 1. Killed vaccine. 2. Formalin's vaccines with adjuvant: 1 ml s/c

Fowl typhoid –(*Salmonellagallinarum*) :-**Important symptoms:** Chicks hatched from infected egg, moribund or dead chick may be seen in the incubator. Sometimes disease is not seen for 5-10 days. Peak mortality during second or third week. Affected birds may exhibit a shrill cry when voiding excreta, which is white or greenish brown. Infection spread within the flock for a long time without any distinct signs. Reduction in egg production, fertility and hatchability. Birds show diarrhea and greenish faeces and systemic disturbances.

Specimens to be collected: -Ailing bird or fresh carcass or liver, spleen and intestine from freshly dead birds by special messenger on ice

Diagnosis

Isolation and identification of organism, tube and plate test, clinical observation and necropsy findings (Bronze liver

Control / Treatment

Sulpha-TMP drugs, Quinelone group are used. Nitrofurans (Furazolidone) are used with some success.

1. Killed vaccine.

Prevention and treatment of fowl pox: There is no treatment for fowl pox and prevention is through vaccination of replacement birds. Where preventative vaccination is used, all

replacement chickens are vaccinated when the birds are six to ten weeks of age and one application of fowl pox vaccine results in permanent immunity. Vaccination of broilers is not usually required unless the mosquito population is high or infections have occurred previously. Chicks may be vaccinated as young as one day of age. During outbreaks, unaffected flocks and individuals may be vaccinated to help limit the spread. If there is evidence of secondary bacterial infection, broad-spectrum antibiotics may help reduce morbidity and mortalities. As mosquitoes are known reservoirs, mosquito control procedures may be of some benefit in limiting spread in poultry confined in houses.

Poultry products and by products: - Meat and eggs are not the only important poultry products.

Down and feathers can also be sold. In mixed farming systems, other products such as egg shells can be fed to other farm animals (e.g. pigs).

2. Excreta of fowls is good manure and consists inorganic and organic nutrients. A significant by-product is manure, which has robust economic value, whether sold or directly applied to crops by farmers.

3. Birds feathers are used in sericulture for handling first instar larva.

4. Birds excreta is also used in biogas plant.

5. The shells of Eggs are good source of calcium carbonate and used in manufacture of cement.

6. The waste products like intestine, legs, etc., can be recycled by manufacturing bird meal which can be used for fish feeding, pig feeding or bird feeding itself since it is good source of protein.

BREEDS OF CATTLE FOUND IN INDIA

The Indian breeds of cattle are categorized into the following types;

1. **Milch Breeds:** - Females yield a large quantity of milk, while the bullocks are not of high quality, e.g., Gir, Red Sindhi, Sahiwal, Tharparkar and Deoni.

2. **Gir:** This is a native of Gujarat, but also found in Maharashtra and adjacent Rajasthan. Gir cows are good milkers. The milk yield ranges from 1,200 to 1,800 kg. The age at first calving varies from 45 to 54 months and the intercalving period from 515 to 600 days.

3. **Red Sindhi:** The home tract of this breed is Karachi and Hyderabad districts of Pakistan.

However, a number of herds of this breed are found in certain cattle breeding institutions in

the country. Red Sindhi are small in size and are very good milkers. Milk production ranges from 1,250 to 1,800 kg. Age at first calving is 39 to 50 months and the calving interval is of 425 to 540 days.

4. Sahiwal: This is a native of Pakistan. The breeding tract of this breed was Montgomery district which is now named as Sahiwal district. By far it is the best breed of the subcontinent. The animals are usually long and fleshy and with heavier build. The milk yield ranges from 1,400 to 2,500 kg. The age of first calving ranges from 37 to 48 months and the calving interval is from 430 to 580 days.

5. Deoni: This is an admixture of Gir, Dangi and local animals. Its native tract is in western Andhra Pradesh. They have high milk productivity.

Dual-purpose Breeds:

There are a number of cattle breeds in India which are dual purpose— females yield more than an average quantity of milk and the males are good working bullocks.

(i) short- horned, white or light grey cattle with long coffin- shaped skull and face slightly convex in profile; viz., Haryana, Ongole, Gaolo, Rathi, Krishna Valley, etc.; and (ii) lyre-horned, grey cattle, deep bodied with wide forehead, flat or dished in profile, and good draft capacity, viz., Tharparkar and Kankraj.

a. Haryana:

The main tract of this breed is the Haryana state. The centre of origin is around Rohtak, Hisar and Gurgaon districts. This is the most popular dual-purpose breed of the Indo-Gangetic plains, and is widely spread in Punjab, Haryana, and Uttar Pradesh and also in parts of Madhya Pradesh. They are powerful work animals. Good specimens of cows yield up to 1,500 kg of milk per lactation.

b. Ongole:

The native tract of this breed is the Guntur district of Andhra Pradesh. This is essentially a large muscular breed suitable for heavy draft work. An average yield of 1,000 kg is common. Good specimens have given up to 1,500 kg of milk per lactation. Ongole breeds are known as Nellore breed in Brazil.

c. Gaolo:

This breed closely resembles Ongole breed. These breeds are found in Maharashtra and Madhya Pradesh. The animals are basically draft animals. Milk yield in cows is moderate, good specimens yielding up to 1,000 kg per lactation.

d. Krishna Valley:

The home tract of this breed is the black cotton soil along the River Krishna and the adjoining areas of Ghatprabha and Malaprabha in Karnataka. They are also found in certain parts of Andhra Pradesh. The bullocks are massive and powerful, and good for draft in heavy soils. Cows are fairly good milkers.

e. Rathi:

This is also known as Rath. Rathi breeds are mostly located in Alwar district of Rajasthan. They are also found in and around Bikaner district. They are medium-sized dual- purpose animals, good cows yielding up to 1,200 kg of milk per lactation. The bullocks are adopted moderately for heavy ploughing and road work.

f. Tharparkar:

The origin of this breed is Tharparker district in the Sind Province of Pakistan. The animals are also known as Thari. This breed is also found in the adjoining tracts of Rajasthan state, especially around Jodhpur and Jaisalmer. The males are good draft animals. The milk yield in cows ranges from 1,800 to 2,600 kg per lactation.

g. Kankrej:

The home tract of this breed is southeast of Rann of Kutch in Gujarat—from the southwest corner of Tharparkar district (now in Pakistan) to Ahmedabad and from Dessa in the east to Radhanpur in the west. They are fast and powerful draft cattle. Cows are average milkers, yielding about 1,400 kg per lactation in terms and less in villages.

Draft Breeds:

A large majority of the indigenous breeds are of draft type, in which cows are poor milkers, but bullocks are superior in quality. Prominent draft breeds of cattle in India are Nagauri, Bachaur, Kherigarh, Malvi, Hallikar, Khillari, Kangayam and Amritmahal. The last four breeds are also known as Mysore breeds. Besides, Ponwar and Siri are other important draft breeds. They are also known as hilly breeds.

i). Nagauri:

This is famous for trotting and as a draft animal. The bullocks are prized for their fast road work. Nagauri breeds are found in the district of Jodhpur in Rajasthan. This breed is supposed to have been evolved from Haryana and Kankrej breeds.

ii) Bachaur:

This breed is found in Sitamarhi district of Bihar. It has very close similarity to the Haryana breed. The males are well known for their draft capacity and their ability to thrive under poor conditions of feeding. The females of this breed are not good milkers.

iii). Kherigarh:

The home tract of this breed is the Kheri district of Uttar Pradesh. Lighter in general appearance, Kherigarh cattle are very active and good animals for light draft and trotting

iv. Malvi:

These are found in Gwalior region of Madhya Pradesh and also in Andhra Pradesh. They are of massive built and in some respects resemble the Kankrej.

v. Hallikar:

This breed originated in the former princely state of Vijayanagaram (presently in Karnataka). The animals are compact, muscular and medium-sized. The breed is best known for its draft capacity and especially for its trotting ability. It was used in the war by Tipu Sultan for carrying cannons.

vi. Khillari:

Khillari breed closely resembles the Hallikar. Its home tract is Sholapur and Sitapur districts of Maharashtra. The animals are compact and tight. Khillari bullocks are regarded as fast and powerful draft animals.

vii. Kangayam:

This breed originated in the Coimbatore district of Tamil Nadu. The animals are of moderate size with compact bodies. The males have black or very, dark colour on the head, hump, neck and quarters. A large number of bullocks produced in the northern tract are sold to cultivators in other parts for working on the black cotton soils.

viii. Amritmahal:

The home tract of Amritmahal is the former princely state of Mysore. Its breeding tract stretches from Krishna basin to Cauverybasin. The Amritmahal breed is primarily a draft animal, but during the early days, it was known for its milch qualities. Maharajas of

Mysore had developed large farms called Kavals for developing this breed. The animals are closely related to Hallikar.

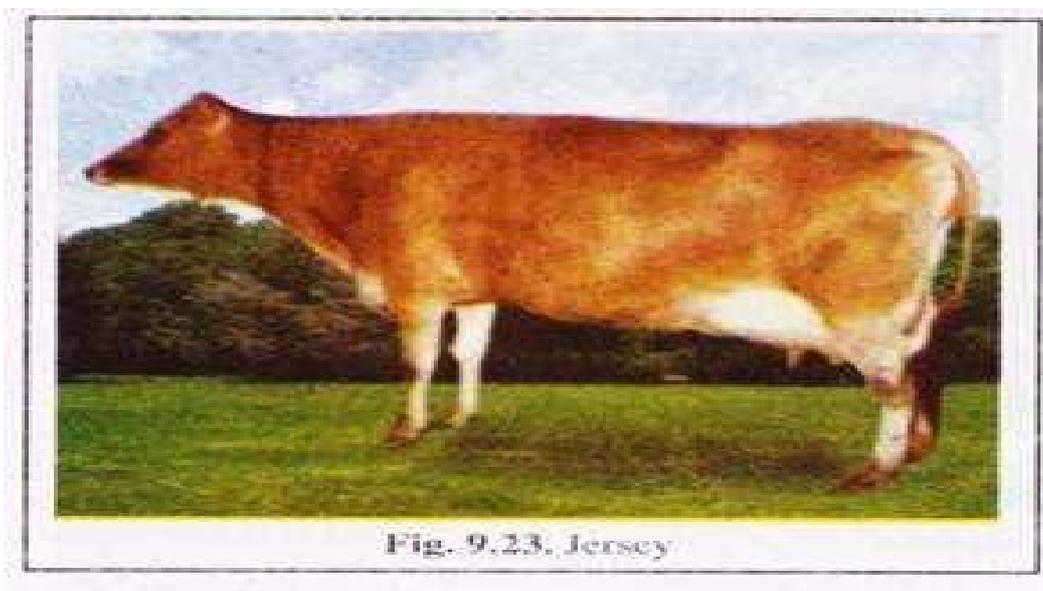
EXOTIC BREEDS:

Some of the exotic breeds, with heavy milk yielding capacity, have also been developed in India, especially in military farms. The maximum milk yield per lactation is 6,000 kg in military farms, while the average milk yield of exotic breeds is 2,600 kg. The individual maximum daily yields are above 50 kg.

Exotic Breeds of Cow:

1. JERSEY:

The Jersey breed (Fig.) originated on the Island of Jersey, a small British island in the English Channel off the coast of France. The Jersey is one of the oldest dairy breeds and has been reported to be pure-bred for nearly six centuries. This breed was known in England as early as 1771 and was regarded very favorably because of its milk and butterfat production. At that time, the cattle of Jersey Island were commonly referred to as Alderney cattle, but later were referred to only as Jerseys. Adaptable to a wide range of climatic and geographical conditions, outstanding Jersey herds are found from Denmark to Australia and New Zealand, from Canada to South America, and from South Africa to Japan. They are excellent grazers and perform well in intensive grazing programs. They are more tolerant of heat than the larger breeds. With an average weight of 500 kg, the Jersey produces more milk per kilogram of body weight than any other breed.

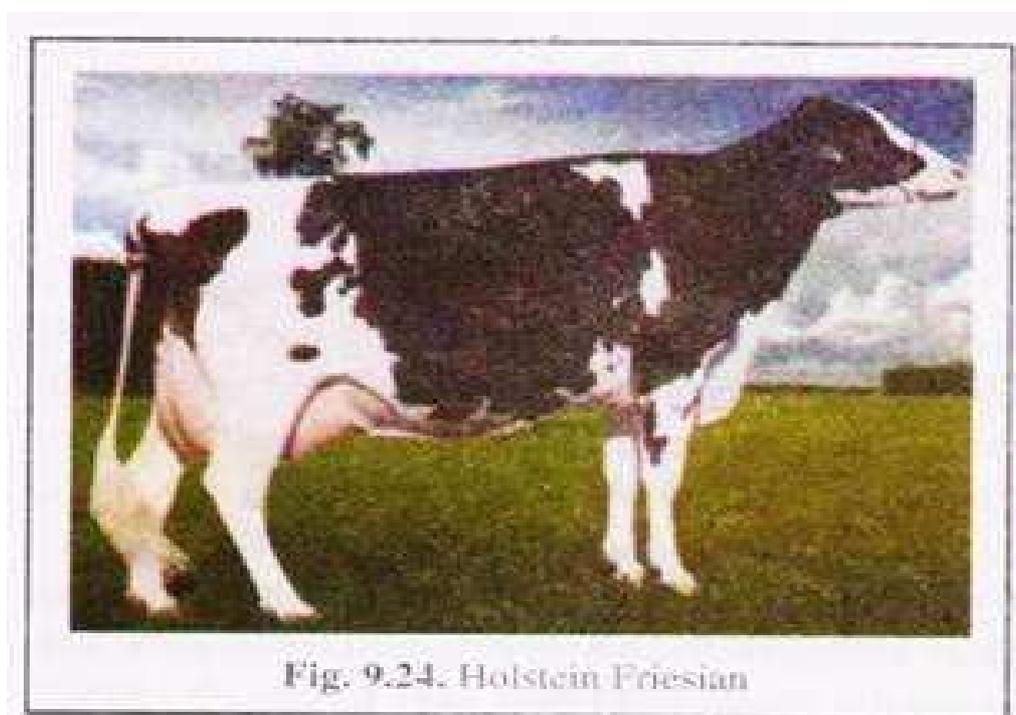


The modern Jersey breed is widely used in dairy farms. Additional emphasis on milk production and less stress on butterfat production had resulted in general acceptance of Jersey cows. Cows show very marked refinement about their heads and shoulders, carry long, straight top lines and usually carry out long and level at the rump. There is no other appealing dairy animal than the well-balanced Jersey cow. She is usually docile and rather easy to manage. Jersey bulls, while small as compared to the other dairy breeds, are extremely masculine. They are quite muscular around their crests and shoulders and are considerably less refined throughout than are the females. They usually range in weight from 650 to 900 kg. Jersey bulls are known for having the least docile temperament of the common breeds of cattle. Modern Jerseys may be of a wide range in colour. The colour in Jerseys may vary from a very light grey or mouse colour to a very dark fawn or a shade that is almost black. Both the bulls and females are commonly darker around the hips and about the head and shoulders than on the body. Jersey and Jersey crossbreed cows are most suitable for those parts of India where availability of green fodder is scarce and extreme climatic conditions are observed. Average production of milk for all Jersey cows reared at a Model Dairy Farm in Anand in 2007-2008 was 4000 kg. Average fat content is 4.8% and average SNF (Solid Not Fat) is 8.4%.

2. HOLSTEIN FRIESIAN:

The Holstein cow (Fig.) originated in Europe. The major development of this breed occurred in the Netherlands and more specifically in the two northern provinces of North Holland and Friesland which lay on either side of the Zuider Zee. The original stock was the black animals and white animals of the Batavians and Friesians, migrant European tribes who settled in the Rhine Delta region about 2,000 years ago. For many years, Holsteins were bred and strictly culled to obtain animals which would make best use of grass, the area's most abundant resource. The cross-breeding of these animals evolved into an efficient, high-producing black and white coloured dairy cow. Holsteins are quickly recognized by their distinctive colour markings and outstanding milk production. Holsteins are large, stylish animals with colour patterns of black and white or red and white.

A mature Holstein cow weighs about 800 kg and stands 58 inches tall at the shoulder. Holstein heifers can be bred at 15 months of age, when they weigh about 450 kg. While some cows may live considerably longer, the normal productive life of a Holstein is 12 years. Average production for all Holsteins reared at a model dairy farm in 2007-2008 was 6000 kg. Average fat content is 3.8% and average SNF is 8.35%.



3. **SWISS BROWN:** - This breed from Switzerland originated on the east and north of Alps. But now, they are seen in most parts of the world. The colour varies from a light fawn to almost black. the muzzle and a stripe along the backbone are light in colour. The nose, switch and horn tips are black. The animals are fairly large in size and have extremely strong constitution and hardiness. The breed is triple purpose animal in the homeland i.e. milk, meat and draught. Cows of this breed have large bones, large heads which are usually dished. The breed is quiet, docile and easily manageable. Calves are nearly white at birth and become darker with the age. Adult males weigh about 700 to 800 kg and adult females about 500 to 600 kg. On an average a Brown Swiss cow produces 5,250 kg of milk which contains 4.2 % fat. Females calve for the first time between 28 to 30 months per lactation and thereafter maintain a regular calving interval of 13 to 14 months.



Ayrshire: - This breeds takes its name from the country of Ayrshire and South west Scotland. where it was developed. The animals are cherry red to brown in colour and are of medium size. Ayrshire is considered by many as the most beautiful dairy breed. This is a relatively nervous breed and is known for its hardiness and good grazing ability. The

animals are strong and robust. The udder is strongly and evenly balanced and well-shaped. They have long horns which are trained up wards. The average milk production of this breed cows is 4,840 kg per lactation. The milk contains about 4.0 % fat. This is an early maturing (first calving at 20-30 months' age) and regular breeder (interval 13 to 14 months).



GUERNSEY: -This breed was developed and named from one of the islands between France and England in the English Channel. The animals have a shade of fawn with white markings clearly defined. Skin has golden yellow colour pigmentation. Usually, markings are dominant on the face, legs, switch and flanks. The nose may be creamy or buff coloured. Cows of this breed are alert and active. They are easy to handle and manage. Generally, milk has golden colour. Adult males weigh around 600 to 800 kg and adult females about 400 to 500 kg. Good herds produce on an average 4000 kg milk per lactation. The milk contains about 5% fat. This is also an early maturing breed.



ARTIFICIAL INSEMINATION

Introduction: Artificial insemination is the technique in which semen with living sperms is collected from the male and introduced into female reproductive tract at proper time with the help of instruments. This has been found to result in a normal offspring. In this process, the semen is inseminated into the female by placing a portion of it either in a collected or diluted form into the cervix or uterus by mechanical methods at the proper time and under most hygienic conditions. The first scientific research in artificial insemination of domestic animals was performed on dogs in 1780 by the Italian scientist, Lazanno Spalbanzani. His experiments proved that the fertilizing power reside in the spermatozoa and not in the liquid portion of semen.

Few further studies under research station conditions helped this technique to be used commercially all over the world including India.

Artificial insemination is not merely a novel method of bringing about impregnation in females. Instead, it is a powerful tool mostly employed for livestock improvement. In artificial insemination the germplasm of the bulls of superior quality can be effectively utilized with the least regard for their location in faraway places. By adoption of artificial insemination, there would be considerable reduction in both genital and non-genital diseases in the farm stock.

ADVANTAGES – DISADVANTAGES

Advantages and disadvantages:

Artificial insemination (A.I.) is deposition of semen into the female genital tract by means of instruments.

ADVANTAGES OF ARTIFICIAL INSEMINATION:

There are several advantages by artificial insemination over natural mating or servicing.

- There is no need of maintenance of breeding bull for a herd; hence the cost of maintenance of breeding bull is saved.
- It prevents the spread of certain diseases and sterility due to genital diseases.
Eg: contagious abortion, vibriosis.
- By regular examination of semen after collection and frequent checking on fertility make early detection of inferior males and better breeding efficiency is ensured.
- The progeny testing can be done at an early age.
- The semen of a desired size can be used even after the death of that particular sire.
- The semen collected can be taken to the urban areas or rural areas for insemination.
- It makes possible the mating of animals with great differences in size without injury to either of the animal.
- It is helpful to inseminate the animals that are refuse to stand or accept the male at the time of estrous cycle.
- It helps in maintaining the accurate breeding and cawing records.
- It increases the rate of conception.
- It helps in better record keeping.
- Old, heavy and injured sires can be used.

Disadvantages of A.I:

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- Requires well-trained operations and special equipment.
- Requires more time than natural services.
- Necessitates the knowledge of the structure and function of reproduction on the part of operator.
- Improper cleaning of instruments and in sanitary conditions may lead to lower fertility.
- If the bull is not properly tested, the spreading of genital diseases will be increased.
- Market for bulls will be reduced, while that for superior bull is increased.

MOET (Multiple Ovulation Embryo Transfer Technology) is the technique in which multiple eggs are fertilized in an animal and the embryo is collected on the 7th day, without any surgery. It is the traditional method of embryo production and is practiced in cattle. In the process of MOET, the hormones, especially the Follicle Stimulating Hormones are used to stimulate the ovaries of the cycling cattle to induce multiple ovulations. The animal is artificially inseminated and multiple eggs are fertilized in the reproductive tract. After 7 days, the embryos are collected and frozen to transfer later. They may also be transferred as fresh embryos.

It is an excellent method of enhancing the genetic potential of the best animals. Normally a cow produces one calf a year. But by using MOET it is possible to produce more than one offspring from the genetically fit cows.

Procedure of MOET Technology

MOET is carried out in the following steps: **Programming:** - The donor cattle are treated with follicle stimulating hormone and prostaglandin. These are injected only in the muscles. The cows need to be provided with proper nutrients before and after calving. They should have completed their cycle. Routine checkups are vital to ensure that they are clean. **Heat Detection:** - Heats need to be accurately recorded while the cows are being artificially inseminated. **Embryo Collection:** - The donor and recipient cattle are placed in a secured and covered place. The donor cow is injected with an epidural to relax her bowel. The rear end is washed properly and sterilized to prevent any infections. The veterinary doctor inserts its hand in the rectum of the cow and locates a catheter into one horn of the uterus. Fluid is then run into the uterine horn. The fluid is run back through the catheter and a very fine filter where the embryos are caught. Thus the embryos are collected. The cow is then injected with prostaglandin after 3 days for proper cycling. **Embryology:** - The filter is observed under a microscope for the embryos. The embryos

detected are counted, graded and washed. The embryos are either frozen and preserved in liquid nitrogen at -190°C for later use or are transferred into the recipients with the help of transfer guns.

Embryo Transfer: - The recipient cows are injected with an epidural. They are washed and their ovaries observed to check their cycle. The embryo is deposited into the uterus with the help of a transfer gun.

Advantages of MOET

The advantages of MOET are as follows:

1. Increase in the reproductive rate of the animals.
2. No surgery is required.
3. The entire procedure can be easily carried out on a farm.
4. The embryos can be frozen and stored in the laboratory for future use.
5. The embryos can also be cryopreserved in banks for future use.

MILK AND MILK PRODUCTS: Dairy products, milk and any of the foods made from milk, including butter, cheese, ice cream, yogurt, and condensed and dried milk.

1. Milk is good source of proteins, minerals and vitamins and milk is wholesome food from infants to old persons.
2. Curds is also good food and helpful in digestion and contains useful bacteria.
3. Butter milk is also good drink particularly in summer seasons because it hydrates the body.
4. Ghee is another by-product of milk which is used in preparations of sweets and other dishes.
5. Butter is also used in consumption of bread along with jam.
6. Milk powder is manufactured from milk by removing the water content in milk. And used in preparation of milk where milk is not available. Badam milk powder is mixture of milk and badami.
7. Various sweets are manufactured using milk as base.

Pasteurization: - Pasteurization is most important in all dairy processing. It is the biological safeguard which ensures that all potential pathogens are destroyed. Extensive studies have determined that heating milk to 63°C (145°F) for 30 minutes or 72°C (161°F) for 15 seconds kills the most resistant harmful bacteria. In actual practice these temperatures and times are exceeded, thereby not only ensuring safety but also extending shelf life.

Most milk today is pasteurized by the continuous high-temperature short-time (HTST) method (72 °C or 161 °F for 15 seconds or above). The HTST method is conducted in a series of stainless steel plates and tubes, with the hot pasteurized milk on one side of the plate being cooled by the incoming raw milk on the other side. This “regeneration” can be more than 90 percent efficient and greatly reduces the cost of heating and cooling. There are many fail-safe controls on an approved pasteurizer system to ensure that all milk is completely heated for the full time and temperature requirement. If the monitoring instruments detect that something is wrong, an automatic flow diversion valve will prevent the milk from moving on to the next processing stage. Higher temperatures and sometimes longer holding times are required for the pasteurization of milk or cream with a high fat or sugar content.

Gobar Gas:- Biogas is the mixture of gases produced by the breakdown of organic matter in the absence of oxygen, usually consisting of certain quantities of methane and other constituents. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source. In India, it is also known as "Gobar Gas".

Biogas is produced by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials.^[1] This closed system is called an anaerobic digester, bio digester or a bioreactor.

Biogas is primarily methane (CH₄) and carbon dioxide (CO₂) and may have small amounts of hydrogen sulfide (H₂S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat.