

# **LIVESTOCK PRODUCTION & MANAGEMENT**



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# *Livestock Production and Management*

This eCourse Developed By  
**TNAU (ICAR)**



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**Lec1: Prelusion-Significance of livestock and poultry in Indian economy-Livestock and Poultry census - role of livestock and poultry in Indian agriculture.**

Livestock farming is an integral part of crop farming and contributes substantially to household nutritional security and poverty alleviation through increased household income. The returns from livestock especially dairying and mixed farming in small and medium holdings are larger and highly sustainable. The progress in this sector results in more balanced development of the rural economy and improvement in economic status of poor people associated with livestock. Indian agriculture is an economic symbiosis of crop and livestock production with cattle as the foundation. Dairy animals produce milk by converting the crop residues and by products from crops which otherwise would be wasted. Dairy sector contributes by way of cash income, draught power and manure. Livestock provides for human needs by way of 1. Food 2. fibre. 3. Fuel. 4. Fertilizer. 5.. Skin and 6. Traction. It is a living bank providing flexible finance in time of emergencies and also serves as insurance against crop failure for survival. If Agriculture is the foundation of our national economy Animal husbandry constitutes the sheet anchor of agriculture. Indian agriculture marches on the patient back of the bullock.

70 percent of the livestock are owned by 67 percent of small and marginal farmers.

76 percent of the milk is produced by weaker sections of society.

One fifth of the worlds livestock population is present in India .

India has nearly 57 % of the worlds buffalo population, 16% of the cattle population, 20% of goat population and 5 % of sheep population although India constitutes less than 3 % of the worlds total land area.

**Population of livestock and poultry in India and Tamilnadu**

<b>CATTLE</b>	–	<b>209.08 MILLION &amp; 9.10 MILLION</b>
<b>Buffaloes</b>	–	<b>92.19 Million &amp; 2.93 Million</b>
<b>Goat</b>	–	<b>120.60 Million &amp; 5.87 Million</b>
<b>Sheep</b>	–	<b>56.47 Million &amp; 5.61 Million</b>
<b>Pig</b>	–	<b>15.42 Million &amp; 0.60 Million</b>
<b>Poultry</b>	–	<b>3430 Million &amp; 240 Million.</b>

**The production Parameters are**

Milk – 81 Million tonnes ( 00 –01 ) – I in the world ( contributing 14% of the world milk production)

32.4 Billion eggs – 5<sup>th</sup> in the world

47.6 million kgs of wool

4.7 million tonnes of meat

Per capita Milk availability is 221 gms / day ( 00 –01 ) whereas the requirement is 280 gms / day

Per capita egg availability is 33 eggs/ year whereas the requirement is 180 eggs

Per capita availability of poultry meat is 700 gms/ annum whereas the requirement is 10 kgs/ annum.

It is estimated that about 18 million people are employed in the livestock sector in principle or subsidiary status. Export earnings from livestock sector and related products are progressively rising. Finished leather accounted for 50 % ( Rs.1745 crore ) and meat and meat products accounted for 42 % (Rs1457 crore) of the total export from the livestock sector during 2000-01. The contribution of livestock sector to the total Gross domestic product (GDP) was 5.9% in 00-01, accounting for 27 % of total agricultural output.

Though the cattle wealth is quite abundant in terms of population the production from these animals is very poor viz., 987 kgs per lactation whereas the world average is 2038 kgs per lactation. The main reasons for this shortcoming is the abundant population of nondescript cows, chronic shortage of feed and fodder, poor nutritive value of the available feed and fodder, low fertility rates, destruction of grazing land, increasing human population and competition between animals and man for the available feed resources.

To satisfy the nutrient requirement for the huge population of livestock the options are 1.to reduce the unproductive/ low productive animals. 2. feeding of non conventional feed stuffs – among these are the horticultural by products like agriculture by products, vegetable wastes and horticulture industrial wastes.

First step that bridges livestock and agriculture is the efficient utilization of agriculture/horticulture waste to feed animals and convert to high quality meat, milk, wool, egg etc.,

Second linkage is through application of organic fertilizers to crops.

The third application is the usage of draught animal power for ploughing of land.

**Nutrient content of animal and poultry manure**

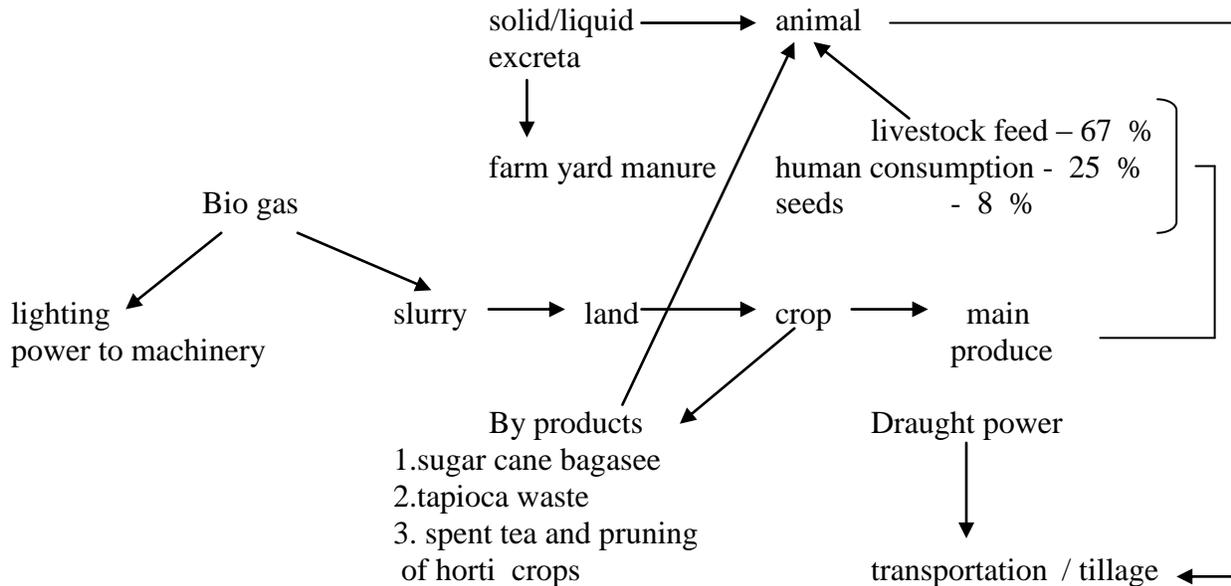
Nutrient	Nutrient content of manure (mg g dry weight <sup>-1</sup> )				
	Cattle	Sheep	Pig	Horse	Poultry
Nitrogen	25-40	20-45	20-45	17-30	28-62
Phosphorus	4-10	4-11	6-12	3-7	9-29
Potassium	7-25	20-29	15-48	15-18	8-29
Calcium	5-8	8-19	3-20	7-29	17-69
Magnesium	5-8	3-6	2-3	3-5	3-8
Sulphur	3-4	2-3	3-5	1-3	4-7

Apart from manurial value biogas can be produced from livestock dung and poultry droppings. 32 kg of cow dung/20 kgs of pig faeces/12 kgs of poultry droppings can produce 1 m<sup>3</sup> – 34 cft of bio gas. the calorific value of bio gas –500 to 700 BTU per cft in comparison to Natural gas – 850 BTU/cft.

1 m<sup>3</sup> of slurry fed to biogas plant produces on an average 0.15 to 0.20 m<sup>3</sup> of biogas daily. Based on equivalent effective heat produced 2 m<sup>3</sup> biogas plant replaces in a month fuel equivalent of 26 kgs of LPG contained in standard gas cylinder or 37 litres of kerosene or 88 kgs of charcoal or 210 kgs of fuel wood or 740 kgs of animal dung.

1. 83 million draught animals
2. The power generated from 83 million draught animals is equivalent to 30,000 million watts in terms of electric power
3. 0.33 ha area of land is cultivated by the animals. The power rating of a full grown bullock a pure Indian draught breed is 0.70 HP average is 0.5 Hp only. A35 Hp tractor can plough about 2.5ha of land in an eight hour shift and consume about 5l diesel / hr.
4. Animal power is also utilised for transport.

25,000 million tonnes km of freight per year which saves 6 million tonnes of diesel /petrol worth Rs.4000 crores



Cow is taken as the basal unit and all other types of animals are equated to have a common platform

cow	1.0	example: if the goat population is is 120 million it means it is equivalent to 24 million cows $120 \times 0.2 = 24.0$
bullock	1.2	
young stock	0.6	
buffalo	1.2	
sheep and goat	0.2	

Nutrient content of animal and poultry manure

Nutrient	Nutrient content of manure (mg g dry weight <sup>-1</sup> )				
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Sulphur	3-4	2-3	3-5	1-3	4-7

### Livestock and Poultry Production

Introduction : Importance of Livestock and Poultry in Indian Agricultural livestock and poultry census and its role in Indian Economy.

1. India owns nearly 23% of the world livestock population.

2. Agricultural is the back bone of Indian Economy and within agriculture livestock plays an importance role in providing sustainable income to farmers throughout the year.
3. Failure of monsoon, pest infestation, floods etc – when crop husbandry fails next alternate is livestock and poultry industry.

**Animal Husbandry – important steps are -Breeding, Feeding, Weeding and Heeding**

Importance of livestock in Agriculture

1. Income from livestock and poultry enterprises contribute as high as 10% of the total national income and nearly 50% of agricultural sector income.
2. Effective utilization of labour – family labour is effectively utilized in animal husbandry.
3. Soil fertility : organic manure – promotes and maintain soil fertility.
4. Effective utilization- cow produces 8 tonnes of farm yard manure per year and farm biomass farm products which includes fodder, feed, edible weed, tree fodder, bund grass are better utilized – and converted to Edible products like – Milk, Meat and Egg.
5. Effective utilization of agri industrial by products  
By products obtained from grain processing (bran), oil seed process (oil cakes), pulses processing (gram, husk) and molasses.
6. Better standard of living : family income from livestock and poultry -‘Bankers cheque’
7. Inter relationship

Man, animal plant interrelation is interdependent (one cannot survive without the help of other) Man not only depends on plants and animals for food but also for income and other needs. He co-ordinates activities of the crop and other husbandry by proper planing.

Main objectives of livestock census

1. To assess the growth rate of the livestock
2. It helps to assess/improve the quality/production performance
3. It helps to reduce the uneconomical livestock by culling.

**Class 2: Various systems of livestock production-extensive - semi intensive- intensive-mixed.**

**Systems of Livestock Production**

**Extensive : Semi intensive- specialized - Intensive – Tethering .**

**Extensive:**

- i. Oldest method**
- ii. Requires extensive land**
- iii. Grazing – dry – housed – night**
- iv. Availability of fodder varies with season so variation in intake.**
- v. Cost of feeding – Nil, Negligible**
- vi. Currently – Not followed – except in**

**Reason : a) Reduction in grazing land**

**b) Tremendous pressure on cultivable land**

**High yielding animal – not suitable**

**i) Temperature ii. Loss of energy iii. Average fodder**

Semi intensive 1. few months grazing

2. Daily / everyday – grazing

During cropping season – confined/other times let loose.

Exercise for the animal : Milch animal : Fat % : Absences of leg problem – over grown Hoof.

Feed cost comparison – less Vs. intensive system, Identification – heat, ailing animals

Dis Adv. : High yielding animal not suitable :

Intensive : Total confinement to shed throughout the year and fed. Restricted movement – energy conservation, management easy. Number of animals can be maintained under direct supervision, space requirement less when compared with. Ext or SI system.

Demerits : over grown hoof ; lack of exercise. Leg problem : improperly maintained disease outbreak – severe – Economical loss – high.

Mixed Farming : Along with crop Husbandry one or more component of livestock or poultry maintained. mixed farming is the economical rearing of different types of Livestock&Poultry in the farm along with

- (a) making use of farm Produce.
- b) Utilization of unconventional feed and fodder
- c) better utilization of farm by products.

Recycling : Farm Yard Manure – Dung – Gas – Slurry – Soil fertility

Bring constant income to the family throughout the year

Indirectly enhances standard of living.

Drawbacks :

- i. No planning
- ii. No Scientific approach.
- iii. No correlation between land availability and number of head of animal maintained.
- iv. Improper planning –over utilization/ under utilized.

Integrated farming system – (IFS)

In the integrated farming system the defects of mixed farming is overcome by proper planning, monitoring and execution of work according to size of the farm, farm resources, Agro climatic etc.

In this type, the type of livestock species or poultry enterprises are selected based on the availability of feed, fodder, water resources of the farm.

Quantity – Availability : No. of animals maintained

Specialized farm

- i. Sole income is derived from one species – Cattle, Buffalo, goat, pig or poultry
- ii. Feed mixture procured
- iii. Specialized farm – Fodder procured, Accomplish partly.
- iv. Location- various with production of fodder, availability of land ; cost , etc.

If located close to town – Advantageous i. Reduce transport cost ii. Marketing easy since avenues more.

Village : Cost of land cheap : investment on feed and fodder less.



4. Green fodder available  
through out the season

4. Cost fluctuating

5. Availability of green fodder during  
summer.

**CLASS 3: INTEGRATED FARMING SYSTEMS- ROLE OF LIVESTOCK AND POULTRY, MANURE  
MANAGEMENT METHODS, DUCK/FISH/RICE CULTURE.**

Integrated Farming system

**CLASS 6**

**Integrated farming system – (IFS)**

- **Component of farming system research a change farming techniques for maximum production – optimum utilisation of resources**
- Defects of mixed farming is overcome –
- proper planning,
- monitoring
- and execution of work according to size of the farm, farm resources, Agro climatic etc.

Focused on a few selected, interdependent and interrelated systems

Type of livestock species or poultry enterprises -selected

- availability of feed,
- fodder,
- water resources of the farm.
- Quantity – Availability : No. of animals maintained

**GOALS**

**Four goals**

- **Maximizing of yield** of all components- steady and stable income
- **Rejuvenation of systems** productivity-ecological equilibrium
- **Control pest, weed and diseases** by stable management.
- **Reducing the use of chemicals** and other harmful agro chemicals

**Advantages**

- **Productivity**
- **Profitability**
- **Potentiality and sustainability**
- **Balanced food**
- **Pollution free environment**
- **Recycling**
- **Adoption of new technology**
- **Solve energy crisis**
- **Employment generation**
- **Improves the standard and literacy**

**Different systems**

- **Lowland farming system**
- **Irrigated upland farming system**
- **Upland farming system**

### Lowland farming system

- Cropping + poultry + duck + pigeon + fishery + mushroom in all possible combinations
- Recycling reduces the cost of output
- one hectare 0.90 ha for crop + 0.10 for fish pond
- 1000 polyculture fingerlings
- 50 babcock layers or 100 pigeons feed requirement for 1000 fingerlings
- Pigeon open grazing ^ profitable

### Other Combinations

- **Crop + piggery + fish+ mushroom**
- **crop + goat + fish**
- **Goat Unit 11.0 t more manure apart from feed requirement**
- **Employment for the farmers**
- **crop residue sand waste of horticulture for producing 5 kg of edible mushroom /day**
- **vermicomposting**

### Irrigated upland farming system

- Crop + Dairy + Biogas + Spawn+ Mushroom
- Dairy of 3 milch animals
- Dung to generate 2m<sup>3</sup> of biogas – sufficient for preparation gruel, lightning 2 lamps and cooking of mushroom and spawn
- Sericulture – mulberry leaves after worm feed – and faecal matter of worms good biogas input
- **Left out after reeling silk yarn** – rich in protein – good feed supplement

### OTHER INTEGRATION

- **Rabbit farming**
- **One unit 10 females and one male** – 200 kindling – weight around 1000 kgs meat
- **coconut border planting** on irrigation channels with 4 m interval – 50 trees – 5000 nuts per annum
- Nutrient enriched by **growing sun hemp**
- **Vermicompost** from plant good organic source

### Horticulture oriented

- ▶ Homestead Garden with vegetables, fruit trees – vermicompost to the land
- ▶ Honey bee hives – collect honey from the flowers
- ▶ Horticulture Waste to the animals (dairy)

### Upland farming system

- **Conventional Rain fed Crops**
- integrating farms and biomass build up
- **Dry Land With Goat+ Fodder Crops + Perennial Grasses**

- 20 ewes and one buck -365 days by short duration field crops ( **Tellicherry** ) – dual purpose – economic traits – manure of 11.2 t of soil excellent source primary, secondary and micro nutrients absorb more moisture and release to the crop

- **After 5 years perennial fodder trees bear the stock**

#### **Other Inputs**

- Buffalo – Good Quality Of Milk Fat with low quality fodder
- Drought Tolerant Fruit Crops like ber, amla, guava, pomegranate raised with legumes or intercrops feed supplement to milch animals
- Farm pond

1/ 25 of the cultivated land – outlet point for the secure run off water  
dimension 40\* 10\* 1.5m

Silt settling unit – silt removed – organic nutrient to perennial fruit trees and stagnation of water more 3 1/2 to 4 months – tilapia a local fish reared in pond

#### **Constraints**

- **Heavy investment at initial stage**
- **involvement of multi disciplinary activities like animal husbandry**
- **Lack of marketing**
- **Lack of knowledge of preparation of own feed**
- **non availability of new variety**

#### **Specialized farm**

- **Intensification of agricultural activity** aimed at maximising the production/unit area /unit time.
- **Operational efficiency** and speed of execution.
- Focused on a **single system**.
- **Management skills**

If located close to town –  
Advantageous

i. Reduce transport cost

ii. Marketing easy since avenues more.

Village : Cost of land cheap : investment on feed and fodder less.

- **Mixed Farming** : Along with crop Husbandry one or more component of livestock or poultry maintained. mixed farming is the economical rearing of different types of Livestock&Poultry in the farm along with
- (a) making use of farm Produce.
- b)Utilization of unconventional feed and fodder
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**Class 4 :** Definition of breed-classification of indigenous, exotic cattle and buffaloes -Breed characteristics of Sindhi, Kangayam and Umblacherry, Jersey, Holstein Friesian, Murrah and Surti.

**Breed:** Definition : Denotes and established group of animals / birds having the similar general body shape, colour, structure and characters which produced offspring with same characters

### **I. Cattle - 1. Indigenous 2. Exotic**

Indigenous Breeds are classified under three groups based on utility / purpose.

- a. Milch - Example- Sindhi, Sahiwal, Gir and Deoni
- b. Dual - Example- Hariyana, Ongole, Tharparkar, Kankrej
- c. Draught – Example- Kangayam, Umblacherry, Amritmahal, Hallikar

2. Exotic – Milch – Jersey, Holstein Friesian

### **Red Sindhi**

**Also Known By:** *Malir (Baluchistan), Red Karachi, Sindhi*

The Red Sindhi originated in the Pakistani state of Sind but due to its hardiness, heat resistance and high milk yields they have spread into many parts of India and at least 33 countries in Asia, Africa, Oceania and the Americas.

Under good management conditions the Red Sindhi averages over 1700 kg of milk after suckling their calves but under optimum conditions there have been milk yields of over 3400 kg per lactation.



The average height of a Red Sindhi cow is 116 cm with a body weight of 340 kg. Bulls average 134 cm in height and a body weight of 420 kg. They are normally a deep, rich red color but this can vary from a yellowish brown to dark brown. Males are darker than females and when mature may be almost black on the extremities, such as the head, feet and tail.

### **Red Sindhi in Australia**

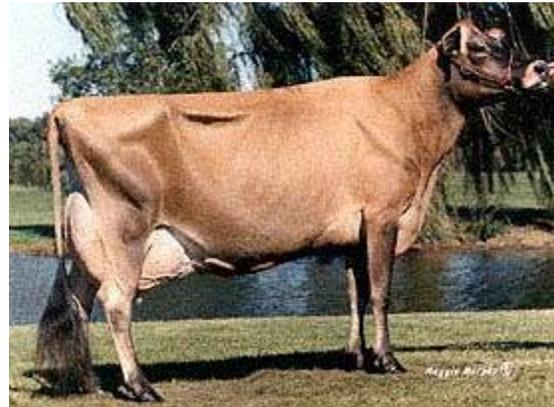
Red Sindhi cattle arrived in Australia in 1954 from Pakistan, as a gift to the Australian Government. While traditionally considered a milking breed they have been successfully used in crossing systems with British breeds to produce tropical beef types. In Australia,

they have been an adaptable, hardy breed, good foragers and have a high degree of resistance to heat and ticks.

## JERSEY

The Jersey breed 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, having been reported by authorities as being purebred for nearly six centuries.

The breed was known in England as early as 1771 and was regarded very favorably because of its milk and butterfat production. At that early date, the cattle of Jersey island were



commonly referred to as Alderney cattle although the cattle of this island were later referred to only as Jerseys. Jersey cattle were brought to the United States in the 1850's.

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 900 pounds, the Jersey produces more pounds of milk per pound of body weight than any other breed. Most Jerseys produce far in excess of 13 times their bodyweight in milk each lactation.

The modern Jersey breed is unexcelled in dairy type. Breeders in the United States commonly referred to two distinct types of Jerseys in the past, these being the Island and the American; this distinction is not commonly made at present. It should be recalled that this is a different usage of the word "type" than is usually implied and refers to the general size and quality of the animal rather than to its use for dairy purposes. The Island-type Jerseys excelled in refinement and those qualities that were deemed necessary to win in the show ring. Refinement and beauty of such cattle in mature form led to the marked superiority of cattle imported from the island of Jersey or their direct descendants in winning most of the major awards of the American show ring. The so-called American-type Jerseys were noted much more for production than for beauty. Cattle referred to by this description are usually larger, a bit coarser, and have been bred for years for

those qualities that suit them for milk and butterfat production. Some have referred to them as the "Farmer's" Jersey. Usually after two or three generations in the United States in the hands of the ordinary feeder, the refinement of the Island cattle gives way to the larger and less refined American kind.

In recent years there has been less concern about these type variations; no doubt the program of type classification has tended to reduce the extremes. Additional emphasis on milk production and less stress on butterfat production had, no doubt, resulted in general acceptance of Jersey cows with more size and scale. Recent importations of Jerseys have consisted of larger cattle than many previously brought to the United States. Their offspring have not only been acceptable in type but have also been used advantageously in improving production.

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. For their size, they are usually deep in the body and full and deep in the barrel. There is no more appealing dairy animal than the well-balanced Jersey cow, and although usually somewhat more nervous in disposition than the other dairy cows, she is usually docile and rather easy to manage. Jersey cows usually have an extreme weight range of between 800 and 1200 pounds, but medium-sized cows are usually preferred.

Jersey bulls, while small as compared to the other dairy breeds, are extremely masculine. They are quite muscular about their crests and shoulders and are considerably less refined throughout than are the females. The same general qualities of straight lines and dairy conformation as are found in the cows are desired in bulls. They usually range in weight from 1200 to 1800 pounds, but as in the females, medium weights are usually preferred. Jersey bulls are known for having the least docile temperament of the common breeds of cattle. It is folly to trust any dairy bull and particularly Jerseys past eighteen months of age.

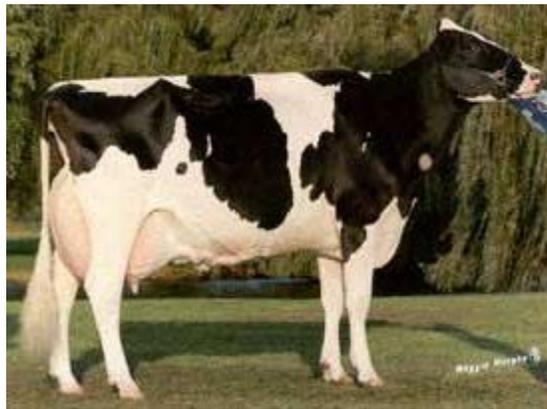
Modern Jerseys may be of a wide range in color. There is little preference today between the solid and broken colors although most breeders slightly prefer the cattle with an unbroken color pattern. Most prefer the dark tongue and switch, but this is more a matter of an identification point than a point of discrimination. The color in Jerseys may vary from a very light gray or mouse color to a very dark fawn or a shade that is almost black. Both the bulls and females are commonly darker about the hips and about the head and shoulders than on the body. Most breeders slightly prefer the medium shades of color to the extremes, but nearly all of them realize

that type and producing ability are far more important than the shade of color or whether the color is solid or broken.

## **Holstein**

### **Origin of the Breed**

The Holstein cow originated in Europe. The major historical development of this breed occurred in what is now 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 were 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 intermingling of these animals evolved into an efficient, high-producing black-and-white dairy cow.

### **Imports to America**

After the New World was settled, and markets began to develop for milk in America, dairy breeders turned to Holland for their seed stock.

Winthrop Chenery, a Massachusetts breeder, purchased a Holland cow from a Dutch sailing master who landed cargo at Boston in 1852. The cow had furnished the ship's crew with fresh milk during the voyage. She proved to be such a satisfactory producer, that Chenery made later importations of Holsteins in 1857, 1859 and 1861. Many other breeders soon joined the race to establish Holsteins in America.

After about 8,800 Holsteins had been imported, cattle disease broke out in Europe and importation ceased.

### **Americans Build Their Own Breed**

In the late 1800's there was enough interest among Holstein breeders to form associations for the recording of pedigrees and maintenance of herdbooks. These associations merged in 1885 to found the Holstein-Friesian Association of America, the Holstein Association.

### **Characteristics of Holsteins**

Holsteins are most quickly recognized by their distinctive color markings and outstanding milk production.

### **Physical Characteristics**

Holsteins are large, stylish animals with color patterns of black and white or red and white.

A healthy Holstein calf weighs 90 pounds or more at birth. A mature Holstein cow weighs about 1500 pounds and stand 58 inches tall at the shoulder.

Holstein heifers can be bred at 15 months of age, when they weigh about 800 pounds. It is desirable to have Holstein females calve for the first time between 24 and 27 months of age. Holstein gestation is approximately nine months.

While some cows may live considerably longer, the normal productive life of a Holstein is six years.

### **Milk Production**

Average production for all Holsteins enrolled in official U.S. production-testing programs in 1987 was 17,408 pounds of milk, 632 pounds of butterfat and 550 pounds of protein per year.

## **Kangayam**

The Kangayam cattle conform largely to the Southern Indian Mysore type, though there is evidence of the blood of the gray-white Ongole cattle in their composition. Possibly this mixture has given the breed its larger size in comparison with other cattle of the Mysore type. This breed, in its native area, is also known by other names of Kanganad and Kongu though the name Kangayam is well-known. These cattle are bred in the southern and southeastern area of the Coimbatore district of Madras State in India. It is observed that there are two varieties of Kangayam cattle, one small and the other large. The smaller variety is found to be more numerous in the Kangayam, Dharampuram, Udmalpet, Pollachi, Paddadam and Erode subdivisions, while the larger variety is found in



in  
of  
the

areas of Karur, Aravakurchi and Dindigul subdivisions. The breed is found in its pure form in the herds of some large breeders, notably the Pattagar of Palayakottai, who is supposed to have one of the best herds of the breed in the country.

### **Characteristics**

Both varieties of this breed are strong and active, with compact bodies and short, stout legs with strong hooves. Horns in the smaller variety spread apart nearly straight, with a slight curve backwards. In the larger variety, the horns are much longer, curve outwards and backwards and almost complete a circle at the point where they approach the tips. The head is of moderate size with only slightly prominent forehead. The head is more proportionate to the body with a straighter profile than in most of the Mysore type cattle. The ears are small, erect and pointed. The eyes are dark and prominent with black rings around them.

The neck is short and thick. The back is short, broad and level. The body is compact, with well sprung ribs. The quarters are slightly drooping. The dewlap is thin and extends only up to the sternum. The sheath is well tucked up to the body. The hump in bulls, though well-developed, is firm. The hair is fine and short and the skin is dark in pigment and fine in texture. The tail is of moderate length with a black switch reaching well below the hocks.

Kangayam color is usually gray or white. The males generally are gray with black or very dark gray coloring on the head, neck, hump and quarters. In the cows, the prevailing color is white and gray with deep markings on the knees, and just above the fetlocks on all four legs. The calves are light or dark brown with gray or white on the inside of the thighs, ears and forelegs, and occasionally with gray or white rings on the pasterns and fetlocks. At two years the heifer turns gray or dark gray and retains this color but with advancing age after maturity the color fades and becomes white. Male calves become dark gray or iron gray with black shading over the head, neck, hump, dewlap, fore and hind quarters. With maturity the black shading becomes intensified. Castrated males, however, show fading of the color.

Kangayam cattle are of moderate size, active and powerful, and are highly prized draft animals. The cows are generally poor milkers but there are encounters of fair producing abilities.

## **II. Buffalo – Murrah, Surti**

Murrah ;

The breed tract is Rohtak, Hisar and Jind of Haryana. The breed characteristics are massive body, neck and head comparatively long, horns short and tightly curled, Udder well developed, hip broad and fore – and hind quarters drooping. The tail is long reaching the fetlocks. The colour is usually jet black, with white markings on tail, and face and extremities sometimes found. The bullocks are good draught animals though slow and powerful. The average milk production per lactation is 1,500 to 2,500 kgs. and the heritability of this trait is 0.2-0.3. The age at first calving is 45 – 50 months in villages but in good herds it is 36 – 40 months in intercalving period is 450 – 500 days.

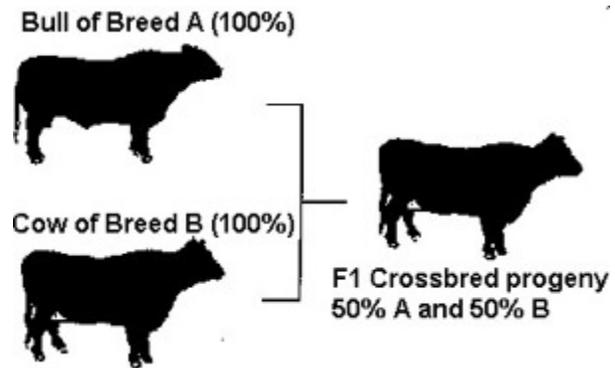
Surti : The breeds tracts of this breed is Kaira and Baroda districts of Gujarat. The body is well shaped and medium sized. The barrel is wedge shaped. The head is long with prominent eyes. The horns are sickle shaped. moderately long and flat. The back is straight and tail is fairly long. The colour is black or brown the peculiarity of breed is two white collars one round the jaw and the other at the brisket. The milk yield ranges from 900 – 1300 Kgs. The age at first calving is 40 to 50 months with an intercalving period of 400 – 500 days. The heritability of the trait is 0.2 to 0.3. the peculiarity of breed is very high fat percentage in milk (8 to 12%). The bullocks are good for light work.

**Class 5 :Breeding- importance of cross breeding. Signs of estrous cycle-Artificial insemination-merits and demerits.**

**CROSS BREEDING:**

This is mating of animals from the two different established breeds

Eg.: Jersey (b) x Kangayam (c) : Jersey (c) x Holstein Friesian (b). The cross bred animals will exhibit the mixture of qualities of both the parents breeds. The progeny will improve in production performance and will exhibit marked disease resistance characteristics of the native breed and is well adapted to with stand local climatic condition. 62.5% of exotic blood & 37.5% local blood – ideal .



Jersey x local breed.-  $F_1$ . 50% ND(c) x J (75%) + 25% ND –  $F_1$  50 J 50 ND x 100 J (B) So cross breeding is also taken up to evolve new breed.

**Age at maturity**

**Economic traits**

- 1.Age at 1<sup>st</sup> calving : Age in days of the cow or buffalo on the date of 1<sup>st</sup> calving.
2. Lactation Length : Days in milk from the date of calving to the final drying off or or cessation of milk (305 days)
3. Lactation Yield : Milk yield in Kgs from the date of calving to the date of drying (corrected to 305 days)
4. Dry period : Days from the date of drying to the date of calving
5. Inter calving period: Days from the date or one calving to the date of next calving (1<sup>st</sup>,2<sup>nd</sup> )
- 6.Peak yield : The highest daily yield in Kgs during lactation period
7. Average Fat% : Average Fat %
- 8.Service period :The interval between calving and subsequent service resulting in conception
- 9.Breeding efficiency : Measured as the No. Services/Conception

**Breeding** : Production of off springs / young ones

Scientific breeding is needed to get better performance in livestock – milk – meat – wool – Egg

**Inbreeding** : mating of closely related animals in the same breed such as brother – sister mating

ii. **parents off spring mating-** when the mates have common ancestors -with in 4 generations this results in inbreeding

Advantage : A pure line of a particular breed can be maintained

Dis advantage : Loss of vigour, size, production fertility problems

Out breeding : Mating of unrelated animals in the same breed but with no common ancestor for a minimum of 4-6 generations.

**Grading** : Grading is a form of out crossing, where in bulls of a distinct breed are bred on non descript cows from generation to generation, so that in course of time a populations essentially resembling the breed from which the Bulls are used.

Non descript cow x Jersey Bull

F<sub>1</sub> 50% ND + 50% Jersey x Jersey Bull

F<sub>2</sub> 25% ND + 75% Jersey x Jersey Bull

F<sub>3</sub> 12.5% ND + 87.5% Jersey x Jersey Bull

After 5-6 generations the off springs will have 96.9 & 98.3% of the hereditary characters of ‘Pure Breed’

So grading is a process by which a few ‘Pure Breed’ sires can rather quickly transform local variety of animals into a ‘Group’ resembling the pure breed.

Economic Traits

Particulars	Local	Exotic	Cross breed
Birth weight	20Kg	Jersey – 25-30kg. Friesian – 30-35kg.	
Age at maturity	33 Months	15 months	18-24 months
Age at 1 <sup>st</sup> calving	42 months	24 months	30 months
Lactation yield	12000 Kg.	3000-6000Kg.	2100-2400

Lactation period	180-210 Days	305 days	240 – 270 days
Dry period	90-120 days	60 days	75 days
Inter calving period	18 months	12-13 months	13-14 months

### Oestrus cycle

**Proestrus:**( 2 days) Period of building up growth of graffian Follicle which helps for the nourishment of ovum fluid contains hormone called ‘oestrogen’. It causes changes in uterus, blood supply.

**Oestrus:** ( 1 day) During which the female is ready to receive male.

**Metooestrus :**( 4 days) Implantation of the embryo takes place C.L. takes place. Prevents the growth of graffian follicle thereby arrests oestrus cycle.

**Diestrum :** ( 14 days)Further development of uterus takes place. If the animal has not conceived involution of uterus take place.

### Symptoms of Heat:

1.Off feed 2. Drop in milk yield 3. restless and excited 4. Bellowing 5. Oedema / swelling of genitalia 6. frequent utination 7. Transparent mucous discharge 8. cow/buffalo which are in heat will mount on other animals and allows mounting of other animals.

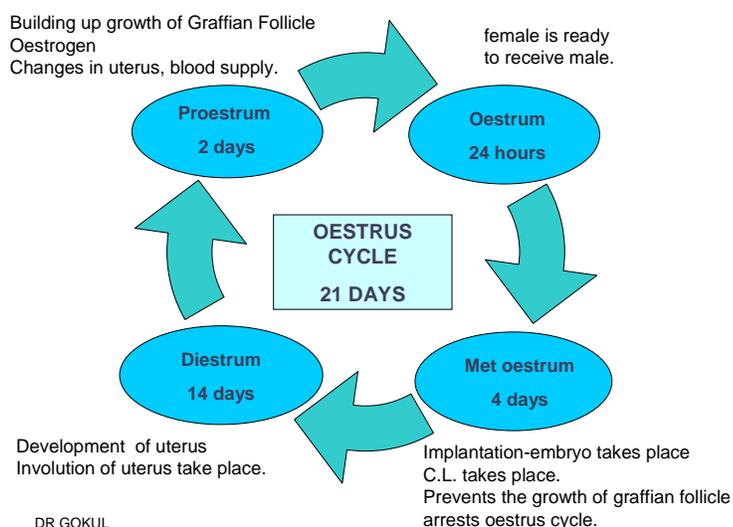
### OPTIMUM TIME FOR CROSSING

Egg/ova from ovary – released about 12-18 hours after the onset of symptoms of heat. Ovum will survive upto 16 hours after the release. Sperm live for 12-14 hours.

Morning signs of heat are exhibited – AI done in the evening : 12 hours delay.

**Proestrus :** This marks the animal – coming in heat.

GF – Ovary – growing – increased



secretion of follicular fluid – Estradiol - increase No.of Cilia – increased Vascularity of uterus  
– increase in thickness of Epithelial wall of vagina .

The vaginal wall adjustment is well filled to prevent possible damage to the wall when coitus occurs.

**Oestrum :** This is the period of desire.

‘Graffian Follicle’ – Ripe or very turgid

This period is brought to an end by the rupture of the follicle (or) ovulation. Vulva becomes swollen. Vulva and Vagina – congested

**Met Oestrum :** This is the period when the organ returns to normal non congested condition.

During this period the cavity of the GF from which ovum has been expelled becomes recognized and forms a new structure known as C.L.

1. It prevents the maturation of further graffian follicle
2. It is essential for the implantation of the fertilized egg.
3. It is intimately concerned which the development of mammary gland.

**Diestrum :** Longest part of estrus cycle

Implantation – uterine milk –for the nourishment of the embryo prior to implantation. Absence of pregnancy. – returns to normal and thus the cycle continues.

### ARTIFICIAL INSEMINATION.

Artificial insemination is the deposition of male reproductive cells (sperm) in the female tract by mechanical means rather than “Natural Service”

### ADVANTAGES :

1. Increases usefulness of superior sires to extra ordinary degree.
  2. Services of Superior Sires are greatly extended.
- If the sires are used for Natural Service the animal can serve only animals/year but under Artificial Insemination the amount of semen secreted by the animal can be used to satisfy the requirements of 1000 animals per year

### DILUTION OF SEMEN

Average of Sperm/mL : 1000 million



50-60

Total volume of semen/2 ejaculate	:6 mL
	: (i.e.) 6000 million sperms.
No. of motile Sperms	: 90 %
∴ Total number of motile sperms	: 5400 million.
Expected wastage during processing (i.e.) filling and sealing	: 10 %
Net no.of sperms available	: 5400-540= 4860
Minimum No. of sperms required / dose	: 30 Million.
∴ @ this rate no. of doses that could be prepared	: 4860 /30 = 160 doses
So, total no. of doses that can be prepared / week	: 160 x 52 weeks = 8320 doses.
Frozen semen required / dose	: 1 mL.

3.No need to maintain Breeding Bull.The frozen semen can be stored in the Liquid Nitrogen-196<sup>0</sup>C.

4.Semen can be quickly and easily transported by air to different continents.

5.Spreading of diseases is absolutely- NIL.

6.Overcomes the difficulty of size and weight between Dam and Sire.

7.Increase the rate of Conception because in the artificial insemination the semen is being deposited in the mid cervix .

8.Outstanding animals located apart can be mated.

9.Helps in better record keeping.

10.Old and heavy sizes bulls ,injured / disabled sires can be used.

#### MERITS:

1.Semen can be stored in the frozen state , so progeny can be obtained even after the transfer, WHY even after death of bull-15-20 years.( atomic, radioactive, X-ray unit)

2.Semen is expanded and no. of animal can be crossed.

3.Frozen semen can be transported to destination once in a month from the semen bank.

#### DISADVANTAGES.

1.Some bulls semen may not freeze well.



- 2.If inferior bull semen is frozen and used –Extensive damage is caused.
- 3.Maintenance of frozen semen bank is not economical for a small area of operation.
- 4.Requires well trained technical personnel's and special equipments and hygienic measures are to adapted in preparation.
- 5.Improper cleaning of instruments and unsanitary condition may lead to lower fertility and may be nucleus for the spreading of diseases.

**Class 6: Housing management-farm site selection-space requirement for calves, heifer, milch animal and work bullocks-Type design of house.**

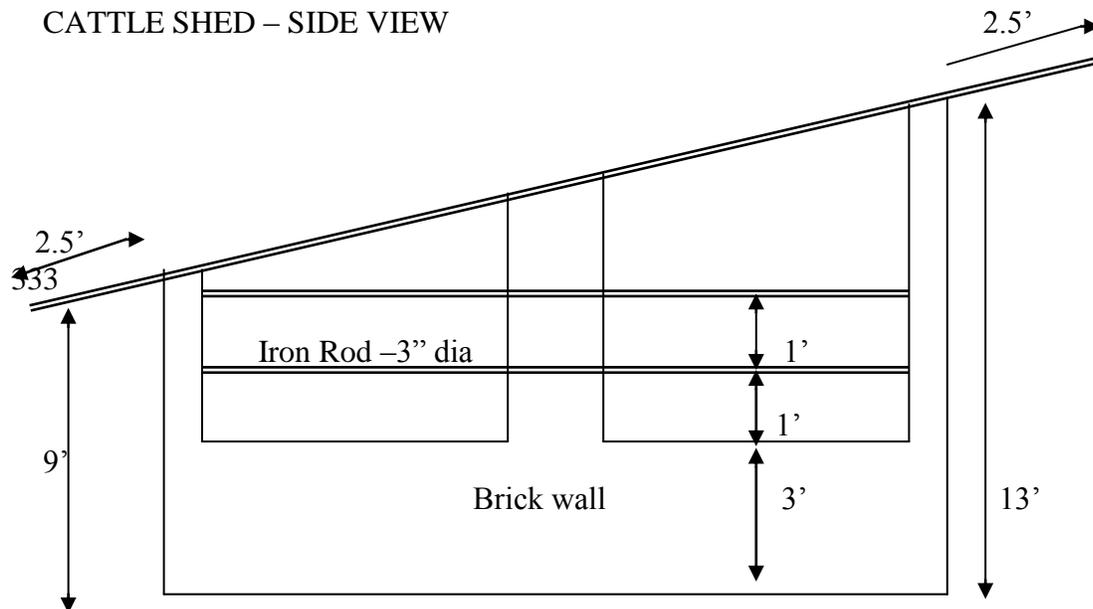
**Housing of cattle**

Housing is a essential for maintaining health, comport and protection for getting maximum production from the livestock.

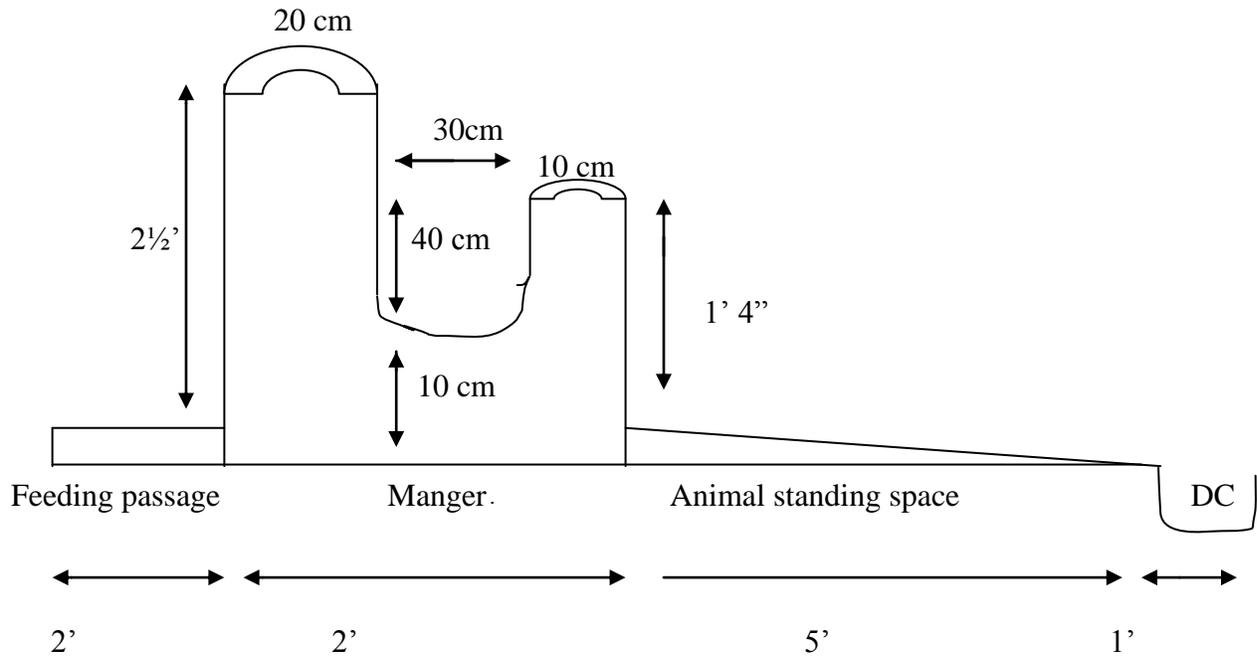
**Selection of site :**

1. Topography and Drainage
2. Soil Type
3. Water Supply
4. Accessibility
5. Labour
6. Marketing
7. Electricity
8. Ventilation
9. Theromo neutral zone
10. Miscellaneous

CATTLE SHED – SIDE VIEW



CROSS SECTION



Floor space requirement per animal

	Covered area ( m <sup>2</sup> )	Open area ( m <sup>2</sup> )
Cow	3.5	7
Buffalo	4	8
Young stock Upto 3M	1	1.5
Young stock upto 3-6M	1	2.5
Young stock >6	2	4
Pregnant Cow	4	8
Bull	12	120

Roofing material

- a. Thatched – 1. Palmyra 2. Coconut
- b. Tiles – 1. Country tails 2. Mangalore tails 3 Flat tiles.
- c. Asbestos
- d. Iron sheets
- e. Light roofing
- f. RCC



**Class 7: Systems of housing-Single row system-Double row system- head to head and tail to tail-merits and demerits.**

- Types of Housing –
1. Single row – Less than 15 animals
  2. Double row – More than 15 animals
    - a. Tail to tail system
    - b. Head to head system

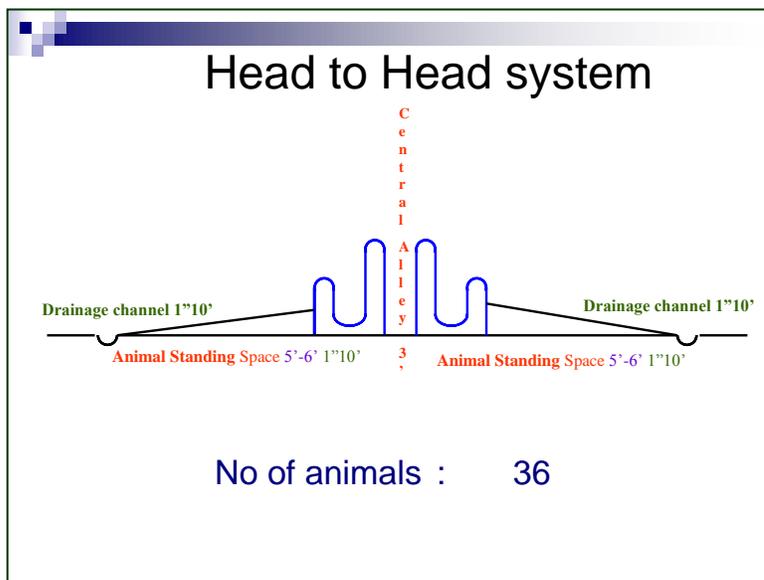
Advantages of tail to tail system

1. All animals get fresh air.
2. Spreading diseases through respiratory system is minimum
3. Supervision of animals are easy (60% of the time is being devoted on the hind quarters)
4. Cleaning is easy

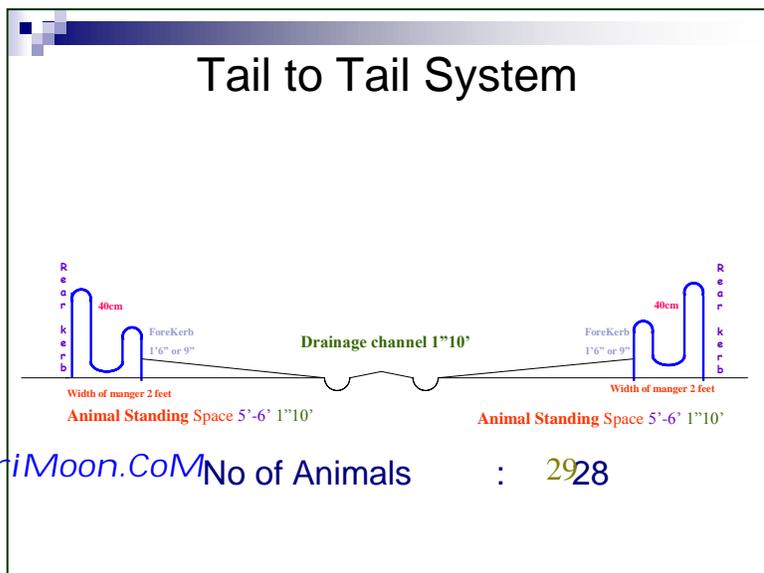
Disadvantages of tail to tail system

1. Spreading of diseases through digestive and reproductive system is high
2. Drainage channel is not exposed to sunlight.
3. Feeding of animals is laborious

Head to head system



advantages – vice versa of tail to tail



**Class 8: Care and management of new born calf and heifers.**

Care of the New-Born calf

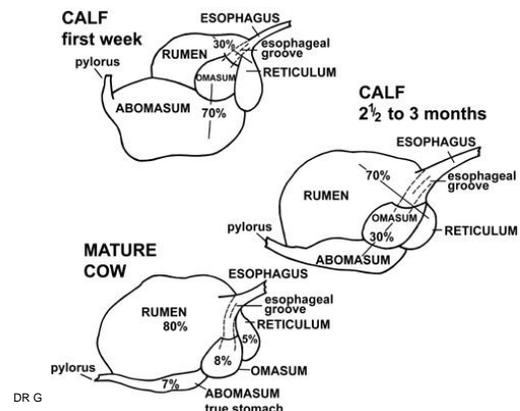
Remove the mucus from the nose and mouth and clean it. If the calf does not start breathing, artificial respiration should be used by pressing and relaxing alternatively, the chest walls with hands. Another method is to hold the calf by the rear legs and lift from the floor with the head down. This may be repeated several times and helps in restoring respiration.

As soon as the calf starts breathing, observe as to whether the navel cord is still attached. The navel cord should be disinfected. The navel cord of the calf is tied about 2.5 cm away from the body and cut about one centimetre below the ligature. Apply tincture of iodine to the cut end and repeat it 2-3 days. This will prevent infection. Then, if the cow does not lick the calf dry, or if the weather is cold, the herdsman should wipe the calf to clean and dry.

The next important step to follow is to feed the Colostrum **within 15 minutes** of calving, the calf should be fed with colostrum at the rate-  $1/10^{\text{th}}$  of body weight and buffalo calves at the rate  $-1/15^{\text{th}}$  of body weight. Colostrum containing low fat, high protein, vitamins and minerals forms a balanced feed for new-born calves. This helps to protect the calf against various diseases as it contains antibodies. Colostrum also helps to eliminate the material accumulated in the digestive tract before it was born.

**If muonium (first faecal matter)** is not voided out, mild enema by dissolving soap in a liter of warm water should be given.

Weaning: If weaning at birth is followed care should be taken to see that adequate colostrum is fed for the first 3-4 days. If weaning is practised 4 days after calving, then further ration has to be fed as per the schedule described.



Calf rearing system varies with the facilities available to farmers. They may be reared indoors or outdoors or partly indoors and partly outdoors. The important factors to be considered are:

1. Availability of quality fodder.
2. The humid tropical environment is ideal for the proliferation of internal parasites and it is very difficult to keep the calves free from massive infection if they are grazing.
3. Outside grazing may not provide sufficient nutrients from optimum growth.
4. Climatic stress affects growth and utilization of feed nutrients.

In humid tropics, it may be desirable to keep the calves indoor in day time and outdoor at night. This will reduce parasitic infection also. Thus, it is advantageous to keep new born calf in individual pen for the first 3-4 weeks of age. Calves that are running in batches often suckle or lick each other after feeding and it is a good practice to keep them in their ties for some time after milk feeding. Hair swallowed by the calves after suckling each other often form a hard ball in the abomasum and this is a constant cause of digestive disturbances. Cleaning the mouth of the calves after each milk feeding is a sanitary practice. The calf pens should provide comfort and easy cleaning.

**Identification :** This is essential for good management, especially in breeding farms. The best method of permanent identification is by tattooing the inside of the ear with indelible ink. Metal ear tags or button with letters and numbers may be inserted in the ear as a means of identification. Neck strap or neck-chain with a number plate attached, make an easy method of identification.

**Body weight:** of the calf is recorded on a balance along with length, breadth and height for the computation of milk allowance. Well fed cross bred calves on an average should gain 400 grams a day or 2.5 to 3 kilograms per week.

Removal of supernumerary teats is also important and this has to be carried out before development begins. This is usually done in the first month of age with the help of a short pair

of sterile scissors. If the extra teat is at the base of the normal teat, veterinary help may be resorted to remove it.

Dehorning or disbudding: Disbudding is carried out either by the use of hot iron, caustic sticks and electrical dehorning cone. Both the buds are destroyed at the early age (within 3 to 10 days).

Feeding Management: Utensils in which whole milk or milk replacer is fed to calves, must be clean and should be cleaned after each feeding. Severe digestive upsets can result from such contamination of the feeding parts. Either the nipple pail or the open type bucket are satisfactory for feeding milk or milk replacer. It may take less effort to teach a calf to nurse from a nipple pail than to drink from an open pail. Also, a rapid consumption of milk from an open pail may at times cause digestive upsets.

To teach a calf to drink from an open pail, place your fingers in its mouth and after it starts to nurse lower its head into a pail of warm milk or milk replacer. It may be necessary to repeat the process several times. A stubborn calf may need to be backed into a corner and restricted by standing aside its neck. Maintaining the temperature of the milk as removed from the cow is not necessary. However, it should be aimed to feed the milk at this temperature itself. However, cold milk at 35<sup>0</sup> to 40<sup>0</sup> F may cause calves to shiver and chill. At any rate, calves should not be overfed.

### **CARE AND MANAGEMENT OF HEIFERS.**

- 1.Heifers are reared indoors,outdoors- 9-12 months.
- 2.Outdoors-protection from the adverse climatic condition ,rain,hot sun, snow, heavy winds biting flies , parasitic infestation.
- 3.Exotic breeds-Heifers performance is slow in tropical areas in the out doors.
- 4.Small breeds –Age at first breeding -15 months.Large breeds-18 months.
- 5.Adequate live weight would be 200-225 kg for smaller breeds and 275 kgs for the larger breeds.

6. Cross bred heifers show signs of heat as early as 10 months of age but none of them are mated until attain the body weight of 225/275 body weight or a minimum of 14 months age.

7. Age at first calving 25-28 months.

8. Feeding of Heifers.

A. Concentrate feed :

- a. 3 months- 1 year : 1 kg.
- b. Above one year : 2 kg.
- c. Pregnant Heifers : 3-3.5 kg.

B. Green Fodder

- a. Leguminous fodder : 10 kg.
- b. Non Leguminous fodder : 25 kg.

C. Dry fodder : 3 kg.

9. Vaccination Schedule.

Brucella Strain 19 –to prevent abortion due to Brucellosis-Vaccinated at the age of 4-6 months of Calf.

Other Contagious Disease Vaccination are done accordingly prior to the prevalence of disease and prior to rainy season

Foot and Mouth disease : Once in 4 months/9 months/12 months.

Rinderpest : 1-3 years.

Haemorrhagic Septicaemia: 1 year.

Anthrax : 1 year.

Black Quarters : 1 year.

Housing : Already discussed in the housing Class.

a. Outdoor system / Grazing method                      b. Indoor method

a. Reared chiefly of grazing

1. Care to be taken not to overstock on limited grazing land.
2. Rotational grazing.
3. Arrangement of shade and drinking water – pasture land
4. Concentrate feed is to be provided – Centrally located feed trough.

5. Protect from rain.

b. Indoors

1. Management in covered area.
2. Sufficient concentrate feed and fodder provided.
2. Steaming up of heifers.

Feeding grains to pregnant heifers prior calving at 1.5 Kg. per day. It helps in their growth, bear the stress of foetus. It produces more milk after calving and increases lactation length.

Training of heifers.

Heifers in early stage should be lead with halter to make them docile.

Pregnant Heifers are to be housed along with milking cows atleast a month prior to calving.

The udder should be washed warm water and mopped with cloth to accustom her to feel the hands in this place. Just few days prior to calving pulling teats slightly may be practiced so that heifer would not excited.

Control of Parasites – Dewormed periodically – 4 – 6 months intervals

Grooming is to be practiced to avoid ecto- parasites.

**Class 9: Care and management of pregnant, lactating animals and work bullocks.**

**Care, management of Pregnant animals**

1. Identify pregnant-after A.I.-90 days
2. Provide gentle treatment
3. First quarter of gestation period are critical
4. In early stages of pregnancy disturbances can cause abortion.
5. Provide concentrate feed 3.5 kg per day.
6. Provide 25 – 35 Kg. Green fodder per day and 5 Kg. Paddy straw.
7. Minimum 45 – 60 days of dry period is essential.
8. Avoid long distance travel.
9. Avoid slippery condition in the shed.
10. Avoid chasing by dogs, bulls or children.
11. Avoid infighting between pregnant animals.
12. Separate pregnant animals from recently aborted animals or carriers of diseases like brucellosis.
13. Provide adequate clean drinking water
14. Protect against extremes of climate.

**Care and Management: Lactating animals.**

1. Protection against inclement weather.
2. Housing – Discussed earlier – space requirement.
3. Hygiene and sanitation of cattle shed and animals grooming, washing, disinfection etc.
4. Feeding a) concentrate – DM, DCP TDN b) Roughages – GF – L, NL – DF

Thumb Rule : 450 – 500 g Concentrate / Kg. milk production

DCP 15% : TDN 75% : M.33% GNC : 25% Wheat Bran : 40% Mineral Mixture : 1% Salt :  
1%

Green Fodder – 1/3 L : 2/3 NL

5. Peak yield – 6 week – ‘ca’ definition 1-1-1.3/1.18 g ca : 1.1/1.0 g ‘p’

Supplemented : Lime coat manger : ca i/v injection

6. Breeding – 60 days after calving does not come to heat – check with veterinary Doctor.
7. Artificial Insemination – Pregnancy verification – 90 days

conception delayed – 2 A.I : check – 13-14 month calf.

8. Pregnant – 45 – 60 days period.

9. Drying – withdraw concentrate : feed dry fodder : milking alternate M/E –4 days.

10. Periodical vaccination

RP, Bq, Hs, Anthrax Once in a year.

Foot and mouth – once – 4 months.

11. Isolation of pregnant animal

Gilmore (1952) reproductive efficiency

$RE = 12 \times \text{No. of calves born} / (\text{age of cot (month)} - \text{Age at 1}^{\text{st}} \text{ breeding}) + 3 \times 100$

$$= 12 \times 4 / (60-15) + 3 \times 100 = 12 \times 4 / 45 + 3 \times 100 = 100\%$$

### **Care and management of Work Bullocks**

1. 60% - 70% of time – allotted to care and management of limbs and neck.

2. Total energy required for Agrl. Sector is 44 million hp energy for both stationery and tillage.

11.8

million hp – Human source : 28.0 million hp Livestock : 4.2 mhp – electricity

80 million work animals : 70 million work bullocks : 8 million . Buffalo

3. Avoid over working the bullocks. The work should be evenly distributed in such a way that light

and heavy work are distributed evenly.

2. Protect the bullocks from rain and inclement weather exposure

3. Lean type roof on the side of farmers house.

4. Shoe the bullock properly before using them for work on hard ground.

5. The hoof should be prepared first and shoe should made to fit the natural shape of hoof.

6. Shoeing – road work – once in a month

Field work – once in two months.

7. Hooves should be hard, black and waxy

the two halves should be even. The cleft of hoof should be narrow.

8. Grooming is essential as it increases cutaneous respiration, spreads subcutaneous uniformly and parasitic infection is avoided.

9. Feeding depends of type work

1. Normal – 2-4 hours
2. Heavy - 8 hours (Ploughing, pulling loaded cart etc.)

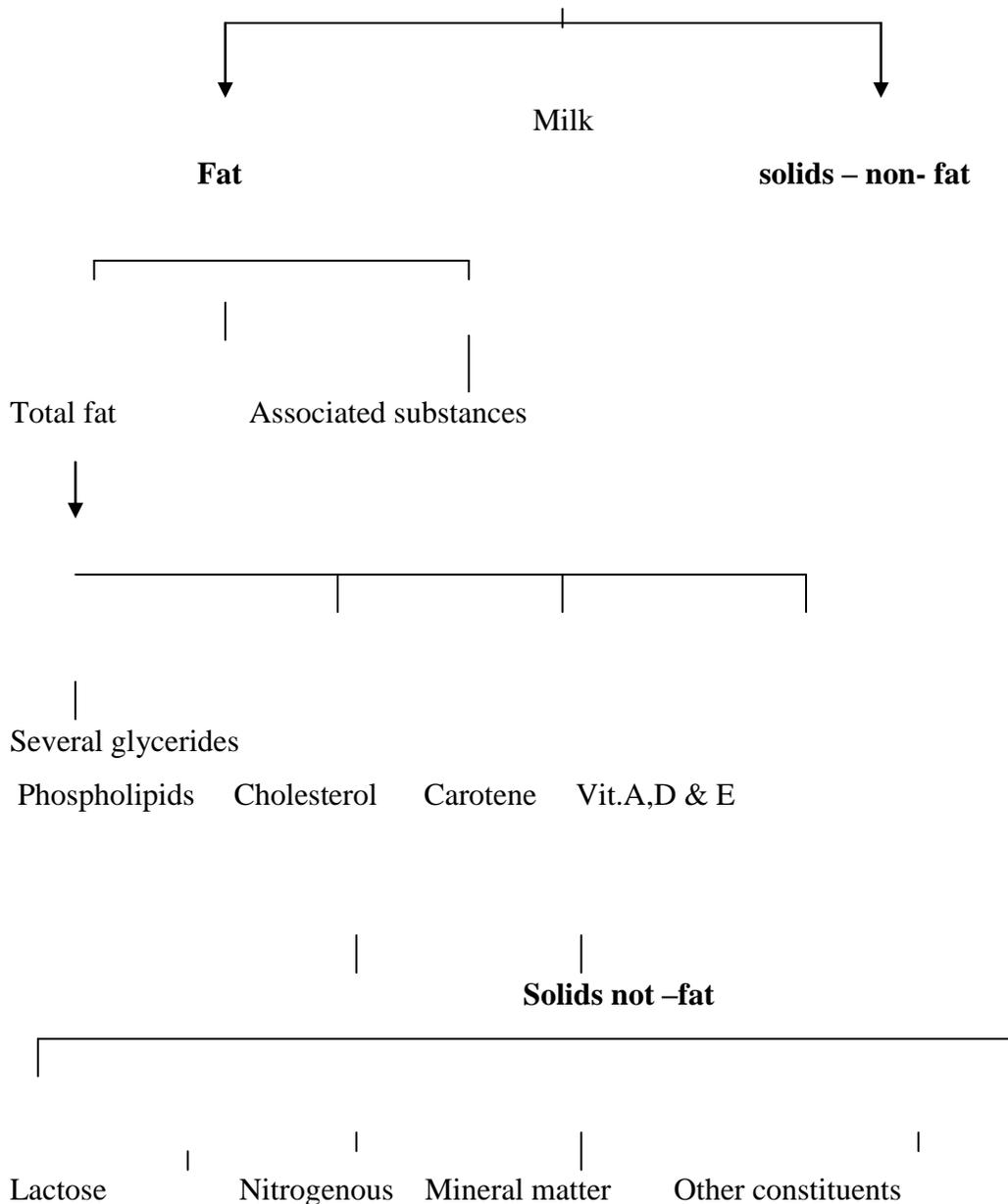
Maintenance – 1.5Kg. concentrate

Body weight	Normal work	Heavy work
300 Kg.	2 Kg.	2.5Kg.
400 Kg.	2.5 Kg.	3 Kg.
500	3	3.5

In addition 25 Kg of green and 3 to 5 Kg of dry fodder should be give.

**Class 10: Milk-Definition – clean milk production-methods of milking – hand and machine milking. Preservatives and common adulterants of milk.**

Milk is the lacteal secretion of the mammary glands of animals. It is obtained generally from the cow or the buffalo during the period following at least 72 hours after calving or until the milk is colostrum free. Milk is a white opaque fluid in which fat is present as an emulsion, protein and some mineral matters in colloidal suspension, and lactose together with some minerals and soluble proteins in true solution.



Protein	Non-protein nitrogen	Phosphates, citrates and chlorides of K,Na,Ca,Mg: traces of Cu, I Fe, chromium, cobalt, manganese Zinc.	Dissolved gases	Bacteria	Vitamin Thiamine, riboflavin, nicotinic acid, Pyridoxine, choline, folic acid pantothenic Vitamin B <sub>12</sub> , ascorbic acid.
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Average composition of milk of different mammals (in per cent)

Species	Water	Fat	Protein solids	Total	SNF	Lactose	Ash
Human	87.43	<b>3.75</b>	1.63	12.57	8.82	<b>6.98</b>	0.21
Cow	86.61	<b>4.14</b>	3.58	13.19	9.25	<b>4.96</b>	0.71
Buffalo	82.76	<b>7.38</b>	3.60	17.24	9.86	<b>5.48</b>	0.78
Goat	87.00	4.25	3.52	13.00	7.75	4.27	0.86
Sheep	80.71	7.90	5.23	19.29	11.39	4.81	0.90
Camel	87.61	5.38	2.98	12.39	7.01	3.26	0.70
Mare	89.04	1.59	2.69	10.96	9.37	6.14	0.51
Ass	89.03	2.53	2.01	10.97	8.44	6.07	0.41

Average composition of milk of some important milch breeds of cows (per cent)

Breed	Total solids	Fat	Protein	SNF	Lactose	Ash
Red Sindhi	13.66	4.90	3.42	8.76	4.81	0.70

Jersey	14.91	5.37	3.73	9.54	4.93	0.70
Friesian	12.26	3.40	3.13	8.86	4.86	0.67
Crossbred	13.13	4.50	3.37	8.63	4.92	0.67

Clean Milk production :

Both pre-and post-secretory management of milk at the farm level should be focussed upon for controlling the quality of milk. The post-secretory changes in milk are of paramount importance. Some of the vital factors responsible for good milk production that deserve immediate attention are type of farming, type of milk, impact on environment, farm waste disposal facilities, milking practices, procurement systems and inconsistent price policy and farmers' education/training programmes.

Milk once secreted becomes the target for transformation by a variety of host organisms at the farm itself. Hence, proper care must be taken regarding preservation of milk, protection of milk constituents, protection against high temperatures and natural calamity. Strict protocols are to be observed and implemented both in hand and machine milking. The microbiological quality deserves special attention for stringent export requirements for milk products in global market. The custodian of milk should never compromise on quality.

### **Rural milk collection**

In India, milk production is a subsidiary activity to agriculture in contrast with organized dairy in western countries. Farmers and landless labourers mostly maintain 1-5 milch animals. As a result, small quantities of milk are produced in a scattered manner. Milk procurement models from western countries, such as bulk cooling, bulk transportation etc. are not applicable due to this reason, under Indian conditions. Collection of small amounts of milk scattered over long distances, therefore, poses a formidable challenge in maintaining the quality attributes and keeping costs down.

A systematic approach to rural milk collection suitable for tropical climatic and techno-economic conditions prevailing under in India has been developed based on the indigenous experience gained over past few decades. In the first phase, extensive surveys are undertaken in the milk shed areas, where milk plant is to be established. The second phase involves "route planning" taking into account availability of quantities of milk, access to roads for plying vehicles and distance from the site of dairy plant. Then zones are identified, representing equal costs of collection and transportation. In the third phase, planning is done for locating the

primary collection centres as well as chilling centres, where, **milk can be cooled to 4°C** before transporting to the milk plant. Milk may be collected from individual procedures either by the contractor or by forming village level cooperative societies.

At the village level, milk brought by the individual farmers is first tested for quality. As soon as the milk supply reaches collection centres, it is weighed and a representative sample is drawn for quality grading. The common tests carried out at the point of milk collection are taste and smell, sediment, fat and SNF contents and acidity test. These quick tests generally form the basis for acceptance or rejection of milk supplied. In India it is common to pay the producer on the basis of the quantity of fat, while the minimum standard for SNF is set for accepting milk. All the milk so collected is generally filled in cans to enable transportation to the chilling centre or directly to the milk plant. Care should be exercised to bring the milk for chilling/processing within 3 hours of milking otherwise serious deterioration of milk takes place, which affects the quality of products.

Transportation :

In the Indian context, most of the milk is transported from rural collection centres to the dairy plant depending upon the volumes of milk handled.

- Cans for handling up to 2,000 litre of milk per day.
- Tankers for handling between 2,000 and 5,000 litre per day.
- Rail tankers for handling 10,000 litre or more for long distance transportation as in the National milk grid.

### **Grading of milk at collection centres**

Following criterion, based on organoleptic tests may be used for grading of milk at the rural milk collection centre.

Flavour	: 45
Sediment	: 10
Cleanliness of container and closure	: 5
Temperature	: 5°C

### **Milk reception at chilling centre**

In a distant milk plant, rurally collected milk is first brought to a common chilling centre. In view of the high ambient temperatures prevailing in the tropical climatic conditions in India, it is imperative to chill and milk to 4°C and transport it at the same temperature to the milk processing plant. The chilling centre may be operated by dairy plant directly or by the contractor, in accordance with the prevailing situations. The collection of milk from the chilling centre usually takes place once a day. At the chilling centre, milk is promptly chilled to 4°C and stored in large tanks of 2,000-10,000 litre capacity. Chilling centre operation is economical only when about 30,000 litre of milk is handled per day. It is then transported, though tankers, to dairy processing unit.

### **Following equipment are used for chilling of milk:**

Surface cooler : (Direct expansion type, ice bank and brine)-for handling up to 5,000 litre of milk.

**Plate cooler** : This is suitable for handling more than 30,000 litre of milk.

### **Grading of milk at chilling centre.**

Smell	: 45
30 MBR test	: 35
Sediment	: 10
Container/Closure	: 5
Temperature	: 5°C

Titration, clot on boiling test, alcohol test, and alcohol alizarine test may be done on suspected samples of milk for confirmation.

### **Milk reception at dairy plant**

The milk at the dairy plant is received either in cans or road/rail tankers. There are separate reception docks where milk is received through tankers and cans. Milk reception dock

is designed for unloading the cans directly on the platform. Milk cooled in cans is brought to the dairy in trucks/lorry from where the cans are unloaded onto a conveyor

The milk from each can is automatically or manually emptied into a weighing bowl, that indicates the quantity, which is recorded by the operator. The empty cans are further conveyed to can washer where they are automatically washed with detergent and hot water and steam sterilized to be made ready for next collection trip. The milk from chilling centre is usually transported in tankers to the dairy. Milk received by tanker can be measured by weight or by volume. Generally the milk from the tanker is measured by volume. A flexible line is connected between the tanker milk delivery pump and **flow meter** installed at the reception dock. The milk is pumped through the flow meter into large vertical storage tank (25,000-1,50,000 litre capacity) called '**Silo**'. The flow meter continuously indicates the volume of milk received. Alternatively, the tanker can be weighed before and after unloading to know the amount of milk received at the dairy. This is also possible by using special tanks fitted with load cells that supply electric signal, which is proportional to the weight of the tank. The weight of the contents in the tank can be recorded after all the milk is delivered. The milk is then pumped into the silo.

Preservation of raw milk.

In order to produce milk products conforming to international quality standards, it is important that the milk is collected, transported and cooled immediately under strict hygienic conditions. Ideally, all the milk reaching to the dairies should be bulk cooled.

Under tropical conditions, it would be beneficial to have access to methods, other than refrigeration, for retarding the bacterial growth in raw milk during collection and transportation to the dairy plants. However, whatever method is adopted it should not have harmful or toxicological effects. Further, the main objective of the method should be to maintain food safety and not otherwise. One of the methods, which has some merit and is worth considering, is LP system (Lactoperoxidase/thiocyanate/hydrogen peroxide system). The LP system is an indigenous anti bacterial system in milk and human saliva. The enzymes lactoperoxidase is present in cow and buffalo milk in relatively high concentrations. The anti bacterial effect of the LP system is mediated by short-lived oxidation products of thiocyanate. To activate the LP system

is milk, adequate concentrations of thiocyanate and hydrogen peroxide are added. The optimum way of applying LP activation has to be decided from case to case basis, but it is quite feasible that the required concentration of hydrogen peroxide, the thiocyanate are converted in the form of tablet which is sufficient for one can of milk. It is very important that preservation of raw milk by LP system is controlled at the society level and the individual farmers do not have direct access to such chemicals.

### **Adulteration : Adulterants in milk**

Definition : Addition or removal of legally prohibited substances from the milk with the view to increase quantity and reduce the quality to make extra profit.

Common adulterants :

1. Addition of water
2. Removal of fat.
3. Addition of starch
4. Addition of milk powder
5. Addition of carbonate and bicarbonate.

The practice of adulteration of milk is a reality. It is paradoxical that human instinct for greed so far as to touch the precious food meant to protect the health of vulnerable groups of infants, children and the elderly. Some of the known adulterants are water, salt, sugar, wheat, starch, washing soda, formalin, urea, hydrogen peroxide etc. Some are used for increasing volume and SNF content of milk while others as preservatives to extend shelf life.

### **Detection of adulterants**

Detection of water : water is a most common adulterant and its presence can be detected by testing the freezing point of milk. The official method of AOAC assumes a freezing point for normal milk of  $-0.550^{\circ}\text{C}$

$$0.55 - x_t$$

Percentage added water =  $\frac{0.55 - x_t}{0.55} \times 100$  where x is freezing point depression.

0.55

A tolerance of 3% is allowed which is equivalent to specifying a minimum freezing point depression for authentic milk of  $0.5335^{\circ}\text{C}$ . The presence of water can also be checked by the use of lactometer.

### **Detection of neutralizer in milk**

Difference in coagulation behaviors of milk in the presence of alcohol. Add 5 ml of distilled alcohol (95%) to 5 ml of milk sample, mix the contents thoroughly by shaking and observe the coagulation behaviour of the sample. Appearance of fine and uniform sized flakes indicates the presence of added neutralizers in milk whereas appearance of bigger and unevenly sized flakes indicates their absence.

### **Rosalic acid test:**

Add 4 drops of freshly prepared alcoholic solution of 1% Rosalic acid to the above mixture and mix gently. Appearance of pink colour at the junction of mixture and Rosalic acid indicates the presence of either sodium hydroxide potassium hydroxide or calcium hydroxide added to milk, and that of rose red colour indicates the presence of sodium carbonate or sodium bicarbonate. The appearance of brownish colour indicates the absence of any of these neutralizers.

This test can detect the addition of sodium hydroxide, potassium hydroxide and calcium hydroxide in milk up to 15-20 mg/100ml and sodium carbonate, sodium bicarbonate and potassium carbonate up to 25-30 mg/100ml. The higher amounts of the neutralizer can be detected from the appearance of pink rose red colour even after thorough mixing. The presence of neutralizers can also be detected by testing ash content.

### **Detection of starch:**

Place in a test tube about 3ml of well-mixed sample. Boil it by holding the tube over a flame. Allow cooling to room temperature. Add a drop of 1% iodine solution. Presence of starch is indicated by the appearance of a blue colour that disappears when the sample is boiled and reappears on cooling,

### **Detection of gelatin:**

Gelatin produces a yellow precipitate with picric acid solution. While cloudiness shows smaller amount and yellow precipitate a large amount of gelatin in milk.

**Detection of cane sugar:**

To about 15ml of milk in a test – tube add 1 milliliter of concentrated hydrochloric acid and 0.1g of resorcinol and mix. Place the tube in boiling water-bath for 5 minutes. In the presence of cane sugar red colour is produced.

**Detection of saccharin:**

Curdle an aliquot of the diluted sample (about 25ml) with dilute acetic acid. Shake well and filter. Acidify the clear filtrate with 2ml of concentrated hydrochloric acid and extract with 25ml portion of ether. Draw off adequate layers and wash the combined ether extract with 3 successive portions of 5ml of water. Evaporate the ether extract on water bath and add a drop or two of water, mix well with glass rod and taste little. Characteristic sweet taste indicates the presence of the saccharin.

**Detection of glucose or monosaccharides (Barfoed's test) :**

The reagent is prepared by dissolving 6.5 of crystallized copper acetate in 100 ml of 1% acetic acid solution. For the test heat 5ml of Barfoed's reagent in boiling water for 3 ½ minutes. Production of red precipitate of cuprous oxide indicates the presence of monosaccharides.

**Detection of sodium chloride :**

Take 2 ml of milk and add 0.1ml of 5% potassium chlorinate and 2ml of 0.1 N silver nitrate. Appearance of red precipitate indicates the presence of sodium chloride.

**Detection of urea in milk :**

Take 2ml of milk and add 2ml of p-dimethyl amino benzaldehyde reagent (1.6% in ethyl alcohol containing 10% HCl). Development of distinct yellow colour denotes the presence of urea. The pure milk samples show a faint pink colour which should be ignored due to the presence of natural urea (up to 50mg/100ml.) This test should be carried out with the control sample. A sample paper strip method has also been developed using the above principle.

**Detection of formalin:**

Take 5 ml of milk sample in test – tube and add 5ml of concentrated sulfuric acid containing traces of ferric chloride. Formation of purple ring at the junction indicates presence of formaldehyde in milk.

**Detection of hydrogen peroxide :**

The presence of hydrogen peroxide can be detected by an intense blue colour developed on addition of 2 drops of paraphenylene diamine hydrochloride to 10ml of milk.

**Detection of buffalo milk in cow milk:**

The presence of buffalo milk in cow milk can be detected by Hansa test, which is based on immunological assay. A drop of suspected milk after dilution with water (1:4) is treated with a drop of antiserum obtained by injecting buffalo milk proteins into rabbits. The characteristic precipitation reaction indicates the presence of buffalo milk.

**Detection of added colour:**

The chief colouring materials which are considered here are some natural colouring material like annatto, turmeric or coal-tar dyes. Some of these dyes are permitted only in some products. While the use of annatto is prohibited in milk, its use is permitted in butter. To detect annatto the milk fat is shaken with 2% sodium hydroxide and the mixture is poured on filter paper. The filter paper absorbs the colour, which remains even after washing with water. When the stain is treated with a drop of 40%  $\text{SnCl}_2$  and dried, a purple colour indicates the presence of annatto. Turmeric is detected when the colour aqueous or alkali, extracted is treated with HCL. The resulting orange colour is treated with  $\text{H}_3\text{BO}_3$  crystals, a red colour indicates the presence of turmeric.

Coal-tar dyes adhere to animal fibres more firmly than natural colour. The curd of pure milk is white when extracted with ether but one containing coal-tar dyes remains orange or yellow; this when treated with concentrated hydrochloric acid becomes pink.

**Detection of pulverized soap :**

Soaps are generally defined as sodium and potassium salt of fatty acid. Therefore, to detect the presence of pulverized soap, iodine value refractive index, fatty acid composition, salt ratio and ash content are excellent methods. The presence can be judged by qualitative method. For example, in 10ml milk, 10ml hot water is added followed by 1-2 drops of phenol-phathlene indicator solution. Development of pink colour indicates the presence of soap in milk.

Detection of vegetable fat:

The adulteration of vegetable fat in milk can easily be detected by the following methods. In case of synthetic milk, the fat is extracted either by Rose-Gottleib method or fat extracted in butyro-meter can also be used.

- Fatty acid composition : Milk fat is characterized by lower chain fatty acids. for example butric capric, capralic, etc. whereas most of the vegetable fats do not contain these fatty acids. Therefore, the adulteration of the vegetable fat can easily be detected by analyzing the fatty acid profile by gas chromatography.
- Detection by measuring different physico-chemical properties: The adulteration of vegetable fat can also be detected by measuring various physico-chemical properties. For example, refractive index, RM and Polenske values iodine value. etc.
- Hydrogenated vegetable oils like vanaspati is a common adulterant in milk fat. Its presence in milk fat can be detected by the fact that sesame oil is added in vanaspati as per the law. The presence of sesame oil can be tested by Baudoin test.

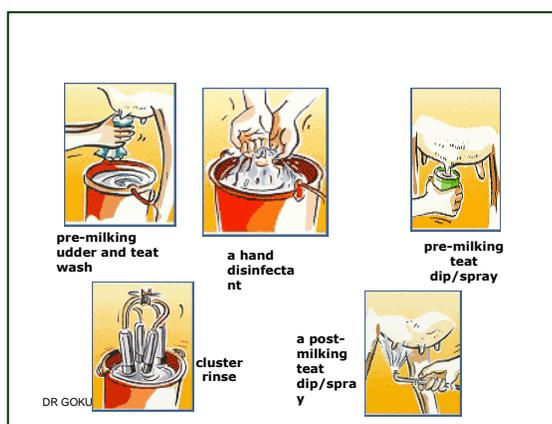
Detection of adulteration by using kits: with the advancement in analytical chemistry, several test kits for testing chemical adulterants antibiotic residues, aflatoxins, pesticides, etc have been developed. In India, The National dairy Research Institute, Karnal, and Central Food Technological Research Institute, Mysore, have developed rapid detection kits for chemical adulterants and environmental contaminants respectively. Similarly for detection of mastitis, simple strip test has been developed and is being used under field conditions. Further, M/s Gist-brocades. The Netherlands, have developed Delvotest Kit for testing presence of antibiotics and sulphur residues in milk.

**Preservatives:**

For testing of samples it is essential milk must be kept sweet (without decomposition) while the sample is being assembled. This is accomplished by use of a preservative. It is a good plan to place the preservative in the empty bottle before milk is added. A wide-mouthed glass bottle with a rubber stopper has been found to be the most reliable and practical container for keeping composite samples of milk or cream. The common preservatives used are; (i) Mercuric chloride or corrosive sublimate. This is very poisonous. It may be added in the form of tablets, which are coloured (usually bright red) to prevent the milk being mistaken for food. (ii) Formalin. This is a 40 per cent solution of formaldehyde. Being in liquid form, it is very convenient to handle. However, it interferes with the fat test. (iii) Potassium dichromate. This is not as effective as the above two, but it is easy to handle in dairy plants because it is available in tablet form.

### Clean milk production :

**Definition :** Milk is defined as whole, clean lacteal secretion – complete milking healthy milch animals excluding that obtained 15 days before or 5 days after calving and containing prescribed % of fat SNF.



fresh,  
of  
and

### Clean milk:

#### Advantages :

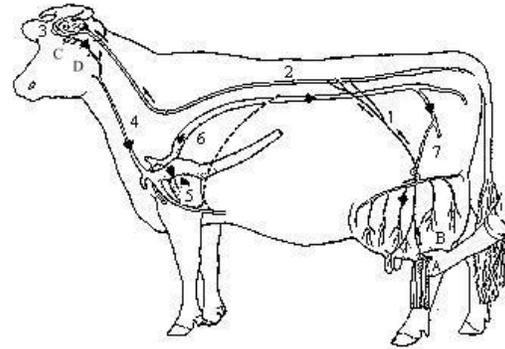
1. Protects the health of calves
2. Protects the health of consumers especially infants, growing children and aged people.
3. The cleaner the milk longer in its keeping quality and flavour.
4. Consumer will demand milk when confidence is developed on its wholesomeness.
5. Sour and off flavoured milk – not readily marketable

#### Disadvantages.

1. Keeping quality of milk is poor.
2. Nucleus for spreading of diseases-sore throat, brucellosis.
3. Health of the calves are affected – chances for increased calf mortality.
4. Disposal of poor milk is difficult.

### **PRINCIPLES OF MILKING**

Milking is defined as the critical and laborious process which involves hormonal reflex. The art of milking performed within 5-8 minutes. Normally milking is done twice a day.



The cattle and buffaloes are exclusively maintained for milk production. Though the primary objective is to produce milk, the amount of milk produced by the indigenous breeds are very low compared to the amount of milk secreted by the exotic animal which are very high and which is more and above the requirement of calf. If the calf is allowed to suckle the complete quantity of milk it leads to digestive disturbances, enteritis, etc., usually milk is fed to calves depending upon the body weight of the calf the rate of 1/10 of the body weight during first week and 1/15 the body weight during the second week.

Though milking is a laborious process, under present circumstances new innovation has been made to extract the milk from the udder. They are said to be mechanical milkers or milking machines. The pulsation and intermittent vacuum and pressure are basic concepts of the milking machines. The advantages of the milking machines are that a large quantity of milk can be harvested in a shorter duration with the help of unskilled personnel. The major portion of the work of a dairy man is from milking to disposal of the milk. Nearly 65% of the time is to be devoted for the management in connection with milking and marketing of milk.

### **PRINCIPLES OF REMOVING MILK:**

### **3 PRINCIPLES**

1. Natural Technique (calf suckling)
2. Manual Technique (hand milking)
3. Mechanical Technique (machine milking)

#### **Natural Technique:**

This method calf is able to draw the milk from the udder. To extract the milk the calf presses the teat with the tongue and pallet on the other side. The tongue encircles the teat and vacuum is created in the mouth by separating the jaws and retracting the tongue nearly 100-200 alternating cycles may be observed per minute. A calf's suckling is the best method of evacuating the milk with least damage to the delicate tissue of mammary gland .The art of milking is a cycle

#### **1. Active Phase**

#### **2. Restive Phase**

#### **ACTIVE PHASE:**

- a) Creation of vacuum in the teat canal
- b) Pressure is applied over the teat canal
- c) The base of the teat is apparently occluded with the help of the tip of the tongue with the idea to prevent the back flow of the milk into the gland cistern when the pressure is applied which is followed by restive phase

#### **RESTIVE PHASE:**

At this stage 20mm Hg pressure is created at the teat end .in the phase both active and restive phase are alternated and it has been scientifically proved that the amount of pressure applied over the teat canal by calf is 535mm Hg pressure whereas in the case of hand milking the pressure is 310mm of Hg.

In the mechanical milking pressure on the teat is with the range of 350 mm-400mm Hg. In the case of buffalos 400mm of Hg of pressure is applied but in the case of cattle it can be restricted to 360-380mm of Hg .It has been proved that cycling rate during nursing is twice as fast as hand or machine milking .Thus the difference along with increased cycling rate facilitates and explains the removal of milk from the udder at a faster rate by a calf when compared to hand or machine milking

Hand milking: It is commonly practiced in the harvesting of milk. In order of milking of various teats also differ.

1. Teats crosswise left four and right hind or right four and left hind.
2. Fore quarters teat together
3. Hind quarters teat together
4. Teats appearing more distended should be milked first. The milk should only be squeezed and not drawn

### **STRIP CUP:**

It is a device with four circular plates for each quarter which has the quantity of milk normally first few strip of milk are drawn in the respective circles to assess the physiological status of the udder. If there is any change in color, consistency appearance, etc., the milk should be drawn at the end so as to prevent spreading the disease from one quarter to other.

Prevention of Kicking of the cow:

1. Application of milk man's rope.
2. Anti cow kicker.

### **METHODS OF MANUAL MILKING.**

1. Fisting 2. Knuckling, 3. Stripping

**1. FISTING.** In this method the whole teat is held first with the thumb and the index finger encircling the base of the teat. The base of the teat is closed by the ring formed by the finger, so that the milk that is trapped in the teat canal cannot slip back into the gland cistern. Simultaneously the teat is squeezed between the hollow of the palm and with the middle, ring and index finger. The process is repeated in succession. It is the best method of hand milking though most of the milkmen follow knuckling method.



### **2. KNUCKLING METHOD**

Many milkers tend to bend their thumb against the teat canal and drag the milk out. This practice should be avoided as it is injurious to the teat.

### **3. STRIPPING**

This method is followed where the length of the teat is small; it is normally practiced towards the end of milking in order to evacuate the milk completely. The last drawn milk is called stripping which is rich in fat content. The process of stripping should be done in quick succession otherwise the animal will become stripper where the letting down of milk is delayed.

### **TYPES OF HAND MILKING**

#### ***1. DRY AND 2. WET***

In most of the place wet milking is practiced. The milkman moistens the hand with certain type of emollients like castor oil, or few strips of milk or even their own saliva. This should be avoided for the sake of cleanliness. If wet milking is practiced, the teats will look harsh and there is every possibility of development of cracks. Both the hands can be used for milking in continuous milking. The maximum flow of milk from the udder is usually referred to a letting down and it is a highly inherited character, cows possessing a teat with a small orifice is very difficult for milking and there is leaking teat when the teats are pressed. Both the narrow orifice and leaky teat animals are to be culled.

### **FREQUENCY OF MILKING:**

It depends upon quantity of milk yield. Under normal circumstances the quantity of milk is less than 10 litres/day – 2 times milking is followed when more than 10 litres three times milking is followed. It has been observed and proved that three times milking improves milking 10-15%. The factors that are to be considered during milking.

1. Avoid excitement of the animal during and prior to milking. If the animal is excited then there is release of adrenaline and it will cause vasoconstriction.
2. Prepare and collect all the milking equipments prior to milking.
3. Milking operation should be continuous one.
4. As far as possible exact time of milking is to be followed.
5. Prepare the cow for milking.
6. Complete the milking within 5-7 minutes.
7. Use both hands for milking.
8. Use correct method and type of milking.

9. Weaned animals should not be milked with the calves nearby.
  10. Provide concentrate mixture at the time of milking.
  11. Remove the first few stripping for any possible abnormalities of milk.
  12. Group the animals 2 hours prior to milking.
2. More than one milkman should milk a cow during the lactation so that any change in milkman will not affect / cause any problem in milking especially in the letting down process of lactating animals.

#### **MACHINE MILKING:**

A calf and the machine do the harvesting of milk in a similar fashion. The function of the tongue, dental pallet and jaw movement of the calf is done by the inflation tube, pulsator and vacuum pump. Milk removal is largely dependent upon the differential pressure across the teat canal. The total differential pressure created by the milking machine is approximately 352 mmHg, in the case of cattle and 400 mm Hg.in the case of buffaloes. The pressure facilitates the expulsion of milk from the canal.

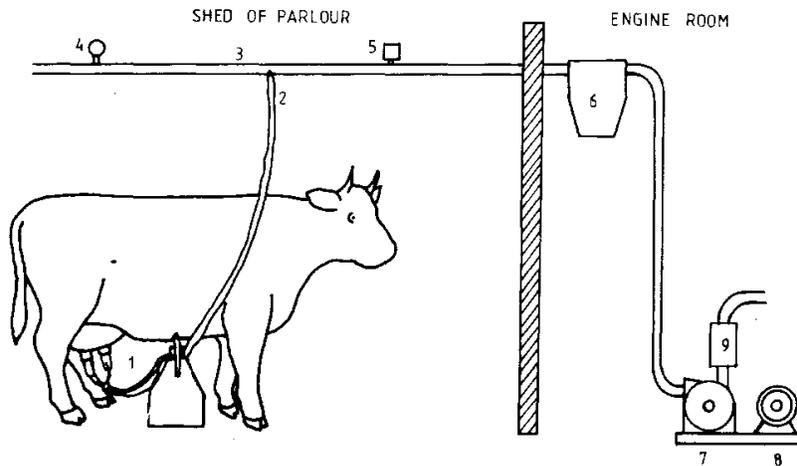
#### **MERITS.**

1. Easy method of extracting milk.
2. Does not require any skill.
3. Keeping quality of milk is high.
4. Chances of spreading of disease of the milk man to udder through milk are negligible.
5. Time consumed is less. One or two animals can be milked simultaneously and the maximum of eight animals can be milked at a time.

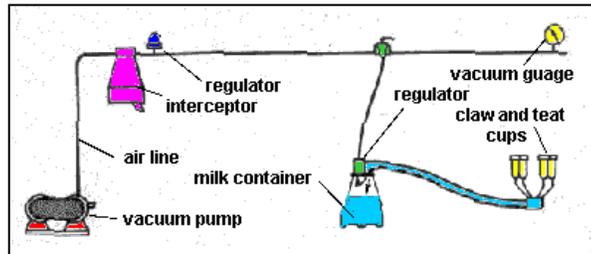
#### **DEMERITS:**

1. Cost is high
2. electricity is essential.

One milking machine for – 10 animals yielding 10 litres / day will be economical to maintain.



- |   |                 |
|---|-----------------|
| 1 Milking Unit with Bucket and Pulsator | 6 Moisture Trap |
| 2 Vacuum Tube                           | 7 Pump          |
| 3 Vacuum Pipe Line                      | 8 Motor         |
| 4 Vacuum Gauge                          | 9 Silencer      |
| 5 Vacuum Regulator                      |                 |



**Class 11: Processing of milk-Cooling-Pasteurization-Definition-Various methods-Low Temperature Long Time, High Temperature Short Time and Ultra High Temperature-advantages and disadvantages.**

Thermal processing :

The main purpose of heat treatment of milk is to render it safe for human consumption and to enhance its shelf life. Thermal processing is an integral part of all operations/processes of milk and milk products manufacturing units. The common pathogenic organisms likely to occur in milk are killed by relatively mild heat treatment. The most resistant organism is the *Bacillus tuberculosis* and hence has been made as index organism to achieve complete safety of milk. Any heat treatment, which may destroy this organism, can be relied upon to destroy all other pathogens in milk. The thermal death of such pathogenic organisms like Tubercle bacilli, Typhus and Coliform bacteria of such pathogenic organisms like Tubercle bacilli, Typhus and Coliform bacteria and **Coxiella burnettie (Q fever organism)** has made the basis for time-temperature combinations is also a matter of optimization where both microbiological effects and quality aspects must be taken into account. Various categories of heat.

**Different categories of heat treatment.**

Treatments	Process	Temperature (°C)	Time(seconds)
Pasteurization	LTLT	63	1800
-	HTST(milk)	72	15-20
-	HTST(cream)	>80	15
Thermization	-	57-68	15
Sterilization	-	115-121	180-780
Ultra-pasteurization	-	115-130	2-4
UHT	-	135-150	1-6

Pasteurization :

**It is the process of heating every particle of milk or milk products, in properly designed and operated equipment to specified temperature and holding at that temperature for specified period of time followed by immediate cooling and storing at low temperatures.** Pasteurization can be achieved either by holding method (batch process) or continuous process. Under batch process the milk is heated to 63°C for 30 minutes in a double-jacketed vat. Heating and cooling is done by spraying or circulating hot water /steam of chilled water between the inner and outer jacket of the vessel. The milk is kept gently agitated mechanically to ensure uniform heating/cooling. The process is called **low temperature long time (LTLT) method**. This method is suitable for small quantities ranging from 200-1000 litre requiring low initial cost of equipment.

**High temperature short time (HTST) treatment for pasteurization** of milk refers to heating every particle of milk in a continuous flow to a minimum of 72°C for at least 15 seconds followed by immediate cooling to 4°C. The entire process is automated and is ideal for large scale handling of 5,000 lph or higher. The complete process of preheating, heating, holding, pre-cooling and chilling is completed in a plate type heat exchanger mounted on a compact frame with inter connected sections to make the process continuous. The heat exchanger plates are so designed as to prevent mixing of thin channels of product and heating/cooling medium by separating the plates with rubber gaskets. The complete equipment consisting of four sections is called pasteurizer. Each section consists of varying numbers of plates depending on equipment capacity. The raw cold milk (4-5°C) from balance tank enters the pre-heating/pre-cooling (regeneration) section, where hot pasteurized milk (72°C) flows counter current to the raw cold milk, within adjacent plates, thereby, transferring heat for pre-heating of raw milk and pre-cooling of pasteurized milk resulting in energy saving. The pre-heated milk then enters the heating section where it is heated to a temperature of 72°C, using hot water or steam, passes to holding section where the temperature of milk is maintained for specified period of time (15 seconds) until it leaves the section. A flow diversion valve is placed at the outlet of holding section that senses the temperature and accordingly diverts the milk either forward or returns to balance tank if not properly heated. The pasteurized milk thus passes to regeneration section followed by cooling section where it is chilled using chilled water or glycol solution as a coolant.



### **Thermization**

This process consists of heating milk below pasteurization temperature to temporarily inhibit bacterial growth. The process is useful where it is not possible to immediately pasteurize all the milk and some of the milk needs to be stored for hours/days before further processing. The milk is heated to 63-65°C for 15 seconds and rapidly chilled to 4°C or below to prevent aerobic spore forming bacteria from multiplying after thermization. Thermization has a favourable effect on spore forming bacteria to revert to vegetative state which are destroyed upon subsequent pasteurization.

### **Ultra –pasteurization.**

Its objective is to enhance or extend the shelf life of the product (milk) by 15 – 30 days. The fundamental principle is to reduce main causes of reinfection of the product during processing and packaging. This is achieved by heating milk to 115-130°C for 2-4 seconds and cooling it to below 4°C. This requires an extremely high level of hygienic practices to be followed during production and maintenance of temperature lower than 4°C during distribution of such products. Ultra pasteurized products are packed in pre-sterilized containers aseptically and held refrigerated to achieve extended shelf life.

### **Ultra-high temperature treatment (UHT)**

It is a technique for preserving liquid food products by exposing them for brief intense heating. In short the process is termed as UHT treatment. The heating temperature normally ranges from 135-150°C for 1-6 seconds. The process is continuous which takes place in a closed system that prevents the product from being contaminated by air-borne microorganisms. The product passes through heating and cooling stages in quick succession followed by aseptic filling as an integral part of the process. There exist two methods of UHT treatment: indirect heating and cooling in heat exchangers and direct heating by steam injection or infusion of milk with steam and cooling by expansion under vacuum. UHT-treated products are packed aseptically in specially designed multilayer containers, and can be stored at room temperature for an extended period of time (2-6 months) without bacterial growth.

**Sterilization :**

In this process milk or condensed milk packed in clean containers is usually subjected to high temperature (115-120°C) for 20-30 minutes. The containers may be tin cans (200-400 g capacity) for evaporated/sweetened condensed milk or glass bottle for milk. The process of heating and partial cooling is achieved in a rotary autoclave for batch production or hydrostatic tower for continuous production. In container sterilization is the original form of sterilization and is still used.

**Microwave heating :**

It is a novel method of heating, which greatly reduces the effect of heat penetration lag associate with traditional process of convection or conduction. Microwaves form part of the electromagnetic spectrum (frequency range 915 and 2450 MHz). The heating effect is achieved by transfer of energy to a dipole (in water) within the product. The constant movement of dipole due to oscillation of molecules generate heat. The high temperature produced in are of high water concentration transfer heat to other areas of food not absorbing microwave energy so well. Microwave absorption is inversely proportional to the penetration depth as a function of water content, salt content and temperature. During microwave heating temperatures at the surface, are often lower due to evaporative cooling than at the centre of the product. Conduction effects are only the means of leveling out the temperature imbalance due to microwave heating, Microwave absorption characteristics change with change in physical phase of the product. In frozen state molecules are less free to move and therefore less able to interact with electrical field. As the product melts the areas of water and dissolved salts appear which absorb microwaves rapidly.

**Keeping quality of milk – treatment of milk – pasteurization different types – preservation and storage**

Keeping quality of milk is influenced mainly by clean milk production and type of milking – mechanical-high, manual-low.

Bacteriological standard milk raw milk. (standard plat count / ml.)

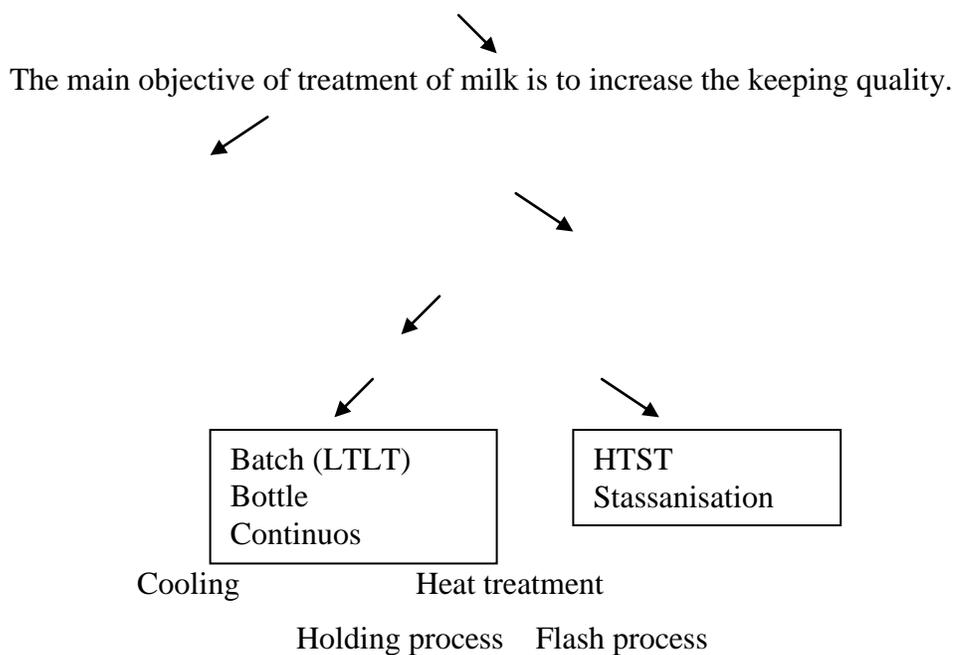
1. spc - not exceeding 2 lacs. very good

- 2 .2 – 10 lacs. – good
- 3. Bet 10-50 lacs fair
- 4. > 50 lacs poor

Pasteurized milk – spc should not exceed 30,000

COB (Clot on boiling test) to determine the heat stability.

### Treatment of Milk



Importance : Milk contains some micro organism when drawn from the udder, that number increases during subsequent handling. The common milk microorganisms grow best between 20 and 40°C bacteriological growth is invariably accompanied by deterioration in market quality due to development of off flavour acidity etc. One method of preserving milk is by prompt cooling to a low temperature.

The term pasteurization has been coined after the name of Louis Pasteur of France (1860-4) who demonstrated that heating wine at 122 to 140°F (50 - 60°C) killed the spoilage organism and helped in its preservation. Although Louis Pasteur pioneered studies of heat treatment for preservation, **pasteurization of milk was attributed to Dr.Soxhlet of Germany in 1888.**

### **EFFECT OF TEMPERATURE ON BACTERIAL MULTIPLICATION**

Effect of storage temperature on bacterial growth in milk

Milk held for 18 hrs at Temperature °C	Bacterial growth Factor *
0	1.00
5	1.05
10	1.80
15	10.00
20	200.00
25	1,20,000.00

\* Multiply initial count with this factor to get final count

### **Pasteurization of Milk**

Louis Pasteur found heating the wine to 140°F (60°C) greatly improved keeping quality by destroying most of the bacteria.

Pasteurization is the processing of exposing the milk to a controlled temperature for a specific time with the object of destroying all the pathogenic bacteria and cooling the milk immediately to a temperature low enough to retard the growth of the surviving bacteria 161°F for 15 seconds and rapidly cooling to 50°F sufficient to kill the most common disease producing bacteria .

Advantages :

1. Pasteurization renders milk safe for consumption

2. It destroys all the common disease producing organism eg. TB, Typhoid, Diptheria, etc. which may be present in milk.
3. Pasteurization destroys approximately 99% of all bacteria and most of the yeast and moulds.
4. Keeping quality is improved facilitating easy transport of milk over long distances.
5. Pasteurized milk or cream – desired type of ripening can be obtained more effectively.
6. Pasteurization eliminates undesirable taints from milk.
7. Products prepared from Pasteurization milk are of more uniform quality.
8. Natural flavour of milk is not affected by Pasteurization.
9. Pasteurization destroys lipase enzyme / which is responsible for rancidity of milk .

### **Objections to Pasteurization**

- a) Organisms developing in Pasteurized milk form harmful products. streptococcus theremophilus, S.liquifaciess and M.candidus varian and M.Luteus.
- b) Infants do not develop so well on Pasteurized as on raw milk
- c) Products of bacterial growth are not destroyed.
- d) Pasteurization may be used to mask dirty milk.
- e) Pasteurization bring about chemical changes in milk. Cause ppt. of ca and Phosporus
- f) Pasteurization - partial destruction of vit.E and K, vit.C is destroyed varying degree dependent on the system.

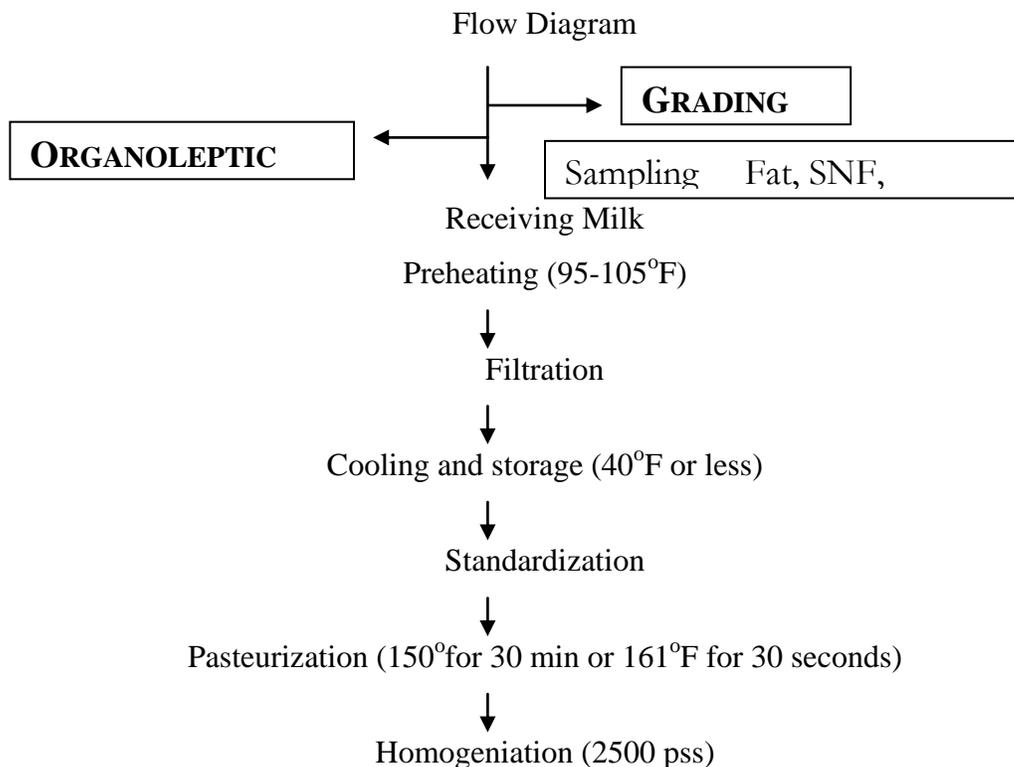
**Holding process:** Low temperature long time (LTLT method milk is heated to 150°F and is held at that temperature for 30 minutes then it is cooled to a temperature not more than 50°C.

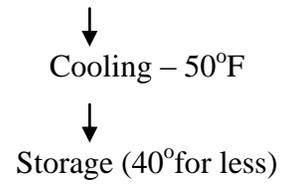
### **Flash Pasteurization**

1. Milk is heated to 161°F held for 15 sec.
2. Plate heat exchanger is the most widely used.
3. It includes a section of regenerative heating and cooling followed by final heating and cooling.
4. From the balance tank milk is sucked under slight vaccum through regenative section – 120-130°F by the hot Pasteurization milk flowing in pipeline.

5. The partially heated milk then is pumped thro final heating section under 10 lbs pressure, where it is heated to the required temperature by hot water at temperature 2 to 3°F higher then final temperature.
6. Final heating section- the pasteurized milk passes through a holding tube of such capacity that the holding time is not less then 15 sec. and then regenerative section where it is partially cooled and final cooling.

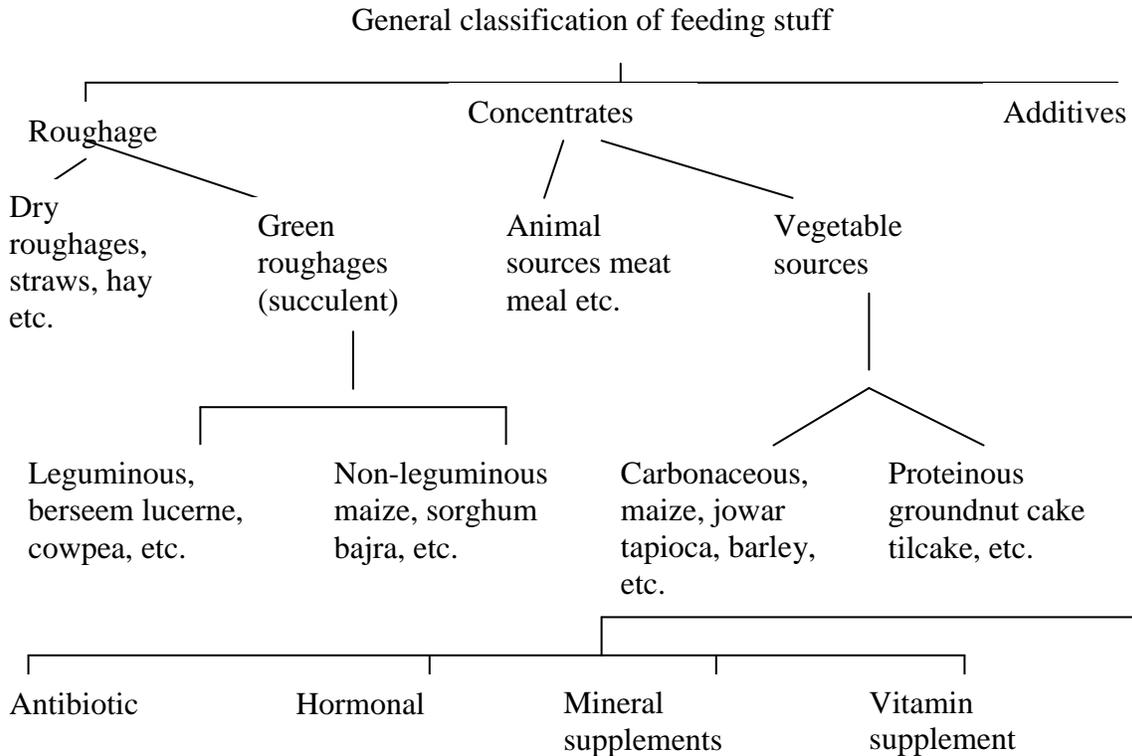
Stassanisation : The milk is heated to about 165°F for 7seconds under slight pressure in a thin layer between two heated surface (in order that all carbonic acid may be returned) the process is carried out in a tubular heat exchanger consisting 3 concentrate tubes by passing milk between two water heated pipes thro narrow space of 0.6 to 0.8 mm. It is claimed that there is practically no milk stone formation, less destruction of vitamins, no evaporation of milk and more economy in steam utilization than in conventional pasteurization. This device was invented on Dr.Henre Stassano. Adv.Easy cleaning.





HTST : This was 1<sup>st</sup> developed by A.P.V. Co., in the U.K. 1922.

**Class 12: Nutrition-Definition-Ration-Balanced ration-Desirable characteristics of a ration.**



Nutrition involves various chemical reaction and physiological process which transforms Food into body tissue ( milk, meat, egg, wool )and activities (Work power).Nutrition involves ingestion, digestion, and absorption of the various Nutrients and their transport to all the body cell and the removal of unusable elements and waste products of Metabolism.

Nutrients are defined as the substances which can sustain or aids in the support of the life. Lavoiser-French Scientist is referred as father of Nutrition. There are two aspects in Animal Nutrition

1. Science of Nutrition – It is the work of Animal Nutritionist
2. Art of feeding of animals.- Good stockman ship.

**RATION :**

is the feed allowed for a given animal during a day of 24 Hours.

**Balanced Ration.**

Balanced ration which provides essential nutrients to the animals in such proportion and amount that are required for the proper nourishment of the particular animal.

S.No.	Concentrate	Roughages
1.	10 % Moisture and 90% Dry matter	Dry fodder--10 % Moisture and 90%

		Dry matter Green Fodder---80-90 % Moisture and 10% Dry Matter
2.	Highly Digestible	Comparatively less digestible
3.	Crude fibre less than 18%	More than 18%
4.	Nutritive Value/unit mass is high	Low
5.	Compact in Nature	Bulky
6.	Keeping quality -High	Variable : Dry Fodder – High, Green fodder- Less/low

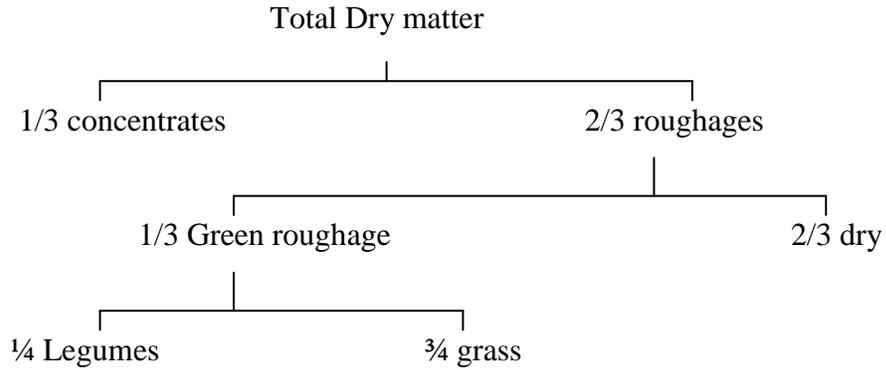
**Desirable Characters of a ration.**

1. Liberal feeding ; Satisfy all the physiological status +waste in preparation+Feeding.NOT over feeding-Doubly Wasteful.
2. Individual Feeding : Avoid Competition ; adequate –individual feeding is always better.
3. Properly Balance : Concentrate; Roughage. a. green fodder i. Leguminous and Non Leguminous  
fodder. b. Dry fodder.
4. Palatable & Variety : Better and balanced mixture of protein, vitamins and other nutrients.
5. Good and Sound : Low quality-unwholesome ingredients, may contain toxic components-poor  
quality –reduce feed value.
6. Mineral Mixture : Every Kg milk- 0.7%.-Deficit –depletion cause metabolic disease. milk contains eg. Ca 3 g and 2.7 g in milk and 3 grams in egg shell.
7. Laxative : otherwise food will be incompletely digested constipation-digestive disorder-utilistion  
–nutrients affected-reduction in production.
8. Bulky : Capacious and satiety .
9. Green Fodder : Source of vitamin-‘A’-reproduction-Bulky- laxative-cost wise cheap-unidentified  
factors-easily digestible.
- 10.Avoid change in the diet: Bacterial digestion-Prevalence of specified species-sudden change –

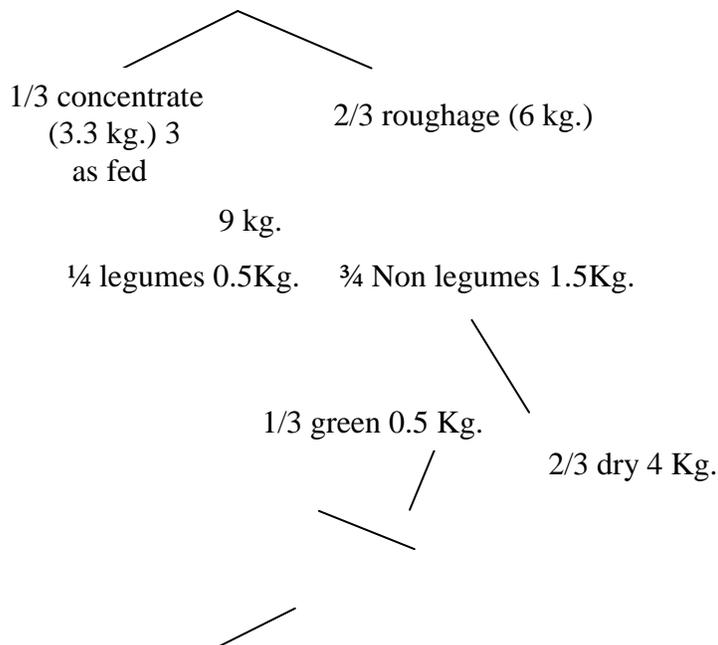
11. Maintain regularity : Glandular Secretion-essential for digestion.

12. Properly Prepared : Hard grain-Coarsely ground-Cottonseed soaked-coarse fodder – chaffed-sprinkled salt-molasses-increases consumption.

13. Labour and cost ; ultimate –aim-profit ; 70 % cost of production is attributed to feeding of animals.



Eg. 400 Kg. B.weight      2 – 2.5 % Bwt. – x-9 (8-10)



**Class 13: Requirement and importance of green fodder, carrying capacity and forage cycle.**

**IMPORTANCE OF GREEN FODDER**

Animals as well as man, could not exist were it not plants, and among them are GRASSES, the most useful of all plants.

Green fodder is the primary only source of vit A for lactation

vit 'A' is present in the form of precursor.

Req. of vit A -50 I.U/live wt M : 87 I.U(M+P)

→Maintenance & function of the mucous membrane

→ is directly related to vision.

→ is essential reproduction a. conception, b. early embryonic mortality, c. maintenance of pregnancy, d. shedding of placenta.

→ is essential for the respiratory tract

→ is essential in the Gastro intestinal tract/ digestive tract-deficiency causes diarrhoea, mal absorption of nutrients etc.,

→ is essential for the urinary tract –deficiency causes stones in the kidney, ureter, bladder.

→ During lactation 2000 I.U. of Vitamin 'A' is eliminated in every litre of milk-It is to replenished

→ laxative in action

→ cheap source of Vitamin 'A'

→ source of minerals, Crude protein, Total digestible nutrients and dry matter

→ unidentified factors.

Carotene Content of some fodder

- a. Agathi 18.3 mg / 100 dry matter
- b. Lucerne 15.6 mg / 100 dry matter
- c. Guinea grass-14.2 mg / 100 dry matter
- d. Desmodium 7.09 mg / 100 dry matter

Feed should be available to cows at least 20 hours / day.

Feed at least 60 % of ration during night in the hot weather (Summer)

Cows → reduce feed intake by about 3.3% for every 2.2 rise in temperature over 24<sup>0</sup> C

High producing cows will eat up to 12 meals / day each averaging 23 minutes.

First calf Heifers will spend 10 to 15 % more time eating time when compared to old cows

Water should be available At libitum.

## **IMPORTANCE OF GREEN FODDER PRODUCTION**

### INTRODUCTION

Green forages have cooling effect on the animal body, more palatable contain easily digestible nutrients, provide fresh effectively utilizable nutrients in natural form and slightly laxative. The use of concentrates no doubt will give the greatest animal production per unit feed intake, but this may not be economical in countries like India where grains and concentrates are costly and/or in short supply. On the other hand animals yielding as high as 8 litres of milk can easily be maintained solely on green fodder without any concentrate. But unfortunately only 6.9 million ha or 4.4% of the country's area is under fodder cultivation and hardly any scope for further expansion because of pressure on agriculture land for food and cash crops.

India has about 15% of world livestock population with only 2% of world's geographical area. The projected green and dry fodder requirements for the year 2000 A.D. are 1136 million and 949 million tons respectively. The current feed and fodder resources in India can meet only less than 50% of the requirement of its livestock population of 450 million. The grazing intensity is very high viz., 2.6 cattle unit per ha as against 0.8 cattle unit per ha in developed countries. We are highly deficient in various livestock products, though we have about one-fourth of the total cattle population of the world. The analysis of this situation reveals that one of the main reasons for the low productivity of our livestock is malnutrition, under-nutrition or both, besides the low genetic potential of the animals. ***Fibre for rumen health.***

- ❖ Forage dry matter consumption should be near 2% of the body weight.
- ❖ At least 19-21% acid detergent fibre should be in the total ration.
- ❖ At least 28-30% neutral detergent fibre should be in the total ration.
- ❖ Provide at least 2 Kg of fibre a day.
- ❖ Rumen PH should be above 6.0. A lower PH could limit fiber digestion and protein synthesis.

- ❖ Fibre particles should be long enough to stimulate 15 minutes of cud chewing time per half a kg. of dry matter.
- ❖ Fibre length should be chopped at ½ inch to stimulate rumen buffering from cud chewing.
- ❖ Sodium carbonate or its buffer equivalent should be added at 0.75% of total ration dry matter, especially with high-corn-silage or high moisture corn rations.
- ❖ Feed should be available to cows at least 20 hours/day
- ❖ During hot weather feed at least 60% of ration at night.
- ❖ Cows reduce dry matter intake by about 3.3 for every 2.2° rise in temp. over 75°F(24°C).
- ❖ High producing cows eat up to 12 meals/day each averaging 23 minutes.
- ❖ Heifer calves will spend 10-15 minutes more time when compared to old cows.

### **SYSTEMS OF FODDER PRODUCTION**

**The system of fodder production vary from region to region, place to place and farmer to farmer, depending upon the availability of inputs, namely seeds, fertilizers, irrigation, insecticides, pesticides, etc. and the topography. An ideal fodder system is that which gives the maximum yield of digestible nutrients per hectare, or maximum livestock products from a unit area. It should also ensure the availability of succulent, palatable and nutritive fodder throughout the year.**

#### **Fodder production for intensive Livestock farming**

The requisites for intensive livestock-farming are that (i) fodder is required in uniform quantity throughout the year, (ii) the fodder crops in the rotation should be high-yielding, (iii) the area for production of fodder should be fully irrigated, and (iv) other inputs, such as fertilizers and pesticides, should be available in optimum quantity. The different systems of fodder production fall into two categories, viz. the overlapping cropping and the relay-cropping. In the overlapping system, a fodder crop is introduced in the field before the standing crop completes its life cycle. In relay-cropping, the fodder crops are grown in successions, i.e. one after another, the gap between the two crops being very small.

### Overlapping system

The overlapping cropping system is evolved by taking advantage of the different growth rate of different species. It ensures a uniform supply of green fodder throughout the year. One such system continues for three years. The best rotation in this system is berseem + sesame - Hybrid Napier + cowpea - Hybrid Napier. This system of intensive fodder production is economically viable only for 3 years. After three years Hybrid Napier is uprooted and fresh planting is taken up. When the stumps of Hybrid Napier become old and the tillering capacity diminishes considerably. This system ensures green fodder throughout the year. It takes care of the dormancy period of Hybrid Napier during winter. The inter-row spaces of Hybrid Napier are efficiently utilized for raising berseem or other legumes in winter and cowpea in summer. The growth of legumes enriches the soil.

### NUTRITIVE VALUE OF FODDER CROPS

These are highly digestible (55 – 65%) mostly when harvested at a proper time. The crude protein may range from as little as 3% in very mature forages to over 30% in young heavily fertilized grass (on DM basis). The soluble carbohydrate of grasses ranges in the dry matter from 4-30%. The cellulose and hemicellulose are generally within the range of 20-30% and 10-30% of the dry matter respectively. Grass proteins are particularly rich in arginine, glutamic acid and lysine. Green forages are excellent source of carotene 250mg/kg), the precursor of vitamin A.

Generally leguminous fodder contain 8-12% DCP and 45-60% TDN. The phosphorus content of leguminous fodder are poor. It is advisable to supplement a ration containing a large amount of leguminous fodder with a limited quantity of wheat or rice bran, which is rich in phosphorus. The non-leguminous fodder are having 2.5% DCP and 45-60% TDN on dry matter basis. Green fodder is the primary source of vitamin A. Vit.A is present in the form of precursor. Green fodder contains 100 mg carotenes /Kg when compared with about 20 mg /Kg in silage. Carotene requirement of milch animals is 60 mg for production,30 mg for pregnancy, for growth requirement is 11 mg carotene per 100 Kg live weight.

Vit A is directly related to vision, maintenance and function of mucous membrane, essential for reproduction (for conception, maintenance of pregnancy, shedding of placenta), deficiency leads to diarrhoea, mal absorbtion of nutrients, incidence of stone in the kidney, ureter & bladder. During lactation 2000 I.U. of Vit.A is eliminated in milk.

### **VALUE OF TREE FODDER**

Trees, which can be grown either in combination with agricultural crops or on separate land usually not fit for agriculture, offer opportunity of producing green nutritious fodder for the livestock. It is seldom realised that in some parts of our country, probably more animals feed on shrubs and trees than on grass or grass legume pasture. Trees can produce as much, if not more, green fodder per unit area as agricultural fodder crops. The more important desirable agronomic features of a tree species are

- .. Be reasonably easily and reliably established
- .. Exhibit a good competitive ability against weeds
- .. Remain regally productive under repeated ability or grazing and browsing.
- .. Be well adopted to the particular climatic and edaphic features of the environment
- .. Require, no or little fertilizer
- .. Be resistant to local pests and diseases
- .. Have adequate forage production or be reliably vegetatively propagated and
- .. Have good nutritive value and reasonable palatability and acceptability to animals.

### **Multipurpose trees (MPTS)**

The term ‘multipurpose tree’ refers to all woody perennials that are purposefully grown so as to provide more than one significant contribution to the production and/or ‘service’ functions of the land-use system they implement.

### **Nitrogen fixing trees (NFTS)**

No flowering plant grows without nitrogen and few crops grow economically without adding inputs of this plant nutrient. Many farmers and tree growers cannot afford to buy nitrogen fertilizers, so yield suffers. A NFT lives in a symbiotic or mutually beneficial relationship with root micro-organisms: the latter transform atmospheric nitrogen into a form usable by the trees which in return provide carbohydrate to the micro-organisms. Such a built-in living nitrogen fertilizer factory often allows an NFT to grow more rapidly with fewer inputs in nitrogen-poor soils than most non-nitrogen-fixing trees. Thus the nitrogen can be used not only for the NFTS growth, but as a green manure for other crops and trees. Protein rich leaves and pods make many NFTS excellent forage that animals readily eat.

**Nutritive value of fodder trees**

Shrubs and leguminous trees are good source of digestible crude protein (DCP) for supplementary feeding to farm animals. Tree leaves are useful as protein supplements to straws and low protein fodder. Tree leaves are good sources of calcium but low in phosphorus. The nutritive value of shrubs and tree species vary widely due to varying inherent nutritive value between species and within species because of climatic and edaphic conditions, cutting and grazing strategies and the soil in which the plant is growing.

**NUTRITIVE VALUE OF TREE LEAVES (%DMB)**

S.No	Tree species	CP	EE	CF	NFE	TA	DCP	TDN
Nitrogen fixing trees								
1	Gliricidia sepium	17.21	4.25	15.50	51.65	11.40	14.90	62.20
2.	Inga dulci	15.21	4.37	13.81	55.71	10.91	-	-
3.	Albizia lebbek	16.85	3.16	15.21	51.98	10.82	14.70	57.30
4.	Sesbania grandiflora	29.88	3.02	8.61	46.08	12.52	-	-
5.	Leucaena leucocephala	16.74	4.90	12.94	53.32	12.10	16.70	65.00
6.	Erythrina indica	17.52	4.29	13.76	50.51	13.92	-	-
7.	Acacia nilotica	14.00	4.30	12.50	64.70	4.50	10.20	66.50
Non-nitrogen fixing trees								
1.	Artocarpus heterophyllus	14.01	5.63	18.74	50.53	11.07	8.04	68.19
2.	Ficus bengalensis	11.40	5.17	15.46	53.59	11.93	6.22	46.63
3.	Ficus religiosa	9.84	3.97	23.20	49.17	13.82	6.24	40.00
4.	Millingtonia hortensis	8.444	4.81	22.49	50.08	14.18	8.29	54.85
5.	Lanea Coromandelica	12.06	5.23	20.61	53.72	7.48	5.93	55.15

**FODDER CULTIVATION PER ACRE (40 GOATS)**

A varieties of green fodder are relished by goats. For better feed conversion and weight gain the goats are to be fed with mixture of leguminous and non leguminous fodder. The fodder obtained from one acre of land is sufficient to maintain 40 heads of goat with its followers. A model out lay of various types of fodder crops to be raised is given below.



A Subabul

----- Live fence

♣ C03 (Cumbu napier)

----- 60 cents

] Agathi

----- 1 meter gap (on the bunds of the water channel)

γ Maize

----- 20 cents

**or**

Δ Soya /Cowpea

----- 20 cents

**or**

β Sorghum

----- 20 cents

≤ Hedge Lucerne

----- 20 cents

**Strategies for improvement**

Several combat strategies have been suggested in different forums to take on the feed and fodder deficiency and a few are listed below:

1. Control of number and better utilization of improved breeds.
2. Increasing the efficiency of available feed.
3. Increasing green fodder production.
4. Judicious use of concentrates.
5. Identification and utilization unconventional feed and fodder.

Allocating more land for their production could not narrow the existing fodder deficiency. Alternatively the Animal Nutritionists globally are searching for Unconventional New Feed Resources (NFRs) like Agro-industrial by products, cellulose wastes livestock wastes, Top feed resources etc.

### **Unconventional Feed resources**

The NFRs in general are poor in available nitrogen, fermentable energy and minerals. The fibre is complex due to lignification. Several anti nutritional factors in them further reduce the nutritive value and affect production and re-production adversely in livestock. The levels of inclusion of various unconventional feeds are given in the tables.

#### **Optimum level of inclusion of unconventional feeds**

<b>Newer feeds</b>	<b>Species</b>	<b>Level %</b>
Fallen tree leaves	Cattle & goat	50
Ground nut haulms	Cattle & goat	40
Cotton seed hulls	Cattle	40
Sun flower straw	Bullocks	50
Sun hemp leaves	Poultry	8
Poultry excreta	Poultry	5-15
	Sheep	20-30
	Cattle	30
Rice husk	Sheep	5
Sugarcane bagasse (Untreated)	Bullocks	10
Sugarcane bagasse (Treated)	Sheep	20-30

Spent tea leaf	Calves	17-20
Castor bean meal	Bullocks	10-30
Mango seed kernel	Calves	20
	Bullocks	40
	Cows	10
Rubber seed meal	Pigs & Poultry	20
	Calves & Cow	20-30
Sorghum straw	Ruminants	20-46
Wood pulp waste		12.5-50.0
Fallen teak leaves		17.5-70
Fallen mango leaves		30-60
Saw dust		30
Cotton straw		45
Castor bean meal	Sheep	10
	Buffalo	30
Safflower cake	Cattle	10
Sunflower head meal	Sheep	48
Niger cake	Cattle	8
Tamarind seed hulls	Calves	10-25

Toxic principles

Type of feed	Toxic principle
Banana waste, stems and leaves	Tannins
Cassava leaves, peeling and pomace	HCN (17.5 mg/100g in leaves)
Castor seed meal	Ricinoleic acid (0.2%)
Cocoa seed husks	Theobromine (trace)
Coffee seed hulls, pulp	Caffeine and tannins (2.8% DM)
Cottonseed cake	Gossypol (0.05-0.20%)
Cowpea seed meal	Trypsin inhibitor
Guar meal	Trypsin inhibitor and gum
Kapok	Cycloponopeniod acid

Mango seed kernel	Tannins (5-10%)
Neem seed cake	Tannins
Palm oil mill effluent	High ash 912-26% DM)
Rubber seed meal	HCN (9mg/100g)
Sal seed meal	Tannins (6.2-13.7%)
Spent tea leaves	Tannins (12% DM)
Water hyacinth	Oxalic acid (2.4% DM)

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Fodder	Toxin	Toxin effect
Acacia leaves	HCN, tannins, fluoro-acetic acid, oxalates	Laboured respiration, depression, coma and death
Albizia foliage and many other tree leaves	Tannins	Depression in dry-matter and protein digestibility, impaired kidney and liver functions
Blighia sapida seeds	Hypoglycin	Hypoglycaemia
Delphinium spp.	Alkaloids	Stiffened joints, bloat and death
Indigofera herbage	Indopicine, 3-nitropropanic acid	Hepatotoxic agent
Lantana foliage	Lantadene	Hepatotoxic agent, photo-phobia and blindness
Leucaena foliage	Mimosine	Goiterogenic and alopecia
Robinia foliage	Robin phytotoxin	
Sambucus nigra	Sambunigrin (glucoside)	Depressed respiration, coma and death.

Sugarcane tops as livestock feed – on study on sugarcane tops feeding to sheep and calves to conducted under NATP project at IAN Kattupakkam Sugarcane tops with either grass, groundnut haulms or sorghum straw were fed to animal in the form of complete ration. The feed efficiency

of these economic feed rations was 15 – 17. Kg. and 5.9 – 6.1 Kg. for sheep and calves respectively. feed cost to produce 1 Kg. live weight was Rs.44 – 51 for sheep. The feeding of sugarcane tops increased to growth rate of ram lambs by 29.4% and calves by 29.2%.

### **Ardu leaves**

Two species of the genus *Ailanthus*, Viz. *Ailanthus grandis* and *A. grandulosa* are commonly found in India. These species grow into enormous trees with clear cylindrical holes. A fully grown tree gives 6 to 7 quintals of edible leaves twice a year. The leaves are quite palatable to both small and large ruminants. The voluntary intake is from 1.5 to 2.0 per cent of the live weight. It contains 13 per cent digestible crude protein (DCP) and 63 per cent total digestible nutrients (TDN). Adult ruminants can be maintained exclusively on ardu leaves.

### **Bamboo leaves (*Dendrocalamus strictus*)**

Bamboo grows in many parts of the tropical region. Its leaves are primarily used for paper manufacture. Nearly 90 to 150 tonnes of leaves are available from a hectare of bamboo forest. The tender bamboo leaves are relished by the livestock. The ruminants can consume about 3.4 to 3.7 per cent of dry matter of the body weight. Fresh leaves contain 40 to 65 per cent dry matter, 15 to 22 per cent crude protein, 3 to 4 per cent ether extract and 20 to 34 crude fibre. The leaves contain about 9.4 per cent DCP and 94 per cent TDN. Negi et. al, (1979) indicated that in spite of the higher crude protein content during the early stage of growth in bamboo, the digestibility of the crude protein was 10 per cent higher at the later stage.

### **Banyan (*Ficus bengalensis*)**

Bargad or banyan is a large evergreen tree. It produces numerous aerial roots from the branches, which, upon reaching the ground, thicken rapidly and form support to the branch. There are many species of *Ficus* such as pepal (*Ficus religiosa*), pilkan (*Ficus infectoria*).

### **Beduli (*Ficus glomerata*)**

Almost all the *Ficus* tree leaves are lopped for feeding the livestock especially the goats. *F. scandens* leaves form a very good nutritive fodder. They are fed as protein supplement to the

lactating animals in the hills during winter. The *Ficus* species are mostly found in plains up to 1,000 m above sea-level. The figs (fruit) of *F.palmata* and *F.roxburghii* are consumed by human beings.

### **Biul (*Grewia optiva* syn. *G.oppositifolia*)**

Biul also known as bhimal is a small, medium-sized tree mostly found at an altitude of 500 to 2,500m above sea -level. It is also found in the plains. A tree gives about 15 to 20 kg of green leaves per year. The bark of the tree is used for rope manufacture.

The leaves are highly palatable and nutritious (Sharma et al., 1966; Negi et al., 1979). They are lopped for animal feeding during winter months. The leaves contain 17 to 23 per cent crude protein, 2.5 to 5.0 per cent ether extract, 17 to 24 per cent crude fibre, 11 to 13 per cent ash, and 35 to 45 per cent N-free extract. The tannin content is negligible while the digestibility of crude protein is very high (75 per cent). The voluntary intake of the leaves is very high (3.5 per cent of the body weight). It contains 15 per cent DCP and 62 per cent TDN. It forms an excellent leaf-meal (Pachauri et al., 1974).

### **Beri (*Ziziphus jujuba*)**

Beri or Chinese dae is a very common shrub in the arid regions of the tropics (Indian subcontinent, Southeast Asia, North Africa, etc.). It is commonly found in the desert regions of India. The leaves are highly palatable and are used as a conventional fodder for sheep and goats. In Rajasthan and Gujarat, that the beri leaves are dried and stored for use as a protein supplement with the normal grazing. It contains about 18 to 20 per cent crude protein, but has poor digestibility owing to the presence of high amount of tannins. *Z.nummularia* is also a good fodder.

### **Erythrina spp.**

It is a leguminous shrub. It is also used as a live fence in southern India and SriLanka. It produces high proteinous leaves (22-25 per cent protein). There are two species common in the subcontinent. One is *E.indica*, a thorny drought-resistant plant commonly found growing in dry

zone. The leaves are lopped for goats and cattle. *E.lithosperma* a non-thorny plant common in hill country, is found growing in areas up to 500 to 1,500 m height above sea-level.

### **Gliricidia(*Gliricidia maculata*)**

Gliricidia is a deep-rooted legume. It is mostly grown as a live fence and is used as a support plant for black pepper and as a shade tree for tea plantations in some of the tropical regions (India, Sri Lanka, the Philippines, etc.).

It grows well on very poor and acidic soils without any fertilizers up to 1,000m elevation. It can be propagated both by seeds and stems.

The leaves contain 25-30 per cent protein and can be harvested at every 3-4 months interval. It is highly palatable fodder. Paddy straw (1.5kg), gliricidia leaves (6kg) and rice bran (1kg) supported a growth rate of 500g in a crossbred heifer at Haregama Farm, Sri Lanka (Ranjhan, unpublished). It is a good fodder for sheep, goats and buffaloes, and can be used as a protein supplement.

### **Ipil-ipil, subabul(*Leucaena leucocephala*)**

It is a perennial shrub. The young foliage is highly palatable and rich in protein. The seeds can be used as feed concentrate. The leaves contains 21-25 per cent protein. The fodder is suitable for ruminants, but is toxic to pigs and horses because of mimosine, a toxic amino acid. When grown for fodder, the first cut can be taken within 6-9 months of sowing and subsequent cuts at intervals of about 4 months.

Subabul can makeup the protein requirement for maintenance of cattle and buffaloes weighing 400 kg, if given at 25-30 per cent of the paddy straws. Feeding larger quantities to lactating cows gives taint in the milk. It is believed to cause sterility in cows and sows. Feeding up to 25 per cent in daily ration has not shown any adverse effect (Chadokar, personal communication).

Subabul has been extensively propagated in the Philippines, Sri Lanka, Thailand and other tropical countries in Asia for animal feed. In the Philippines, subabul leaf-meal pellets are manufactured and exported to Japan for use in poultry feed.

**Jack (*Artocarpus heterophyllus*)**

Jack is a common deciduous tree of 30 m height and 2m girth, in the South and the Southeast Asia. The fruit is used both as vegetable and as a fruit when ripe.

The leaves are palatable to sheep and goats. There is another species of *Artocarpus* (*A. intergrifolia*) which is also common in the southeast Asia. The leaves contain 13 to 14 per cent crude protein.

**Mulberry leaves (*Morus indica*)**

This tree is grow in up to 1,200 m in the sub-Himalayan tract in India. Mulberry is also grown in the silk-producing areas of India where silk-worms feed on these leaves. The leaves are highly palatable to sheep, the feed intake being 3.4 per cent of the body weight. The stalks contain about 11.4 per cent crude protein. The leaves are highly palatable and contain 7.8 per cent DCP and 48.4 percent TDN.

***Melia azedarach***

It is a deciduous tree found in the Indian subcontinent. It is a good fodder tree. Its leaves contain 13 to 14 per cent of crude protein.

**Neem leaves (*Azadirachta indica*)**

The neem or margosa tree grows in the Indian subcontinent, in the major part of Africa and in the arid and sub-humid tropic. The tree remains green throughout the year and is drought resistant.

The leaves are not relished by the large ruminants. Sheep and goats consume them in small amounts. The leaves contain 6.2 per cent DCP and 52.5 per cent TDN.

**Pipal (*F.religiosa*)**

The leaves are relished by sheep and goats. The dry-matter consumption is about 2.4 per cent of their body weight. However, cattle and buffaloes do not relish them and the palatability is only about 0.9 per cent of their body weight. Leaves form a maintenance ration for goats when fed alone. The leaves contain 5.5 per cent DCP and 39.2 per cent TDN.

### **Siras (*Albizia lebbek*)**

Siras is a medium sized deciduous tree. The leaves contain about 11 per cent DCP and 50 per cent TDN. Cattle and buffaloes do not relish the leaves very much, however, sheep and goats like them.

### **Sainjana (*Oleifera moringa*)**

It is a medium-sized deciduous tree common in the tropics. The flowers and fruits are used as vegetable. The leaves are relished by the ruminants. They contain 11 per cent DCP and 62 per cent TDN.

### ***Tamarindus indica***

Tamarind tree is very common in most of the tropical countries. It is a tall deciduous tree, grows to a height of about 20m. The leaves are rich in protein (14 per cent) and are relished by small ruminants.

### **Tapioca leaves (*cassava, Manihot esculenta syn. utilissima*)**

Tapioca is a tuber crop extensively grown in many countries of the tropics. *M.esculenta* is the most commonly cultivated species in India. The annual world production is about 117.2 million tonnes; out of this only 3.5 million tonnes is grown in India. About 41 million tonnes are produced in Asia (35 per cent). At harvest time, the tuber is collected and the leaves are thrown away.

Tapioca leaves are rich in protein. They contain 8.3 per cent DCP and 45.5 per cent TDN on dry-matter basis. When fed to growing calves, 2.3 kg of partially dried tapioca leaves can replace 0.7 kg of groundnut-cake. Lactating animals when fed on tapioca leaf-meal show good results. About 50 per cent of groundnut-cake can be replaced by tapioca leaf-meal contain about 7.6 mg of HCN per 100 g of dried leaf-meal (ICAR, 1970). At an intake level of 0.5 to 0.8 per cent of body weight, it does not produce any adverse effect.

### ***Thespia populnea***

It is a big deciduous tree that grows in the sub-humid region of the tropics and is common to the Indian subcontinent. The leaves can be included up to 30 per cent in the ruminant's ration along with paddy straw for maintenance without deleterious effect (Chadokar, personal communication). It contains 19 to 20 per cent protein. Ferric salts have been used to reduce the uptake of mimosine and DHP from *Leucaena*. They also have a positive effect on the use of high-tannin sorghum by poultry. Polyethylene glycol is effective in counteracting the

effect of condensed tannins by complexing with them to the exclusion of protein (Barry and Balaney 1987; Pritchard et al. 1988). The current price of polyethylene glycol makes it this uneconomic as a supplement but there is always the possibility of natural analogues (soluble, nondegradable polyhydroxy compounds) occurring in other feed plants, with a positive interaction if the plants were fed together. Activated charcoal can be used as a general agent for binding toxins in the gut.

Although providing supplements may seem impractical in some village farming systems, the low sodium content of tree leaves and, indeed, most forage plants in the humid tropics indicates that optimum growth will not be obtained without salt supplementation (Little et al. 1988).

### **Leaf meal**

Plant leaves are commonly processed into leaf meals for non-ruminants particularly for poultry. A good quality leaf meal must be free of stems, kiln dried, and dehydrated. It must not be sun dried, because this treatment inactivates a high percentage of the carotenoids. Leaf meals are included in poultry feeds primarily as pigmenting agents because of their low energy value (<6.25MJ/kg) and low protein digestibility. The maximum level in broiler diets is about 3%, as high levels may decrease growth rates. Conversely, good quality leaf meal is almost always used in feed formulations for layers, the usual upper limit being 5% by weight of feed.

In general leaf meals are good pigmenting agents. This is due to the presence of several different xanthophylls of the general family of carotenoids. Xanthophylls are the hydroxy derivatives of carotene hydrocarbons. Feeding trials with growing pigs have shown that feeding LLM at 5, 10 and 15% caused no ill effects (Patricio 1956; Iwanaga et al. 1957; Rivas et al. 1978). In fact, LLM at 5 and 10% levels is useful in growing and fattening swine. Rivas et al. (1978) found that pigs fed 20% leucaena without FeSO<sub>4</sub> showed the lowest growth rate, average feed intake and feed conversion efficiency; pigs also lost hair and had defective hoofs and pasterns. Growing finishing pigs, however, could be raised using a diet containing 20% LLM, provided 0.4% FeSO<sub>4</sub> was added.

### Cutting management

#### **Method of harvesting the tree fodder**

Management of tree components at suitable age and interval is one of the vital importance in an agro forestry system. This is primarily required to provide necessary light reception to ground flora.

Many trees and shrubs have the capacity to regenerate new growth after being cut. Several different harvest methods like coppicing, pollarding, lopping, pruning and thinning are advocated as cutting technologies for trees.

#### **Coppices:**

It is one of the most widely used harvesting method in which individual trees are cut at base usually between 15-75 cm above ground level. New shoots develop from the stumps. For pole and fodder production 2-3 sprouts should be allowed to grow. Several rotations of coppicing are usually possible for most tree species. The length of coppice period depends on the specific tree products that are needed. For exclusive fodder production, the tree can be coppiced very frequently. The coppice shoot growth of 1.5 years old subabul had been found to be equal to that of original 3 years growth of that tree. Eventually after several harvest sprouting vigor diminishes. Subabul and *Gliricidia sepium* are examples of good coppiciers.

#### **Pollarding:**

In this system all the branches including top of the tree are removed at a height of 1-3 meters above ground level. New shoots sprout from the main stem to form new crown. The main stem continue to increase in diameter but not in height. This system is used for management of live fences, hedge rows in alley farming etc. An advantage of this system is that the new shoots are high enough off the ground and thus are out of reach of grazing livestock. Subabul, *Gliricidia sepium*, *Erythrina indica*, *Moringa oleifera*, Mulberry, Neem etc. respond well for pollarding.

#### **Lopping:**

In this system most of the branches are removed. Though this system is widely used in our country, excessive and in discriminate lopping of fodder trees result in depletion of valuable tree fodder resources and consequent soil erosion. Intensity and frequency of lopping depend upon the species, age, growth rate of the tree, soil type etc.

#### **Pruning:**

It is the harvesting system usually involves in the removal of smaller branches and stems. These pruned biomasses constitute a major source of fodder, fuel and mulch for tree crops. Pruning is often required for maintenance of fruit and forage trees, alley farming and live fences. Among fodder trees, *Gliricidia sepium*, *Subabul*, *Acacia* etc. respond for pruning

### **Thinning:**

It is a traditional forestry practice followed to maintain desirable trees by eliminating the poor and desired ones to improve the stand by reducing competition for light and nutrients.

Other management factors that affect tree productivity include age at first cutting, cutting height, cutting frequency and season of cutting. It has been generally stated that where trees are older at first cutting, higher rates of regrowth will be observed. This would be expected because older trees would have thicker stems, more carbohydrate 1m is often used for fast growing short rotation trees. Grown up trees could be pollarded at a height of 2-4m in order to facilitate manual working and to avoid frequent browsing by livestock. The cutting interval will be dictated by the purpose for using the trees. In humid climates, where the major emphasis is on leaf production for feeding to animals, shorter cutting intervals (6-10 weeks) will be preferred. This will produce feed of a higher nutritive value. Longer intervals (10 - 14 weeks) would be appropriate if fuel wood is also important. With fast growing trees, the regrowth height will be 1.5m for leaf production and 2.5m for leaf and wood production. In less humid environments, longer cutting intervals may be required. The critical period for food supply to the animals is the dry season. Hence carrying over the leaves of wet season into dry season and successive cuttings during dry season are recommended. The surplus production of foliage during wet season should be conserved as hay and silage for feeding in dry season. Most of the long and medium rotation trees tolerate annual lopping (30-50%). The *L.leucocephala*, *Giliricidia* and *Sesbania* species tolerate recurring lopping.

### **Feeding the tree tops during lean periods**

All the tropical and subtropical grasses, owing to their faster rate of growth during the monsoon provide grazing for the livestock, mainly in the monsoon and post-monsoon periods. With the advent of winter and owing to the lack of sufficient moisture in the soil in a ready available form, they enter dormancy. Thus during the lean periods of spring and summer, tree-tops come to the rescue of the livestock-owners. The young leafy, succulent material, highly nutritive and rich in crude protein and minerals, serves as a concentrate, even if fed in small

quantities along with other dried grasses and crop residues. The lopping of the trees obtained in spring and summer also contain some substances, which bring the animals quickly into the reproduction phase. Some of the important trees giving lopping and producing gum are koo-babul (*Leucaena leucocephala*) and *Sesbania aegyptiaca* and *Saculeata*. The gum content in the seeds of the two species of *Sesbania* is of superior quality and has a property to reduce the cholesterol content in the blood. These trees, therefore, need immediate attention and may be planted on the boundaries of the fields, in the cattle-yards, etc. to serve as shade-cum-fodder-cum-gum-producing plants. The spacing between the trees should be 6-8 metres or even more in cattle-yards and 5-6 metres on the bunds of the fields.

Besides the use of trees on the farm for various purposes the trees are planted in the pastures as companion species with grasses.

### **Method of feeding**

Physical treatments like sprinkling of molasses, water, salt solution or wilting in shade for 8 hours for *Gliricidia* or neem leaves, shade wetting resulted in the significant improvement in palatability for sheep rather than feeding fresh leaves. Roughage should be fed at the rate of 65% of dry matter requirement in ruminant animals. However, feeding of cereal and legume green fodder alone meet the nutrient requirements for producing up to 10 kg of milk. For small ruminants cereal fodder, legume fodder and tree leaves at 2:1:1 ratio supply the nutrient requirements.

#### Leaf meals

Leaf meals are commonly included in broiler ration up to 3% and layer ration up to 5% primarily as pigmenting agents for pigmentation of meat and egg. This is due to the presence of xanthophyll. A good quality leaf meal must be free of stems, klin dried and dehydrated. It must not be sun dried because this treatment inactivates high percentages of carotenoids.

**NUTRITIVE VALUE OF TREE LEAVES (%DMB)**

S.No	Tree species	CP	EE	CF	NFE	TA	DCP	TDN
Nitrogen fixing trees								
1	Gliricidia sepium	17.21	4.25	15.50	51.65	11.40	14.90	62.20
2.	Inga dulci	15.21	4.37	13.81	55.71	10.91	-	-
3.	Albizia lebbek	16.85	3.16	15.21	51.98	10.82	14.70	57.30
4.	Sesbania grandiflora	29.88	3.02	8.61	46.08	12.52	-	-
5.	Leucaena leucocephala	16.74	4.90	12.94	53.32	12.10	16.70	65.00
6.	Erythrina indica	17.52	4.29	13.76	50.51	13.92	-	-
7.	Acacia nilotica	14.00	4.30	12.50	64.70	4.50	10.20	66.50
Non-nitrogen fixing trees								
1.	Artocarpus heterophyllus	14.01	5.63	18.74	50.53	11.07	8.04	68.19
2.	Ficus bengalensis	11.40	5.17	15.46	53.59	11.93	6.22	46.63
3.	Ficus religiosa	9.84	3.97	23.20	49.17	13.82	6.24	40.00
4.	Millingtonia hortensis	8.444	4.81	22.49	50.08	14.18	8.29	54.85
5.	Lannea Coromandelica	12.06	5.23	20.61	53.72	7.48	5.93	55.15

**CARRYING CAPACITY OF PASTURE.**

Sheep in India are mostly maintained on the Pasture. The type grasses in the pasture are highly variable according to the location. Paddocks which were commonly sown with White Kollukkattai (*Cenchrus ciliaris*), Black Kollukkattai (*Cenchrus setigerus*), Blue buffel (*Cenchrus glaucus*), Kikiyu (*Pennisetum clandestinum*), Tuber Grass (*Phalaris tuberosa*), Rye grass (*Lolium multiflorum*, *L.perennae*) and clover variety (Subterranean Clover) of grasses.

Eighteen ewes were allowed to graze on the basis of 0.2 ha / sheep in sown pasture and 0.4 ha / sheep in natural pasture. The ewes under the sown pasture paddocks showed better gains than on natural pasture paddocks. It has been proved that under natural pasture paddock there was a reduction of 7 % in the plant cover paddocks. Allowing for improvement of the poor grassland, the grazing capacity for the maintenance is recommended at 2.47 wethers per hectare on year long basis. On an average the wether produced 1099 g of wool per head per year, which compares favourably with the average production of Marwari breed. Growth studies conducted

in lambs showed greatest gain in body weight under continuous controlled grazing on a year long basis.

### FODDER CYCLE.

Is directly related to number of heads of livestock that can be maintained with the green fodder bio mass that is obtained from the specified quantum of land. The area of land for forage production will vary according to the type and variety of green fodder.

The requirement of green fodder will vary according to the live body weight of the animal. On an average 8-10 % of live weight of the animal is to be provided in the form of green fodder. An adult Cattle weighing 400 kg body weight will consume 32-40 kg green fodder. Out of the total requirement of green fodder one third of green fodder is to be provided as Leguminous fodder and remaining two third is to be provided as non leguminous fodder.

For an example a mini dairy with 10 cows and 5 calves will require green fodder as follows :

10 Cattle x 35 kg/day x 365 days = 127.75 tonnes.

05 Calves x 20 kg /day x 300 days = 30.00 tonnes.

Totally approximately 150 tonnes /year.

Leguminous fodder : 50 tonnes

Non leguminous fodder : 100 tonnes.

To produce the above quantity of green fodder the land area is to be worked out based upon the type and variety fodder crops that are cultivated.

Eg : Let us taken an example that Co3 variety yields 150 tonnes /acre/year Lucerne yields 80 tonnes / acre means two third acre is to be allotted for production of Co3 grass and 60 cents are to be allotted Lucerne to get sufficient fodder to meet the requirement of 10 cattle with its 5 followers .

To maintain 40 goats with its followers a minimum one acre of land with irrigation facilities is essential to produce sufficient quantity of various variety green fodder. (40 adults x 5 kg x 365 days = 73 tonnes ;

100 kid x 2kg x 180 days = 36 tonnes; 73 + 36 =109 approximately 100 tonnes)

**UNDERSTANDING PASTURE-STOCKING RATE AND CARRYING**

**Determining Carrying**

**Capacity**

**What is Carrying Capacity?**

One of the first questions the new owner or potential buyer of a unit of pasture or rangeland asks is "How many cattle, sheep, horses, etc. can I graze on this land?" In other words, what is the carrying capacity.

There is no simple answer to this question. Carrying capacity may vary depending on management goals, grazing systems, season of use, weather, and many other factors. There are several terms related to carrying capacity that need to be defined.

**CARRYING CAPACITY** is defined as the maximum stocking rate possible which is consistent with maintaining or improving vegetation or related resources. It may vary from year to year on the same area due to fluctuating forage production..

**STOCKING RATE** is defined as the number of specific kinds and classes of animals grazing or utilizing a unit of land for a specified time period. It may be expressed as animal unit months or animal unit days per acre, hectare, or section, or the reciprocal (area of land/animal unit month or day).

**GRAZING CAPACITY**, although sometimes used synonymously with carrying capacity, is defined as the total number of animals which may be sustained on a given area based on total forage resources available, including harvested roughages and concentrates.

**GRAZING CAPACITY** is the relationship between number of animals and area of land at any instant of time. It may be expressed as animal-units per acre, animal-units per section or AU/ha. For definitions of other terms used in this discussion, see the Glossary of Terms Used in Range Management.

## The Recommended Method to Determine Carrying Capacity



By far the easiest and most accurate method of determining the carrying capacity of a unit of land is to obtain past stocking rates and grazing management history from the previous owner/grazer and then assess the ecological status (range condition) and **range trend** of the land.

If range trend has been stable or upward the past few years, then the stocking rates have been within carrying capacity limits and past management practices have been effective. If trend is downward, then an adjustment in management or stocking rate is needed.

**Caution!** Downward trend does not necessarily mean numbers of animals should be reduced. In fact, stocking rate is the last thing to consider. A more likely cause of downward trend, especially on Idaho rangelands, is poor livestock distribution. This can be easily assessed by doing some simple utilization mapping. If there are areas of a pasture that are under used and others over used, then what can be done to encourage the livestock to make more use of the under utilized areas?

Other factors to consider before reducing stocking rate are:

- Is a change in grazing season warranted?
- Is the grazing system being used working or are changes needed? Would a shorter period of grazing or a season of rest improve the range?
- Is the appropriate kind of animal being used (i.e. is the rangeland better suited for sheep than cattle, etc.)?
- Is there an alternative source of forage available? Or is brush or weed control warranted?
- Has there been a recent extended drought?
- Have other uses increased (i.e. numbers of wildlife) or caused the downward trend?

If it is determined that one or more of these factors is not the cause of downward trend, then an adjustment in stocking rate may be warranted. Make the adjustments you feel may be necessary, monitor trend, and readjust upward or downward as conditions warrant.

Another easy and fairly accurate method of determining carrying capacity is to look at comparable pasture or rangeland in the area and find out what their carrying capacity estimates are. The local [Cooperative Extension Service](#) or [Natural Resources Conservation Service](#) offices may also be able to assist you in determining carrying capacity. If the unit of land you are interested in is public land, the administrating agency should already have an estimate of carrying capacity.

#### **What if there is no historical stocking rate available?**

If there is no historical stocking rate information available or the local Extension Service or Natural Resources Conservation Service offices can not provide such information, they may be able to assist you in measuring annual forage production on the land in question and calculate an estimate of carrying capacity.

This may very well be the case if you have irrigated pasture that is seeded to a forage species or mix of species that is not commonly grown in your area.

**Caution!** This method works well in theory, but is based on a series of estimates. The final result is only as good as the estimates. Contact your local [Cooperative Extension Service](#) or [Natural Resources Conservation Service](#) office for assistance.

### **Carrying Capacity**

In ecological terms, the carrying capacity of an [ecosystem](#) is the size of the population or community that can be supported indefinitely upon the available [resources](#) and services of that ecosystem. Living within the limits of an

ecosystem depends on three factors:

- the amount of resources available in the ecosystem;
- the size of the population or community; and
- the amount of resources each individual within the community is consuming.

The concept of carrying capacity is closely related to the idea of "capital". The term "capital" is most commonly used to refer to money and material goods. However, in the context of sustainability, communities have several different types of capital that need to be considered - natural, human, social, and built capital. Together, these types of capital are referred to as community capital. All four types of capital are necessary for communities to function. All four types of capital need to be managed by a community. All four types of capital need to be cared for, nurtured and improved over time. A community that is living off the interest of its community capital is living within the carrying capacity. A community that is degrading or destroying the ecosystem on which it depends is using up its community capital and is living unsustainably. Carrying capacity is much harder to measure for human, social and built capital than for natural capital but the basic concept is the same - are the different types of capital being used up faster than they are being replenished?

For example:

- A community that allows its children to be poorly educated, undernourished, and poorly housed is eroding its human capital.
- A community that allows the quality of its social interactions to decline through lack of trust, respect, and tolerance is eroding its social capital.
- A community that allows its buildings, roads, parks, power facilities, water facilities, and waste processing capability to decay is eroding its built capital. Additionally, a community that is creating built capital without considering the future maintenance of that capital is setting itself up for eventual decay.

So, in the context of sustainability, carrying capacity is the size of the population that can be supported indefinitely upon the available resources and services of supporting natural, social, human, and built capital.

**Class 14:Diseases-classification-viral, bacterial and metabolic-General control and preventive measures.**

Health

The Condition in which all the organs and tissues in the system functions normally and harmoniously.

Any change from normal state either to single or great extent is called disease stage.

Health is fundamental for a sound enterprise.

Most of the disease can be avoided by proper attention, sanitation, hygiene, nutrition and management practices.

Once outbreak of disease complicated – strain – financial loss – dual – production expenditure on medicines.

So the farmer – vigilant – day to day activities- to avoid or prevent spreading of disease and to have a check on financial loss.

**Control of Disease**

Provide well ventilated and proper housing

Provide balanced nutritious diet

Strict hygiene and sanitation of animal houses.

Adhere regular and routine ‘vaccination’ schedule

Avoid entry of outsiders within the farm-premises.

Follow up of latest scientific know how and management practices.

Disease

Bacterial	Viral	Mycotic	Metabolic
BQ	FMD	Dermatitis	Hypo cal pica
Hs	Rp		mg tetany

Prevention is better than cure

Periodical vaccination

Quarantine

Hygienic measures – Mastitis public importance economic loss.

Deworming : Broad spectrum antihelmenthic-Panacur, Nilverm, helmonil , Cu so<sub>4</sub>

Ecto + Endo – Ivermectin

Ecto – Butox

Tictac

Pestoban

Ectomin

### Classification

Infectious or contagious	Non infectious or non contagious
1. Bacterial a) Anthrax    b) Black quarters    c) Halmorrhagic septicalmia d) T.B    e) Brucellosis	Metabolic Milk fever or Hypocalcaemia Acetonemia or Hypo glycaemia, Ketosis
Viral a) Rinderpest b) Foot and Mouth	Dietary Tympanites or Bloat impaction Non specific enteritis
Parasitic Ecto parasite : Tick, lice and mite Endo parasite : Tape, Round	
Fungal Aflatoxicosis	

**CLASS 15:VIRAL DISEASES-FOOT AND MOUTH - BACTERIAL DISEASES- ANTHRAX, HAEMORRHAGIC SEPTICEMIA AND BLACK QUARTER - METABOLIC- TYMPANITES, KETOSIS AND MILK FEVER. MASTITIS AND ITS CONTROL.**  
**Foot and Mouth Disease**

FMD – Highly communicable disease – cloven footed animals

Causative organism : family : Picornaviridae

Genus : Aphthovirus

Smallest of the Animal virus : 7 types virus : O,A,C Asia I, SAT 1,2,3

Transmission : Direct contact : Thro water : manure : Pasture and cattle attendant

Symptom : Incubation period 2 – 5 days : Temperature 40°C

Drooling of saliva : Loss of appetite

Vesicles in Tongue : gum : inter digital space, udder & teat . Rough coat with long hair, panting.

The animal loses appetite and body weight milk production reduced. Lameness on account of painful foot lesions.

Treatment : Nil. External application of anti septics contributes to the healing of ulcers and wards off attacks by flies

Antibiotics may be administered to counter bacterial infections.

Prevention : Thorough disinfection of shed, utensils, clothes of attendants.

Control : Vaccination – polyvalent – once – 4months or varies with type of vaccine

Hoechst 3ml .oil adjuvant : IVPV – 20 ml calves – 40ml adults.

**Rinderpest** : Most destructive of the virus disease

Causative organism : Virus, Family, paramyxoviridae

Genus : Morbillivirus

X-Breed and Pure bred – Highly susceptible

Transmission : Virus found notably saliva, discharge from eyes, nostrils, urine and faeces.

Incubation period of the disease 3-7 days 4 – 6<sup>th</sup> day – Temperature 40-41°C

Symptom: Loss of Appetite : Lachrymation : dryness of muzzle, arching of back.

Shooting diarrhoea : Ulcers in the mouth 7 – 9 day – ulcers in the lips and Gums

Death – 10<sup>th</sup> day after on set of symptom

Prevention and Control : Segregation of affected animal periodical and routine. Disinfection of shed.

Control : Vaccination 1.TCRV 2. GTV – Immunity – 3 years 1 ml s/c – Neck

Treatment : Antibiotics and Astringent : Fluid therapy

**FROM 1.3.1998 TAMIL NADU PROVISIONALLY DECLARD FREE FROM RINDER PEST – INTENSIVE VACCINATION PROGRAM CONDUCTED ZERO SURVEILLANCE BEING UNDERTAKEN.**

**THE SAME VIRUS AFFECTING SMALL RUMINANTS (SHEEP AND GOAT) DISEASE IS CALLED- PPR – PESTE DES PETITS RUMINANTS.**

**ANTHRAX :** Peracute disease affecting cattle, sheep, horses and pigs. **man is susceptible but is not a primary host-wool sorters disease.**

The disease is always fatal in animals

Causative organism : Bacillus Anthracis – Bacterial Disease - sporulation occurs outside the body. spores highly resistant and not killed by heat, light & disinfectant

Symptoms : Peracute – death occurs with in minutes and animal collapses with convulsions

Acute : high rise of temperature : shivering Abdominal pain ; before death blood Oozes out of rectum and nostrils.

All the orifices usually exudate dark tarry blood which does not clot. Death is suspected for anthrax

carcass should not be opened.

Spleen is enlarged 10-15 times its normal size.

Diagnosis : Sudden death : acute bloat : exudation of blood – orifices

Blood smear – presence of large blue rods which pink capsule.

Control : Annual vaccination

A live spore vaccine prepared from a virulent uncapsulated strain of B.Anthraxis dose 1ml.

Prevention : Hygiene and sanitation – the carcass of the animals suspected of dying due to anthrax should never be opened. The carcass is burnt or buried in a deep pit and lime is applied.

## ANTHRAX

Synonyms : Splenic Fever

Etiology : *Bacillus anthracis* is a grass, positive, non motile spore. Forming bacterium of relatively large size (4 to 8 $\mu$  x 1 to 1.5 $\mu$ ) the bacilli grow in chain formation, but may occur singly or in pairs. They form spores after discharge from an infected animal or an opened carcass. The spores are resistant to heat, chemical disinfectants and prolonged drying. Anthrax bacilli have remained viable in soil stored for 60 years in a rubber stoppered bottle.

Transmission : Infection gains entrance to the body by ingestion inhalation or through the skin. It is generally considered that mode of infection is by ingestion of contaminated food or water. Inhalation infection is thought of be of minor importance in animals although the possibility of infection through contaminated dust must always be considered. "Wool sorter's disease" in man is due to the inhalation of anthrax spores by workers in the wool and hair industries. Spread of the organisms with an area may be accomplished by streams, insects, dogs and other carnivores, and wild birds and by faecal contaminate from infected animals.

Clinical findings. : The disease occurs on i. Peracute ii. Acute iii. Chronic and iv. Cutaneous form.

Peracute form: Characterized by its sudden onset and rapidly fatal

- i) staggering, difficult breathing, trembling.
- ii) Collapse after a few convulsive movements.

Acute form

- i. Rise in body temperature (107<sup>0</sup>F)
- ii. Period of excitement followed by depression.
- iii. Respiratory or cardiac distress
- iv. Staggering, convulsion and death

- v. Bloody discharge from the natural body openings.

#### Chronic form

Local lesions confined to tongue and throat is absent mostly in pigs but occurs occasionally in cattle, horses

#### **Cutaneous form (or) Localised form**

- i. characterized by swelling in various parts of the body
- ii. Anthrax organism lodged in wound (or) abrasions of the skin.

#### **Human beings.**

1. Man may develop localized lesions (Malignant ) from contact with infected blood (or) tissue.
2. Acquire fatal pneumonia (wool sorters disease) from inhalation when handling animal by products.
3. Occasionally man develops "Acute meningitis". From systemic involvement, (or) intestinal anthrax from consumption of meat.

#### **Necropsy finding:**

- i. A carcass suspected for 'Anthrax' should not be opened
- ii. Blood smear should be subjected to microscopical examination.
- iii. Striking absence of rigor mortis and the carcass undergoing rapid gaseous decomposition.
- iv. All natural orifices usually exude dark, blood which does not clot
- v. Gross enlargement of spleen

#### **Diagnosis**

Microscopic examination of blood smears

- a. The organisms is stained by "Polychrome methylene blue".

- b. Giemsa stain to demonstrate encapsulated bacilli.
  
- ii. observation of death of guinea pig or mice (experimental animal within 48 hours following inoculation of blood (or) tissue suspension.

**Differential diagnosis:**

- i. Lightning stroke may be confused with anthrax
- ii. Acute leptospiriosis,
- iii. Anaplasmosis (Gall sickness)
- iv. Acute poisoning from bracken fern, sweet clover lead.

**Treatment**

- i. Antibiotics and anti anthrax serum are commonly in treatment
- ii. Penicillin - 5 million units twice daily
- iii. Streptomycin - 8 to 10 g daily in 2 doses - cattle
- iv. Oxytetracycline (5 mg/kg ) parentally in the treatment of clinical cases after vaccination in cattle.
- v. Anti anthrax serum intravenously in doses of 100 to 250 daily is effective in conjunction with an antibiotic. It is too expensive for routine use.

**Prevention:** Vaccination - Periodically in endemic area. The vaccine consists of living attenuated strains of the organisms with low virulence but capable of forming spores have been most successful.

Control:

- i. Hygiene is the biggest single factor in prevention of spread of the disease.
- ii. Careful disposal of infected material in most important
  - a. infected carcasses should not be opened.
  - b. Burned (or) buried together with bedding and soil contaminated by discharges.
  - c. Burial should be atleast 6 feet deep with an ample supply of quick lime

added.

- iii. All suspected cases and in contact animals must be segregated .
- iv. Disinfection of premises, hides, bone meals, wool hair requires special care.
- v. Disinfection with 5% lysol require to be in contact with spores for at least 2 days.
- vi. Strong solutions of formalin or sodium hydroxide (5 to 10%) are probably most effective.

### **Black quarter :**

Acute infectious disease but not contagious - inflammation of muscle, severe toxæmia.

Causative organism : Bacteria – *Clostridium chauvoei* – gram positive

Anaerobic spore.

Young stock mostly affected – 6months – 2years disease outbreak which the onset of rainy season.

Symptom : Animals may die without showing obvious signs – crepitant swelling in hind and fore quarters which crackles when rubbed due to gas in the muscle.

Lameness – Fever – twitching of muscle - affected region is hot and painful but becomes cold and painless.

skin over affected area – dry, hard and dark

Diagnosis : affected part is black or dark red - characteristic rancid smell.

Control: Hygiene and prophylaxis control.

Prevention : vaccination – before onset of rainy season – 5ml –polyvalent s/c (*clostridium* sp.).

Antibiotics like penicillin and tetracycline may be given.

### **Haemorrhagic septicaemia (HS)**

Causative Org : Bacteria – *Pasteurella multocida*

- Symptoms :
- i. Acute form : Septicemia
  - ii. Sub acute form : edematous swelling
  - iii. Chronic form : with pulmonary infection

Acute High temperature 106°F rapid and Difficult breathing discharge from nostrils and watery faeces dehydration, prostration and death.

Sub acute swelling in the throat, neck, dewlap and Brisket extending upto fore lines

Tongue : Swollen and protruded out

Laboured breathing with stertorous sound

Chronic form : Painful with thick and blood discharge from nostrils.

Treatment : injection of sulphadimidine

Prevention : Vaccination once 1 year – before – rainy season

Control : Isolation – Routine hygiene and sanitation

**Mastitis** – Inflammation of the udder – physical and chemical changes in milk – major economical loss to dairy industry – due to reduced milk production.

cause : Bacterial origin mainly – *Str.agalactiae*, *Staphylococcus*, *Coryne bacterium*, *E-coli*.

Transmission: Infection occurs via the teat canal – contaminated environment – skin of udder, milking equipment, milker etc.

Symptoms : Hot, Swollen, painful udder with purulent yellow secretion.

Rise in body temperature enlargement of udder and cessation of milk secretion.

Milk secretion becomes blood stained and may contain pus.

quarters may be completely affected.

In some severe cases animals may die or toxæmia.

Diagnosis : early detection is important by physical examination of the udder.

Many kits are available for diagnosing the disease.

Treatment : Effective drugs of available for treatment

Control: Hygienic measures are important.

a. Animals diagnosed positive should be milked at last.

b. Milkers should wash their hands before milking and should use well washed white overalls.

c. A separate clean cloth for each cow is used for washing the udder with a disinfectant.

d. The first stream of milk from each quarter should not be allowed to drop on floor but collected in a

separate container. Milkers should not wet their hands with first stream of milk.

e. Normal milk-room hygiene including washing of milk containers and equipment should be practised.

**Milk fever :** (parturient paresis, metabolic disease in cows soon after calving  
cause :Serum calcium levels fall in cows after calving as a result of failure to mobilize calcium reserves and of the development of negative calcium balance in late pregnancy.

**symptoms:** Disease flares up with in 72 hours of calving initially the cows show excitement, incoordination of movement muscular tremors in limbs and head, lying in recumbent position with her head directed towards flank. In final stages subnormal temperature, dilatation of the pupil, impalpable pulse, coma and death.

Diagnosis of the disease is based on the occurrence of milk fever in recently calved animals.

**Treatment & Control :** Dramatic recovery by intravenous administration of 300-400 ml calcium borogluconate with Vitamin D3 injected intramuscularly. Continued mixing of ½ liter of supernatant lime water for cow may reduce the incidence.

**Ketosis :** Acetonaemia – disturbance of carbohydrate metabolism in high producing dairy cattle – hypoglycaemia and appearance of ketone bodies.

**Causes :** Disease is caused by deranged metabolism of carbohydrate and volatile fatty acids resulting in reduced level of sugar in blood (hypoglycemia), increased level of ketones in blood (ketonemia) and in urine (ketonuria)

**Symptoms :** Cardinal signs in digestive and nervous type of ketosis usually appear in good milkers from 7 days to six weeks after calving. Loss of appetite, rapid loss of weight and marked reduction in the milk yield observed in digestive type of ketosis. In nervous type symptoms include depression, a staring expression, walking, in circles, treading with the feet, incoordination of movements, convulsions, sudden falling on the ground with wide expression of bulged eyes. Respiration becomes shallow emanating fruity odour on the breath.

Diagnosis : Examination of ketone bodies in the urine helps in diagnosing the disease besides the symptoms noticed.

**Control and Treatment:** Intravenous administration of 500-1000 ml of 40 per cent glucose, Repeat for 5 days. Cases not responding to glucose therapy, intramuscular injection of 100-200 mg of hydrocortisone or 50 to 200 mg of prednisolone acetate. Concentrate feeding with good fodder during dry period in high yielding cows, ½ to one kg maize or cholam made as gruel mixed with ¼ kg of jaggery or molasses daily to be given to cows nearing parturition.

**Bloat :** (TYMPANY); is a disease of ruminants in which rumen and reticulum is over distended with the gases of fermentation.

**Cause :** Excess intake of fresh legumes and feeding of high grain ration lead to frothy bloat. Obstruction to normal expulsion of gases from rumen by choking the oesophageal passage by corncob, turnip and sugar beet cause free gas bloat.

**Symptoms :** Acute form of tympany results in sudden death before rendering any aid to the affected animal. In acute cases, the distension of the rumen occurs quickly, the flank and the whole abdomen is enlarged. On percussion the left flank produces a drum like sound, Initially the animal frequently gets up and lies down, kicks at belly and even rolls. Breath becomes difficult and is evidenced by oral breathing, protrusion of tongue and salivation. When the distension of abdomen becomes extreme, the animal exhibits uncoordinated movement, inability to stand, falls all of a sudden. Collapse and death occur quickly. In chronic tympany, the distension of abdomen and intra-abdominal pressure are not serious. The gas is 'free' but retained because of obstruction of the passage thereby preventing normal eructation of gases.

**Diagnosis** - of tympany is easy by the characteristic symptoms of distension of abdomen and distress by the affected animal.

**Control and Treatment :** in per acute cases puncture the rumen with a sharp knife or with a trocar and canula to expel the gases. Administer orally oil of turpentine 60 ml well mixed with one litre of groundnut oil or gingelly oil or cocounut oil. After six to eight hours administer powdered ginger 30 grams, Asafoetida 30 gram, well mixed to jaggery. Fresh legumes should be wilted and then fed to stallfed animals. Feed dry roughages before turning the cattle to luxuriant pasture to avoid bloating.

**Class 16: Zoonotic diseases – prevention and control (Anthrax, Tuberculosis, Brucellosis, and Rabies)**

ZOONOSES : Are diseases of animals including Homo sapiens. Its infective agents have become adapted to a particular animal species during course of evolution and can exist in these animals by uninterrupted infection chains. In narrow (epidemiological) sense, transfer of causative agent of an animal disease to human beings is zoonoses.

They are diseases and infections the agents of which are naturally transmitted among other vertebrate animals and man. Also included are a number of infections, which are shared but not naturally transmitted.

Classification

- a. Direct Z. – example rabies
- b. Cyclo Z. – eg. -teaniasis
- c. Sapro Z. – eg. – histoplasmosis
- d. Meta Z. – eg. – Japanese encephalitis
- e. Anthrapo Z. – Eg. Brucellosis

Disease	Cause	Non human principal hosts	Modes of infection	Symptoms	Class of zoonoses
Brucellosis	Brucella abortus Br.melitensis Br.Suis Br.canis	Cattle, goat, sheep, swine, caribou, dog.	Occupational exposure through air, contact, Ingestion of infected milk /food	IP 1-3 weeks, or month; septicaemic; continued, intermittent or irregular fever, chills, profuse sweating, weakness, fatigue,	Direct anthroozoonoses

				<p>patients get up as normal in the morning to fall in bed with high temperature in the afternoon, insomnia, headache, arthralgia, splenomegaly, disease lasts for weeks, months or even years.</p>	
<p>Anthrax</p>	<p>Bacillus anthracis</p>	<p>Cattle, sheep, goat, horse, wild herbivores</p>	<p>Occupational exposure through contact, airborne, vehicle (meat)</p>	<p>1 P.2-5 days Cutaneous form : Vesicle develop into black depressed eschar, generally uncared, not treated in time resulting into septicaemia and death. Pulmonary (wool sorters disease)</p>	<p>Direct anthroponosis</p>

				resemble common infection of upper respiratory tract : 1, P 3-5 days, acute, fever, shock and death. gastrointestinal form IP 4 days, gastroenteritis blood in stools, death.	
Tuberculosis	Mycobacterium bovis	Cattle	Occupational exposure through contact; ingestion of raw milk, inhalation	Extra pulmonary form most common. Cervical adenitis, genitourinary, bone, joint infections; meningitis, pulmonary form in occupational groups, transmit back to cattle.	Direct anthroponoses

<p>Leptospirosis Weil's disease</p>	<p>Leptospira interrogans</p>	<p>Rodent, domestic and wild mammals, contaminate soil water at neutral to alkaline pH</p>	<p>Occupational and recreational exposure through contaminated water, ingestion</p>	<p>IP 1-2 weeks, as short as 2 days, septicaemic phase (1-10 days), leptospiuria (1 week to several months) Icteric form (weil's disease), hepatonephritic form fever, headache conjunctivitis, vomiting, diarrhoea and constipation.</p>	<p>Direct anthroponosis</p>
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**CLASS 17: SHEEP AND GOAT FARMING-CLASSIFICATION OF BREEDS OF INDIAN AND EXOTIC ORIGIN-NOMENCLATURE ALONE.**

Sheep belongs to the family Bovidae ,Genus Ovis and Species- aries. The sheep an important economic livestock species contributes greatly to the agrarian Indian economy. They play and important role in the livelihood of a large percentage of small and marginal farmers and land less labourers. Sheep manure is an important source of organic fertilizer especially in the southern state where they are folded on fallow land for increasing fertility of the soil. Sheep are mostly maintained on natural vegetation grazing lands (common) waste lands and uncultivated lands, stables of cultivated crops and tree loppings. Sheep are mostly reared for meat and wool.

Population - world 1110.78 millions (1993)

India – 49.20 million (1992) – 6<sup>th</sup> in over all sheep population in the world.

Breeds: There are 44 describe breeds of sheep

Northern temperate region – Eg. – Gaddi, Kasmir Merino, Gurez

North west Arid region – Eg. Chokla, Nali, Hissardale, Bharath merino

Southern – Nellore, Mandya, Mecheri, Kilakaraisal, Vembur, Coimbatore, Nilgiri, Ramnad White,

Trichy Black, Madras red.

Eastern – Balangir, Shahdadi.

Exotic breeds – Merino, Rambouillet, Dorset, Corriedale.

Nutrition : Sheep prefer ground vegetarian grasses, legumes, and wide varieties of forages.

water requirement adult sheep 2 – 4 liters

Energy : Adult – Non pregnant sheep – 93 K cal. ME / kg. W<sup>0.75</sup>

Lactating - 102 K cal. ME / kg. W<sup>0.75</sup>

Protein – DCP requirement – 1 g for every 1kg live weight (adult non pregnant)

Increases by 50% during pregnancy and 100% during lactation.

Housing and shelter management : Normally sheep do not require elaborate housing facilities but minimum provision will definitely increase productivity. Shed could be along the wall of the house. Further protection could be provided with gunny bags and protection made of thatching material and bamboo.

space requirement – 1 m<sup>2</sup> space per head. shed measuring 18m x 6 m can accommodate 120 sheep.

Dipping and deworming are important management practices to be adopted.

GOAT : Family – Bovidea Genus Capra

Goats provide an dependable source of income to more than 40% of the rural population who live below the poverty line in India.

Population – 114.32 x 10<sup>6</sup> (1992 estimated )

Goats are mostly raised by land less labourers and marginal farmers. Goats produce lean and juicy meats (chevon) which is preferred by all religious sects.

The goat milk contains lower fat percent with smaller fat globules, higher protein and lactose and rich in minerals.

**Breeds :** 23 well defined breeds goats in India

for meat and skin – Black Bengal, Kanni adu

Meats, skin and milk – Barvari, Malabari (Tellicherry), Sirohi, Surti

Meat hair and skin – Gaddi, Kutchi, Marwari

Milk meat and skin – Beetal, Jamunabari,

**Exotic breeds and crossbreeding experience :**

Specialized exotic dairy breeds of the temperate zone, viz, Alpine, Saanen, and Hohair breeds.

, Angora had been used in controlled experiments in India to assess the improvement of milk yield and Mohair production. The level production of crosses of high yielding indigenous dam

breeds, Eg. Beetal were superior to those of the crosses of relatively low yielding Malabari in spite of similar body size. The advantage of improvement in milk yield of exotic crosses at all the experimental stations, has been further discounted by abysmally low fertility and high mortality of kids.

**Nutrition :** Goats generally accept a wide variety of feeds but what is acceptable to one may not be equally acceptable to the others. They prefer to select from the wide variety of feeds and vegetarians (Preferably leaves) and like fresh fodder, grains, seeds and pellets rather than the wet feeds, silages, chopped greens, soiled forages and hays. Goats have higher tolerance to the wide variety of otherwise undesirable phyto-chemical compounds which enable them to consume a wide range of plant species.

In comparison with cows, then milch goats require a higher amount of TDN. Goats have the capability of consuming dry matter to the tune of 5 to 8% of its body weight. As a species, it can utilize lignin and cellulose better than the other ruminants and sustain water deprivation for longer periods. The nitrogen recycling through rumen is also considered better.

The deficiency of major nutrients, energy, protein and dry matter, in the country amounts to 50-60. 50-75 and 80% respectively. Availability of the grass, browse and agro-industrial by-products for goats is approximately to the tune of 40, 9.6 and 48 million tonnes/annum in the country.

Goats are normally reared on browse and pasture forage that other ruminants do not consume. major part of feed of goats comes from natural vegetation on common grazing land range land and other non cultivable areas.

### **Top feed resources**

A large variety of tree leaves (top feed) save as promising feed resources for goats. It is estimated that annual production of green leaves for fodder from trees in the country is to the tune of 24 million tones. Against the requirement of 1.9 m tones of DCP and 17 x 10 Million M call DE the tree leaves provide 0.7 mt DCP and 4 x 10 m M cal DE to goats. Most of the tree

leaves contains 20 – 40% dry matter 4 – 15 % DCP and 50 – 60% TDN depending on the season of harvest but their palatability is poor which limits the energy supply to goats.

### **Housing**

Shed – long axis East west

Floor space- adult goat 1.2.5 – 1.5 m<sup>2</sup>

Pregnant doe and bucks – 2 m<sup>2</sup>.

Kids – 3 – 6 months 0.7 to 0.9 m<sup>2</sup>

6month – 1 year 1m<sup>2</sup>

Individual kidding pens are essential to house does in late pregnancy.

### **Importance of small ruminants in Indian Agricultural**

#### **GOAT**

1. Adapted to different agro-climatic condition.
2. Un fastidious in food habit
3. No religious prejudice against chevon.
4. Low cost of maintenance, short term return and low risk.-better suited for small and marginal farmers.
5. Can thrive in conditions where cows and buffaloes can not sustain.
6. 35% of meat production and 3% of milk production of India.
7. During grazing 50% of time is spent only on tree leaves.
8. Being smaller in size - with larger surface area, well adapted to high temperature - arid areas.
9. Semi-arid areas with sparse vegetation, bushes, shrubs - steeply sloped mountainous regions cannot be suited for cattle but goat and sheep.
10. Physical characters of different breeds in various regions are well adapted. to the local need - large size with longer legs to suit longer distance walk in high temperature areas and small size with shorter legs are found in humid areas.
11. Special feeding habits with mobile upper lips and highly prehensile tongue can

take foliage which are not available to other livestock species.

12. Higher crude fibre digestibility.
13. High growth rate in population (2%) despite being slaughtered at higher numbers due to its prolificacy, short generation, regular breeding through out \ the year, short inter kidding interval.
14. High growth rate in body weight.
15. Adaptable in to any system of management.
16. No competition human beings.
17. Moderate milk yield, (1.5 to 2.5 Litres) from poor quality pasture
18. Manure from 1 goat is sufficient to manure half an acre.
19. High disease resistance.

### **Sheep**

1. High adaptability to extremes of climate
2. Gregarious animal
3. Uniparous
4. Important in arid and semi- arid area for marginal sub-marginal holdings.
5. 6% of world population.
6. Insurance during the crop failure and during monsoon failure.
7. Apt to hilly, drought and desert regions
8. Important subsidiary and complimentary unit in mixed / integrated farming.
9. Can thrive on are agro-climatic regions except rainfall areas.
10. Can thrive in low set sparse vegetation where other livestock can not thrive because of close grazing.
11. No expensive investment for buildings equipment - suitable for marginal small farmers.
12. valuable manure.
13. Populations fluctuate due to diseases

Northern temperate Region - Fine wool

And Nilgiris of Tamil Nadu

North West arid Region - Carpet wool

Southern Region - Meat

Wool potential : 3.5 - 5 kg - exotic breeds

1 - 2 kg - Indian breeds

Poor management <sup>TM</sup> 20% of meat realisation

Effective utilization of and cultivable waste lands, unwanted shrubs and weeds.

Sheep breeds :

**Southern region -**

**1. Mandya**

Native tract : Karnataka

Colour - White

Physical traits - White, compact body, typical reverse "U" shaped from year end.

Body Weight - Male 35 kg : Female 25 kg

Good quality Mutton

**2. Nellore**

Native tract : Andhra

Colour : white

Physical traits : Tallest in Indian breeds.

Body weight - Male 36kg ; Female 30 kg.

**Tamil Nadu**

1. **Nilgiris** : developed from Tasmanian merino, Cheviot, dorset and south down breeds

Colour : white

Physical traits : polled, roman nose,

Body weight : 30 - 40 kgs.

Wool yield : 600 to 900 gm per annum

Only breed in south India producing apparel wool .

2. **Coimbatore / Kurumbai / Sular**

Native tract : Coimbatore District

Colour : White with black or brown markings on face and neck

Body weight : Male 25 kg : Female 20 kg.

Coarse fleece : 400 - 500 g.

3. **Madras red**

Native tract : Chengalpet and Madras District

Colour : brown

Body weight : Male - 35 ; female - 25 kgs.

4. **Mecheri**

Native tract : Salem and Coimbatore District

Colour : Light brown

Body weight : Male 35 kg : Female 20 kg.

Polled

5. **Keezhakaraisal**

Native tract : Ramnad, Dindukal, Pudukottai, Madurai Districts

Colour : Dark tan with black markings on head, belly and legs.

6. **Ramnad white**

Native tract : Ramnad, Pudukottai, Thanjavur Districts

Colour : White with black markings on head , belly and leg.

Body weight : Male - 31 kg : Female - 20 kgs.

7. **Vembur**

Native tract : Virudhunagar, Tuticorin Districts.

Colour : White with red or fawn markings

Body weight : Male - 35 kgs : Female - 28 kgs.

### **8. Trichy black**

Native Tract : Trichy, Arcot, Salem Districts.  
Colour : Black with White face.  
Body weight : Male - 25 kgs : Female - 18 kgs.

### **Exotic Breeds**

#### **1. Merino** : Best fine wool breed

Native tract : Spain  
Body weight : Male - 90 kgs : Female - 70 kgs.  
Dense, strong staple, close crimps

#### **2. Rambouillet**

Native tract : Descendant from Merino developed in France.  
Body weight : Male - 90 kgs : Female - 70 kgs.

#### **3. Polworth :**

Native tract : Australia (for areas not suitable for merino)  
Lincoln x Merino

#### **4. South down :**

Native tract : England  
smallest of meat breed  
Typical meat breed (compactness short legs)

#### **5. Cheviot :** Superior and effective meat producer

Body weight : Male - 80 kgs : Female - 55 kgs.

#### **6. Corridale :** Dual purpose (meat and wool)

Native tract : New Zeland  
Lincoln x Merino

**7. Karakul** : Pelt breed

Goat Breeds :

**Jamunapari**

Home tract : Etawah district and tract between Jamuna and Jambal river in UP.

Physical traits : Large, tall, long folded pendulous ear, prominent roman nose, long and thick bunch of hairs on hind quarters

Length : 3½' - 4½'

Height : 2½' - 3½'

Body weight : Does 45 to 60 kg

Buck 60 to 85 kg

Milk Yield : 2.25 to 2.75 kg per day.

**Beetal**

Home tract : Punjab

Colour : Red, tan

Physical traits

As this breed evolved from Jamunapari physical traits are almost similar to it.

**Barbari**

Home tract : UP, Hariyana

Colour : white with red spots

Body weight : Does 25 to 35 kgs.

Buck 35 to 45 kgs.

Suitable for stall feeding.

Prolific breeder and high milk yielder

**Black Bengal**

Home tract : West Bengal

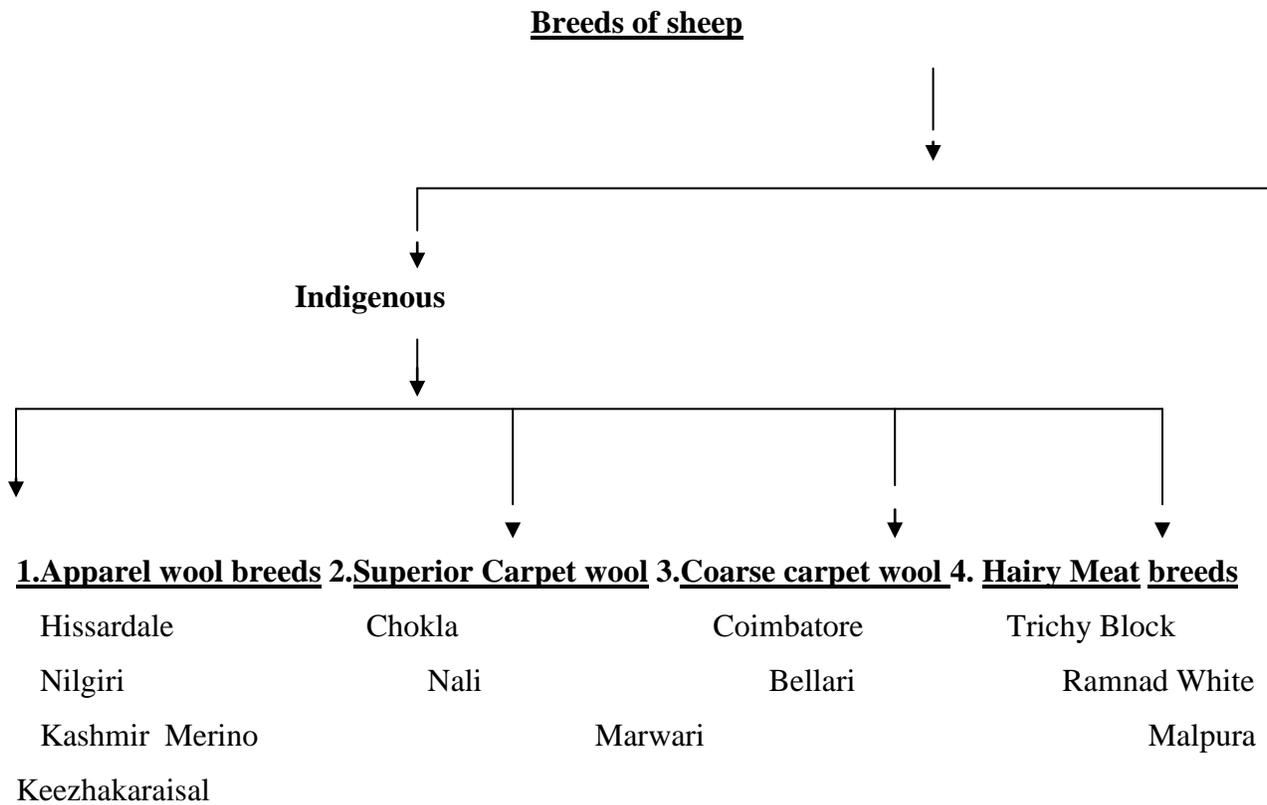
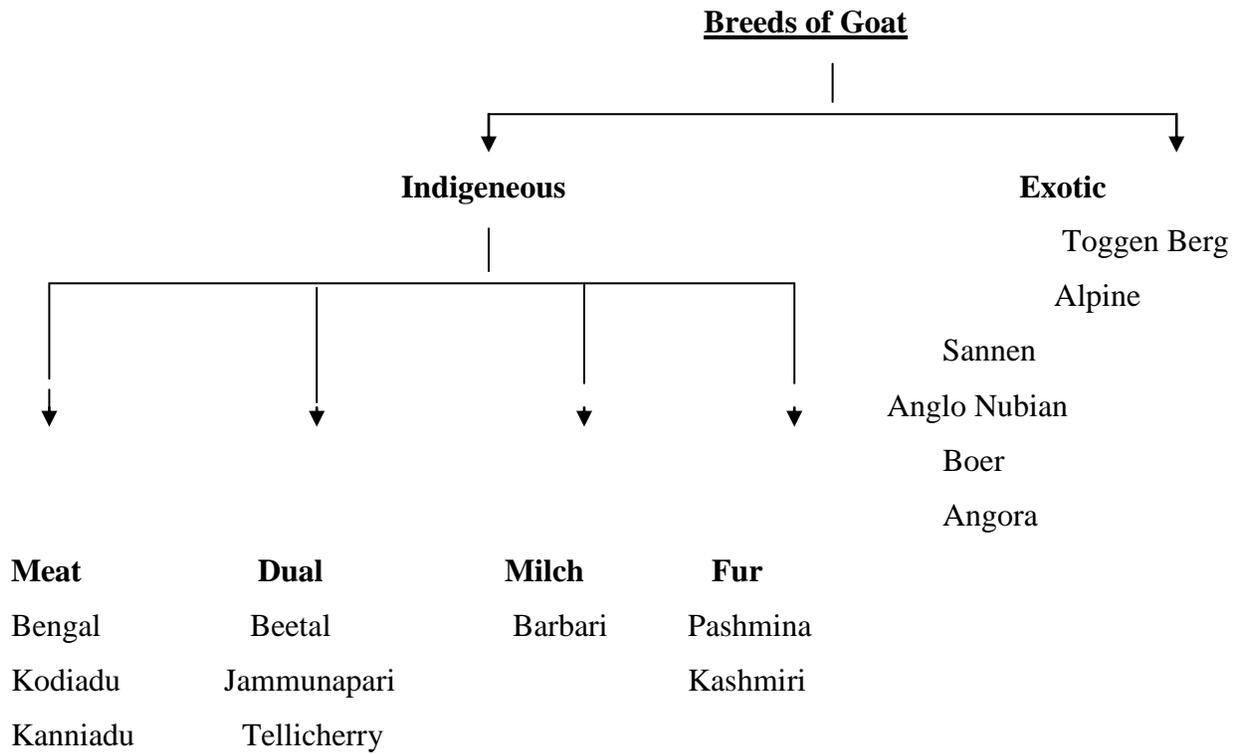
Colour : Black

Physical traits : shorter breed.

Body Weight : Does 10 to 15 kg

Buck 15 to 20 kg

<b>Nomenclature</b>		
Traits	Sheep	Goat
Species	Ovine	Caprine
Group	flock	Band/herd
Adult male	Ram	Buck
Adult female	Ewe	Doe
Young male	Ram lamb	Buckling
Young female	Ewe/Gimmer lamb	Goatling
New born	Lamb	Kid
Castrated Male	Wedder	Wether
Castrated Female	spayed	Spayed
Act of parturition	Lambing	Kidding
Act of mating	Tupping	Servicing



Avivastra	Magra - Bikanari	Vembur
	Jaisalmeri	
Meecheri		
	Poonch	Madras
Red		
	Karnah	Nellore
	Gaddi	Mandya
	Avikalin	

---

<b>Exotic</b>			
↓			
↓			
<b><u>1. Fine Wool Breeds</u></b>	<b><u>2. Mutton</u></b>	<b><u>3. Dual purpose</u></b>	<b><u>4. Pelt</u></b>
Merino	South down	Corridale	Karakul
Rambouillet	Dorset		
Pol worth	Suffolk		

**Breeds**

Temperate Himalayan : good quality wool.

1. Gurez
2. Bharwal
3. Gaddi
4. Ramper Bushiar

**Western region** : - superior carpet wool.

- Magra
- Chokla
- Nali
- Bikanari

**Coarse wool** - Marwari

**Class 18. Systems of rearing-Housing management- Type design- Floor diagram-Space requirement for adult and young stock.**

System of Production :

Nomadic:

Permanent 1. Subsistence

commercial

1. Teathering 2.Extensive 3. Semi intensive 4 Intensive

**Teathering :**

- ❖ Sedentary system
- ❖ Suitable to areas of intensive agriculture
- ❖ Controlled system of management
- ❖ Minimum labour input
- ❖ Utilization of feed stuffs in site

**Extensive system:**

Allowed for grazing on agriculture land after harvesting and on natural bushes, shrubs and natural pasture land.

**Disadvantages :** Low carrying capacity

- ❖ Deficit of nutrients excepts during monsoon.
- ❖ Only poor quality (High fibre) plants are available.
- ❖ Less weight gain : 20-40gm/day
- ❖ No possibility of separating on age basis.
- ❖ No scientific management is possible
- ❖ Improvement by.

1. Indiscriminate breeding – avoided
2. Castration of scrub bucks and rams.
3. Timely vaccination and deworming.
4. Bran supplementation.

Semi intensive system : On return from grazing – being supplemented with concentrates – Western countries – provision – of pen with paddocks. – Growth rate – 40-50 gm/day. High margin of profit.

Intensive system : Confined / provision of pen and run / grazing on cultivated fodder and concentrate supplementation in stalls.

**Advantages :**

- ❖ Don't destroy plants – preventing soil session.
- ❖ Carrying capacity is high.
- ❖ FCR is high
- ❖ Good quality manure is obtained.
- ❖ Labour efficiency is high.
- ❖ Scientific management is possible.

**Disadvantages :**

- ❖ Parasitic problem - external.
- ❖ Free roaming- restriction land to reduced feed in take and weight gain.
- ❖ So should be confined from young age onwards.
- ❖ High quality litter management NH<sub>3</sub> production – respiratory problem.
- ❖ Heat identification – problematic.

**Housing**

1. Not expensive
2. Adequate space
3. Proper ventilation
4. Good drainage
5. Plenty of light
6. Protection from predators and adverse climate
6. Dry floor.

**Space allowance**

Adult :            Male : 20- 25 sq.ft.

Female: 15-20 sq.ft.

Young : 10 sq.ft.

**Intensive system :**

Deep litter system

Slatted floor

Concrete floor

Breedable male shed :2.5 m x 2.0 m

Individual one to avoid fighting

Parturition shed : Individual basis preferably with paddocks.

Segregation / Isolation shed / sick animal shed :10' x 5'

One corner of farm

Leeward side

General flock shed 50- 60 does

Kid shed : 20-30 nos.

Hay racks : Box made up to wooden reaper fixed at the interval of 5 cm. Elevated benches.

**CLASS 19. CARE AND MANAGEMENT OF RAM, EWE AND LAMB-NUTRITION-FEEDS AND FODDER FOR SMALL RUMINANTS.**

Nutrition – small ruminants

Uniqueness

Goat : Browsing – selective feeding of

1. Tender twigs and leaves – not available for other species.
2. Wider feed acceptability.
3. High crude fibre digestibility
4. Consuming more dry matter / unit body weight
5. High convertibility : 45-71% , cow : 38%
6. Capable of thriving on bushes, shrubs, herbs, tree foliage and tree leaves.
7. Highly prehensile tongue and mobile upper lip.
8. Small in size – split feeding is essential
9. Faster passage and fermentation rate
10. To certain extent withstand toxic alkaloids

Sheep : Grazing – better thrive -on stubble after harvest

1. Highly resistant- water deprivation .
2. Bifid upper lip.
3. Consideration for fleece.

Model Concentrate Mixture

	Young	Grower	Adult
Maize	60	30	36
GNC	20	30	21
Fishmeal	10	-	-
Molasses	-	7	-
Bran	7	30	40
Mineral Mixture	2	2	2
Salt	1	1	1

Feeding schedule

upto 3 months : Milk Conc roughage.

3-6 months	:	50 – 100g	adlib
6-1year	:	100 – 150 g	adlib
Adult	:	200 – 250 gm	adlib
Lactating	:	250 – 300 gm	adlib
Pregnant	:	300 – 350 gm	adlib
Breedable male	:	250 – 300 gm	adlib

General considerations

1. Protein feeding during pre-ruminant stage

2. Tree fodder

- a) Emergency fodder
- b) Rich in calcium
- c) Low in fibre when compare to grasses.
- d) Rich in tannin

3. Pasture : Poor in quality

Mixture of legumes and non legumes best.

Rich in nutrients

High voluntary intake

Enrichment of soil

Carrying capacity :

1/unprotected pasture

2-5/protected pasture

40/ cultivated pasture

Rotational grazing

Young ones :

1. Colostrum feeding

2. Milk feeding

3. Milk replacer

4. Creep mixture

Protein rich concentrate from 2<sup>nd</sup> week of life upto 3 months of age, with restricted suckling for better growth and early maturity and marketing.

4 – 5 times a day

60-80 gm gain / day – smaller breed

100 – 140 gm gain / day – larger breed.

Composition :

Maize : 60%

GNC : 20%

Fishmeal : 10% DCP : 18%

Wheat Bran : 7% TDN : 70-80%

Mineral Mixture : 2%

Salt : 1%

Antibiotics

Vitamin mixture : 25 gm

Extra feeding for early weaned, orphaned, and mates of multiple litters.

Fattening young ones:

Concentrate : Roughage ratio varies with market need

Lean carcass : 30-40% roughage

fatty carcass : 20 – 25 % roughage

Replacement stocks :

For early maturity, good quality roughage and concentrate

250 – 400 gm with 10-12% DcP and 65-70% TDN.

Breedable females :

**Flushing :**

Natural flushing

Extra feeding just before breeding season – body weight

Over feeding

early onset of breeding activities

fatty deposition	synchronized.
Poor breeding	Increased ovulation rate
effective in poorly fed animals	
	Increased conception
	Multiple birth
	Better weaning .

Management of breedable males.

1. Selection
2. Breeding allowed at the age of 18months.  
25-30 females / male initially – 40-60 / Matured male  
Females / beyond 2 years of age.
3. Criss crossing of age groups for better breeding
4. Extra males during synchronization
5. Controlled access to females
  - a) Flock mating
  - b) Pen mating
  - c) Hand mating
6. Exercise in paddocks / range land other wise – slow breeding.
7. Teaser maintenance
8. Marking of male's brisket and breast.
9. Changing of individual once in 2 year to avoid inbreeding.
10. Culling – Poor breeder, Extra feeding, infertile, deformed, aged.

Extra breeding just before and during breeding season.

1. Avoiding adipose tissue deposition.
2. Periodical grooming
3. Periodical evaluation of semen.
4. Protection against parasitic infestation and infectious diseases.
5. Disbudding.

Management of female stock

1. Selection 2. Breeding : Regular.

Oestrus Signs : 18 – 21 days : 30 –40 hrs.

Tail wagging

Mucous discharge

Frequent urination

Swollen vulva

Bleating.

Mating : at second day of oestrous

1. Breeding performed – to receive young ones in favourable season

2. Mating by 14 –15 months of age & once in 8 months .

Flushing –

Repeat Breeder.

1. Synchronization of oestrus– Telescoping .

2. Artificial Insemination

3. Embryo transfer technology.

Pregnant females :  $148 \pm 3$  days.

Isolation – diagnosed by  $2\frac{1}{2}$  - 3 months of age.

Quality feeding

Exercise

Pregnant Animals : During last  $\frac{1}{3}^{\text{rd}}$  period 70-80% of growth of foetus so better care is needed.

Good quality legumes and concentrate to support foetal growth.

To make up loss in previous lactation

To maintain reserve for ensuing lactation.

To meet their own growth.

Poor feeding – Low birth weight – poor survivability

Pregnancy toxaemia

Lactating ones. – low voluntary intake – not sufficient

So reserve during pregnancy created – to meet out peak lactation.

Male – Extra feeding just 40 days prior to breeding season to maintain better libido and fertility.

fattiness should be avoided.

Parturient animals.

1. Based on breeding records.
2. Udder engorgement
3. Relaxed perinium
4. Isolation - fussy in nature
5. Care during prolonged time - Dystocia - Due to disproportionate mating
6. Avoid too much handling to avoid abandoning
7. Watch for shedding of placenta and avoid placenta eating.
8. Provide laxative diet – roughage during peripartum to avoid udder stress.
9. Lactating females: Special Nutrition : Avoiding buck odour

Hoof trimming, Weaning, proper udder care.

Culling : Poor breeder, poor mothers, irregular breeders, aged beyond 7 years of age.

Management of young ones.

1. Starts in pregnancy itself
  - a) By extra feeding b) deworming and vaccination
2. Birth in clean environment
3. Cleaning of mucous from all over the body -induce licking by dams.
4. Care of Navel cord – to avoid naval ill and joint ill.
5. Resuscitation for breathing
6. Colostrum feeding with in 15 – 30 minutes.
7. Weighing and identification
8. Fostering : milk feeding for individuals of large litter, orphaned young ones -early weaned.

weak Young ones

I 1/6<sup>th</sup> Birth weight

II 1/8<sup>th</sup> Birth weight

III 1/10<sup>th</sup> Birth weight

Concentrate and roughage from 2<sup>nd</sup> week onwards.

1. Well ventilated shed.
2. Isolation during early stage along with dam for better growth and to avoid licking each other
3. During winter – heat supplementation
4. Creep ration : high quality concentrate containing animal protein sources.
5. High Quality concentrate containing animal protein sources.
6. Periodical weighing and culling.
7. Periodical deworming, vaccination and deticking.
8. Separation of sexes by 3 months of age.
9. Castration of marketable male kids.
10. Disbudding – sometimes.
11. Marketing by 6-9 months of age.
12. Exercise
13. Docking of lambs – to avoid blow fly infestation.

Creep ration

Grains	: 60%
GNC	: 15 %
Fishmeal	: 7%
Bras	: 15%
Mineral Mixture	: 2%
Salt	: 1 %

Antibiotics vitamins.

**CLASS 20. CARE AND MANAGEMENT OF BUCK, DOE AND KID- NUTRITION- FLUSHING.**

Nutrition – small ruminants

Uniqueness

Goat : Browsing – selective feeding of

1. Tender twigs and leaves – not available for other species.
2. Wider feed acceptability.
3. High crude fibre digestibility
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upto 3 months	: Milk	Conc	roughage.
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Adult	:	200 – 250 gm	adlib
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General considerations

1. Protein feeding during pre-ruminant stage

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- a) Emergency fodder
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3. Pasture : Poor in quality

Mixture of legumes and non legumes best.

Rich in nutrients

High voluntary intake

Enrichment of soil

Carrying capacity :

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40/ cultivated pasture

Rotational grazing

Young ones :

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Protein rich concentrate from 2<sup>nd</sup> week of life upto 3 months of age, with restricted suckling for better growth and early maturity and marketing.

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8. Marking of male's brisket and breast.
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10. Culling – Poor breeder, Extra feeding, infertile, deformed, aged.

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Swollen vulva

Bleating.

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Flushing –

Repeat Breeder.

1. Synchronization of oestrus– Telescoping .

2. Artificial Insemination

3. Embryo transfer technology.

Pregnant females :  $148 \pm 3$  days.

Isolation – diagnosed by  $2\frac{1}{2}$  - 3 months of age.

Quality feeding

Exercise

Pregnant Animals : During last  $\frac{1}{3}^{\text{rd}}$  period 70-80% of growth of foetus so better care is needed.

Good quality legumes and concentrate to support foetal growth.

To make up loss in previous lactation

To maintain reserve for ensuing lactation.

To meet their own growth.

Poor feeding – Low birth weight – poor survivability

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8. Provide laxative diet – roughage during peripartum to avoid udder stress.
9. Lactating females: Special Nutrition : Avoiding buck odour  
Hoof trimming, Weaning, proper udder care.

Culling : Poor breeder, poor mothers, irregular breeders, aged beyond 7 years of age.

Management of young ones.

1. Starts in pregnancy itself
  - a) By extra feeding b) deworming and vaccination
2. Birth in clean environment
3. Cleaning of mucous from all over the body -induce licking by dams.
4. Care of Navel cord – to avoid naval ill and joint ill.
5. Resuscitation for breathing
6. Colostrum feeding with in 15 – 30 minutes.
7. Weighing and identification
8. Fostering : milk feeding for individuals of large litter, orphaned young ones -early weaned.



Antibiotics vitamins.

**Class 21: Common ailments of sheep and goat-Sheep pox-Foot and Mouth-Blue tongue-Enterotoxaemia – Ecto and Endo parasites.**

Blue Tongue : Viral Disease

Infectious non contagious disease

transmitted by Culicoides midges

Virus – Orbivirus - Reoviridae

Sheep are mainly affected – congestion, oedema and haemorrhage, fever lameness

Symptom : Inflicting Mucous membrane of the Buccal Mucosa and

Gastro intestinal tract

Epithelial desquamation of sensitive laminae of hoof udder etc.

No vesicle formation

Pyrexia

Congestion oedema and Haemorrhage of Buccal cavity

Control : A live attenuated polyvalent vaccine

prior to rainy season

Annual vaccination

Pregnant animals vaccinated prior to Lambing

Routine hygiene and sanitation.

Vector control is very important in disease prevention.

Sheep pox : Viral Disease – pox virus

Symptom : Contagious Disease : Inflicting severe losses

High fever – Dullness – Isolation from herd discharge from Natural orifices – Eyes and Nostrils with swelling of eye lids – ‘Pox’ eruptions on the skin of ears, head, inside of thighs, scrotum, lower side of the base of the tail. infection affection – Pneumonia in lambs is more common and death.

Treatment: No specific treatment – Nursing is important. Tissue culture vaccines may be administered.

Skin lesions – dressed with sulphaniamide and neem oil

Broad spectrum antibiotic therapy to prevent secondary bacterial infections.

Control: Sheep pox vaccine,

Enterotoxaemia:

Bacterial Disease - Clostridium perfringens type D and Cl. welchii type 'D'

Symptoms: Young stock – death occurs instantaneously, convulsions in lambs prior to death.

Adult: Initially calm and Quiet, frothy mouth ,champing of jaws, rolling of eyes, convulsions.

Treatment: Sulphadimidine 33 1/3% 1/r +antibiotic therapy- tetra cycline, streptomycin + Penicillin.

Lambs: 3-8 weeks – Pulpy kidney disease

Control : Proper disposal of dead animals

Vaccination : Lambs – 2 weeks of age

sheep – yearly – endemic areas – pregnant ewes – before Lambing.

FMD – refer cattle disease notes.

Ecto parasite and Endo parasites

1. Blue bottle fly : Black Blow fly

Eggs – dirty area of open wound

2. Lice and ticks – wool damaged

weak, anemia, Stunted growth

3.Mites – sheep scab –restlessness

wool loss -treated by using melathion 0.5%

Sumithion 0.1% Sevia 0.8%

Dip – lime sulphur 0.4% W/V

a) Fascioliasis – loss of condition

b) Round worms – Anemia

c) Tape worms–bottled jaw–distended Abdomen

Profuse yellow dark watery faeces -

diarrhoea – deworming.

**class 22: Swine Husbandry –Common breeds of exotic origin-nomenclature alone-housing of pigs.**

**SWINE- PIG**

Industry status

- 1.Primitive
- 2.Poor quality meat and low aesthetic value of meat produced.

Advantages

1. High Prolificacy : 6-12 no./litter
2. FCR –1:2.5 - 3
3. Short generation interval
4. More quantity of meat/unit weight
5. More energy / unit weight
6. High meat : Bone ratio
7. Easily adapted to integrated or mixed farming system.
8. Successfully maintained on discarded feed, garden waste and kitchen waste.
9. High dressing percentage
10. High growth rate : 10Kg./month
11. Early maturity : 9-10 month of age
12. Early puberty : 5-8months
- length of oestrus cycle : 21 days
- Oestrus period : 2-4 days
- Service : 2<sup>nd</sup> /3<sup>rd</sup> day of oestrus
- Rebreeding after parturition : 3-4 weeks after weaning.

Comparison between desi Vs. Exotic (India)

	Desi	Exotic
Litter size at birth	7.5	10
Birth weight (Kg.)	0.91	1.4

Weaning weight (kg.)	4.1	13.5
Weaning percentage	54	78.5
Dressing percentage	66	68
Maturity (Months)	14	8 - 10
Growth rate (gm)	70-100	over 300 gm.
Back fat thickness – (cm)	3-7	4-5

Nomenclature

Species : *Sus scrofa vittatus*

*Sus scrofa indicus*

Group : Stock / Drove

New Born : Piglets (Last born piglet- Runt)

Young male : Boarling

Young female : Gilt

Adult Male : Boar

Adult female : Sow

Castrated male: stag / Hog

Parturition : Farrowing

Mating : Coupling

Sound : Grunting

Breeds: Large white Yorkshire : Chester white

Middle white Yorkshire : Tamworth

Berkshire : Landrace

Poland china

Spotted Poland china

Duroc

Hampshire

**Large white Yorkshire : UK**

White, occasionally black spots

Erect ears and dished fore head

Long and deep body

Snout length is medium

Mature body weight : Male : 300-400 Kg.

Female : 230 – 320 Kg.

**Middle white Yorkshire : UK**

Developed from crossing Small and Large White Yorkshire

Extensively used to upgrade desi pigs as it is smaller in size

Early maturity, rapid growth and can be raised on pasture

But not prolific as that of Large white Yorkshire

mature body weight Male : 250-350Kgs.

Female-180-270Kgs.

**Land race : Denmark – Bacon Breed**

White with blackspot,

Long snout

Excellent suited for upgrading desi pigs as it needs less feed resources for their maintenance and efficient converter of feed.

Suitable for breeding smaller desi pigs

Mature body weight : Male : 270 – 360 Female : 200-300

**Swine Nutrition**

Monogastric and omnivorous – low fibre, high quality protein (Animal sources)

Requirement : Energy, protein, mineral, vitamins and additives

Energy : Starch – grains

Fat - oils – upto 10% (normally 4-6%)

fibre – Should not exceed 5-6% if exceeds – low growth rate digestibility

Sources : Cereals, Millets, Byproducts – Bran, molasses – rich in Vit B complex .

Protein : High quality – essential Amino acids – 10

Animal source : rich in lysine % methionine ca, protein, Vit.B.

Vegetables source : rich in Tryptophan and limited in lysine and methionine (Grains – maize)

For effective growth rate : both animal protein sources and vegetable protein sources should be balanced.

By feeding leguminous fodder, we can save the protein requirement from concentrate

Minerals : Micro : Cu, Fe, Co, I, Mn, Se, Zn

Macro: Ca, P, Na, K, Mg.

Ca: P -2:1

‘P’ from plant sources, availability is low as they are in “phytate” form like wise any organic form so DCP, DFRP.

Nacl : 0.5% depending on fishmeal inclusion

Fe: 80 mg/ kg feed

Cu: 8 mg/Kg.feed

Co: essential for B<sub>12</sub> Synthesis

I<sub>2</sub>: deficiency results in gritre, hari less piglets

Zn: Parakeratosis

Vitamins

Fat soluble vitamins (A,E & K) – corns, Legumes

D<sub>3</sub> – sunlight exposure

B-Complex – greens

B<sub>12</sub> -Animal protein sources.

Additives

1.Antibiotics

Water reqt: 2-3 times of feed (4-5 litres/ litre of milk)

2. Probiotics

3.Copper Sulphate

Ration formulation

Requirement

Age	Preweaning	Grower (20 – 90Kg.)	Adults
CP%	22%	18-13	14-15%
ME (k.cal/kg.)	3500	3500-3800	3300

Ca : 0.5 – 0.8%

P : 0.4 – 0.6%

Salt : 0.5%

Model composition

	Creep mixture	Grower	Adult
Maize	53	53	50
Cakes	22	16	7
Wheat Bran	7.5	17	35
Fishmeal	15	12.5	6.5
Mineral mixture	2	1	1
Salt	0.5	0.5	0.5

Allowance

Creep mixture : 0.2 – 0.6

Grower : 0.6 – 2.0

Adult : 2 - 3

Systems of feeding

1. Slope(wet mash) Vs dry mash
2. Restricted – lean meat Production
3. Pelleting
4. Frequency – 2-3 times
5. Fibre diet – Pelleting improves digestibility
6. FCR decreases as age advances – 1.2 – 2.8-3 kg feed / kg. gain during 60 days to

9months.

Breeding animals

Should not become fatty. Grower ration for breedable population. Pregnant animals;  
Should gain 35 Kg – sows 55 kgs. – Gilts

Ration should ensure

1. Good growth rate in piglets
2. Regular Breeding
3. High quantity carcass
4. Good quality carcass
5. Resistance to diseases

High growth rate – deficiency

Soft fat Vs firm fat.

oil rich cakes, maize , Millet, animal protein sources

difficulty in handling

drip loss

During early age : maize and oil rich cakes

during marketing age – cereals and animal protein sources.

Garbage feeding : 1 kg concentrate can be replaced for every 10 kg of garbage (kitchen waste & market waste)

Pig sty :

1. Away from living (Human) dwellings and dairy plants
2. Good flooring – cement to avoid damage due to prodding / snouting
3. Easily cleanable
4. Provision of pen and run
5. Horizontal ventilation
6. Effective drainage
7. Provision for feeder and waterer in pen and run respectively
8. Two rows of house for effective labour management

### Provisions

1. Separate Pens for Boar and Sows.
2. Farrowing Pen
3. Lactating Pen/nursing Pen.
4. Weaned piglets – Grower and finisher

### Farrowing Pen

1. Guard Rails
2. Creep area
3. Brooder arrangement

### Guard rails :

1. To avoid crushing of piglets.
2. To avoid eating of creep ration by sows.

### Brooder

1. Piglets 'born naked'
2. 30-32°C – Heat supplementation for atleast first week of age.

Farrowing crates : To restrict movements of sows during the time of birth

Space 8' x 2'.

### House for piglets

1. Grouped according to body weight
2. Housed in community Pen
3. Not more than 20 numbers.
4. Number reduced as age advances.

Wallows : 10' x 6' x 15"

1. To induce evaporative heat loss
2. Sparse hair

3. Limited sweat glands

4. High subcutaneous fat cover

Poor possibility of heat dissipation especially for breeding and fattening animals.

Slotted floor : metal / wooden slots

1. Avoids contact between animal and excreta 2. Complete confinement

Movable accommodation

] Simple fencing in pastures.

] Periodically changed

] Grouped into 20-30 sows / hectare of pasture

Space Allowance (sq.ft.)

Class of animal

Growers	Pen	Run
20 Kg.	8	8
40 Kg.	12	12
60 Kg.	16	16
90 Kg.	20	20
Pregnant sows and boar	25	25
sow	40-60	35

Weaning : 56 days – 2 farrowings / year

based on weight

To avoid stress, gradual separation of piglets

Deworming

Piglet Anaemia

1. Under intensive system – no snouting of sand and accessibility to greens

2. Milk deficient in Fe & Cu

3. Large litters premature births

low liver storage of iron.

Symptoms : weak/runts – dyspepsia – edematous – death – distressed breathing - thumps.

Prevention :

1. Swabbing of udder – concentrated solution of FeSO<sub>4</sub> (0.5 kg / 10litres of water)
2. 1% FeSO<sub>4</sub> in creep mixture
3. Provision of run with mud and sand
4. Access to pasture
5. Injection Iron Dextron @ 100-150mg. at neck to avoid lameness at 3 weeks of age.

Breedable Population

Boar :

Selection : Masculine

1. Dam's characters (large (10-12) weaned litter
2. High growth rate 90Kg. – 9months of age
3. High FCR
4. Adequate length, width
5. BFT : 3.2 cm Boar  
4.0 cm Gilt
6. Free from physical defects.
7. High birth weight and weaning weight
8. Well descended testicles.

Housing : Individually 15 – 20 sq.ft.

Feeding: 2-2.5Kg (Cp-14%)

Puberty : 5-6 months of age

Maturity : 8-9 months of age

Sex ratio : 10-15 females – young boar

20-40 females – mature

4-5 mating / week - matured one

2-3 mating / week – young one

Mating : Hand mating

Pen mating with change of boar everyday

During first mating, better to allow matured sows rather than Gilts and excited sows to

avoid development of aversion and poor breeding efficiency of young boar.

- \* Mating : cool hours evening and morning
- \* Twice mating at 12 hours interval for better conception.
- \* Careful handling to avoid viciousness in mature boar and timidity in young one.
- \* Fertility checkup : Just prior to breeding season, allowing mating with marketable Gilts more returns – Poor fertility
- \* Good exercise to have high virility
- \* Trimming of feet to avoid lameness
- \* Cutting of tusk to avoid damage during mating – once in year.

## Gilt

Selection :

1. Pedigree records
2. Littermate performance
3. Her own performance
4. Progeny testing

Characters – Large litter – High growth rate – sows – 150 Kg. litter weight at weaning

Gilts – 120 kg. litter weight at weaning

Loin Eye area

BFT – 1 ½ - 2” away from vertebral column

No. of teats – 12-14

Free from physical deformities

Free from genital disease

good temperament

Age to breed : To get first litter by 12-14 months of age

Mating by 100 kg body weight

Mating by 3<sup>rd</sup> heat as ovulation rate increases

Oestrus identification : Oestrus discharge, swollen vulvas – pricked ear – frequent urination –

Grunting – pressing of Hindquarters against walls - restlessness.

Tests : Approaching hind quarters – no mobility.

Riding test : pressing over loin / croup region or even sitting over back will make no movement – standing heat – oestrus- By teasing – Teasers

Time to breed: II and III day or two mating at 12 hours interval.

After weaning : Heat by 2<sup>nd</sup> week – But it is better to breed after weaning – 2<sup>nd</sup> heat after weaning.

Feeding: 12-14% Cp.

Just prior to breeding enhanced feeding will increase ovulation rate and fertility rate.

Effective temperature control – Housing : group – 15-20 sq.ft.

Culling : Repeaters

1. After 5<sup>th</sup> – 6<sup>th</sup> Farrowing
2. Low fecundity
3. Poor mothering ability
4. Poor liter weight at birth and weaning (>1Kg at birth)

Pregnant Animal : Period : 114 days

Separate Pens : Groups initially and latter on just prior to Farrowing individuals

Balanced ration : 14 – 15% Cp

3-5 Kg concentrate

during last part of pregnancy to – recoup loss - Foetus growth – maintenance of themselves – Growth of young glits – Gilts should gain 35-40 Kg during pregnancy. sows should gain 50-60 Kg during pregnancy – periodical exercise – House : 30-40 s.ft. – 40 – 60 s.ft. – good quality water.

### **Management during Farrowing**

1. This period is critical as there is more mortality (20-30%)
2. Transferred to Farrowing pen atleast one week prior to expected Farrowing
3. Date is noted by date of service.

4. Before transferring, animal as well as should be cleaned and thoroughly disinfected.
5. Chopped straw to the tune of 4” is added. But unchopped straw is not advisable as piglets get entangled.
6. Daily exercise.
7. Time of Farrowing is noted by nervousness, tendency to form nest and colostrum secretion.
8. During Farrowing sows should not be disturbed as they become nervous. But attendants should be ready to save the piglets from crushing.
9. Farrowing happened within 2-4 hours and placenta shed within 2 hours.
10. Feeding prior to Farrowing should be restricted and laxative diet.
11. Space allowance : 40 – 60sq.ft.

### **Market Pigs**

Lean meat production – market requirement

Port : 70-75 Kg. – low fat and high protein

Bacon : 75-90 Kg. – Moderate fat.

Heavy hog : 120-125 Kg. – High degree of fat.

Production of port is very economical

Law of diminishing return starts to operates in later stages.

FCR is low (1:1.2 – 1:4)

Proportionately low weight – in latter stages due to fat and high proportionate weight during early part due to accumulation of minerals, proteins and water.

Costly process of conversion of nutrients into fat operates in latter stages.

Pork:

Fat : 24.8%

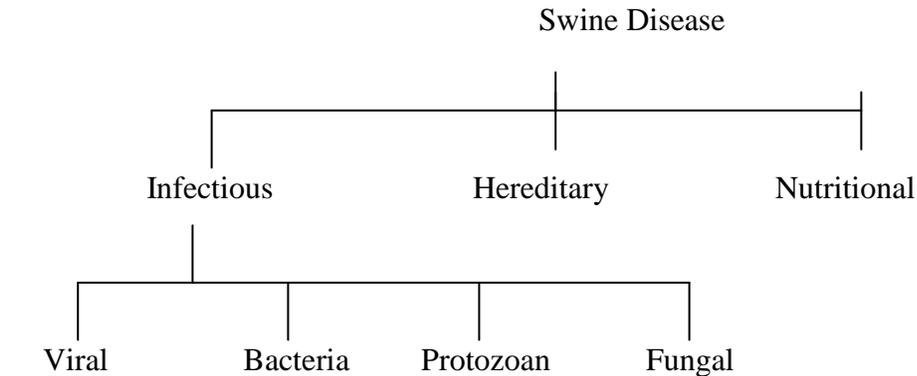
Protein : 17.1 %

Dressing percentage : 70 – 75%

### **Lactating animals**

Housed in Farrowing pen or separate pen. space 40 – 60 sq.ft.

4-6 kg. concentrate with 14-15% CP gradually increased over a period to avoid digestive problem. under fed animals – low milk yield – poor growth rate – high plane of nutrition because highly concentrated form of milk. Protein 6%, fat - 6% and Lactose 6%, Thumb rule : 1.5Kg / sow, 0.5Kg /piglet. Allowing for good quality pasture. Prior to weaning, gradually reduce the feed allowance to reduce milk secretion otherwise stagnation of milk – mastitis.



### **Viral**

Swine fever

1. Young animals more susceptible
2. Dark red or purple colour patches on neck and abdomen.
3. Sticky discharge from eyes
3. High mortality. – Prevention – vaccination –

Swine Pox,

FMD,

Swine influenza

### **Bacterial –**

Swine Erysipelas – *Erysipelothrix thesiopathiae* – High fever – Reddish ‘diamond’ shaped discoloration on body. Prevention and vaccination –

Anthrax –

Brucellosis –

Tuberculosis.

Internal parasites : *Ascaris lumbricoidas*

Ecto parasites : Sarcoptic mange

Nutritional : Avitaminosis – vitamin A –

Rickets –

Piglet anaemia

Control :

1. Clean environment
2. Well ventilated enclosure
3. Frequent removal of faeces
4. Regular vaccination and deworming .
5. Avoiding overcrowding.
6. Isolation of diseased.

Hog Cholera.

Swine Fever

Affects all age group-Viral Disease.

Transmission : Urine and Dung.

Symptom : Pyrexia 105-1080 F ,off feed, Drooping of Head, Arching of back, Cough, mucous discharge, from the eyes, nostrils, Pneumonia Symptoms .Diarrhea Reddening of Skin, Belly and thigh-Vomiting Death.

Control : Hygienic and Sanitation-Vaccination at 3 months.

Ecto and Endo Parasites are eradicated periodically.

Endo parasite affected animals show anaemia, pot belly, diarrhea, stunted growth, edema in the jowl etc.,

**Ectoparasite ;**

Scratching, discoloration of skin Albendazole, Fenbendazole or Narrow Spectrum Copper sulphate. Combination of drug (Ivermectin)of choice for both ecto and endo parasites.

1. Efficient Feed conversion
2. Prolificacy in Reproduction.
3. Mortgage lifters.
4. Generation interval –Less.
5. Pork- Cheaper.
6. Religious Taboo/ unhygienic
7. Quantity meat available from / unit is more
8. Live weight is greater.
9. More energy than any other meats/unit weight.
10. Returns over investment is quick.
11. Simple stomached animals-Requires grains
12. Marketing and feed supply are important.
13. 60-70 kgs within 180-210 days.

#### ECONOMIC TRAITS.

1. Litter Size.
2. Weight at Birth.
3. Weaning Weight.
4. Litter size at Weaning.
5. Growth rate:
  - a. Birth to Weaning --- Weaning wt.- –birth wt./ 56
  - b. Weaning to 154 days---Weight at 154 days-Weaning weigh/ 98 days
  - c. Weight at 154 days to 210 days ---Wt.at 210 days- Wt. at 154 days / 154 days.
6. Feed efficiency – Feed consumed per of kg of Live weight.
7. Mortality percentage.

Points to be considered in Breeding :

Maturity Age ; Male : 7 months, Female ; 6 months.

Optimum weight in Crossing Male : 80-110 kg ; Female 80-100 kgs.

Oestrus Cycle once in 21 days.

Signs of Oestrus :

a. Restlessness, b. Champing of jaws, c. Grinding of teeth, d. Mounting on other animals, e. Time for mating 24 hours after the onset of oestrus, f. Second crossing 8- 12 hours after first crossing ,

Gestation period : 114 days (3 months, 3 weeks and 3 days)

8. Suckling period : 56 days.

Management of Boar :

1. Off springs- Better producing parents.
2. Bigger litter size.
3. Heavier birth weight.
4. Weight at weaning --- 12 kg female ; Male—15 kgs.
5. Boars selected at 5 months Age : atleast 60 kg body weight.
6. No. of teats – Minimum 14 in number.
7. Male : Female = 1 : 5
8. Exercise should be given daily.
9. Boars are to be maintained separately.
10. Periodically tested for Brucellosis.

Management of Sows :

1. Balanced Ration – It should contain 14-16 % Protein.

Maize : 50 parts.

Groundnut Cake : 13 parts

Rice Polish : 10 parts.

Fish Meal : 05 parts.

Mineral Mixture : 1.5 parts.

Salt : 0.5 parts.

Vitamin premix : 2 gram / 10 kg feed; B-Complex- : 5 ml/ animal,.

2. Space requirement : 15-20 sq.ft.

3. Regular Exercise.

4. Do not mix with boars.

5. Sows and gilts are to be maintained separately.

6. Avoid over crowding.
7. During the third quarter sow should gain weight by 30-35 kg and gilt should gain weight by 40-45 kg.
8. Avoid Slippery ground.

### Care and Management of New Born Piglet.

Clean and wipe with a towel and the mucous on the body, nostrils, etc.,

2. Naval cord- 1” –severed ligated-Tincture Iodine.  
Clip the needle Teeth (wolf teeth)
3. Practice Colostrum feeding.
4. Iron injection-Avoid Piglet Anaemia or Thumps.
5. Allow piglet to suckle-5-6 times a day.
6. Creep Mixture- upto 8 weeks of age.
  - a. Crude Protein 22-24 %

### Composition :

Maize	:50 parts.
Groundnut Cake	: 25 parts
Wheat Bran	: 13 parts.
Fish Meal	: 10 parts.
Mineral Mixture	: 2 parts.

Antibiotics—1 gram/ kg feed; Vitamin premix : 2 gram / kg feed

B-complex liquid : 3 ml / animal in Water.

- b. Easily digestible.
- c. Feed : 0-8 weeks.100-600 grams / day up to 10 body weight
- d. **Orphan piglet**- Special ration with milk replacer containing 26-30 % Crude Protein.

Ground Maize	: 45 parts
Groundnut cake	:30 parts.
Fish meal	: 10 parts.

Lucerne Meal : 05 parts.

Molasses : 10parts.

Antibiotics—1 gram/ kg feed; Vitamin premix : 2 gram / kg feed

The feed is wetted with skim milk, antibiotics and vitamins.

Care and Management of Growing and Finishing pigs.

Period of 56 days to market age of (6-7 months) the animal should attain a body weight of 70-90 kg.or the weight gain should be a minimum of 10 kg / month.

Males- Castrated.Open method.

Unwanted gilts-Fattening.

Growers Group according to age size,body weight,etc.,

Space requirement 5-8 sq.feet.Feeder space 20-25 cm.and Water Space 15-20 cm.

Feed Efficiency

2.5 kg-50 kg body weight

: 1 : 2 ,

50 kg- 100kg body weight

: 1: 2.8,

Above 100 kg body weight

: 1 : 4

} Average : 1: 3

To get a body weight gain 60 kg : The animal will consume 180 kg feed.

**GROWER MASH** : 8- 12 weeks; 18-20 % Crude Protein

Maize : 55 Parts

groundnut Cake : 17 Parts

Wheat Bran : 20 Parts

Fish meal : 1.5 Parts

Mineral Mixture : 1.5 Parts

Salt : 0.5 Parts



**Class 23: Care and management of Sow, Boar and Piglets-Nutrition- Creep feeding.  
Control and prevention of swine diseases –Hog cholera, Foot and mouth, Ecto and  
Endoparasites.**

**SWINE- PIG**

Industry status

- 1.Primitive
- 2.Poor quality meat and low aesthetic value of meat produced.

Advantages

1. High Prolificacy : 6-12 no./litter
  2. FCR –1:2.5 - 3
  3. Short generation interval
  4. More quantity of meat/unit weight
  5. More energy / unit weight
  6. High meat : Bone ratio
  7. Easily adapted to integrated or mixed farming system.
  8. Successfully maintained on discarded feed, garden waste and kitchen waste.
  9. High dressing percentage
  10. High growth rate : 10Kg./month
  11. Early maturity : 9-10 month of age
  12. Early puberty : 5-8months
- length of oestrus cycle : 21 days
- Oestrus period : 2-4 days
- Service : 2<sup>nd</sup> /3<sup>rd</sup> day of oestrus
- Rebreeding after parturition : 3-4 weeks after weaning.

Comparison between desi Vs. Exotic (India)

	Desi	Exotic
Litter size at birth	7.5	10

Birth weight (Kg.)	0.91	1.4
Weaning weight (kg.)	4.1	13.5
Weaning percentage	54	78.5
Dressing percentage	66	68
Maturity (Months)	14	8 - 10
Growth rate (gm)	70-100	over 300 gm.
Back fat thickness – (cm)	3-7	4-5

Nomen clature

Species : *Sus scrofa vittatus*

*Sus scrofa indicus*

Group : Stock / Drove

New Born : Piglets (Last born piglet- Runt)

Young male : Boarling

Yong female : Gilt

Adult Male : Boar

Adult female : Sow

Castrated male: stag / Hog

Parturition : Farrowing

Mating : Coupling

Sound : Grunting

Breeds: Large white Yorkshire : Chester white

Middle white Yorkshire : Tamworth

Berkshire : Landrace

Poland china

Spotted Poland china

Duroc

Hampshire

**Large white Yorkshire : UK**

White, occasionally black spots

Erect ears and dished fore head

Long and deep body

Snout length is medium

Mature body weight : Male : 300-400 Kg.

Female : 230 – 320 Kg.

**Middle white Yorkshire : UK**

Developed from crossing Small and Large White Yorkshire

Extensively used to upgrade desi pigs as it is smaller in size

Early maturity, rapid growth and can be raised on pasture

But not prolific as that of Large white Yorkshire

mature body weight Male : 250-350Kgs.

Female-180-270Kgs.

**Land race : Denmark – Bacon Breed**

White with blackspot,

Long snout

Excellent suited for upgrading desi pigs as it needs less feed resources for their maintenance and efficient converter of feed.

Suitable for breeding smaller desi pigs

Mature body weight : Male : 270 – 360 Female : 200-300

**Swine Nutrition**

Monogastric and omnivorous – low fibre, high quality protein (Animal sources)

Requirement : Energy, protein, mineral, vitamins and additives

Energy : Starch – grains

Fat - oils – upto 10% (normally 4-6%)

fibre – Should not exceed 5-6% if exceeds – low growth rate digestibility

Sources : Cereals, Millets, Byproducts – Bran, molasses – rich in Vit B complex .

Protein : High quality – essential Amino acids – 10

Animal source : rich in lysine % methionine ca, protein, Vit.B.

Vegetables source : rich in Tryptophan and limited in lysine and methionine (Grains – maize)

For effective growth rate : both animal protein sources and vegetable protein sources should be balanced.

By feeding leguminous fodder, we can save the protein requirement from concentrate

Minerals : Micro : Cu, Fe, Co, I, Mn, Se, Zn

Macro: Ca, P, Na, K, Mg.

Ca: P -2:1

‘P’ from plant sources, availability is low as they are in “phytate” form like wise any organic form so DCP, DFRP.

Nacl : 0.5% depending on fishmeal inclusion

Fe: 80 mg/ kg feed

Cu: 8 mg/Kg.feed

Co: essential for B<sub>12</sub> Synthesis

I<sub>2</sub>: deficiency results in gritre, hari less piglets

Zn: Parakeratosis

Vitamins

Fat soluble vitamins (A,E & K) – corns, Legumes

D<sub>3</sub> – sunlight exposure

B-Complex – greens

B<sub>12</sub> -Animal protein sources.

Additives

1.Antibiotics

Water reqt: 2-3 times of feed (4-5 litres/ litre of milk)

2. Probiotics

3.Copper Sulphate

Ration formulation

Requirement

Age	Preweaning	Grower (20 – 90Kg.)	Adults
CP%	22%	18-13	14-15%
ME (k.cal/kg.)	3500	3500-3800	3300

Ca : 0.5 – 0.8%

P : 0.4 – 0.6%

Salt : 0.5%

Model composition

	Creep mixture	Grower	Adult
Maize	53	53	50
Cakes	22	16	7
Wheat Bran	7.5	17	35
Fishmeal	15	12.5	6.5
Mineral mixture	2	1	1
Salt	0.5	0.5	0.5

Allowance

Creep mixture : 0.2 – 0.6

Grower : 0.6 – 2.0

Adult : 2 - 3

Systems of feeding

1. Slope(wet mash) Vs dry mash
2. Restricted – lean meat Production
3. Pelleting
4. Frequency – 2-3 times
5. Fibre diet – Pelleting improves digestibility
6. FCR decreases as age advances – 1.2 – 2.8-3 kg feed / kg. gain during 60 days to

9months.

Breeding animals

Should not become fatty. Grower ration for breedable population. Pregnant animals;

Should gain 35 Kg – sows 55 kgs. – Gilts

Ration should ensure

1. Good growth rate in piglets
2. Regular Breeding
3. High quantity carcass
4. Good quality carcass
5. Resistance to diseases

High growth rate – deficiency

Soft fat Vs firm fat.

oil rich cakes, maize , Millet, animal protein sources

difficulty in handling

drip loss

During early age : maize and oil rich cakes

during marketing age – cereals and animal protein sources.

Garbage feeding : 1 kg concentrate can be replaced for every 10 kg of garbage (kitchen waste & market waste)

Pig sty :

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FCR is low (1:1.2 – 1:4)

Proportionately low weight – in latter stages due to fat and high proportionate weight during early part due to accumulation of minerals, proteins and water.

Costly process of conversion of nutrients into fat operates in latter stages.

Pork:

Fat : 24.8%

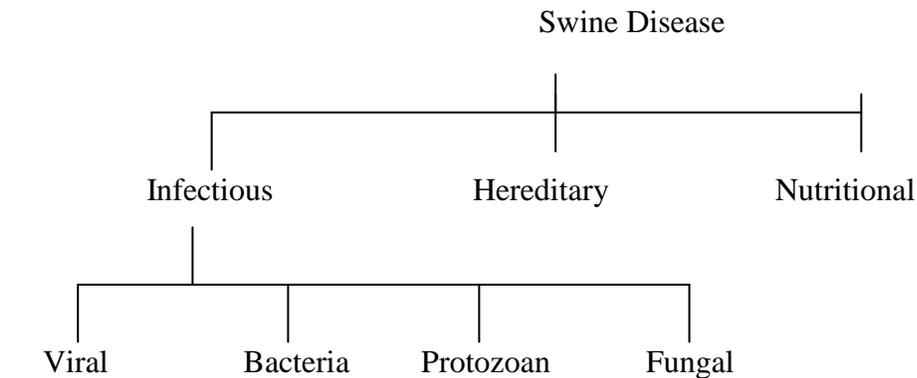
Protein : 17.1 %

Dressing percentage : 70 – 75%

### **Lactating animals**

Housed in Farrowing pen or separate pen. space 40 – 60 sq.ft.

4-6 kg. concentrate with 14-15% CP gradually increased over a period to avoid digestive problem. under fed animals – low milk yield – poor growth rate – high plane of nutrition because highly concentrated form of milk. Protein 6%, fat - 6% and Lactose 6%, Thumb rule : 1.5Kg / sow, 0.5Kg /piglet. Allowing for good quality pasture. Prior to weaning, gradually reduce the feed allowance to reduce milk secretion otherwise stagnation of milk – mastitis.



### **Viral**

Swine fever

1. Young animals more susceptible
2. Dark red or purple colour patches on neck and abdomen.
3. Sticky discharge from eyes
3. High mortality. – Prevention – vaccination –

Swine Pox,

FMD,

Swine influenza

### **Bacterial –**

Swine Erysipelas – *Erysipelothrix thesiopathiae* – High fever – Reddish ‘diamond’ shaped discoloration on body. Prevention and vaccination –

Anthrax –

Brucellosis –

Tuberculosis.

Internal parasites : *Ascaris lumbricoidas*

Ecto parasites : Sarcoptic mange

Nutritional : Avitaminosis – vitamin A –

Rickets –

Piglet anaemia

Control :

1. Clean environment
2. Well ventilated enclosure
3. Frequent removal of faeces
4. Regular vaccination and deworming .
5. Avoiding overcrowding.
6. Isolation of diseased.

Hog Cholera.

Swine Fever

Affects all age group-Viral Disease.

Transmission : Urine and Dung.

Symptom : Pyrexia 105-1080 F ,off feed, Drooping of Head, Arching of back, Cough, mucous discharge, from the eyes, nostrils, Pneumonia Symptoms .Diarrhea Reddening of Skin, Belly and thigh-Vomiting Death.

Control : Hygienic and Sanitation-Vaccination at 3 months.

Ecto and Endo Parasites are eradicated periodically.

Endo parasite affected animals show anaemia, pot belly, diarrhea, stunted growth, edema in the jowl etc.,

**Ectoparasite ;**

Scratching, discoloration of skin Albendazole, Fenbendazole or Narrow Spectrum Copper sulphate. Combination of drug (Ivermectin)of choice for both ecto and endo parasites.

1. Efficient Feed conversion
2. Prolificacy in Reproduction.
3. Mortgage lifters.
4. Generation interval –Less.
5. Pork- Cheaper.
6. Religious Taboo/ unhygienic
7. Quantity meat available from / unit is more
8. Live weight is greater.
9. More energy than any other meats/unit weight.
10. Returns over investment is quick.
11. Simple stomached animals-Requires grains
12. Markerting and feed supply are important.
13. 60-70 kgs within 180-210 days.

#### ECONOMIC TRAITS.

1. Litter Size.
2. Weight at Birth.
3. Weaning Weight.
4. Litter size at Weaning.
5. Growth rate:
  - a. Birth to Weaning --- Weaning wt.- –birth wt./ 56
  - b. Weaning to 154 days---Weight at 154 days-Weaning weigh/ 98 days
  - c. Weight at 154 days to 210 days ---Wt.at 210 days- Wt. at 154 days / 154 days.
6. Feed efficiency – Feed consumed per of kg of Live weight.
7. Mortality percentage.

Points to be considered in Breeding :

Maturity Age ; Male : 7 months, Femalle ; 6 months.

Optimum weight in Crossing Male : 80-110 kg ; Female 80-100 kgs.

Oestrus Cycle once in 21 days.

Signs of Oestrus :

a. Restlessness, b. Champing of jaws, c. Grinding of teeth, d. Mounting on other animals, e. Time for mating 24 hours after the onset of oestrus, f. Second crossing 8- 12 hours after first crossing ,

Gestation period : 114 days (3 months, 3 weeks and 3 days)

8. Suckling period : 56 days.

Management of Boar :

1. Off springs- Better producing parents.
2. Bigger litter size.
3. Heavier birth weight.
4. Weight at weaning --- 12 kg female ; Male—15 kgs.
5. Boars selected at 5 months Age : atleast 60 kg body weight.
6. No. of teats – Minimum 14 in number.
7. Male : Female = 1 : 5
8. Exercise should be given daily.
9. Boars are to be maintained separately.
10. Periodically tested for Brucellosis.

Management of Sows :

1. Balanced Ration – It should contain 14-16 % Protein.

Maize : 50 parts.

Groundnut Cake : 13 parts

Rice Polish : 10 parts.

Fish Meal : 05 parts.

Mineral Mixture : 1.5 parts.

Salt : 0.5 parts.

Vitamin premix : 2 gram / 10 kg feed; B-Complex- : 5 ml/ animal,.

2. Space requirement : 15-20 sq.ft.

3. Regular Exercise.

4. Do not mix with boars.

5. Sows and gilts are to be maintained separately.

6. Avoid over crowding.
7. During the third quarter sow should gain weight by 30-35 kg and gilt should gain weight by 40-45 kg.
8. Avoid Slippery ground.

### Care and Management of New Born Piglet.

Clean and wipe with a towel and the mucous on the body, nostrils, etc.,

2. Naval cord- 1” –severed ligated-Tincture Iodine.  
Clip the needle Teeth (wolf teeth)
3. Practice Colostrum feeding.
4. Iron injection-Avoid Piglet Anaemia or Thumps.
5. Allow piglet to suckle-5-6 times a day.
6. Creep Mixture- upto 8 weeks of age.
  - a. Crude Protein 22-24 %

### Composition :

Maize	:50 parts.
Groundnut Cake	: 25 parts
Wheat Bran	: 13 parts.
Fish Meal	: 10 parts.
Mineral Mixture	: 2 parts.

Antibiotics—1 gram/ kg feed; Vitamin premix : 2 gram / kg feed

B-complex liquid : 3 ml / animal in Water.

- b. Easily digestible.
- c. Feed : 0-8 weeks.100-600 grams / day up to 10 body weight
- d. **Orphan piglet**- Special ration with milk replacer containing 26-30 % Crude Protein.

Ground Maize	: 45 parts
Groundnut cake	:30 parts.
Fish meal	: 10 parts.

Lucerne Meal : 05 parts.

Molasses : 10parts.

Antibiotics—1 gram/ kg feed; Vitamin premix : 2 gram / kg feed

The feed is wetted with skim milk, antibiotics and vitamins.

Care and Management of Growing and Finishing pigs.

Period of 56 days to market age of (6-7 months) the animal should attain a body weight of 70-90 kg.or the weight gain should be a minimum of 10 kg / month.

Males- Castrated.Open method.

Unwanted gilts-Fattening.

Growers Group according to age size,body weight,etc.,

Space requirement 5-8 sq.feet.Feeder space 20-25 cm.and Water Space 15-20 cm.

Feed Efficiency

2.5 kg-50 kg body weight

: 1 : 2 ,

50 kg- 100kg body weight

: 1: 2.8,

Above 100 kg body weight

: 1 : 4

} Average : 1: 3

To get a body weight gain 60 kg : The animal will consume 180 kg feed.

**GROWER MASH** : 8- 12 weeks; 18-20 % Crude Protein

Maize : 55 Parts

groundnut Cake : 17 Parts

Wheat Bran : 20 Parts

Fish meal : 1.5 Parts

Mineral Mixture : 1.5 Parts

Salt : 0.5 Parts



**Class 24: Classification of poultry viz. layer, broiler and dual purpose- Nomenclature of commercial layer and broiler strains.**

India occupy 5<sup>th</sup> place in worlds Egg production -32700 million. The per capita consumption of an India is approximately 33 eggs as against the recommendation of 180 egg.

Indian poultry population – 435 million – 4% World poultry.

Tamil Nadu ranks second in the country producing 4400 million eggs per year. Namakkal is a second largest poultry pocket in India with the population of 75 lakhs chicks and growers and about 196 lakhs layer birds. The poultry production through out the world is carried out by a highly specialized efficient Poultry Industry that has been a leader in trends of scale. Poultry Industry has shifted itself rapidly and completely from a small scale non intensive production units to a highly specialized intensive industry. The progress is attributed to the conceptual change that had taken place in the middle of the century.

Which is attributable to the demands of the situation

Shortage of red meat,

Lesser cost and land involvement

Shorter generation interval

Higher multiplication rate.

The following are the reasons for the phenomenal development of the Industry.

1. Evolution of High yielding strains
2. Economic management systems.
3. Improved Nutritional systems.
4. Advanced Desired control technology.
5. Automation in operation.
6. Integration
7. Increased consumer awareness.
8. Improved marketing system.
9. Insurance and Bank Assistance.

Poultry Industry:

Grand parent Hatchery

Parent Hatchery      Sub-Franchisers

Grower farms

Feed manufacturers

Equipment manufacturers

Marketing enterprise.

disease control units and poultry service organisation.

Breed of poultry

Class : Many groups of birds belonging to a particular tract or locality Eg. English, Asiatic, American.

Breed refers to a group of domestic fowls with a common ancestry and having similarity in shape, conformation, growth, temperament, shell colour of egg and breed true to type. Variety is a subdivision of breed and within a breed there may be several varieties. The term variety is used to distinguish fowls having the characteristics of the breed to which they belong but differing in plumage colour, comb type etc. from other groups of the same breed. A breed/variety may also have several strains or lines identified by a given name and produced by a breeder through at least 5 generations of closed flock breeding for a particular purpose. Several strains within a breed/variety phenotypically may look alike but often differ in their production performance depending upon their breeding history.

Breed of Poultry

<b>Asiatic</b>	<b>American</b>	<b>English</b>	<b>Mediterranean</b>
Aseel	Plymouth Rock	Sussex	Leghorn
Karaknath	Wyandotte	Orpington	Minorca
Ghagus	Rhode Island Red	Australorp	Ancona
Chittagong	New Hampshire	Cornish	Spanish

Mini			Andalusian
Brown Desi			
Denki			
Naked neck			
Brahma			
Cochin			
Langshan			

Poultry may also be classify based on were utility

1. Layer – Leghorn, Minorca
2. Broiler – Orpington, Cornish
3. Dual – Plymouth, Rhode island red

Based on the utility and perfomance many hybrid strains of poultry have been developed and commercially produced.

Layer – Babcock 300, Hyline-WS 36, Bovans.

Broiler – Ross, vencobb, hybro.

Egg Science and Technology :

Egg is the physiological product of the female reproductive system and a hen’s egg, apart from the ovum does contain other nutrients for the growth and development of the embryo.

Egg average weight : 50-60 gm.

Egg contains yolk – 30%

White or albumen – 58%

Inner & outer shell membranes & shell – 12%

Nutrient composition : on egg weight

12% Protein

11% Fat

12% minerals and 65 % water

Colories : 148 cal/100 gm.

grading of eggs :

By wt. :	Extra large	60 gms/egg
	Large	53-59 g.
	Medium	45-52 g.
	Small	38-44 g.

Agmark grading :

- A- grade : Clean, unbroken shell, aircell, 4mm depth, clear, firm white well centered yolk free from defects.
- B-grade : Clean, moderately tainted shell, aircell 8 mm depth, slightly off centered and shape visible
- No grade : Eggs classified as loss or no grade is edible - contaminated by smoke, chemical and other foreign materials, which may effect the character and appearance.

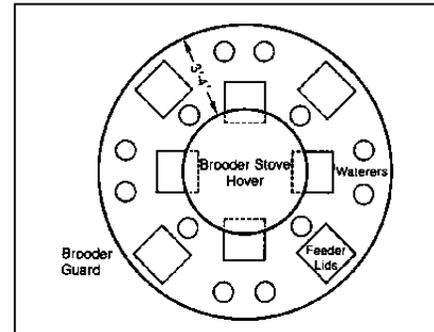
## 25. Care and management of day old chicks-Brooder management.

### Preparation of Brooder

Brooder means to give a heat source by artificial means for the period of growth of chicks from 0 day (Day old) to 4 weeks. The heat source generally has a large reflector (Hover) under which the chicks will get the heat uniformly.

### Aim

The day old chicks do not possess the insulating feather coverage to protect them from cold. It may result in the losing of body heat to the environment resulting in chilling which will create the ground for many diseases.



Preparation of Brooder and daily routine work carried out in the farm

### Objective

Chicks do not possess a well-developed thermo- regulatory mechanism. The day old chicks don't possess the insulating feather coverage to protect them from chillness. The body temperature of chick is  $107^{\circ}\text{F}$  which is always more than the ambient temperature. It may result in the losing of body heat to the environment. So a source of heat is given by natural brooding or by Artificial brooding up to 4 weeks of age.

### Materials required

Hover or wooden cross bar. Automatic brooder, fuel heaters like lantern.

1. Bulbs
2. Chick guard
3. Thermometer ( $0$  to  $110^{\circ}\text{F}$ )
4. Waterer
5. Linear feeder,
6. Lime powder

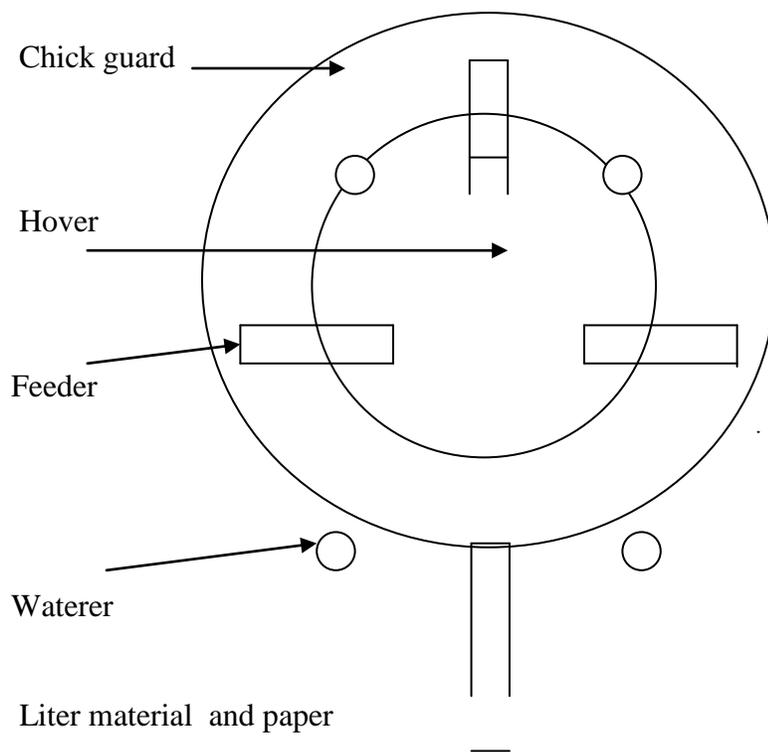
7. Lysol
8. Sprayer
9. Coirpith, GN husk or paddy husk
10. Waste news paper
11. Flame gun
12. Automatic vaccinators .
13. Debeaker
14. Bucket
15. Broomstick
16. Rake
17. Electrolyte
18. B Complex and Vitamin A
19. Antibiotics
20. Lasota F<sub>1</sub> Vaccine
21. IBD Live vaccine

### **Preparation of Brooder House**

1. The litter material of the previous batch should be heaped up first so that building up of germs could be destroyed.
2. After 2 to 3 days the heaped up material can be removed from the brooder room.
3. The portion of the litter sticking over the ground must be scraped and removed.
4. The removal of spider web, cob webs and dirt are also essential.
5. The floor and sidewalls should be washed with plain water.
6. Disinfection of the room is carried out by spraying phenyl, lysol, etc at 5%

concentration.

7. Use Flame gun to destroy the insects.
8. The entire floor and side walls should be white washed with fresh limestone.
9. Feeders, waterers, , chick guards should be washed and disinfected in phenyl or lysol. Dry it in the sun for a day.
10. Hang the gunny bags around the brooder house to maintain the room temperature to maintain temperature notbelow 80<sup>0</sup>F in the first week 75<sup>0</sup>F in the 2<sup>nd</sup> week 70<sup>0</sup>F III week, 65<sup>0</sup>F -IV week.



**Decide on the no. of brooders depending on the number of chicks ordered**

1. Connect the chick guards in circular fashion with diameter of 5 feet to accommodate 150-200 chicks.
2. Spread the litter material like coirpith, or paddy husk or ground nut husk on the prepared floor to a depth 2 inches.

3. The litter material is to be covered with newspaper.
4. The feeders and waterers are to be arranged in a radiating fashion from the light source.
5. 4 hours before the scheduled arrival of chicks place the waterers with water in order to bring water to room temperature.
6. The brooding unit should be kept ready at least a day before the arrival of chicks.
7. The brooding bulb must be switched on atleast 24 hours earlier to make the area warm at the time of housing the chick.
8. Depending on weather condition put curtains on all four sides of room to maintain room temperature.

### **Brooder Management**

1. Spread finally grained maize over the news paper before the arrival of chicks.
2. Give cool water after boiling. Add electrolytes, B Complex and antibiotics.
3. Distribute chicks equally after counting under the brooders.
4. Before putting chicks under the brooder scale their beaks with water.
5. For first 3 days provide crushed maize twice a day. Also provide ground maize in the feeder.
6. Change newspaper sheets immediately if they get wet.
7. Remove newspapers on 5<sup>th</sup> day.
8. Remove wet litter under waterers immediately and add fresh liter.
9. On fifth day give Lasota F<sub>1</sub> Vaccine.
10. According to the age of the birds brooder temperature should be adjusted.
11. Medication and vaccination
  - a) 1<sup>st</sup> day give 5% glucose in water.
  - b) 2<sup>nd</sup> to 4<sup>th</sup> day - antibiotic + Vit.A + B Complex.

- c) 5<sup>th</sup> day - RDVF vaccination
  - d) 10<sup>th</sup> day - IBD vaccination.
12. Daily morning and evening wash the waterer and give freshly boiled and cooled water.
  13. Give 24 hrs. light up to 3 weeks to induce night feeding.
  14. Debeaking is done at 2<sup>nd</sup> week to prevent cannibalism and feed wastage.
  15. Chick mash should contain 22% protein and 2800 kcal/kg ME

### **Observation**

Watch the chicks under light, if chicks are spread uniformly under the light and brooder area, then the temperature maintained is correct. If the chicks are huddled under the light, heat provided is not enough.. If the chicks are away from the light source, the heat intensity is high. Give enough space for watering and feeding for growing chicks according to the age of the birds.

Brooder management : Zero –8 weeks

Chick hood is the most critical age in birds life as it readily picks up problems due to chilling, mal - nutrition, over crowding and diseases.

Productivity of a layer or a broiler depends largely on the way how they start their life.

New born chicks require warmth to keep them in comfort. Hence they are provided with artificial heat by a device called brooder.

Brooder can be hover type, flat, type, wooden reapers fitted with bulbs or heating bulbs or infra red bulbs

Brooding Temperature : 95°C I week

90°C II week

85°C III week

80°C IV week

Floor space : ¼ sq.ft/bird 0-3 weeks

½ sq.ft./bird 4-8 weeks

Feeder space

0-3 weeks 1”

4-8 weeks 2”

Water space

0.3 week ½”

3-8 weeks 1”

Arranging for brooding

Spread litter on a prepared floor, over which place old news paper arrange the heating device in the middle. Cover the desire area with chick guards. Keep waterers and feeders, radiating from the heat source.

Conserve heat by blocking the side-mesh with gunny sacks.

Medications

I day glucose- 5% in water

II to 7<sup>th</sup> day – antibiotic + Vit.A + B Complex

III week & VI week coccidiostats in water.

Always use boiled and cooled water for 1<sup>st</sup> three weeks.

Then sanitize the water for the rearing period

Vaccination : Mareks, Ranikhet and Fowl pox.

After 3 weeks continuous or 23 hours light period has to be given to the chicks to induce night feeding and avoid trampling. Debeaking is done at II week to prevent cannibalism and feed wastage – Feed used in chick mash. Contains 22% crude protein and 2800 kcal/kg ME.

Grower management

8 - 20 weeks. –floor space : 1-1 ½ Sq.ft. feeder space – 3” water space : 1½-2” feed – Grower mash

Restricted feeding

To keep the birds in normal desirable wt. range -10% to 20% of the feed required by the bird is restricted from 10-18 week of age.

Lighting : Grower should not be provided with extra light except day light to counteract undesirable effect on sexual maturity.

Deworming :

Debeaking, delicing if necessary – are to be carried out before the onset of lay.

## **26. Systems of housing- Deep litter and cage systems – merits and demerits.**

### **System of poultry rearing :**

In the annals of Poultry Development, one can see a gradual development in respect of the allotment of space, feeding, nutrition and in management etc. on the basis of scientific and technological developments poultry management moved from free range system to semi intensive system and then to intensive system.

### **Free range system:**

Birds are allowed free range, such that it can wander at will, over the allotted paddock or field and are not controlled by fences.

Deforested land was used. 200 birds/acre allotted. In an ordinary land 100 birds/Acre was allotted. They received their bulk quantity of feed from the land in the form of herbage, seeds, insects etc. besides in small quantity by hand feeding. A small housing is provided for night shelter.

### **Advantages :**

1. Maintenance on clean ground decrease the risk of disease.
2. Reduction in cost of management.
3. Birds get good amount of feed from the land
4. Cost of housing is less.
5. Soil fertility is maintained
6. Farming operation is not interfered with

### **Disadvantages**

1. Losses are serious where predatory animals are abundant
2. Wild birds may consume much feed and they transmit disease.
3. Eggs may be lost when laid in hedge rows.
4. Impossible for adoption unless ample land is available.

**Semi Intensive systems :**

Birds are provided with a pen and run. Pen is an enclosed house and run is an enclosed grass area with fence.

As few as six to as many as 200 can be kept in are acre of land in this system.

3 to 4 sq.ft / bird in the pen.

Floor level should be at least 10” from the ground level

Advantages:

- 1.Complete control over operation
- 2.Useful for record purposes
- 3.Operational throughout the year
- 4.Economic use of land (free range)
- 5.Better protection during winter

**Disadvantages**

- 1.High cost in fencing
- 2.Danger of over stocking

**Intensive system**

- 1.Deep litter system
- 2.Cage system

**The concept of deep litter system**

Birds are raised within four walls, over litter material which is of organic in nature capable of absorbing moisture and releasing moisture to the atmosphere and also to serve as a bedding material for the birds.

Coirpith

Paddy husk

Ground Nut

Saw dust

Wood shavings

straw chopping

paper straw chopping

sugarcane baggase

When moisture is absorbed there will be controlled microbial activity and odour will also be minimum.

Vit. B12 and B2 are available

depth four inches at beginning. 6-8” – later

Qualities of good liter material

- 1.It should readily absorb moisture
- 2.should not cause injury to birds.
- 3.Moisture level should be less than 15%
- 4.Should get decomposed and form good manure.
- 5.Should spread evenly
- 6.Should be non-toxic.
- 7.Should not cause dust pollution.

Advantages:

1. Land requirement is minimum
2. Easy and economic management
3. Scientific feeding and management
4. High degree of supervision.
5. Minimum Labour.
6. Automation is possible.
7. Manural value is increased.

Disadvantages

If the management is bad, liberation and accumulation of ammonia, wet litter problem dirty eggs, disease problems may result.

Cage system : Battery cages.

Very popular, called as Californian cage system. Birds are kept under total confinement with minimum space feed and water provided from outside. Eggs laid will get rolled out by the inclined floor bottom.

Types of cages

1. Single

2. multiples

colony cages 20-30

Advantages :

1. Vertical expansion

2. Easy feeding and management.

3. Protection from Vermin and wild birds.

4. Litter borne disease are avoided

5. Spreading of disease minimum

6. Minimum area is required / bird.

Single 1 /sq.ft.

Multiple – 0.75 sq.ft.

colony – 0.5 sq.ft.

7. Cleaner eggs.

8. Research data collection easier

9. Identification of birds, handling and culling of non layers easier.

10. Insects and pests controlled

11. Vices are kept at minimum

12. Birds are of softer flesh than the floor reared birds.

Dis-advantages.

1. High cost of installation

2. Breeding is not possible unless Artificial Insemination is practiced.

3. Cage layer fatigue or paralysis is a problem if not attended to.

#### Housing management

Poultry should be provided with a good housing which will facilitate 1. shelter 2. Protection from wild animals 3. Bad weather condition. Ideal housing helps the birds to perform well. To establish a viable poultry enterprise capital, land, labour and technical know how are essential.

The housing design should be flexible and it depends on

1. Age and stage of the birds.
2. Functional requirement.
3. The climate and environment.
4. For efficient supervision
5. Minimum structures to have efficiency.
6. Economy in construction.

Selection of site and construction of houses.

1. Hard soil type
2. elevated area should be selected for house construction
3. Cheaper in cost.
4. should have continuous water supply - good and wholesome.
5. Should be away from the urban area and also should be at an easy reach.
6. should have good road/rail facilities for transport.
7. should be easily accessible for supervisor
8. should have good ventilation
9. There should be freely available space for expansion.
10. Marketing- preferential
11. Management of brooder cum grower, layers, breeders should be specified in distinct areas to avoid crisscross movement of birds and inter current infection - such segments should be 100 feet away from each other.

12. Building should be constructed in east-west direction that is long axis should lie in east-west direction

13. Width of the building should be restricted to 30 feet and the length can be extended to the requirement. Height 10-12 feet.

14. North and South sides of the building should be fitted with wiremesh to permit airflow.

15. Roofs can be –thatch, Tiles, asbestos, light roofing or zinc sheet.

16. there should be minimum structures so that there could be good air movement

17. Manure pit and the incineration room should be constructed at the far end in leeward direction.

18. Farm house should be located at the entrance to minimize the movement of visitors into the deeper areas.

19. Agriculture operations can be combined with poultry farming.

Design of poultry houses.

Shed – lean to roof

Gable

Half Monitor

Full Monitor

Flat roof houses.

kinds of poultry houses.

1. Brooder house.
2. Brooder cum grower house
3. Layer House
4. Breeder House
5. Broiler House
6. Cage House

		Layer	Broiler
--	--	-------	---------

Temperature	Comfort Zone	10-24°C	21-25°C
	Optimum	13-20°C	24°C
Humidity	Acceptable	50-75%	50-75%
	Preferable	60%	60%

## **CLASS 27 : RAISED PLATFORM HOUSING – FLOOR SPACE REQUIREMENT – LITTER MANAGEMENT.**

### **Latest developments in Housing and management of commercial Layer Farms.**

New concepts in poultry house design and farm management are finding their way for improved flock performance through better environmental conditions and automation in feeding, drinking and related systems. All this ensures more comfort to birds leading to better production and higher profitability. Among the recent innovations which have been successfully adopted in the country including construction of elevated platform cage and environmentally controlled houses with automatic drinking and feeding systems for rearing layer birds. This integrated and latest approach to housing design, nutrition, management and disease control would eventually influence flock performance and profitability.

### **ALTERNATIVE HOUSING SYSTEMS**

#### **TRADITIONAL FREE RANGE :**

In the past , free range was a general description indicating only that poultry was allowed to range over the fields. Today, free range is specific term and flocks were described as much meet the criteria listed below.

1. Birds should have continuous access to open runs and the ground to which they have access must be mainly covered with vegetation.
2. The entire area should be well fenced to keep out the predators.
3. Stocking density should be not greater than 1000 birds / ha. of available ground (1 hen / 10 m<sup>2</sup>)
4. A very high degree of management is required.

#### **Semi-intensive –Modified free Range :**

For these systems , as for free range with exception that the maximum outdoor stocking density should not be greater than 4000 hens / ha. of land available (1 hen / 2.5 m<sup>2</sup>)

### **DEEP LITTER**

An egg producer who wants to market eggs with label “deep litter” must fulfil the following conditions. The maximum stocking density may not be less than 7 hens / m<sup>2</sup> of available floor space (1400 cm<sup>2</sup> / bird ) with at least one third of this area are being covered

with litter material. A sufficient large part of the floor area should be available for the collection of droppings.

**MODIFIED CAGES :**

These cages offer the hen a more complex environment while retaining the advantages of small colony size, hygiene and economics of battery system. Birds area specifications are identical to battery cages. At least 450 cm<sup>2</sup> of cage area per bird and 10 cm / bird of trough space with an adequate water supply is essential.

Management problems associated with rearing birds in alternative systems have received critical attention and their 'Welfare friendly' status is frequently diminished as the project is translated from the experimental to the commercial situation. Alternative systems offer a degree of freedom to the birds, which the battery system fails to satisfy ; they also encourage a greater degree of conflict within the flock and the latter is not commensurate with 'GOOD' shell formation.

**ELEVATED PLATFORM TYPE CAGE HOUSES FOR LAYERS.**

The main purpose of poultry house is to provide comfortable and healthy environment to the birds. Ventilation is a major factor in producing good environment in poultry houses. It also a deciding influence on the flock performance, disease control and energy used. Ventilation system designed to create the proper flow of air in the shed to keep the birds healthy and protective. A good ventilation system in a house will:

- a. Provide adequate fresh air and oxygen for the birds, thus maintaining a uniform and healthy environment throughout the house.
- b. Provide the desired temperature and humidity – necessary for optimum performance and efficiency of the birds.
- c. control moisture and poisonous gases arising from the microbial fermentation in dropping / litter (ammonia etc.,)
- d. Maintain better conditions minimize incoming dust
- e. Dilute disease- causing organisms.
- f. Allow a large increase in the number of birds per house.

An essential requirement of any ventilation is to have a constant control of air movement in a poultry house. Air volume in summer months must be adequate and in correct direction to ensure uniform distribution throughout the poultry house.

**Specification of elevated platform type cage house in layer farms:**

01 Pillar height to lay platform

4.5- 6.0 feet depending on the capacity of the birds and soil type of that area.

02 Length of the house

Length can be at any length depending upon the capacity of the birds.

03 Breadth of the house

Breadth of the house is restricted to 30-330feet.

04 Height of the wire mesh

From the platform to overhang 8 to 10 feet.

05 Height of the house.

14 feet from platform to centre.

06 Arrangement of cages

2- M type cages triple deck in centre of the house + 2-L type cages in two sides.

3- M type cages triple deck, 4 birds / cages compartments.

07. Distance between cage arrangements (Pathway)

2.50 to 2.75 feet.

08. Feeder and drinker

Channel type feeder and waterers

09. Channel type and nipple drinkers

Automatic feeding system + nipple watering system.

09. Side mesh.

Chain link 2 inch x 2 inch

**ADVANTAGES IN ELEVATED TYPE CAGE HOUSES IN LAYER FARMS.**

- i. Hens reared in elevated type cage houses attained 50 % egg production earlier than other systems.
- ii. Bird reared in elevated type cage houses resulted in higher hen-housed and hen-day production.

- iii. Eggs collected from elevated cages houses had better shape index, Haugh unit and yolk colour scores.

#### **ENVIRONMENTALLY CONTROLLED LAYER HOUSES.**

An environmentally controlled layer house is one which inside conditions is maintained as close as possible to the bird's optimum requirements. The house is closed and insulated and trusts on artificial ventilation and air movement. The structural make up is similar to that of elevated platform layer houses. Large number of layers may be accommodated in these houses.

In the environmentally controlled layer houses air is mechanically moved inside, the width of the house greater and is 40' making it more economical to construct. To provide working comfort the side height of the house at the eaves should be 8'. To minimize heat gain in summer and heat loss in winter the ceiling must be fully insulated and it should be wash proof. Care must be taken to see that there is no air leak in the roof. Double walled plastic curtains along the side walls with which arrangements to open or close are to be provided. The curtain should have an overlap of 3"- 4" over the side wall to prevent leakage of air. The floor should be of concrete or watertight stone slabs.

#### **ADVANTAGES OF ENVIRONMENTALLY CONTROLLED LAYER HOUSES.**

- a. Number layers can be accommodated.
- b. Less labour and more efficient working atmosphere.
- c. Less feed wastage and more feed efficiency.
- d. Less fuel cost in turn less cost of production.
- e. Less cost of medication and more livability.
- f. Higher egg production and more profitability.
- g. Cleaner egg production.

#### **FUTURE PROSPECTS IN MODERN POULTRY HOUSING AND MANAGEMENT.**

The above innovations have improved the poultry house environment and permit increased density thereby housing a large number of birds in the same house. With introduction of various devices to control environment in poultry houses, it would not be long before microprocessors would be used to monitor temperature, humidity, noxious gases, and consumption of water, feed and the light. Also devices to collect eggs, computed record keeping would expedite these processes.



## 28. Care and management of layers.

Layer Management: From the point of lay to one year it is called laying period.

When first egg laid – Pullet – pullet egg.

Floor space	: 2 sq.ft.
Feeder space	: 4 sq.ft.
Water space	: 2 sq.ft.
Nest space	: 1 box for 5 birds
Litter Depth	: 6 box for 5 birds.

**Feeding :** Layer mash is fed during this period - 18% protein. Daily ration is decided and issued two to three times in a day. This helps in lesser feed wastage and better balancing.

**Choice feeding of calcium :** Calcium is supplied to the birds in feed. Supply of calcium in the feed assures a more uniform intake of calcium by all the birds.

For hens in very high egg production and in high environmental temperature supplementation of extra calcium is necessary. This is given in the form of shell grit. 5-10 Kgs./100birds/Month.

**Lighting :** Layer birds has to be kept with a period of at least 16 hours a day. Twelve hours of day light is supplemented with additional 4 hours night lighting. It is introduced as step up programme.

20 <sup>th</sup> week	6-6 ½ PM	5.30 – 6.00 AM
21 <sup>st</sup> week	6-7 PM	5 - 6 PM
22 <sup>nd</sup> week	6-7.30 PM	5 – 6 AM
23 <sup>rd</sup> week	6 – 8.00 PM	5 – 6 AM
24 <sup>th</sup> week	6 – 8.30 PM	5 – 6 AM
25 <sup>th</sup> week	6 –9.00 PM	5 – 6 AM

Light stimulates anterior pituitary gland through brain and the liberation of F.S.H. helps the follicles to mature.

A forty watts bulb at a height of 7 feet with 100 feet distance from another, will provide the required intensity of light for 100 sq.ft. area.

General guidelines :

1. Provide balanced feed.
2. Use clean wholesome water
3. Never reduce the light during laying period
4. Supplement vitamins to relieve stress
5. Deworm once in 45 days.
6. Litter to be raked up once a week
7. Add Lime at 5-10 Kg/100 sq.ft. to keep them dry.
8. Cull-the unproductive birds/then and there.

Vaccination - refer disease

Culling

Cage layer fatigue

Calcium feeding.

## 29. Care and management of broilers.

Broiler management :

Broiler is defined as the tender meated chicken of either sex which grow from 35 to 40 gms of initial weight to 2kg or more in 6 weeks of age by consuming around 4 kg of feed.

	0-4	4-8
floor space	½ sq.ft.	1 sq.ft.
feeder space	3 sq.ft.	6 sq.ft.
water space	2 sq.ft.	4 sq.ft.

Brooding and management similar to layer brooding

Feeding : Two types

1. Broiler starter - 0-3weeks - CP 23 – E 2900
2. Broiler finisher - 4-6 weeks - Cp 20 – E 3000

Vaccine : 1. Mareks Vaccine day old

2. R.D.V.F. 5- 7<sup>th</sup> day

The use of liver stimulants and vitamins help in better feed utilization and better body weight gain.

Mortality and livability

Market weight

Feed conversion efficiency.

### **30. Poultry Nutrition-Feed formulation-composition of chick mash grower, layer, broiler starter and finisher mashes .**

#### Feeding Management

Poultry being simple stomached species, cannot synthesise most of the nutrients required for them and so the nutrients become dietary essentials chicken has to be fed adequate quantities of balanced diet for its growth, livability and to exhibit its genetic potential to the full extent.

Poultry differ from other species of livestock in body temperature and digestion

Biological activity and maturity.

Poultry feed is composed of

60-65% Energy giving materials

30-35% of Protein source

2-8% Minerals source.

And above all water. Which is considered as the Principal nutrient should be pure, whole some, free from physical impurities, toxic substances and Bacterial contamination.

Water : feed ratio 2.2 : 1

It is variable with age, climate, feed and physiological activity. Excess energy is stored as body fat.

Yellow maize

cumbu

cholam

Rice polish.

This energy materials constitute 50% of the ration.

Protein : Protein is required by the bird for

1. Growth 2. Maintenance of body tissues 3. Production.

Both vegetable and animal proteins are used in the feed.

Vegetable Protein :

Ground nut oil cake

Soyabean oil cake

Gingelly oil cake

Sunflower oil cake

Mustard oil cake

This is added at 15-25% in the ration. It is always advisable to add two or more for better balancing.

Animal Protein: Fish meal, meat meal, Blood meal

silk worm pupa meal

out of this fish meal is ideal

this forms -5-10% of the ration.

Grain bye products like bran in included from 10-30% for fibre, bowl movement and minerals.

if molasses available it can also be added for energy at 5-7% levels, which is a cheap source of energy, reduces dustiness, improves palatability.

Mineral mixture for poultry :

Included at 2.3% It is advisable to use salt free mineral mixture because fish meal available in our country is salted. Calcium supplements such as shell grit, calcite, limestone, etc. are used at 4-5% levels.

Standard requirement of nutrients:

	Chick	Grower	layer mash	Broiler starter	Broiler Finisher
Crude Protein % min.	22	16	18	23	20
Crude fibre % max.	7	8	10	6	6
Calcium % min.	1	0.8	2.75	1	1
Total phosphorus % min	0.7	0.6	0.75	0.7	0.7
Metabolizable Energy K/ca/kg.	2800	2600	2700- 2750	2800	2900
Lysine (%min.)	1.0	0.7	0.5	1.0	1.0

Methionine (% min)	0.35	0.25	0.25	0.35	0.35
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Approximate feed intake by commercial chicken in tropics

	Egg type (gm.)	Broiler (G.)
1 <sup>st</sup> week	10	15
2 <sup>nd</sup> week	15	25
3 <sup>rd</sup> week	20	35
4 <sup>th</sup> week	25	50
5 <sup>th</sup> week	30	65
6 <sup>th</sup> week	35	85
7 <sup>th</sup> week	45	105
8 <sup>th</sup> week	50	120

9-12 weeks – 40

13-16 weeks – 50 Restricted feeding

17-20 weeks – 60

During laying

0% Egg Production	80 gm.	70 %	115
25% Egg Production	95 gm.	80 %	120
50% Egg Production	105gm.	Over 80%	12
60% Egg Production	110 gm.		

Guide lines for feed management

1. Purchase quality ingredients / feed. with least moisture and devoid of adulteration.
2. If own feed is mixed formula may be modified depending upon the cost and availability of ingredients
3. If agricultural farm is attached farm grown grain can be used
4. Purchase one month or two months requirements.
5. Screen the feed store room against rodents, sparrows other vermins.
6. Observe the feed intake by the birds during summer, winter.

7. If moisture level exceeds 15% (except molasses) during hot season it may cause growth of fungus and precipitate problems like aflatoxicosis.

The feeder should not to filled to full to minimize the feed wastage..

**Class 31 : Feed Conversion Ratio / dozen eggs or kilogram of meat. Marketing channels in poultry-Integration.**

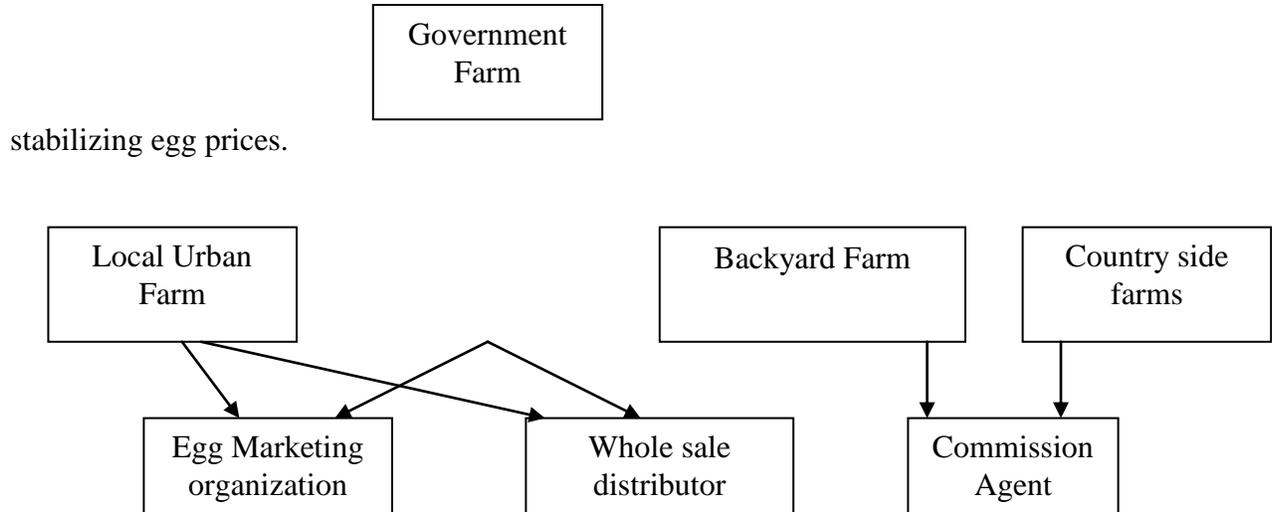
Egg marketing : The wholesale trade of eggs in big cities, where potential demand exists, is in the hands of a few traders who have monopolized this trade for their own advantages. Egg prices vary from one market to another and from one season to another. In summer, the egg prices crash down to a level which is sometimes less than the cost of production, even though the retail price does not vary proportionately. Therefore proper attention has to be given to the problem of most efficient disposal of market eggs.

Distribution channel.

The eggs are distributed through different channels, viz. producers to consumers, producers via retailers to consumers, producers via assemblers to consumers, wholesalers, trailers to consumers, and producers to consumers via co-op societies/egg marketing organizations. Eggs should be distributed through relatively shorter channels to speed up supply and avoid delay and repeated handling.

Marketing agencies.

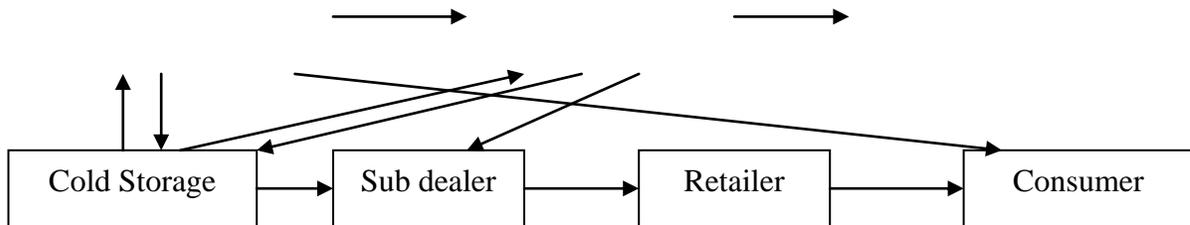
Marketing of eggs is primarily handled by traders and commission agents. The NAFED regulates price stabilization activities. The NECC nowadays plays vary important role in



stabilizing egg prices.

MARKETING OF BROILERS

Marketing plays a vital role in overall development of any economic unit, since marketing



consists of the performance of business activities that direct the flow of goods and services from the producer to the consumer or user for the transfer of title of the ownership of goods .In broiler marketing ,the producers/farmers and buyer are brought together.

Market is a place wherein the exchange of goods or the change of title of goods takes place.

Broiler marketing Covers the job of

1. assembling of birds from the area of production
2. converting them into cut that are in demand by the final consumers and
3. placing these products in the hands of such at the desired place, at the right time and in quality.

Thus the marketing of broilers includes all the intermediaries from the producer to the final consumer in the channel of marketing.

The large farms which had their own retail outlets, made more profit due to better sale price per kilogram live weight. In Tamilnadu 41.98% of farmers resorted to direct marketing, 45.68% through middleman and 12.34 % resorted to both direct and through middlemen.

### **MARKETING INTERMEDIARIES**

Marketing Intermediaries are institutions that facilitates flow of goods and services between poultry industry and its final market. They include wholesaler, agents (brokers), transporting companies, warehouses and retailers.

### **CURRENT MARKETING SYSTEM.**

At present in Tamilnadu, broilers are marketed through i. Wholesalers ii. Retailers with cold storage (deep freezer facilities ),iii Retailers without cold storage facilities, iv. Chain storage v. Hotels and restaurants

Retailer with cold storage

These retailers sell broiler and layer chicken regularly either as fresh or frozen depending on the facilities and demand from the consumers. These retailers also stock other animal products in addition to chicken products Many retailers have slaughtering facilities at their premises. Some retailers

purchase dressed chicken from wholesalers and sell them after packing with a margin. The higher income and middle income groups of consumers prefer to purchase these frozen /chilled chicken as they are kept in hygienic condition

### **RETAILER WITHOUT COLD STORAGE FACILITIES.**

These retailers mostly purchase live broiler from wholesalers / producers and stock the live birds in their premises .As and when the consumers demand ,the live birds are dressed and sold as fresh and remaining birds are kept for subsequent days sale -since most of the consumers of middle and lower middle class people like only fresh chicken rather than frozen or chilled . Now a days these retailers even started selling portion of chicken.

### **CHAIN STORES**

There are many organizations having branches situated at different localities of the same city and different towns ranging from 3to 6 branches with cold storage facilities. All the branches of each organization are under central ownership and control .It is a compromise between large scale and

small scale organizations. The management , purchase , processing and controls are centralized while sales are decentralized and carried out on a small scale. The chain stores obtain their supplies directly from producers instead from wholesalers. They buy in lots and perform the work of wholesalers in respect of transport , warehousing, risk bearing and financing .Chain stores are strictly retailers enterprise to eliminate the wholesalers.

### **MARKETING CHANNEL**

Marketing Channels simply mean the paths or routes through which produce from the producer reach the ultimate destination ( consumers). There are five different marketing channels being identified in broiler marketing in Tamilnadu.

- 1.Producers----- Wholesaler-----Retailer-----Consumer.
2. Producers----- Wholesaler -----Consumer.
3. Producers-----Chain store -----Consumer.
4. Producers -----Consumer.
- 5.Producer-----Integrator/Commission Agent-----Wholesaler-----Retailer----Consumer.

The first channel is more commonly observed in all the cities. The wholesaler purchase the live birds from farm itself on live weight basis and transport in their own transport vehicle and sell to retailers either live or dressed and the retailer in turn sell the product to consumers. In general live birds are preferred over dressed chicken in the city, accordingly large number of live birds are sold to retailers. The wholesaler take the risk of transport , storage losses due to shrinkage and mortality.

In the second channel retailer procure the birds from the farm and sell to the consumer either dressed or live.

In the third channel , the chain store procure birds from the farm and sell them after processing to consumers.

In the fourth channel, the birds are either sold as live or dressed and in this the producer is able to get 100 percent of consumers rupee since there are no intermediary.

The fifth channel, operates mostly outside the state and in the districts where the integration of poultry farming is gaining momentum.

### **CONSTRAINTS OF MARKETING.**

1. Increase cost of feed.
2. Variable quality of poultry feed.

3. Presence of many poultry diseases(Panic sales with low price).
4. Seasonal fluctuation in poultry meat prices.
5. Unorganized market infrastructure.
6. Non-adherence to quality and safety standards(Bio Security Measures).
7. Lack of Vertical integration.
8. Little efforts for manufacturing value added products.
9. Due to unplanned growth in poultry industry, mushroom growth of small hatcheries without adequate hatchery hygienic practices.
10. Unexpected arrival from other states.
11. Chicken meat is more perishable than egg and thus requires an immediate sale.
12. Lack of consumer preference.
13. Transportation of dressed chicken carcasses in refrigerated trucks to marketing centers is costly affair.
14. Defective processing, storage and distribution of dressed carcasses

### **INTEGRATION IN BROILER INDUSTRY.**

An integrated marketing in broiler industry covers all the aspects of production i.e. from breeding to marketing of the final product. Two kinds of integration exist in marketing:

1. Vertical integration: When more than one stages of producing and marketing a poultry product are controlled by the same individual or company ,e.g. A hatchery supplying chicken and marketing the farmer's final product.
2. Horizontal integration: Two or more companies at one level join together to follow a new marketing opportunity.

A completely integrated production and marketing system can also be organized under the management of a grower ; wholesale processing co-operative, hence called cooperative integration.

Poultry industry provides dramatic examples of the integration of farm production and marketing activities. Poultry production itself is a highly integrated operation combining specialized breeding, hatchery, grain farming and feed mixing, packing operations and marketing firms.

There are 3 types of production- marketing integration in poultry industry.

1. Owner Integration: The integration of product and marketing is controlled by an individual or a single firm, i.e., the facilities for the meat production is under the ownership and the meat are marketed by him to retailer or consumer.

2. Contract marketing: Buyers sets minimum standards for the meat to be produced by the producer. Here the meat producer bears price uncertainties in addition to production cost. But the quality of meat and the time of delivery are specified and assured.

3. Contract production: Here the producer is asked to grow the birds for the specific distributor under closely supervised conditions and for a guaranteed return, i.e., the integrator supplies inputs like chick, feed, field supervision, etc., and the grower using his sheds, water and labour grows the birds and returns after getting specified amount plus incentive for superior feed conversion efficiency.

### MARKETING INTEGRATION IN BROILER

Broiler farming in India is following the path towards integration. The integrator is involved in all the above steps, which may or may not include supply of chicks to independent commercial farmers. In some parts of the country, a trend towards integration on part of dealers has started. The broiler dealer who were already operating at the middle of the above pathway by purchasing grown birds from commercial farms is now going into forward and backward integration.

i. Forward integration : It includes some sophistication in his dressing plant and extending his reach to retail and institutional outlets.

ii. Backward Intrgration : It involves the following steps:

- a. Setting up his own /contract commercial farm.
- b. Becoming chick agent for the hatchery to supply chicks to farms.
- c. Setting up of a feed plant to supply feed to farmers.
- d. Setting up of hatchery, purchasing of eggs and producing day old chicks for his farmers.
- e. setting up a breeding farm to supply the hatchery

Normally, in broiler industry, the chicken reaches the consumer through : 1. Breeder 2. Hatchery 3. Commercial growers. 4. Processor 5. Wholesaler and finally 6. Retailer at each step, overheads and profits are added making retail price very high for the consumer thus losing competitiveness in business .But in the integrated operation, it does not take the profit at each

stage into account, but only from the sale of the end product. Hence, there is an urgent need for integration in the broiler industry.

Advantages:

1. In broiler industry a farmer spends Rs 25 /= for production of one kg. of meat. While marketing entrusts only to the wholesalers. So the farmer is able to sell his broilers 2 to 5 rupees per kg than the actual market price. But in integrated marketing, the fluctuation in market price and considerable amount of profit to middlemen will not arise.
2. In integrated marketing, a farmer does not involve directly in marketing. So he need not maintain different age groups of birds in his farm. He can rather switch to “All –in-All-out” system of rearing. Hence, he attains profit as a whole in a single spell itself.
3. As chicks, feed and vaccines and other inputs are provided by the integrator the farmer needs to put only a lesser investment.
4. Variation in consumers’ demand and market prices depending upon season will not affect the farmer.
5. Timely attention with respect to the diseases prevention is provided by the integrator himself which reduces loss.
6. There is change of shift in broiler units from urban area to rural areas, as the integrated marketing makes the farmers not to trust the wholesaler for the marketing their birds. Moreover, the cost of land and labour are comparatively very cheap in rural areas.

Benefits to Integrators.

1. The chicks produced in hatcheries are better channeled through farmers to market. Further, the hatchery receives the cost of chick from the farmer at a specified period and marketing is well organized.
2. Since, the feed is prepared as a lot, production cost of feed is also reduced to the integrator.
3. Integrator can decide over the market place of broiler meat as most of the rearing units are in the hands of integrators.

**32. Classification of Poultry diseases-Viral-Bacterial-Protozoan- causative organisms, symptoms and prevention – Viral diseases – Ranikhet disease – Infectious bursal disease.**

Disease and their control.

Disease is defined as the deviation from the normal state of health which may be characterized by impaired body functions, decrease in production, mortality and morbidity

General Control measures:

1. Buy chicks from reputed disease free companies.
2. Adhere strictly to vaccination programme.
3. Keep the houses dry cool and well ventilated.
4. Rodent and fly proof.
5. Sanitation of litter, feeder and waterer.
6. Follow medication schedules.
7. P.M.disposal through burial or incineration of the waste and dead.
8. Earmark areas for specific age group.
- 9.Screening visitors.
- 10.Foot baths with sanitizers.
- 11.All in all out system.
12. Personnel sanitation.

**Vaccination**

It is correctly pointed out that " Prevention is better than Cure ".Many viral diseases cannot be treated but can be controlled only by preventive vaccination.

**1) Routes of administration**

Administration through 1) Drinking Water : It is time and labour saving method. Vaccine is reconstituted in cold drinking water along with skim milk powder at the rate of 4 gram per litre of water and used immediately. For example RDV Lasota Vaccine.

## **2) Intra ocular -Intra nasal instillation.**

The vaccine is reconstituted in normal Saline solution. One drop of diluted vaccine is applied to the nostrils or eye. Ex : RDVF . The virus particle gets absorbed in the mucous membrane and immunization is obtained.

## **3) Spray Vaccine**

Spray or mist spraying is done in chick boxes in the hatcheries. Small drops of equal size is sprayed and the boxes are allowed for 10 to 15 minutes for drying. Drying should not be done near light or by hot air.

## **4) Wing Web puncture method**

Fowl pox vaccine is reconstituted in 50% glycerol saline and taken in forked needle and vaccination is done by puncturing through wing web. Care should be taken that muscle, nerve and blood vessels are damaged by the vaccination.

## **5) Feather Follicle Method**

Pigeon pox vaccine is reconstituted with 50% glycerol saline. After plucking of the feather follicles in the internal thigh region, with the help of a glass rod, the vaccine is smeared

and rubbed . After 5 days the birds have to be examined for "Takes" . Takes are cellular reaction taking place in the nervous system.

**6) Subcutaneous injection**

Ranikhet K vaccine is reconstituted with normal saline and 0.5ml is given between two layers of skin in the wing web region without damaging nerves, blood vessels and muscle The vaccine should be protected in ice box during vaccination and should be used within one hour.

S.No.	Age	Name of the vaccine	Route of administration
1.	1 <sup>st</sup> day	Marek's Disease vaccine	Subcutaneous injection at Hatchery
2.	7 <sup>th</sup> day	Ranikhet Disease F Strain/Lasota. RD killed.	Eye drop or Nasal drop.0.2 ml S/C.on the same day
3.	14 to 16 days (II week)	Infectious Bursal disease(live) IBD(killed)	Eye drop 0.2 ml. S / C on the same day
4.	21 to 24 th day (III week)	Infectious Bronchitis	Eye drop
5.	30 to 35 days	Ranikhet disease-Lasota strain	Eye drop
6.	42 to 45 days	Infectious Bursal disease (live)	Eye drop
7.	56 to 70 days (8-10 th week)	Ranikhet disease "K" (Mesogenic)	Subcutaneous
8.	84 to 91 days (12 - 13 <sup>th</sup> week)	Fowl Pox vaccine	Wing web puncture or Intramuscular
9.	91 to 98 days (13 to 14 <sup>th</sup> week)	Infectious Bronchitis Vaccine	Through Drinking Water
10.	126 to 133 days	Ranikhet disease K" (Mesogenic)	Subcutaneous Injection

11.	After peak production , every 8 Weeks	Ranikhet Disease Vaccine "Lasota"	Through Drinking Water
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1. Live vaccine and killed vaccine should be administered on the same day by different persons.
2. The IBD vaccine should be administered only in the out break area.
3. In the pullet( nearing egg laying stage)or during out break of Ranikhet disease the RDVK vaccine should be preferred toLasota strain.
4. Before RDVK vaccination the birds should be dewormed.

### Debeaking

It is recommended to debeak the layer birds to control feather pecking and cannibalism, bullying. It is carried out by means of electrocautery. It is important to remove only one third of the upper beak taking care to avoiding tongue. It is usually practiced at the age of 10-14 days and repeated at the age of 14-16 weeks. Debeaking should never be done with penknife.

Overcrowding, inadequate space for standing/ feeding/ watering and resting, starvation, external wounds, less fiber diet and deficiency of vitamins and minerals may pre dispose the birds to cannibalism.

### Procedure

The bird has to be restrained by holding wings and legs by left hand and the tongue is pushed backwards by opening mouth and introducing index finger so that the tongue is not cut The upper beak is cut to 1/3<sup>rd</sup> of it's length and the lower beak is slightly trimmed.. After

debeaking vitamins and antibiotics are to be administered for 3-5days to avoid stress and secondary infections.

### **Deworming**

Is the process of removing worms from digestive tract of the birds. The tapeworm passes segments and is consumed by intermediate host (earthworm, cockroach) where intermediate stage get developed and passed out, which inturn is consumed by host. The eggs or ova of round worms are passed in the droppings which is picked by other birds directly or indirectly with the help of chance carriers (personnel, insects, flies, ants, etc). Sometimes wild birds such as crows may serve as source of infestation.

Birds show the following symptoms when they are infested with worms

- 1 Dullness- weakness, emaciation
- 2 Paralysis-due to toxins produced from worms
- 3 Enteritis-diarrhea with blood
- 4 Anemia-due to sucking of blood by worms.
- 5 Drop in egg production.

If infestation is on a larger scale there may be mechanical block of intestinal lumen and some times rupture occurs. This may also result due to intestinal stasis of food particles.

Deworming is practiced at intervals of 45days in layer birds and also before RDVK vaccination. Deworming is done against tape worms only on absolute necessity.

### **Delicing**

Is the process of removing of external parasites like ticks, mites and fleas which suck the blood from the bird .The following symptoms are observed during external parasitic infestation:

itching, restlessness, external wounds, loss of body weight, weakness, anemia and drop in production.

### **Procedure**

The dipping of the birds in sunny days has to be done with the following chemicals to remove the external parasites.

1. sumathion or malathion -5ml in 100ml of water. The bird has to be immersed in the chemical solution avoiding eye and mouth. The dipped one has to be dried in a separate enclosure. The feeders, waterers and building should be sprayed with this chemical solution to remove the external parasites. After dipping, to relieve stress to the bird vitamin A, B complex has to be given to improve the health of the birds.

Ranikhet Disease – New Castle Disease

Virus- Para myxo viridae

Very important disease affecting poultry

rainy season in India has been found to be more favourable for the occurrence and spread of the disease. In native fowls this disease occurs in summer.

Peracute- without symptoms and sudden death

In a typical outbreak depression is observed, characterised by prostration, closed wyes, drooping wings and loss of appetite.

There is usually greenish or yellowish diarrhoea.

sometimes in neural form there may be twitching of neck, incoordination or even paralysis. Egg production drops and sometimes-soft shelled or shell less eggs may be laid. Respiratory distress may be observed.

Prevention and control: chicks should be vaccinated with F strain or lasota strain on the first day or within 5 days after hatch and with a booster dose at 8-10 weeks. RDVK strain is usually

administered at 8 weeks of age. In layer flocks, booster dose of Ranikhet vaccine is given every 2 months.

Infectious bursal disease: Gumboro disease

-Highly contagious

IBD virus

Bursa is affected- Immuno suppression- humoral antibodies production affected

Usually chicks of 2-6 weeks old affected

Symptoms- whitish diarrhoea, vent pasting, unsteady gait, tremors,

Prevention – Vaccination at 2<sup>nd</sup> & 3<sup>rd</sup> weeks of age

**33. Bacterial diseases-E.coli-Coryza-Salmonellosis-Protozoan–Coccidiosis-casuative organism – symptoms and preventive measures. Nutritional deficiency diseases and its control.**

**Bacterial Diseases**

Coli Bacillosis

**Escherchia coli** infection

Aggravated by other stress factors

Symptoms- Diarrhoea, swelling of joints, comb, and wattle.

mortality – very high

Prevention- Proper sanitation and management, avoiding stress  
addition of antibacterials and anti biotics in feed and water

Infectious coryza

**Haemophilus gallinarum**

Symptoms- all ages – affected, Acute respiratory infection, high morbidity and low mortality,  
oedema of face, wattle and comb, discharge from nostrils

Recovered birds – carriers

Prevention and control- Better hygiene, Addition of Anti bacterials and antibiotics – Sulpha in  
feed, Tylosin, tetracycline

**Salmonellosis**

Paratyphoid, Pullorum

visceral organs –affected

**S.pullorum**- pullorum disease

, **S. gallinarum**-typhoid/bacillary white diarrhoea

, **S.typhimurium**- paratyphoid

Symptoms- Chalk like diarrhoea, huddling, weight loss, pasted vent.

Treatment: Sulpha drugs, Hygienic management, hatchery hygiene is important.

## **PROTOZOAN**

Coccidiosis:

*Eimeria tenella*, *E.necatrix*

Severe upto 10 weeks of age, due to poor litter management, bloody droppings, high mortality, production performance is hampered  
Prevention and control: Anti coccidials, litter management and hygiene.

Amprolium, sulpha drugs. Coccidiostats may be mixed with feed.

Nutritional Deficiencies and control:

Vitamin:

Vit A: Xerophthalmia- Gout, - retarded growth, discharge from eyes and nose. – Cod liver, fish liver oil, vit A supplementation

Vit D3: Rickettsia, - leg weakness, swollen hock joints, rubbery beak, thin shelled eggs.- Cod liver, fish liver oil, vit D3 supplementation

Vit E: Encephalomalacia- crazy chick disease – paralysis of leg – retraction of head, convulsions, death- vegetable oils, synthetic Vit E.

Vit B1: Thiamine – poly neuritis – paralysis of wing and neck.- yeast products, synthetic vit B1

Vit B2- Riboflavin – curled toe paralysis- tendency to walk on hocks – dermatitis on corners of mouth, vent and foot pads – fish products, Vit B2, rice bran.

Vit B12- Cyanacobalamine- retarded growth, increased mortality, drop in production and hatchability- fish meal, meat meal, synthetic B12.

Choline – Fatty liver syndrome- poor feed utilization, ruffled feathers, increase in liver fat, -fish, meat, ground nut meal.

Mineral deficiency:

Manganese: slipped tendon – deformity of hock joints – fish, meat meal

Goose stepping – Zinc,magnesium deficiency – bone formation affected.

Calcium, Phosphorous: def of vit D, deficiency during laying- imbalance in Calcium and Phosphorous- poor egg shell formation, curved beak, bone deformities.- supplementation with ca and p.

External And internal parasites; Lice , ticks and mites- deticking, delicing round worm, tape worm infestation – deworming regularly.

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