# Livestock Production Management

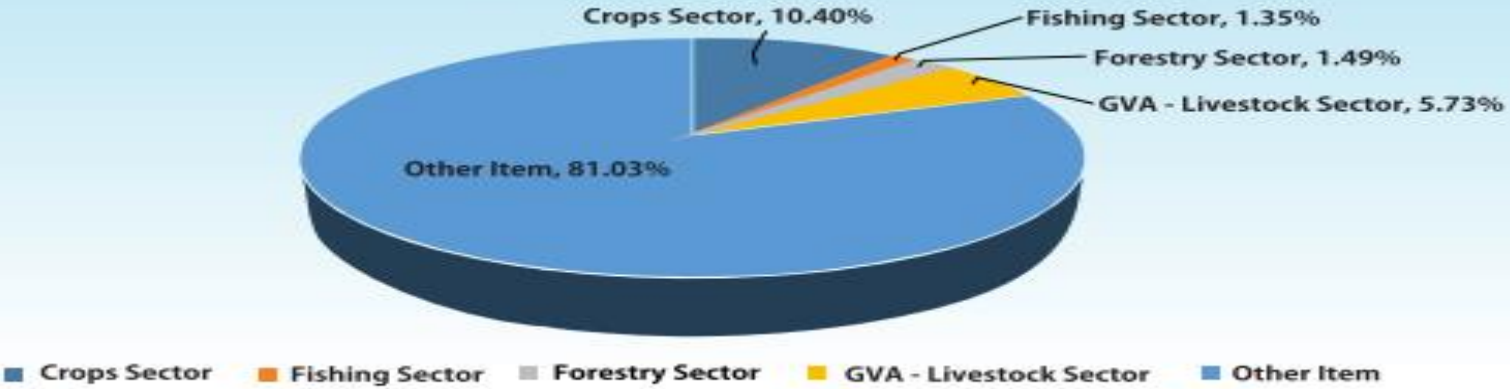
# Roles and Importance of dairying in India: critical role in the socio-economic development of the country

1. Source of Income and Livelihood
2. Food Security and Nutrition: milk and meat
3. Employment (8.8 % of the population in India)
4. Economic Growth and Rural Dvelopment: Contribution to GDP:
   - ✓Agriculture and allied sector: 18.97% of Total GVA
   - ✓Livestock GVA: 30.19% of Agricultural and Allied Sector GVA
   - ✓Livestock GVA: 5.73% of Total GVA in 2021-22.

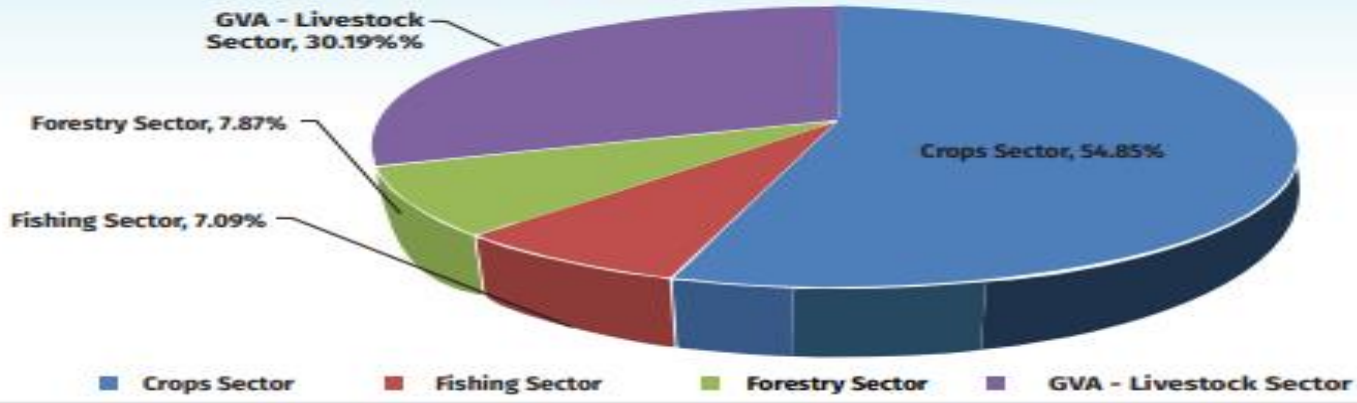
✓**Gross value added (GVA)** is the measure of the value of goods and services produced in an area, industry or sector of an economy.

✓**GDP**: The sum of GVA across all industries and sectors, plus taxes on products minus subsidies on products

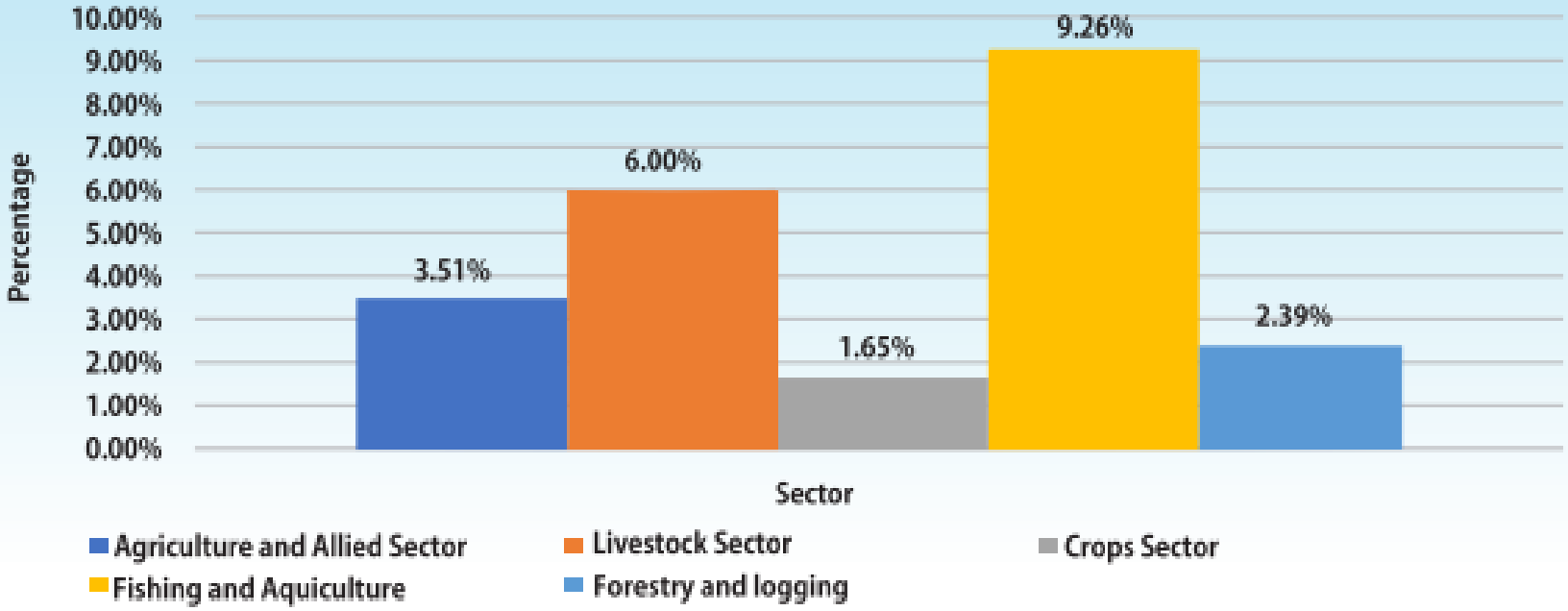
## Graph 2.31: (a) Item-wise % contribution total GVA at (Current Prices) 2021-22*




## Graph 2.31: (b) Item wise % contribution Agriculture Sector at (Current Prices) 2021-22*



## Graph 2.32: Item-wise growth rate for fy 2021-22* over previous year (at constant prices)



- **20th Livestock Census (2019):**
- India's total livestock population stands at 536.76 million (4.82% up):
- 192.49 million cattle (1.34% up)→ 2nd
- 109.85 million buffaloes (1.06% up)→ 1st
- 148.88 million goats (10.14% up)→ 2nd
- 74.26 million sheep (14.13% up)→ 3rd
- 9.06 million pigs (-12.03% down)
- 851.81 million poultry birds (16.81% up): 317.07 million in backyard poultry and 534.74
- million in commercial poultry→ 7th in total poultry

- Census started in India in 1919-20

- **Milk Production**

✓ India is the world's largest milk producer

✓ 230.58 million tonnes in 2022-23 (3.83% increase over previous year).

✓ Per capita availability of 459 grams per day in 2022-23.

✓ Top 5 milk producing states are Uttar Pradesh (15.72%), Rajasthan (14.44%), Madhya Pradesh (8.73%), Gujarat (7.49%), and Andhra Pradesh (6.70%).

✓ Nearly 45% of the milk production by Indigenous/Non-Descript Buffaloes.

✓ 32% by crossbred/Exotic cattle.

✓ 20% by indigenous cows.

✓ 3% by goats

✓ Per-capita availability (g/day): Punjab (1283), Rajasthan (1138), Haryana (1098) and AP (799) and lowest being Dadra & Nagar Haveli and Daman & Diu (4).

**Egg Production**

- India ranks 3$^{nd}$ in egg production, with a total production of 138.38 billion eggs (6.77% up) in 2022-23.
- Per capita availability of 101 eggs per annum
- Top 5 egg producing states are Andhra Pradesh (20.13%), Tamil Nadu (15.58%), Telangana (12.77%), West Bengal (9.93%) and Karnataka (6.51%).

- **Meat Production**
- India ranks 8th globally in meat production.
- India produced 9.77 million tonnes of meat (5.13% up) in 2022-23
- 3% of world total meat production.
- The per capita availability of Meat during 2022-23 is around 7.10 Kg/Annum.
- Poultry meat contributes 51.14% (4.995 million tonnes) of the total meat production.
- Top 5 meat producing states are Uttar Pradesh (12.20%), West Bengal (11.93%), Maharashtra (11.50%), Andhra Pradesh (11.20%) and Telangana (11.06%), together contributing 57.90%.
- Buffalo meat 17.61%, goat meat 14.47% and sheep meat 10.51%.
- Chicken meat: India is one of the top producers globally, ranking around 5th.
- Goat meat: India ranks 2nd globally.
- Wool production:
- India ranks around 7th globally in wool production. However, the quality of wool produced is generally coarse and primarily used in carpets and blankets rather than fine textiles

# Dairy development schemes in India: Department of Animal Husbandry & Dairying, Government of India

**1. The Rashtriya Gokul Mission (RGM):**

- Implemented for development and conservation of indigenous bovine breeds since December 2014
- The scheme is under umbrella scheme Rashtriya Pashudhan Vikas Yojna from 2021 to 2026 with a budget outlay of Rs.2400 crore.
- This programme also benefit women in particular since over 70% of the work involved in livestock farming is undertaken by women.

**Objectives:**

i. To enhance productivity of bovines and increasing milk production in a sustainable manner using advance technologies.

ii. To propagate use of high genetic merit bulls for breeding purposes.

iii. To enhance Artificial insemination coverage through strengthening breeding network and delivery of AI services at farmer's doorstep.

iv. To promote indigenous cattle & buffalo rearing and conservation in a scientific and holistic manner.

.

**2. Supporting State Dairy Cooperatives and Farmer Producer organizations (SDC& FPO) Objective:**

i. Started as a part of "Infrastructure Development Fund" from 2021-22 to 2025-26 to assist the Cooperative Societies and farmer producer organizations (FPO)

ii. Engaged in dairy activities by providing capital loan to tide over the crisis on account of severely adverse market conditions or natural calamities.

iii. To provide stable market access to the dairy farmers.

iv. To enable Cooperative Societies and farmer producer organizations engaged in dairy activities to continue to make timely payments of dues to the farmers.

v. To enable the cooperatives & farmer producer organizations engaged in dairy activities to procure milk at a remunerative price from the farmers, even during the flush season

**3. Dairy Processing and Infrastructure development fund scheme (DIDF):** From 2017-28 with NDDB

**Objectives of the DIDF scheme:**

- To modernize the milk processing plants and machinery and to create additional infrastructure for processing more milk.

**4. National Livestock Mission:** since 2014-15.

**Objectives:**

1.Employment generation through entrepreneurship development in small ruminant, poultry and piggery sector & Fodder sector

2. Increase of per animal productivity through breed improvement

3. Increase in production of meat, egg, goat milk, wool and fodder.

4.Increasing availability of fodder and feed to substantially reduce the demand – through strengthening the fodder seed supply chain and availability of certified fodder seeds

5. Encouraging establishment of fodder processing units to reduce the demand supply gap

6. Promoting risk management measures including livestock insurance for farmers

7. Promoting applied research in prioritized areas of poultry, sheep, goat, feed and fodder

8. Capacity building of state functionaries and livestock owners through strengthened extension machinery to provide quality extension service to farmers.

9.Promoting skill based training and dissemination of technologies for reducing cost of production, and improving production of livestock sector

**5. Livestock Health & Disease Control scheme:**

**Objectives:**

1. To implement Critical Animal disease control programme to eradicate PPR by 2030 by vaccinating all sheep and goats and to control Classical Swine Fever (CSF) by vaccinating the entire pig population
2. To provide veterinary services at the farmers' doorstep through Mobile Veterinary Units (MVUs)
3. To assist States/UTs for Control of Animal Disease (ASCAD) by prevention & control of important livestock and poultry diseases prevalent in different States / UTs as per the State /UT's priorities.

**6. National Animal Disease Control Programme (NADCP):** from September, 2019.

**Objective:**

1. The overall aim of the National Animal Disease Control Programme for FMD and Brucellosis (NADCP) is to control FMD by 2025 with vaccination and its eventual eradication by 2030.
2. Intensive Brucellosis Control programme in animals is envisaged for controlling Brucellosis which will result in effective management of the disease, in both animals and in humans.

**7. National Programme for Dairy Development scheme: from 2021-22 to 2025-26**

**Objective:**

1. To enhance quality of milk and milk products and increase share of organized milk procurement.

# Dairy development Plans, Schemes, Programmes & Projects in Punjab:

## •1. National Dairy Plan Phase-I

## Sub-Projects Under NDP-1

1. Strengthening of Semen Station: Nabha
2. Production of High Genetic Merit Murrah Buffalo Bulls through Progeny Testing: Patial, Sangrur, Barnala
3. Production of High Genetic Merit Nili Ravi Buffalo Bulls through Pedigree Selection: Amritsar, Tarantaran, Ferozpur and Fazilka
4. Production of High Genetic Merit Sahiwal Bulls through Pedigree Selection: Fazilka, Ferozpur, Mukatsar, Ludhiana
5. Rashtriya Gokul Mission: all district
6. National Programme on Bovine breeding: all district

## 2. National Project for Bovine Breeding: Rashtriya Gokul Mission and Gokul Gram

- The State of Punjab is creating new Bull Mother Farm at village Rauni with State of Art infrastructure facilities having capacity of 300 animals. It is proposed that 200 quality Sahiwal cows will be sourced from various regions of Punjab especially districts of Punjab bordering Pakistan and from reputed Gaushalas which are conserving these animals.

**Objectives**

- To locate superior germ-plasm in the farm and Breeding tracts through milk recording and registration of Animals.
- To introduce systematic recording in the breeding tract.
- To study the production records collected in the breeding tracts and organized cattle farms & lay down standard for selection.
- To collect the Production and breeding data of all registered animals for general guidance and inter-farms Inter-breeder exchange of Animals.
- To propagate and awaken consciousness amongst the breeders to improve their economics through Livestock improvement by Constant publicity and incentive.
- Animal health surveillance by identifying and tracking specific animals.

- **3. National Mission on Bovine Productivity**
- **Objectives:** with special reference to farmers from socio-economically weaker sections and doubling their income:
- To enhance milk production and productivity of bovine population by increasing population of disease free high genetic merit female population and check on spread of diseases.
- To improve quality of dairy animals, milk and milk products.
- To increase trade of livestock and livestock products by meeting out sanitary and phytosanitary (SPS) issues.
- To create e-market portal for bovine germplasm for connecting breeders and farmers, especially from socio-economically weaker sections.
- To increase farmer's income as a part of goal set by Hon'ble PM for doubling farmers' income by 2022.

## Table 1.2: Agro-climatic regions/zones in India

| S.No. | Agro-climatic regions/zones | States represented |
|---|---|---|
| I | Western Himalayan region | Himachal Pradesh, Jammu & Kashmir, Uttarakhand |
| II | Eastern Himalayan region | Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal |
| III | Lower Gangetic plain region | West Bengal |
| IV | Middle Gangetic plain region | Uttar Pradesh, Bihar |
| V | Upper Gangetic plain region | Uttar Pradesh |
| VI | Trans Gangetic plain region | Chandigarh, Delhi, Haryana, Punjab, Rajasthan |
| VII | Eastern plateau and hills region | Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, West Bengal |
| VIII | Central plateau and hills region | Madhya Pradesh, Rajasthan, Uttar Pradesh |
| IX | Western plateau and hills region | Madhya Pradesh, Maharashtra |
| X | Southern plateau and hills region | Andhra Pradesh, Karnataka, Tamil Nadu |
| XI | East coast plains and hills region | Andhra Pradesh, Odisha, Puducherry, Tamil Nadu |
| XII | West coast plains and ghat region | Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu |
| XIII | Gujarat plains and hills region | Gujarat, Dadra & Nagar Haveli, Daman & Diu |
| XIV | Western dry region | Rajasthan |
| XV | Island region | Andaman & Nicobar Islands, Lakshadweep |

**Source** : Planning Commission (Khanna, 1989) has identified 15 resource development regions in the country, 14 in the main land and remaining one in the islands of Bay of Bengal and Arabian Sea.

## TABLE 1.8. DENSITY WISE PREPONDERANCE OF LIVESTOCK SPECIES AND LIVESTOCK PRODUCT PRODUCTION IN DIFFERENT LIVESTOCK FARMING ZONES OF INDIA.

(NOTE: C = CATTLE; B = BUFFALO; S = SHEEP; G = GOATS; P = PIGS)

| *Agro-climatic regions* | *SPECIES PRIORITY* | | | | *REGION'S SPECIES PROFILE* | *REGION'S PRODUCTS PRIORITY* |
|---|---|---|---|---|---|---|
| | *VERY HIGH* | *HIGH* | *LOW* | *VERY LOW* | | |
| WH | | S | CBG | P | Sheep-Goat –Cattle | Wool-Meat |
| EH | | CP | G | BS | Cattle-Goat-Pig | Meat-Draft |
| LGP | CGP | S | B | | Cattle-Goat-Pig | Draft-Meat |
| MGP | P | CBG | S | | Pig-Bovine-Goat | Draft-Meat |
| UGP | BP | G | CS | | Buffalo-Pig-Goat | Milk-Meat |
| TGP | B | SP | CG | | Buffalo-Sheep-Goat | Milk-Meat |
| EPH | | C | BSGP | | Cattle-All others | Draft-Meat |
| CPH | SG | B | CP | | Sheep-Goat-Buffalo | Wool-Meat |
| WPH | | | CBSG | | All livestock | Supplementary |
| SPH | S | | CBGP | | Sheep – All others | Meat-Suppl. |
| ECPH | | BS | CGP | | Buffalo-Sheep | Milk-Suppl. |
| WCPG | C | G | P | BS | Cattle-Goats-Pigs | Draft-Meat |
| GPH | | | CBSG | P | All livestock | Supplementary |
| WD | S | | BG | CP | Sheep-Others | Wool-Meat |
| I | | | GP | CBS | Low livestock | Supplementary |

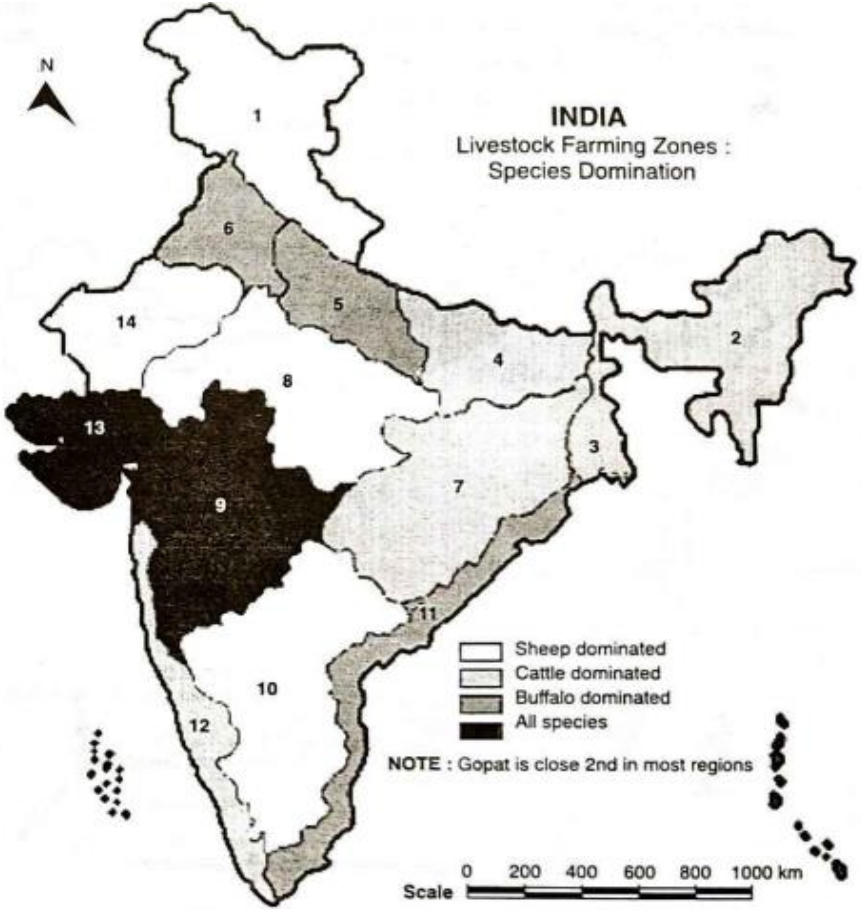
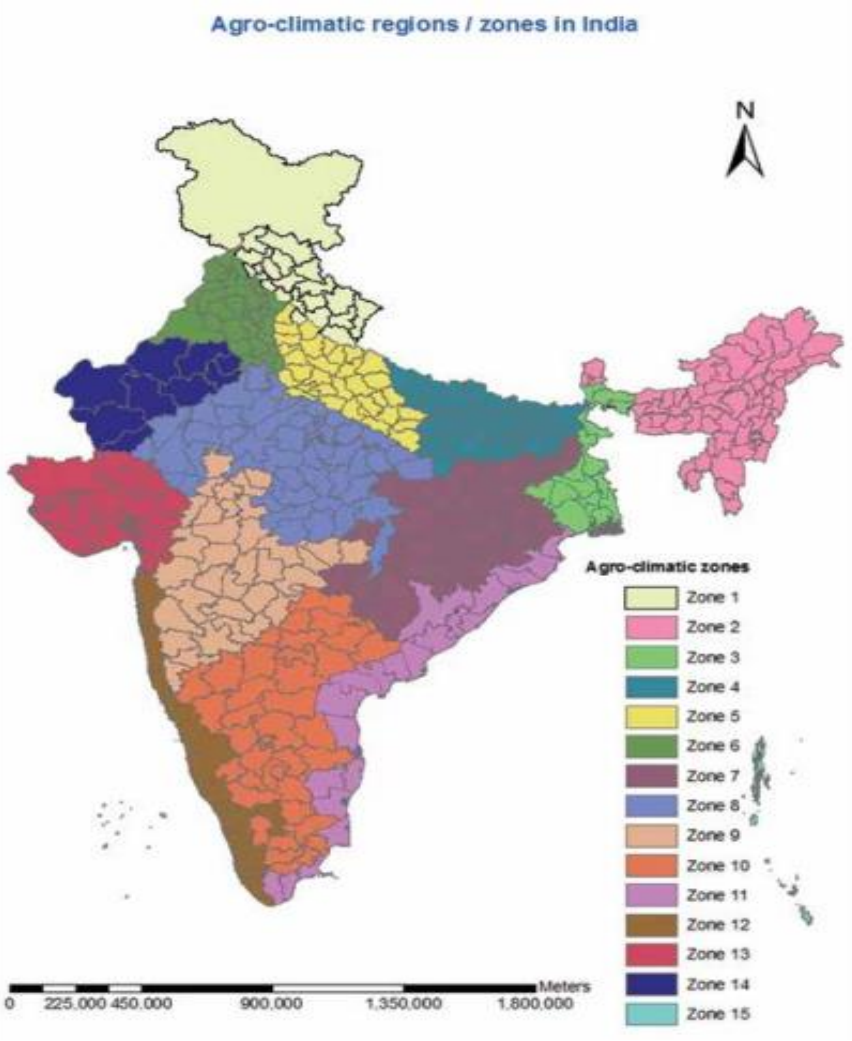



FIG. 1.4. PREDOMINANT LIVESTOCK REARED IN DIFFERENT REGIONS.



# Pillars of LPM

- Breeding
- Feeding
- Weeding: process of removing undesirable animals from a herd. This is also known as culling
- Heeding: proper care and management of animals, including their housing, hygiene, sanitation, and general supervision

# Common Animal Husbandry Terms

**Livestock:**

- ✓ Livestock means domesticated animals that is live, raised (used) for the production of items such as milk, meat, eggs, fur, leather, wool etc. for commercial and domestic consumption.
- ✓ Livestock term in broad sense: includes all animals, birds and other living creatures used for producing product for the use of man.
- ✓ Livestock term in narrow sense: include the mammal farm animals.

**Species:**

a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding and produce fertile offspring.

**Breed:**

A stock of animals within a species having a distinctive appearance and typically having been developed by deliberate selection.

↓

**Artiodactyla**

**A. PIGS - Suina**
Family > Suidae (true pigs)
Genus > Sus
Species > *Sus domesticus*
(domestic pig)

**B. CAMELS –Tylopoda**
(with padded toes)
Family > Camilidae
Genus > Camelus
Species > *Camelus dromedarius*
(one-humped camel)
Species > *Camelus bactrianius*
(two-humped camel)

**C. TRUE RUMINANTS - Pecora**

Family > Bovidae
(hollow horned)
Genus > Bos
Species > Taurine group:
*Bos taurus*
(humpless cattle)
*Bos indicus*
(humped/zebu cattle)
Bubaline group:
*Bos/Bubalus bubalis*
(water buffalo)

Family > Bovidae
(hollow horned)
Genus > Ovis
Species > *Ovis aries*
(farm sheep)

Family > Bovidae
(hollow horned)
Genus > Capra
Species > *Capra hircus*
(farm goat)

**Perissodactyla**
Family > Equidae
Genus > Equs
Species > *Equs caballus* (horse)
*Equs asinus* (ass)
Mule =
Male ass X Female horse
Jennet =
Male horse X Female ass

**CLASS: Aves (true birds)**
Sub-class: Neognathae
**Order**: Anseriformes
(webfooted swimmers & divers)
Species > *Anas platyrhynchos*
(ducks)
Species > *Anser albifrons*
(geese)
**Order**: Galliformes
(clawed, runners & scratchers)
Species > *Gallus gallus*
(chicken)
> *Meleagris gallopovo*
(turkeys)

- Ruminants four chambered stomach
- Pseudoruminants: 3 chambered stomach – omassum absent. E.g. Camel, Hippopotamus
- First domesticated animal: Dog followed by Goat

| Details | Cattle | Buffalo | Sheep | Goat | Pig | Horse |
|---|---|---|---|---|---|---|
| Species | Bovine | Bovine or Bubaline | Ovine | Caprine | Swine | Equine |
| Groups of animals | Herd | Herd | Flock | Flock or band | Drove or herd or stock | Pack |
| **Chromosome number** | **60** | **River: 50 Swamp: 48** | **54** | **60** | **38** | **64** |
| Adult male (uncastrated) | Bull | Buffalo bull | Ram or Tup | Buck | Boar | Stallion |
| Adult female | Cow | She buffalo | Ewe | Doe/ nanny | Sow | Mare |
| Young male | Bull calf | Buffalo bull calf | Ram lamb / Tup lamb | Buckling | Boarling | Colt |
| Young female | Heifer calf | Buffalo heifer calf | Ewe lamb | Goatling | Gilt | Filly |
| New-born | Calf | Buffalo calf | Lamb | Kid | Piglet | Foal |
| Cry/ sound | Bellowing | Bellowing | Bleating | Bleating | Grunting | Neighing |
| Castrated male | Bullock /Steer | Buffalo bullock | Wether/ Wedder | Wether/ Castrated | Hog / Stag /Barrow | Gelding / Geld |
| Sterilised female | Spayed | Spayed | Spayed | Spayed | Spayed | Spayed |
| Act of mating | Serving | Serving | Tupping | Serving | Coupling | Covering |
| Act of parturition | Calving | Calving | Lambing | Kidding | Farrowing | Foaling |
| Female with its offspring | Calf at foot | Calf at foot | Suckling | Suckling | Suckling | Foal at foot |

| | | |
|---|---|---|
| Humpless cattle | *Bos taurus* | 60 |
| Swamp buffalo | *Bubalus carabanensis* | 48 |
| Riverine/ water buffalo | *Bubalus bubalis* | 50 |
| Goat | *Capra hirucs* | 60 |
| Sheep | *Ovis aries* | 54 (Barbari sheep – 58) |
| Horse | *Equus caballus* | 64 |
| Ass/ Donkey | *Equus assinus* | 62 |
| Mithun | *Bos frontalis* | 58 |
| Yak | *Bos grunniens* | 60 |
| One humped camel | *Camelus dromedaries* | 74 |
| Two humped camel | *Camelus bactrianus* | 74 |
| Pig | *Sus domesticus* | 38 |
| Dog | *Canis familiaris* | 78 |
| Cat | *Felis domesticus* | 38 |
| Rabbit | *Oryctagalus cuniculus* | 44 |
| Hare | *Lepus nigricollis* | 48 |

***Draft animal power***

| Species | : | Capacity (horse power) |
|---|---|---|
| Horse | : | 1.0 |
| Buffalo | : | 0.75 |
| Bullock | : | 0.74 |
| Mule | : | 0.75 |
| Cow | : | 0.45 |
| Donkey | : | 0.35 |

***Special heat types***

*Goat, ruminants, horse* : Gestational heat
*Mare* : Foal heat (9-14 days)/ Dhaman
*Sow* : Post-partum heat
Post weaning heat

***Young one / year***

*Cattle* : 0.9
*Sheep* : 1.0
*Goat* : 1.5
*Pig* : 20
*Rabbit* : 30-48

| | |
|---|---|
| Stray Bull | Whose ancestral record is not known |
| Pedigree Bull | Whose ancestral record is known |
| Brahmin Bull | Whose are left in the name of dead person |
| Scrub Bull | It is non-descript type of stray village cattle |
| Ox | Ruminant member of the bovine family/ a castrated bull used as a draught animal |
| Bull | Uncastrated male animal |
| Steer | Young castrated male cattle which are castrated before sexual maturity (2-4 months) |
| Bullock | Male bovine castrated after developing secondary physical characteristics of a bull |
| Stag | Male pig castrated after reaches sexual maturity |
| Buller | A cow always in heat / estrus condition |
| Calf | Young animal of bovine species either male or female, under one year of age |
| Cow | Female animal that has had a calf/ calved at least once |
| Calf starter | Concentrate feed offered to the young calves after 2 weeks of age |
| Casting | It is throwing down the animal and securing the limbs for various purpose |
| Challenge feeding | Feeding higher levels of concentrate to reach her maximum milk production |
| Flushing | A temporary but purposeful elevation in the plane of nutrition around breeding time |
| Steaming up | Feeding high-energy diet in last month of pregnancy to prepare a pregnant cow for calving and lactation. |
| Cryptorchid | A male animals in which one or both the testicles fail to descent into the scrotal sac |
| Culling | Removal of undesirable or unproductive animals from herd |

| | |
|---|---|
| Deworming | Removal of internal gastro-intestinal parasites from the body |
| Dry period | Interval between date of drying to the date of next calving |
| Gestation period | The period of pregnancy of animals |
| Service period | The period between parturition to successful conception express in days |
| Heifer calf | A female calf under one year of age |
| Heifer | A female individual that has not yet calved (Usually < 18-24 months of age) |
| Inter-calving period | No. of days between two successive calving |
| Maintenance ration | A ration that maintain non-production condition with good health only |
| Open animal | Female animal that have not been bred |
| Parturition | Act of delivery in animals |
| Ration | The total amount of feed that an animal is offered during a 24 hour period of time |
| Springer | A female bovine showing signs of advanced pregnancy/ cow close to giving birth |
| Weaning | Separation of the calf from the cow and feeding them artificially |
| Prolificacy | Ability to produce large number of offsprings |
| Fecundity | Ability to give birth to offspring's frequently |
| Puberty | When reproductive tract & secondary sex organ start to acquire their mature form |
| Foal | Young horse (male or female) below one year of age |
| Veal | The meat of calf below the age of 3 months |
| Veal Calves | Calves fed for early slaughter, usually less than 3 months old |

| | |
|---|---|
| Beef | The meat of cattle |
| Carabeef | The meat of buffalo |
| Mutton | The meat of sheep |
| Chevon | The meat of goat |
| Pork | The meat of swine |
| Red meat | Beef, lamb, mutton, pork, veal, venison and goat |
| White meat | Rabbit and Poultry |
| Fertility | Ability of an animals to produce living young/ Ability to produce fertilizable ova |
| Sterility | Inability to produce any offspring/ Normal Young |
| Free martin | A sterile heifer born twin with the male |
| Castration | It is removal of testicles (infertile bull) |
| Teaser | A vasectomized bull used to detect the heat or oestrus of female |
| Cattle | Members of the cow species – cow, bull, bullock, heifer calves etc. |
| Wet cows | Milking cows |
| Yearlings | Uncastrated bovine between 1 to 2 year age. |
| Conception | Act of fertilization |
| Dam | Female parent |
| Sire | Male parent |
| Broken-mouth animal | Indicate that the animal is starting to lose some teeth, an indication that it is an older animal. |

| PIG (SWINE) | |
|---|---|
| Pig | young swine |
| Barrow | castrated male swine |
| Boar | uncastrated male swine |
| Farrowing | Act of parturition in swine |
| Gilt | female swine that has not had a litter |
| Sow | female swine that has had a litter |
| Open Gilt | A Young Female pig which has not been served |
| Closed Gilt | A Young female pig which has become pregnant |
| Store pig | Pigs between weaning and fattening usually between 8 and about 15 weeks |
| Runt/Cad/Crit/Critling | The last young one farrowed in a litter |
| Rooting | The act of a pig burrowing its nose into the ground in order to access vitamins and minerals in the soil and eat small insects |

| Sheep | |
|---|---|
| Crone | An old broken-mouth ewe which has been retained in a breeding flock because of her excellent breeding performance |
| Gimmer | A female sheep which is between 1st and 2nd shearing |
| Seggy | A ram castrated after service |
| Yeld or Eild | A barren or non lactating animals |
| Shearing | Removal of wool |
| Hogget | A sheep from weaning until its first shearing |
| Cosset | Lamb raised without help of its mother |

| Horse and mule | |
|---|---|
| Colt (Foal) | A male young one under 1 year of age |
| Filly (Foal) | A female young one under 1 year of age |
| Yearling | A horse over 1 year and under 2 year of age |
| Mule | Offspring of a mare and a male donkey. It is sterile. |
| Hinny | Offspring of a stallion and a female donkey. Mostly sterile. |
| Stallion | Uncastrated male horse |
| Stud Horse | A stallion that used for breeding |
| Jack | A male uncastrated donkey |
| Jenny/Jennet | A female donkey |
| Pony | A small type horse, under 14.2 hands (about 57 inches) at the Withers |
| Light Horse | Horse normally 14.2 and 17.0 hands high, used for riding/racing/showing |
| Draft Horses | Horse normally over 16.0 hands at withers, used for work. |

| Dog | |
|---|---|
| Dog | An adult male |
| Bitch | An adult female dog |
| Pup | A young one of either sex of dog |
| Whelping | The Act of giving birth to young one |

| Cat | |
|---|---|
| Tom | An uncastrated male cat |
| Queen | An adult female cat |
| Neuter | A castrated cat |
| Kitten | Young one of either sex of cat |
| Queening | The act of giving birth to a young |

| Poultry | |
|---|---|
| Chick | New-born chickens |
| Cockerels | Young male chickens |
| Cocks | Adult male (uncastrated) chicken |
| Pullet | Young female chicken |
| Hen | Adult female chicken |
| Capon | Castrated male chicken |
| Broiler | Young chickens raised for meat up to age of 6-8 weeks. |
| Roasters | Mature chickens used for meat |
| Layers | Chickens developed to produce large numbers of eggs. |
| Rooster | Adult male (uncastrated) chicken having tendency to roost or stand on a perch while sleeping or looking for danger |
| Laying | Act of parturition in chickens |
| Flock | A group of poultry birds. |

| Sound produce by animals | |
|---|---|
| Cattle and buffalo | Bellowing |
| Sheep and Goat | Bleating |
| Pigs | Grunting |
| Dogs | Barking |
| Horse | Neighing |

| House of Animals | |
|---|---|
| Cattle and Buffalo | Shed /Byre/Barn |
| Sheep and Goat | Pen |
| Pigs | Sty |
| Dogs | Kennel |
| Horse | Stable |
| Rabbit | Hutch |

| Gestation period in different spp. | |
|---|---|
| Dog | 2 months ± 2 days |
| Pigs | 3 months ± 3 weeks ± 3 days (114 days) |
| Sheep/ Goat | 5 months ± 5 days |
| Cattle | 9 months ± 9 days |
| Buffalo | 10 months ± 10 days |
| Horse | 11 months ± 11 days |
| Elephant | 2 years (22 months) |

| Scientific names | |
|---|---|
| *Bos indicus* | Indian humped cattle |
| *Bos Taurus* | Exotic polled cattle |
| *Bubalus bubalis* | Riverine buffaloes |
| *Ovis aries* | Sheep |
| *Capra hircus* | Goats |
| *Sus scrofa* | European swine |
| *Sus vittatus* | Indian swine |
| *Equus caballus* | Horse |
| *Gallus gallus* | Poultry. |

| **Animal** | **House** |
| --- | --- |
| **Cattle and Buffalo** | Shed / Byre / Barn |
| **Sheep and Goat** | Pen |
| **Pigs** | Sty |
| **Dogs** | Kennel |
| **Horse** | Stable |
| **Rabbit** | Hutch |

# Identification of animals

- Two main reasons: Proof of ownership and management/Traceability
- Purpose:
  - ✓For identification and issuing certificates.
  - ✓For registering in the milk society.
  - ✓For insurance purposes.
  - ✓For licensing of breeding bulls under livestock improvement act.
  - ✓For identification in case of animals to be exported or purchasing of breeding bulls to issue / get certificates for diagnostic test.
  - ✓For keeping livestock records to assess the production and reproductive performance of individual animal or herd.
  - ✓For selection and culling.
  - ✓For progeny testing

**Birds**
- Leg band
- Wing band
- Microchip implants

**Sheep and Goat**
- Branding
- Collar (electronic & non-electronic)
- Ear tags (non-electronic & electronic)
- Semi-permanent paint

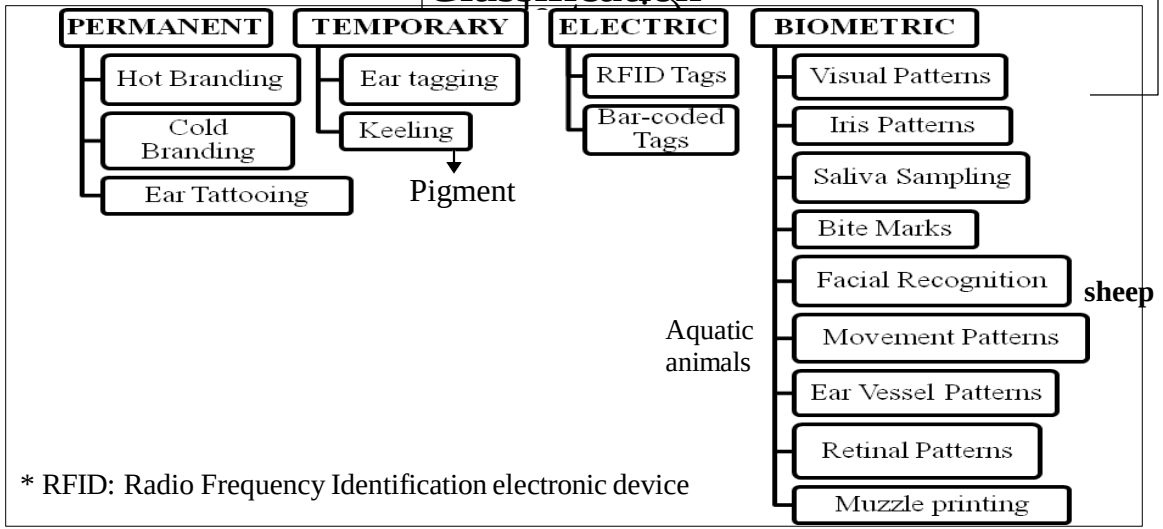
**Pigs**
- Collars
- Ear notching
- Ear tags (non-electronic)
- Tattoo

**Dogs**
- Collar
- Microchip implants
- Tattoo

**Horse**
- Collars (non-electronic)
- Branding
- Microchip implants
- Lip tattoo

**Cattle and Buffalo**
- Branding (freeze)
- Branding (hot-iron)
- Collars
- Ear tags (non-electronic &

**Classification**



# COMMON METHODS OF IDENTIFICATION USED

**Cattle/Buffalo:** Ear tags, tattoo and branding
**Sheep/Goat:** Ear tags and tattoo
**Horse:** Lip tattoo
**Pigs:** Ear tags and ear notches
**Poultry:** Leg band and wing band

## CHARACTERISTICS OF GOOD IDENTIFICATION METHOD

- It should be of minimum digits and given with ease.
- It should be easily visible (contrast with the background) without ambiguity.
- Animal should suffer with least disturbance while referring to the mark.
- It should not hinder in the animals health and production.
- The adopted system should be documented and be able to use for long time.

## Branding: Hot and cold branding – iron shaped as digits

- Hot branding (most practical method) – 4”x3” for 3-5 sec.

  Disadvantages: reduces value of skin quality, painful.

  Precautions: avoid rainy season and wet hairs, skin. Apply mustard oil, ZnO.

- Cold branding: horses and baby calves:- Dry ice (-79$^{o}$C) or Liquid $N_2$ (-196$^{o}$C) Advantage: does not reduce the value of skin (rod in coolant for 24 hr) Disadvantage: not for white skinned animals (destroy melanocytes).

- Horn branding: in mature buffaloes

**Tattooing: Ear**

- Wound with dye- retained under skin
- Disadvantages: Not suitable for dark animals and it not visible from distance

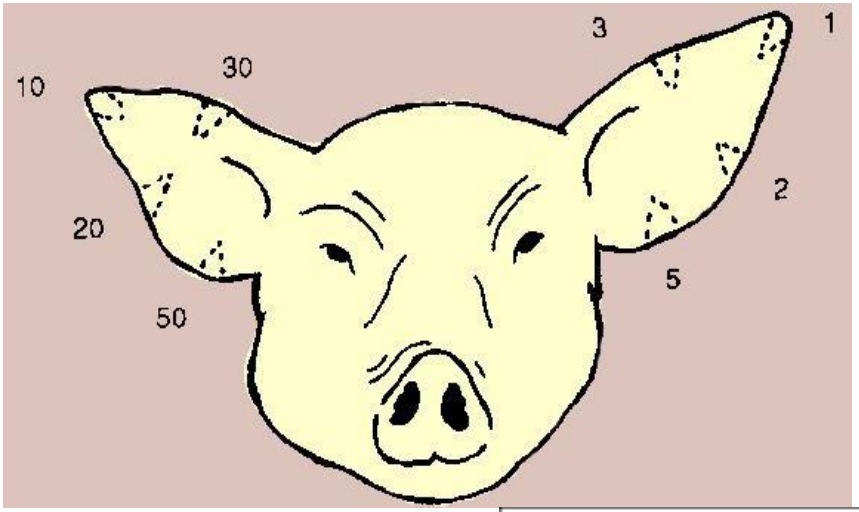
**Ear Tagging:** numbered metal or plastic material

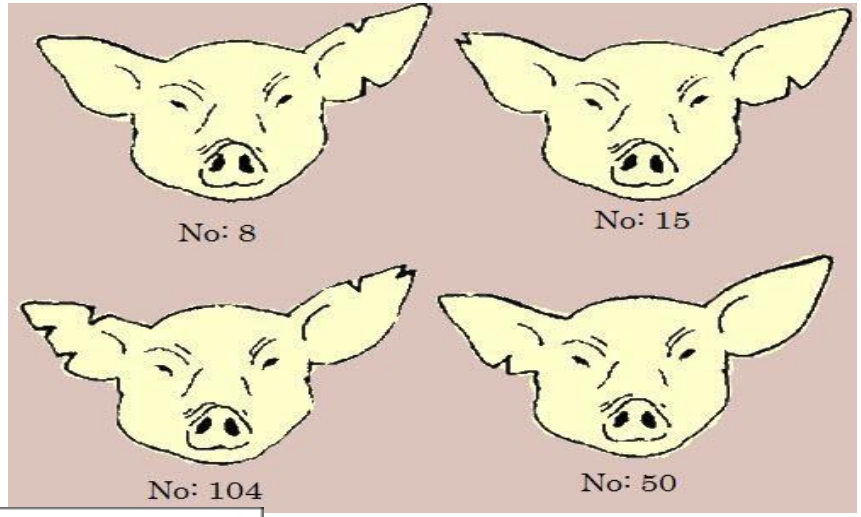
- Advantage: applied quickly and easily and also not difficult to read.
- Disadvantage: lost frequently and may damage the ear.

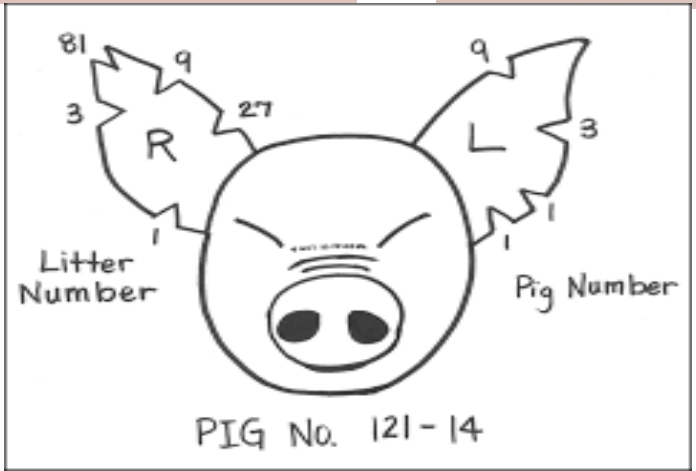
**Keeling:** Pigs - with a pigment having a greasy basis. It is temporary.

**Ear Notching:** pigs – V-cut on specific site of ear.

Identification of up to - 161 litter and 26 pigs


10
30
3
1
20
2
5
50


No: 8
No: 15
No: 104
No: 50


81
9
3
27
R
1
Litter Number
9
3
L
1
Pig Number
PIG No. 121-14

- Casting of animals: throwing animals on ground
- Commonest and most efficient method for cattle: Reuff’s method – 8 meter long rope used
- Halter: 3-4 meter rope

with flinges above and below to accommodate

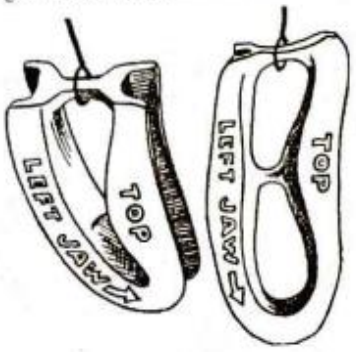



FIG. 1.14 DRINKWATER'S GAGS

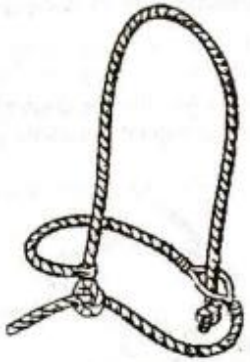


FIG. 1 15 A ROPE HALTER

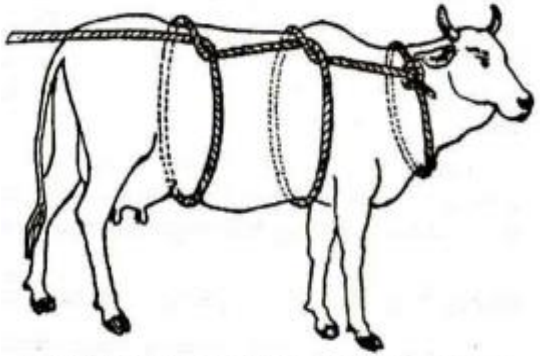


FIG. 1.24. APPLICATION OF ROPES FOR REUFF'S METHOD OF CASTING LARGE ANIMALS

FIG. 1.16 A SIMPLE ROPE HALTER

FIG. 1.17 A LASSO IMPROVISED AS A HALTER

- Kangaroo
  - male: boomer
  - Female: Flyer
  - Young one: Joey
- Male Duck: Drake
- Goose
  - Male: Gander
  - Female: Goose
  - Young one: Gosling
  - Group: gaggle/ flock
- Fox
  - Male: Reynard
  - Female: Vixen
  - Group: earth/ skulk

- Young ones
- Keet: Guinea fowl
- Squab: Pigeon
- Fawn: Deer
- Cub: Lion

# Body conformation

- Conformation means appearance of part or body when viewed externally
- Means of selecting and judging of animal
- For dairy cows, the ideal body shape is triangular or wedge-shaped when viewed from different angles.
- Rump/ croup: region of sacrum extending from behind loin to the tail head including incline of hips
- Point of Hip: external angle of ileum forming the top posterior angle of flank
- Escutcheon or milk mirror: space just above the udder between buttocks

# Economic Character in Dairy Animals

1. Directly observed traits: e.g. body weight, body length etc.
2. Generated traits: e.g. generated from information available in pedigree sheets of animals
3. Production traits: e.g. Milk and lactation related e.g. lactation yield, Milk fat%

| **Important trait** | **Dairy cattle/Buffalo** | **Beef cattle/Buffalo** |
|---|---|---|
| Production | Milk yield<br>Concentration of milk solids | Body size or weight<br>Growth rate<br>Carcass quality<br>Age and weight at slaughter Leanness, carcass percentage |
| Reproduction | Age at first calving<br>Calving interval<br>Age at first collection of semen<br>Fertility index (for bull) | Age at first calving Calving interval Mothering ability<br>Scrotal circumference |
| Health | Disease resistance | Disease resistance |
| Management | Longevity Milk let-down | Calving ease<br>Temperament |
| Physical appearance | Body colour, shape, and dimensions, udder characteristics, structural traits and body condition | Body colour, shape, dimensions, structural traits and body condition |

# Economic Traits

- **Lactation yield:** total milk yield in a lactation period. Less in Indian breed, higher in exotic.
  - ✓ This is dependent on no. of calving, frequency of milking, persistency of yield.
  - ✓ Normally in dairy cattle 30 - 40 % increase in milk production from first lactation to maturity is observed.
  - ✓ After 4$^{th}$ lactation the production starts declining.

•**Peak milk yield:** After parturition the milk yield per day will be increased and reaches peak within 4-6 weeks (6 weeks) after calving called as peak yield.

- **Persistency:** ability of animal to maintain milk production after peak during lactation period.
  - ✓ Rate of reduction of milk yield after achieving maximum/ peak yield is called persistency.
  - ✓ For high level of lactation yield, this peak yield should be maintained for longer period as far as possible.
  - ✓ Slow decrease (normally 2-2.5% per week) in dairy milk yield after reaching peak yield is necessary.
  - ✓ High persistency is necessary to maintain high level of milk production.
- **Lactation length:** length of milk producing period after calving. Cow 305 days and buffalo 310 days optimum.
- **Age at first calving:** The age of animal at first calving is very important for high life time production.
  - ✓ The desirable age at first calving: Indian cow- 3 years, cross breed cattle- 2 years and Buffaloes- 3.5 years.
  - ✓ Prolonged age at first calving will have high production in the first lactation but the life time production will be decreased due to less no. of calving.

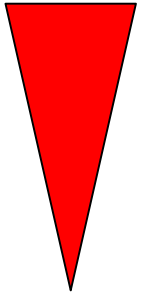
- **Service period:** period between date of calving and date of successful conception.
  - ✓ The optimum service period helps the animal to recover from the stress of calving and also to get back the reproductive organs back to normal.
  - ✓ For dairy animals, the optimum service period is 60-90 days.
  - ✓ If the service period is too prolonged the calving interval prolonged, less no. of calving will be obtained in her life time and ultimately less life time production.
  - ✓ If the service period is too short, the animal will become weak and persistency of milk production is poor due to immediate pregnancy.
- **Dry Period:** period from the date of drying (stop of milk production) to next calving.
  - ✓ Rest period to compensate for growth of fetus and mammary tissue repair.
  - ✓ A minimum of 2–2.5 months (**60 days**) dry period should be allowed. Indian breeds >90 days
- **Inter-calving period:** period between two successive calving. Indian breeds: 16-18 m.
  - ✓ CI = service period + gestation period or lactation period + dry period
  - ✓ Ideal: 12 months i.e. one calf yearly in cattle and at least one calf for every 15 months in buffaloes.
- **Feed Utilization Efficiency/ Feed Conversion Ratio:** The animal should utilize feed efficiently to convert into the milk.
- **Disease Resistance:** Indian breeds are more resistant to majority of disease compared to exotic cattle.
- **Conception rate:** No. of conception/No. of AI x100

- **Reproductive Efficiency:**
  - ✓ The reproductive efficiency means the more number of calves during life time, so that total life time production is increased.
  - ✓ The reproduction or breeding efficiency is determined by the combined effect of hereditary and environment.
  - ✓ Several measures of breeding efficiency like number of services per conception, calving interval, and days from first breeding to conception are useful.
  - ✓ Reproductive efficiency has generally a low heritability value indicating that most of the variations in this trait is due to non-genetic factors.
- **Age at puberty** – means the age at which young female shows the first heat. Heifers should show 1st heat when they attain 50% of body weight.
- **Breeding efficiency**
  - ✓ Measured as the number of service per conception.
  - ✓ This should be calculated for first calving, second calving etc.
- **Non return rate**
  - ✓ Means proportion of animas that, after breeding, have not shown heat signs at the expected normal interval.
  - ✓ Indication of conception
  - ✓ Gestational heat- a normal physiological feature
- **Replacement rate :** Percentage of female cows reached to AFC out of total female calves born.
- **Selective value:** It is estimated as no. of female adults reaching to milking herd from each cow.

# Important Dairy Cow Characteristics

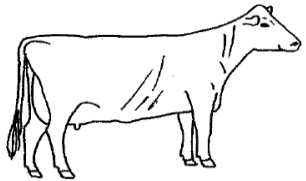
- **40%** **Mammary System**
- **20%** **Dairy Character**
- **15%** **Frame**
- **15%** **Feet & Legs**
- **10%** **Body Capacity**

Most Important

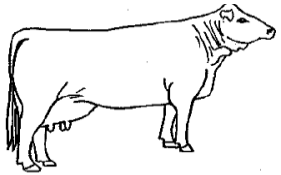


Least Important

A feminine cow will be straight topline Sharp and clean fronted, with a lean neck Long, smooth muscling.



Feminine cow



Non-feminine cow

# Economic traits of horse, pig and camel

| | | |
|---|---|---|
| **Horse** | Performance Traits | Speed and Stamina |
| | | Temperament |
| | | Strength and Agility |
| | Reproductive Traits | Fertility |
| | Health and Longevity | Disease Resistance |
| | | Longevity |
| | Physical Conformation | Body Structure |

| | | |
|---|---|---|
| **Pig** | Production Traits | Growth Rate |
| | | Feed Conversion Efficiency |
| | | Litter Size |
| | Meat Quality Traits | Carcass Quality |
| | | Backfat Thickness |
| | Health and Disease Resistance | Disease Resistance |
| | Reproductive Traits | Sow Longevity |

| | | |
|---|---|---|
| **Camel** | Production Traits | Milk Yield |
| | | Meat Production |
| | Adaptability Traits | Heat and Drought Tolerance |
| | | Disease Resistance |
| | Work and Performance | Load-Carrying Capacity |
| | Reproductive Traits | Calving Interval |
| | Health and Longevity | Longevity |
| | Physical Conformation | Body Condition |

# Age determination in dairy animals

## DENTAL FORMULA

| Species | Temporary | Permanent |
|---|---|---|
| C/B/S/G | **2 (0/4, 0/0, 3/3, 0/0)= 20** | **2 (0/4, 0/0, 3/3, 3/3)= 32** |
| Horse | 2 (3/3, 0/0, 3/3, 0/0)= 24 | 2 (3/3, 1/1, 3/3, 3/3)= 40 |
| Pig | 2 (3/3, 1/1, 3/3, 0/0)= 28 | **2 (3/3, 1/1, 4/4, 3/3)= 44** |
| Dog | 2 (3/3, 1/1, 3/3, 0/0)= 28 | 2 (3/3, 1/1, 4/3, 2/3)= 40 |
| Camel | 2 (1/3, 1/1, 3/3, 0/0) = 24 | 2 (1/3, 1/1, 2/3, 3/3)= 34 |

Canine teeth usually appear only in male horses; they are regressed or absent in mares.
Wolf teeth, Dental star, Galvayne's groove – terms related to equines

# Age of cattle/buffalo

| | | Cattle | Buffalo |
|---|---|---|---|
| • Central (1st incisors) | → | 24-30 months | 30 months |
| • Centrolateral (2nd pair) | → | 36 months | 42 months |
| • Lateral (3rd pair) | → | 48 month | 54 months |
| • Corner (4th pair) | → | 54-60 months | 70-72 months |

## Age determination by horn rings

- Age of the animal: no. of horn ring + 2

## TABLE 1.12 ERUPTION OF DIFFERENT TEETH IN SHEEP

| *Possible age in months* | *Eruption of incisors* | *Note* |
|---|---|---|
| A birth | 0 to 2 pairs of temporaries | A in Fig. 1.37 |
| 6-10 | All temporaries | B in Fig. 1.37 |
| 14-20 | Permanent centrals | C in Fig. 1.37 |
| 21-25 | Second pair | D in Fig. 1.37 |
| 26-30 | Third pair | E in Fig. 1.37 |
| 30-40 | Permanent corners | F in Fig. 1.37 |

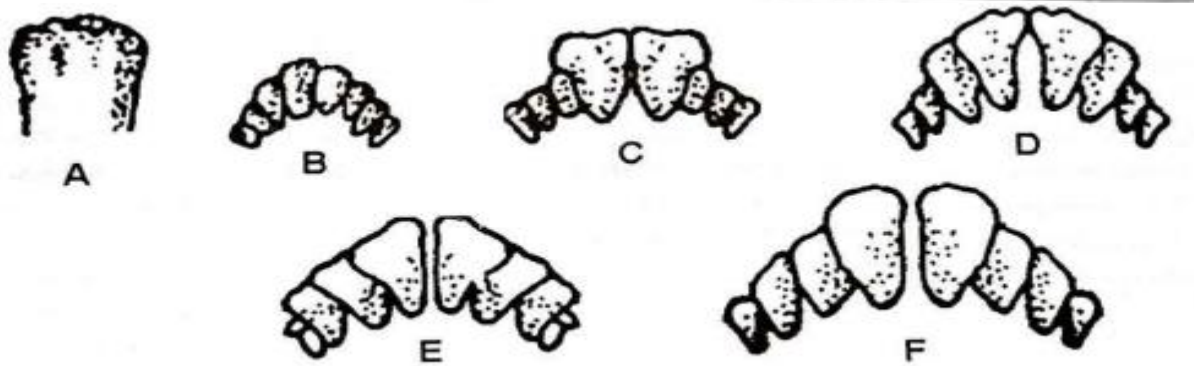



**FIG. 1.37 AGE & ERUPTION OF INCISOR TEETH IN SHEEP** (see details of a-f in text)

- Elephant teeth: tusks - elongated incisors
- Molar progression refers to the sequence and developmental changes of molars throughout an organism's life.
- Seen in Cervidae (deer)
- Tusks in pigs are modified canine teeth that can grow continuously throughout their lives, primarily in male pigs (boars).
- Needle teeth in Piglets

# General Farm Practices

- Feeding
- Grooming
- Bedding
- Exercising
- Dehorning
- Deworming
- Castration
- Heat detection
- Pregnancy diagnosis
- Milking
- Waste disposal

# COMMON FARM MANAGEMENT PRACTICES

- **Extra teat removal**
- Normal udder should have four teats of uniform size. But animals may have one or even two extra teats. Such extra teats may be blind or leaky.
- It should be removed before the calf attains 6 months of age.
- Cleaned and disinfected with Tincture iodine and mark extra teats before removal. These teats are clipped off with scissors. Suture may be applied.

**Deworming**

- Should be started from the first week of calf.
- A single oral dose of 10 g piperazine is recommended
- Every month for first 6 months, thereafter once in three months.

**Quarantine**

- Segregation of apparently healthy animals being brought into the herd for first time.
- Objective: to prevent the risk of infection to healthy animals.
- Normal quarantine period: 1 months but for rabies 6 months.
- Screen and treat the animals for endo- and ecto parasite during quarantine.
  - ✓ Deworming: 23$^{rd}$ / 24$^{th}$ day
  - ✓ Dipping / spraying: 25$^{th}$ / 26$^{th}$ day

# DISBUDDING / DEHORNING

- Dehorning: Removal of horn
- Disbudding: to arrest the growth of horns at an early age by destroying horn bud or button.

**Objectives:**

- ✓ To avoid injury to the animal as well as the handler.
- ✓ It is pre-requisite for loose housing.
- ✓ It will give uniform appearance.
- ✓ To economize the floor space/ stocking density (10-15% more animals).
- ✓ To prevent problem of horn cancer, broken horn etc.

- **Age of disbudding:**

- **Buffalo calves : 7-10 days (1st week)**
- **Cow calves : 10-14 days (2nd week)**
- **Goat kids : 14-21 days (3rd week)**

- **Methods of disbudding**

✓ Chemical method: Caustic potash (KOH)/Caustic soda (NaOH) sticks

✓ Hot iron method: Mechanical method

✓ Electrical method: 540 $^{o}$C x 8-10 seconds

- **Methods of dehorning:**

✓ Mechanical method: Saw

✓ Rubber band method: tight rubber band

✓ Amputation of horns: surgical method → Cornual nerve block

# CASTRATION

- Impairment of testicular function.
- Should be performed during cold season and strictly avoid rainy season.

**Objectives:**

- ✓ To make male animal docile
- ✓ To prevent indiscriminate breeding and prevent genital diseases
- ✓ To improve the fineness of neck for proper fitting of yoke in cattle and buffalo used for drought purpose.
- ✓ To improve the growth and masking of male odour in meat animals
- ✓ Improves meat and skin quality as well as dressing percentage

**Methods of castration:**

- ✓ Surgical / open method - cut spermatic cord; within 3 months of age
- ✓ Non-surgical / closed (bloodless method)

1. Crushing of spermatic cord with Burdizzo castrator. It is most commonly used method for ruminants. Crush the spermatic cord. 3-5 cm above the testicles and press for a few seconds. Again at 1cm below the first one. **Done within one year of age.**
2. Rubber Band/ elastrator Method: Prevent blood supply to testicle. within 3 months of age. It is very painful to the animal and not usually recommended.

**Proper time breeding:**

- Oestrus animals should be breed at their mid oestrus stage in order to get maximum conception rate.
- If oestrus signs observed in morning/ evening, breeding should be done in the evening/ next day morning.

**Proper time pregnancy diagnosis:**

- Within 60-90 after breeding for confirm the pregnancy.
- This should be done by qualified veterinary doctor.
- This facilitates optimal feeding and care of pregnant animals in positive animals.
- This provides clear way to breed the animal in next oestrus in negative cases.
- Proper pregnancy diagnosis reduces the inter-calving period and increases the production.

# Bull nose ring

- 8-12 months old bull
- Bull leader: bamboo pole of 1.5m long

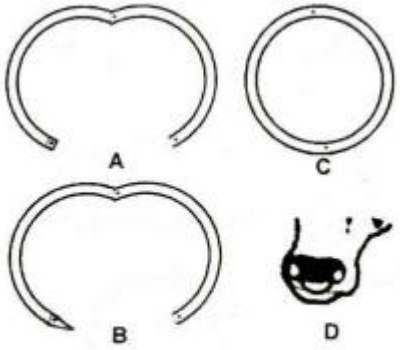



FIG. 1.11. BULL NOSE RING

A. Ordinary type, B. Self-piercing type, C. Closed ring, D. Nose-ring in position

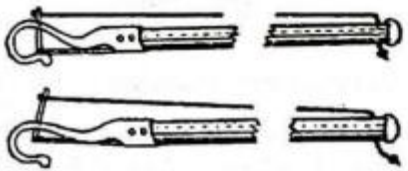


FIG. 1.12 BULL LEADER / POLE

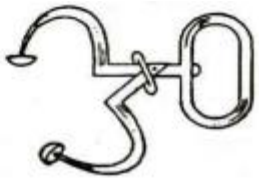


FIG. 1.13 BULL HOLDER

# Vaccination Schedules for Cattle and buffalo

| S.no | Name of Disease | Age at first dose | Booster dose | Subsequent dose |
|---|---|---|---|---|
| 1 | Foot and Mouth Disease (FMD) | 4 months and above | 1 month after first dose | Six monthly |
| 2 | Haemorrhagic Septicaemia (HS) | 6 months and above | - | Annually in endemic areas. |
| 3 | Black Quarter (BQ) | 6 months and above | - | Annually in endemic areas. |
| 4 | Brucellosis | 4-8 months of age (Only female calves) | - | Once in a lifetime |
| 5 | Theileriosis | 3 months of age and above | - | Once in a lifetime. Only required for crossbred and exotic cattle. |
| 6 | Anthrax | 4 months and above | - | Annually in endemic areas. |
| 7 | IBR | 3 months and above | 1 month after first dose | Six monthly (vaccine presently not produced in India) |
| 8 | Rabies (Post bite therapy only) | Immediately after suspected bite. | 4th day | 7,14,28 and 90(optional) days after **first** dose. |

# Vices in animals

- Vices – Cattle
  - Eye rolling
  - Tongue rolling: Brown Swiss breed exhibit it most frequently
  - Licking & eating own hair
  - eating solid objects
  - Inter-suckling by calves
  - Inter-suckling by Adult animals
  - Self sucking
  - Coprophagy
  - Onanism/ Masturbation
  - Head rubbing
  - Kicking

- Vices sheep and goat
  - Stealing young/ lamb stealing
  - Wool-pulling and wool eating
  - Eating solid objects

  Swine
  - Tail biting
  - Belly nosing
  - Anal massage
  - Sham-chewing: chewing without any substance in mouth
  - Drinker pressing

**Horses**

1. **Cribbing (Wind-Sucking):** The horse bites onto a surface, arches its neck, and pulls back, often swallowing air. To avoid provide adequate forage to keep the horse busy, use cribbing collars, and add cribbing deterrents (like anti-chew sprays) to surfaces.
2. **Weaving (Swaying Side to Side):** A repetitive swaying motion, usually at the stall door, indicating boredom or anxiety. Increase turnout time, provide social interactions with other horses, and add visual stimulation to the stall.
3. **Wood-Chewing:** Horses chew on wooden surfaces like fences or stall walls, often due to boredom or mineral deficiencies. Offer free-choice mineral supplements, increase forage (especially fiber-rich options), and cover wood surfaces with anti-chew products.

- **Poultry**

1. **Feather Pecking and Cannibalism:** Chickens peck at each other's feathers, sometimes leading to severe injury. Provide ample space, limit overcrowding, and use enrichment like hanging vegetables or pecking blocks. Ensure diets are nutritionally balanced and reduce stress from lighting or noise.
2. **Egg-Eating:** Chickens break and eat eggs, which can quickly spread among the flock. Collect eggs frequently, provide ample nesting boxes, and use roll-away nest boxes. If persistent, isolate egg-eating birds.
3. **Boredom Pecking and Ground Scratching:** Chickens may develop destructive pecking or excessive scratching behaviors due to boredom. Add variety in the environment, such as perches, dust baths, and hanging greens.

- **Dogs**

1. **Excessive Barking:** Dogs bark excessively due to boredom, anxiety, or territorial behavior. To avois, Increase exercise, training and socialization. Training techniques like “quiet” commands can be helpful, along with desensitization for anxious dogs.
2. **Destructive Chewing:** Dogs chew on inappropriate objects like furniture, shoes, or doors. Provide chew toys and ensure sufficient exercise. For young dogs, limit access to off-limits areas and use deterrent sprays.
3. **Digging:** Some dogs dig out of boredom or instinct, especially breeds prone to digging (e.g., terriers). Create a designated digging area, keep the dog entertained with toys and exercise, and supervise outdoor time.
4. **Separation Anxiety:** Dogs show signs of stress (e.g., barking, destruction) when left alone. Gradual desensitization to alone time, using crate training for security, and considering calming aids or behavior therapy.

# Transportation of animals

- **General conditions for transport**

1. Healthy animals should be transported.
2. Qualified veterinarian should be certify the animals are fit for the journey.
3. The vehicle used to transport the animals is designed, constructed, maintained and operated so as to avoid injury and suffering and ensure the safety of the animals.
4. Loading and unloading facilities are adequately designed, constructed, maintained and operated so as to avoid injury and suffering and ensure the safety of the animals.
5. Personnel handling the animals must be trained for this purpose.
6. Transport without delay to the place of destination and the welfare conditions of the animals are regularly checked and appropriately maintained.
7. Sufficient floor area and height is provided for the animals during transportation.
8. Appropriate quality and quantity of water, feed and rest should be offered.

- **Animals unfit for transportation:**
  - Unable to move independently without pain
  - Severe open wound, or prolapse
  - Pregnant females with 90 % or more of the gestation period has already passed, or females who have given birth in the previous week.
  - New-born animals whose navel has not completely healed
  - Pigs of <3 weeks, lambs of <1 week and calves of <10 days of age if they are transported >100 km.
  - Dogs and cats of <8 weeks of age, unless they are accompanied by their mother

# Transportation of Animals

1. **Movement on foot:** for short distances
   - ✓ most economical way of transport
   - ✓ Cattle can easily be driven for about 30-35 km a day.
   - ✓ But usually cattle/buffalo and sheep/goat should not be walked more than 15km and 6.8km/day, respectively.
2. **Transport by rail:** for long distances
   - ✓ 10-15 cm thick layer of sand
   - ✓ Stock should be watered every 12 hours
3. **Transport by road:**
   - ✓ Cost of transport per km is somewhat greater than and it gives lot of stress on animals
4. **Transport by Air:**
   - ✓ This route is used very rarely for transport of costly race horses, zoo animals or for the import or export of pure bred animals.

# Transportation by Rail

| Type of animals | Broad gauge | Metre gauge | Narrow gauge | Space ($m^2$) |
|---|---|---|---|---|
| Horned cattle/Buffalo | 10 | 8 | 6 | 2.0 |
| Horned C/B/ with calf | 8 | 6 | 4 | 2.0 |
| Horse | 8 | 6 | 4 | 2.0 |
| Suckling calf | 20 | 15 | 10 | 1.0 |
| Sheep/Goat | 70 | 50 | 25 | 0.25 |
| Mule/Hinny | 10 | 8 | 6 | 1.75 |
| Donkey | 12 | 10 | 8 | 1.5 |
| Pigs | 50 | 35 | 20 | 0.4 |

# Weight loss during transportation

- The weight losses during transportation in cattle, sheep and **pig** varies from 6.3-12.63 %, 0.9-3.6% and 12-20% per 24 hr., respectively.
- The mortality rate in case of **cattle**, pig, and sheep varies from 9.69-18.57%, 0.17-3.77% and 0.3-3.6%, respectively.

- **Pre-loading precautions for cattle/ buffalo**

1. Cattle should be mixed in a pen 24 hours before loading
2. Most animals can be fed and watered before transporting (settling effect).
3. Do not mix horned and hornless animals and different species.
4. Bulls should not be carried together with other stock unless separated by a strong partition.
5. Vehicles should be fitted with a portable ramp to facilitate emergency offloading.

# Precautions for cattle transportation

**1. Trekking**

- Only cattle, sheep and goats can be successfully moved on hoof.
- Opportunities for grazing, watering and overnight rest.
- The maximum distances trekked depend on weather, body condition, age etc.

**2. Time of the day**

- Cooler mornings and evenings or even at night.
- High environment temperatures→ heat stress and mortality.
- High humidity and high temperatures is especially deadly to pigs.

**3. Duration of journey**

- Journeys should be short and direct, without any stoppages.
- Cattle/ sheep/ goats should not travel for more than 36 hours and should be off loaded after 24h for feed and water.
- Pigs should have access to frequent drinks of water during long journeys, particularly in hot and humid conditions.

**4. Driving**

- Smoothly, without jerks or sudden stops.
- Corners should be taken slowly and gently.
- Vehicles should be driven at a speed not more than 35 km/h.

# Transport of Cattle

**1. Trekking**

- Cooler mornings /evenings or even at night.
- Only where road and rail infrastructure does not exist and suitable for short distances

**2. Transport of cattle by train**

- Watering arrangements on route shall be made and sufficient quantities of water shall be carried for emergency.
- Sufficient feed and fodder with adequate reserve.
- Adequate ventilation shall be ensured.
- Every wagon carrying cattle shall have at least one attendant.
- Rations for padding, such as straw, shall be placed on the floor to avoid injury if a cattle lies down and this shall not be less than 6 cm thick.
- Cattle-in-milk: milked at least twice a day.
- Cattle may be moved during the nights only. During day time, if possible, they should be unloaded, fed, given water and rested and if in milk, milking shall be carried out.

**3. Transport of Cattle by road or truck**

- It has the convenience of loading at the farm and direct transit to the point of market.
- Vehicles shall be provided with anti-slipping material and one attendant.
- No goods vehicle shall carry more than six cattle.
- The goods vehicle shall not be loaded with any other merchandise and to prevent cattle being frightened or injured, they should preferably, face the engine.

# Transportation of Horses

**1. Road Transportation**

- Wide variety of vehicles
- Carried in either trailers (“floats”) or in modified vans or lorries.
- Trailers or “floats” designed to carry 2or 3 horses (Europe) and 6-9 horses (USA)
- Speed not more than 35 kilometers per hour

## 2. Space allowances of horse for transportation

| Category | Area ($m^2$/animal) |
|---|---|
| Adult Horses | 1.75 $m^2$ |
| Young horses (6-24 months old) for journeys of up to 48 hours | 1.2 $m^2$ |
| Young horses (6-24 months old) for journeys over 48 hours | 2.4 $m^2$ |
| Foals (0-6 months) | 1.4 $m^2$ |
| Pregnant mare | 2 $m^2$ |
| Mares with Foal at Foot (up to 6 months) | 2.25 $m^2$ |

## 3. Rail Transportation of horses

- Rail transport of horses may have commenced in the mid 1800's
- Horses shall be loaded parallel to the rails, facing each other
- Material for padding on floor not <6 cm thick
- Two breast bars provided on each side of the wagon, at a height of 50 to 80 cm

**4. Sea Transportation of horses :** Sea transport of horses was, at least until the early 1990's

## 5. Air transport of horses

- Most popular mode of transport, is commonly used for race horses.
- In aircrafts animals are either secured in crates of 2 to 3 horses each in each pen.
- The floors of aircrafts are provided protected by a thick layer of wood shavings and covered with polyethylene.
- All animals shall be administrated tranquilizers before loading.
- A veterinary first-aid kit with the veterinarian shall always be available in the aircraft.
- Hay bundles shall be placed in between the hind legs and sides of the aircraft.

**Floor space for transportation of Poultry**

| S. N. | Kind of poultry | Minimum | Dimension (cm) | | | Number in container |
|---|---|---|---|---|---|---|
| 1 | Day old chick | - | 60 | 45 | 12 | 80 |
| 2 | Poult (young) | - | 60 | 45 | 12 | 60 |
| 3 | Broiler | 75 $cm^2$ | 60 | 30 | 18 | 24 |
| 4 | Three month old | 230 $cm^2$ | 55 | 50 | 35 | 12 |
| 5 | Adult | 480 $cm^2$ | 115 | 50 | 45 | 12 |

# Culling

- Removal of animals from the herd or flock that are no longer desirable for breeding or production.
- Culling rates in dairy herds vary, ranging from 20% to 30% per year
- Infertility (32.6%) is the most prevalent reason of culling followed by mastitis (6.5%).

**Advantage of Culling**

- Improves the overall productivity and profitability, genetic potential of the farm by replacing less productive animals.
- Ensures good market prices for surplus breeding stock.
- Helps maintain healthy and productive livestock

**Reasons of culling:** The most common causes of *voluntary culling* were economic reasons (29.1%), low milk yield (23.0%) and aging (19.7%).

- The common causes of *involuntary culling* were infertility (17.7%), chronic mastitis (8.5%) and foot injuries (2.0%).

# Types of Culling

**I. Policy Culling**: based on various predefined criteria:

i. Not true to breed/type.

ii. Unknown parentage (if pedigree is important).

iii. Genetic defects

iv. Poor production/reproduction performance

v. Surplus stock

vi. Age limits:

- **Cattle**: Older than 12 years or after five calvings.
- **Sheep and goats**: Six years old or gummers (broken mouths).
- **Swine and rabbits**: Older than two years.
- **Work cattle**: Too old and unfit for labor.

**II. Veterinary Culling**: culling recommended by veterinarians when:

- Animals have disorders that do not respond to treatment.
- Animals become unsuitable for production due to physical incapacity.
- Animals experience significant weight loss or stagnation during growth or lose 25% or more of their adult weight.
- Animals are suspected or confirmed to have contagious, infectious, or zoonotic diseases. In such cases, disposal follows rules prescribed by animal disease acts.

**II. Emergency Culling**

- Animals involved in accidents or predatory attacks with a grave prognosis.
- Animals suffering from severe non-specific diseases with a grave prognosis.
- Animals confirmed to have diseases like tuberculosis, Johne's disease, or brucellosis may be destroyed as per farm management policies.

# DISPOSAL OF CARCASS

**Importance:** To prevent the spread of infection

**1. Burial method:** Most common method

- Site: away from water body and water level at least 2.5 m below the ground.
- Burial pit: get ready burial pit before arrival of carcass.
- Highest part of carcass must be 1.5 m below the ground level.
- Burry left over feed, bedding, excreta of animal and top 5 cm soil with carcass.
- Drench carcass with kerosene, crude phenol to make it unpalatable for marauding animals.
- Cover the carcass with thick layer of lime/salt followed dirt and place some rock.

**2. Incineration/cremation/burning of carcasses**

i. Pit method: 2.0 m x 1.2 m x 1.2 m
ii. Surface burning method: open burning, by constructing a bed of combustible materials.
iii. Placing the carcass on the bed
iv. Flame gun method: powerful flame directed towards carcass
v. Incineration in a destructor

# DISINFECTION

- Disinfection: To make surface free of pathogenic microorganism.
- Disinfectant: agents usually applied on nonliving surface.
- Antiseptic: applied on living surface.
- **Types of disinfectant:**

  1. Physical disinfectant: sun light (UV rays), Heat (Dry or Moist as steam), boiling water
  2. Gaseous disinfectants : Formalin gas, Ozone gas, Cresol gas
  3. Chemical disinfectant- Chemicals

# CHEMICALS FOR DISINFECTION

| Disinfectant | Utility |
|---|---|
| Bleaching powder (Ca-hypochlorite) | Commonly used disinfectant for sterilization of water supply and disinfection of sheds after disease outbreak |
| Sodium hypochlorite | Sterilization of water supply and disinfection of sheds after disease outbreak |
| Phenol (1-2%) | Good disinfectant in presence of organic matter |
| 2-3 % Cresol | Effective against acid fast bacteria also |
| Caustic soda 2 % | Effective against virus and bacterial spore |
| Washing soda 4 % (Sodium carbonate) | Effective against virus and bacterial spore |
| Lime (CaO) | Deodorant and disinfectant, sprinkling on manure and excreta |
| Boric acid 4-6% | Antiseptic, Eye wash |
| QAC (cetrimide, chlorhexidine, and benzalkonium chloride) | For utensils, udders and milkers hand- mainly for washing |
| Oxidizing agents | Potassium permanganate (1-2mg/lit) can be used. |

# Temp, pulse and Resp.

| Kind of animal | Temperature | | Rate per minute | |
|---|---|---|---|---|
| | °C | °F | Pulse | Respiration |
| Buffalo | 38.3 | 101 | 40—50 | 15—20 |
| Dairy cow | 38.5 | 101.4 | 50—60 | 20—25 |
| Goat | 39.8 | 103.8 | 70—90 | 12—30 |
| Sheep | 39.1 | 102.4 | 70—90 | 12—30 |
| Pig | 39.1 | 102.4 | 70—80 | 10—16 |
| Chicken | 41.7 | 107.2 | 128—140 | 12—28 |
| Camel | 36.3 | 97.4 | 32—50 | 5—12 |
| Cat | 38.5 | 101.4 | 100—130 | 18—22 |
| Dog | 38.8 | 102.0 | 70—100 | 15—25 |
| Elephant | 36.3 | 97.4 | 22—35 | 10—15 |
| Mare | 37.7 | 100.0 | 38—45 | 8—12 |
| Rabbit | 39.5 | 103.2 | — | — |
| Man | 36.8 | 98.4 | 60—90 | 10—25 |

- **Total number of indigenous breeds now in the country: 220**
  - ✓20 for buffalo,
  - ✓53 for cattle
  - ✓39 for goat,
  - ✓45 for sheep,
  - ✓8 for horses & ponies,
  - ✓9 for camel,
  - ✓14 for pig,
  - ✓3 for donkey,
  - ✓3 for dog,
  - ✓1 for yak,
  - ✓20 for chicken
  - ✓3 for duck
  - ✓1 for geese

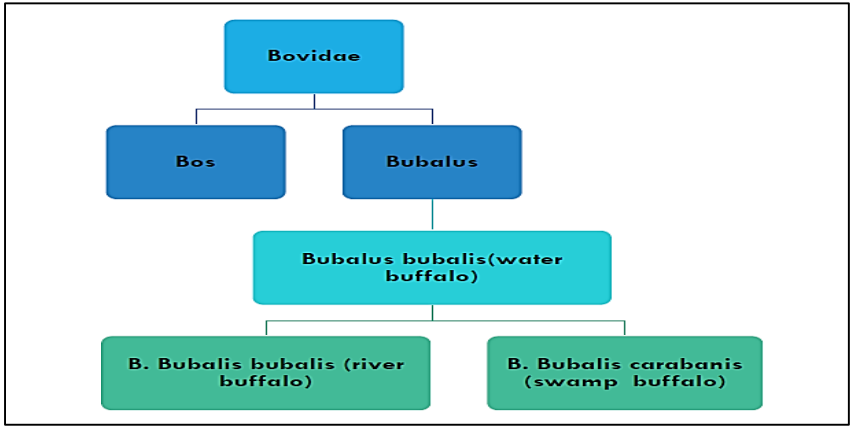
# Livestock Breeds

- Breed Registration by ICAR- National Bureau of Animal Genetic Resources (NBAGR) Karnal-132001 (Haryana)

- **8 New breeds registered:**
  - Sheep: 01 ➔ Macherla (Andra Pradesh)
  - Goat: 02 ➔ Anjori (Chhattisgarh), Andamani (Andaman & Nicobar)
  - Pig: 01 ➔ Andamani (Andaman & Nicobar)
  - Horse: 01 ➔ Bhimthadi (Maharasthra)
  - Chicken: 01 ➔ Aravali (Gujrat)
  - Duck: 01 ➔ Andamani (Andaman & Nicobar)
  - Synthetic Cattle: 01 ➔ Frieswal (UP, Uttarakhand)

| Buffalo breeds: 20 | | | | | |
|---|---|---|---|---|---|
| **S.N.** | **Breed** | **Home Tract** | **S.N.** | **Breed** | **Home Tract** |
| 1 | Bhadawari | UP and MP | 11 | Banni | Gujarat |
| 2 | Jaffarabadi | Gujrat | 12 | Chilika | Orissa |
| 3 | Marathwadi | Maharashtra | 13 | Kalahandi | Odisha |
| 4 | Mehsana | Gujarat | 14 | Luit (Swamp) | Assam and Manipur |
| 5 | Murrah | Haryana | 15 | Bargur | Tamil Nadu |
| 6 | Nagpuri | Maharashtra | 16 | Chhattisgarhi | Chhattisgarh |
| 7 | Nili Ravi | Punjab | 17 | Gojri | Punjab and HP |
| 8 | Pandharpuri | Maharashtra | 18 | Dharwadi | Karnataka |
| 9 | Surti | Gujarat | 19 | Manda | Odisha |
| 10 | Toda | Tamilnadu | 20 | Purnathadi | Maharashtra |

# Buffalo




## CLASSIFICATION

| | |
|---|---|
| 1. Murrah group - | Murrah, Nili Ravi, Kundi, Godaveri |
| 2. Gujrat group. – | Surti, Jaffarbadi, Mehsana |
| 3. Uttar Pradesh group- | Bhdawari, Tarai |
| 4. Central India group- | Nagpuri, Pandhepuri, Manda, Jerangi, Kalandi, |
| 5. South India group – | Toda |

# Important breeds of buffaloes

## Murrah

**Habitat:** Rohtak, Jind, Hisar, Gurgoan (HR)
**Synonym:** Kundi, Kali

**Physical Characters**

1. Jet black colour.
2. Tightly curved and short horn.
3. Long tail with white switch reaching fetlock.
4. Butter fat content is 7%.
5. Average lactation yield (Highest milk producer) :1500-2500 kg
6. Average milk yield is 6.8 kg/day.
7. Age at first calving is 45-50 months and inter calving period is 15-16 Month.

## Nili-Ravi

**Habitat:** Ferozepur, Amritsar (Pb) **Synonym:** Panchkalyani/ Panch bhadra **Physical Characters**

1. White markings on forehead, face, muzzle, legs and tail (Panchkalyani)
2. Walled Eyes and small tightly curled horns.
3. Head is elongated, bulding at top and depressed between eyes.
4. 1,500–1,850 kg/ lactation.
5. Lowest fat: 4% and first calving at 45-50 months

# Surti

**Habitat:** Kheda, Vadodara, Surat (GJ)

**Physical Characters**

1. Rusty brown to silvery grey colour coat.
2. Sickle shaped horn with hook at tip
3. Two white collars/ chevrons one round the jaw and the other at the brisket.
4. MY: 900 to 1300 kg.
5. The age at first calving: 40-50 months

# Mehsana

**Habitat:** Mehsana, Gujarat

**Physical Characters**

1. Mostly black/ brown color
2. Curly horns
3. Wedge shaped Barrel
4. Medium sized
5. Eyes very prominent & bulging.
6. Supposed to be crossbreed of Surti and Murrah
6. MY: 1200-1500 kg.
7. Longest lactation

# Bhadawari

**Habitat:** Agra, Etawah (U.P) & Gwalior (M.P)

## Physical Characters:

1. Copper Colored Hair, Grey Skin
2. Two White collars/ Chevrons at lower part of neck
3. Wheat Straw Colored legs
4. Horns Curling Downward, Backward then upward
5. Highest Fat Percentage (10-14%)
6. Efficient converter of coarse feed into butterfat

# Jaffarabadi

**Habitat:** Gir forest (Gujarat)

## Physical Characters

1. Horns Curved downward, sideways then upwards, compressing head
2. Broad and convex forehead
3. Heaviest buffalo Breed

# Marathwada

**Habitat:** Latur, Aurangabad (Maharastra)

## Physical Characters

1. Coat colour – greyish black to jet black.
2. Medium Size with horns medium in length reaching up to shoulder.
3. White Markings on forehead and lower neck are common.

# Nagpuri

**Habitat:** Nagpur, Wardha, Akola (MH)

## Physical Characters

1. Colour black with occasionally white patches/ markings on the face, legs & switch.

2. Long flat horns carried: Sword shaped horns backwards near to shoulder.

3. Naval flap is short or almost absent.

# Pandharpuri

## Habitat

➢Kolhapur, Sholapur, Satura (Maharastra)

## Physical Characters

1. Horns extend beyond shoulder blade (Bharkand, Toki, Meti): Sword shaped
2. Frontal bone comparatively long & straight.
3. Udder hidden between hindquarters.

# Toda

## Habitat

➢ Nilgiris (TamilNadu)

## Physical Characters

1. Crescent shaped horn.
2. Coat colours are fawn and ash-grey.
3. Anterior half - thickly covered with hair
4. Posterior half – sparsely.
5. Most violent buffalo breed

# Banni

**Habitat:** Kach, Saparkantha, Surendranagar, Kheda (Gujurat)

**Physical Characters**

1. Coat mainly black sometimes copper coloured.
2. Inverted Single or Double coiling of horns.
3. Milch, excellent drought tolerance.
4. Peak Milk yield 15.7 kg/day

# Chilika

**Habitat:** Bhusandapur, Brahmagiri, Satpada (Orissa)

**Physical Characters**

1. Horns curved upward and inward.
2. Brownish black coat
3. Small sized
4. Draught breed.
5. Milk yield- 500 kg.

| BREEDS OF CATTLE: 53 | | | | | |
|---|---|---|---|---|---|
| **S.N.** | **Breed** | **Home Tract** | **S.N.** | **Breed** | **Home Tract** |
| 1 | Amritmahal | Karnataka | 28 | Tharparkar | Rajasthan |
| 2 | Bachaur | Bihar | 29 | Umblachery | Tamilnadu |
| 3 | Bargur | Tamilnadu | 30 | Vechur | Kerala |
| 4 | Dangi | Maharashtra and MP | 31 | Motu | Orissa, Chhattisgarh and AP |
| 5 | Deoni | Maharashtra and Karnataka | 32 | Ghumusari | Orissa |
| 6 | Gaolao | Maharashtra and Madhya Pradesh | 33 | Binjharpuri | Orissa |
| 7 | Gir | Gujrat | 34 | Khariar | Orissa |
| 8 | Hallikar | Karnataka | 35 | Pulikulam | Tamilnadu |
| 9 | Hariana | Haryana, UP and Rajasthan | 36 | Kosali | Chhattisgarh |
| 10 | Kangayam | Tamilnadu | 37 | Malnad Gidda | Karnataka |
| 11 | Kankrej | Gujarat and Rajasthan | 38 | Belahi | Haryana and Chandigarh |
| 12 | Kenkatha | Uttar Pradesh and MP | 39 | Gangatiri | Uttar Pradesh and Bihar |
| 13 | Kherigarh | Uttar Pradesh | 40 | Badri | Uttarakhand |
| 14 | Khillar | Maharashtra and Karnataka | 41 | Lakhimi | Assam |
| 15 | Krishna Valley | Karnataka | 42 | Ladakhi | Jammu and Kashmir |
| 16 | Malvi | Madhya Pradesh | 43 | Konkan Kapila | Maharashtra and Goa |
| 17 | Mewati | Rajasthan, Haryana and UP | 44 | PodaThurpu | Telangana |
| 18 | Nagori | Rajasthan | 45 | Nari | Rajasthan and Gujarat |
| 19 | Nimari | Madhya Pradesh | 46 | Dagri | Gujarat |
| 20 | Ongole | Andhra Pradesh | 47 | Thutho | Nagaland |
| 21 | Ponwar | Uttar Pradesh | 48 | Shweta Kapila | Goa |
| 22 | Punganur | Andhra Pradesh | 49 | Himachali Pahari | Himachal Pradesh |
| 23 | Rathi | Rajasthan | 50 | Purnea | Bihar |
| 24 | Red Kandhari | Maharashtra | 51 | Kathani | Maharashtra |
| 25 | Red Sindhi | On organized farms only | 52 | Sanchori | Rajasthan |
| 26 | Sahiwal | Punjab and Rajasthan | 53 | Masilum | Meghalaya |
| 27 | Siri | Sikkim and West Bengal | | | |

# Classification on the basis of body characteristics

| Type of conformation | Name of the breeds |
|---|---|
| Lyre Horned and dished face | Kenkatha, Kankrej, Tharparkar, Malvi |
| Short Horn & Coffin shaped skull | Mewati, Ongole, Rathi, Nagori, Gaolao, Bachaur, Haryana |
| Long horn & Powerful quarter (Mysore type) | Amritmahal, Alambadi, Khillari, Kangayam, Bargur, Hallikar |
| Lateral Horns, Pendulous dewlap & sheath | Gir, Red Sindhi, Sahiwal, dangi, Deoni |

# Classification of cattle

## Milch purpose: (1000-1500Kg/lactation)

- Gir
- Sahiwal
- Red Sindhi
- Rathi
- Tharparkar

## Dual purpose (500-1000 kg/lactation)

- Hariana
- Kankrej
- Deoni
- Ongole
- Krishana valley
- Mewati
- Dangi
- Nimadi

- Draught purpose (<500 kg/lactation)
- Amritmahal
- Nagori
- Killari
- Kangayam
- Hallikar
- Malvi
- Khanketha
- Siri
- Purnea
- Alambadi
- Ponwar
- Bargur

# Important breeds of cattle

## Sahiwal

- Originated in Montgomery region of undivided India
- This breed otherwise known as Lola (loose skin), Lambi Bar, Montgomery, Multani, Teli
- Best indigenous dairy breed
- Reddish dun or pale red in colour, sometimes flashed with white patches
- Heavy breed with symmetrical body having loose skin
- MY: 1400 - 2500 kgs per lactation.

## Gir

- Originated in Gir forests Gujarat.
- This breed is otherwise called as Bhadawari, Desan, Gujarati, Kathiawari, Sorthi, and Surati
- Basic colours of skin are white with dark red or chocolate-brown patches or sometimes black or purely red
- Horns are peculiarly curved, giving a 'half moon' appearance.
- Milk yield ranges from 1200-1800 kgs per lactation
- Known for tolerance to stress condition, hardiness & disease resistance
- Longest Lactation pd: 325 days

# Tharparkar

- Originated in Tharparkar district (Pakistan)
- Synonyms: White Sindhi, Gray Sindhi and Thari
- They are medium sized, compact and have lyre-shaped horn
- Body colour is white or light grey
- The bullocks are quite suitable for ploughing and casting and the cows yield 1800 to 2600 kgs of milk per lactation.
- Highest disease resistant

# Amritmahal

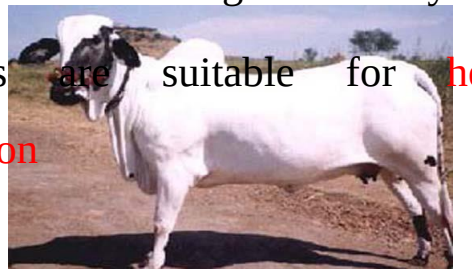
- Origin: Karnataka
- Amiritmahals are grey cattle but their shade varies from almost white to near black
- The muzzle, feat and tail are usually black.
- Horns are long and end in sharp black points.
- Best draught breed of India


# Belahi

- Also known as Morni/ Desi
- Medium sized well-built dual purpose migratory breed

# Deoni

- Synonym: Dongerpati, Dongari, Wannera, Waghyd, Balankya, Shevera
- Origin: Andra Pradesh.
- Body colour is usually spotted black and white
- MY: 636 to 1230 kg per lactation
- Caving interval average is 447 days
- Bullocks are suitable for heavy cultivation



# Vechur

- Origin: kerala
- Smallest cattle breed


# Red Sindhi

- Synonym: Red Karachi and Sindhi and Mahi
- Originated in Karachi and Hyderabad (Pakistan).
- Colour is red with shades varying from dark red to light, strips of white
- Milk yield ranges from 1250 to 1800 kgs per lactation
- The distinguishing feature between Sahiwal and Red Sindhi is muzzle. Red Sindhi have dark colour muzzle.
- Widely used in crossbreeding programmes

# Ongole

- Otherwise known as Nellore
- Home tract: Ongole taluk in Guntur district of Andhra Pradesh
- Large muscular breed with a well developed hump
- Suitable for heavy draught work
- Cattle with pure white colour
- MY: 1000 kg per lactation

# Kankrej

- Synonym: Wadad or Waged, Wadhiar
- Origin: Rann of Kutch of Gujarat and adjoining Rajasthan.
- The horns are lyre-shaped
- Colour of the animal varies from silver-grey to iron- grey or steel black
- Haviest breed of cattle.
- Kankrej is the most prized breeds of cattle in India
- The gait of Kankrej is peculiar called as 1 ¼ paces (sawai chal)
- Kankrej is valued for fast, powerful, draught cattle. Useful in ploughing and carting
- The cows are good milkers, yielding about 1400 kgs per lactation

# Hariana

- Origin: Rohtak, Hisar, Jind and Gurgaon districts of Haryana.
- Horns are small, horizontal and body color white.
- Flat forehead and well marked bony prominence at the centre of the poll
- First class/ best dual-purpose breed.
- The bullocks are powerful work animals
- Hariana cows are fair milkers yielding 600 to 800 kg of milk per lactation.

# Kangayam

Kangayam (pride of tamilnadu)

Use in Jallikattu

## Holstein Friesian

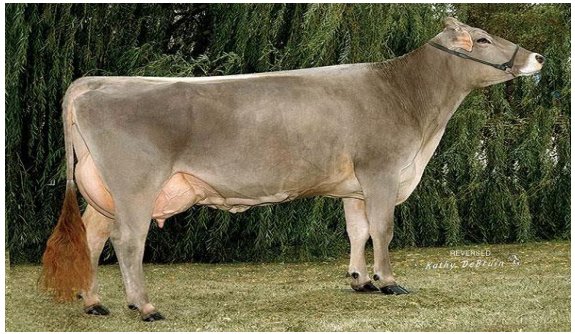
- Origin: northern parts of Netherlands, especially in the province of Friesland
- Largest dairy breed and ruggedly built is shape and possess large udder
- Breeds have typical marking of black and white that make them easily distinguishable
- Highest milk production: 6000 to 7000 kg per lactation.

# Jersey

- Originated from Jersey Island, U.K.
- Smallest of the dairy types of cattle
- In India this breed has acclimatized well and is widely used in cross breeding with indigenous cows
- The typical colour of Jersey cattle is reddish fawn
- Dished forehead; compact and angular body
- Economical producers of milk with 4.5% fat
- My: 4500 kg per lactation.

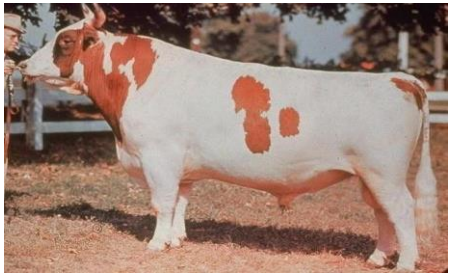
## Brown Swiss

- The mountainous region of Switzerland.
- Breeds are rugged in nature and good milk production
- MY: 5000 kg per lactation
- Highest milk lactose%: 5%
- The Karan Swiss is the excellent crossbred cattle obtained by crossing this breed with Sahiwal cattle at NDRI, Karnal



## Ayrshire

- Origin is Ayrshire in Scotland.
- The breed was also known as Dunlop cattle or Cunningham cattle
- Most beautiful dairy breed. These are very active animals but hard to manage
- They do not produce as much milk or butter fat (only 4%) as some of the other dairy breeds



# Cross Breeds

- Vrindavani cattle: exotic inheritance of Holstein-Friesian, Brown Swiss, Jersey and indigenous inheritance of Hariana cattle at IVRI
- Jersindh: Jersey X Red Sindhi
- Sunandini: Brown Swiss X Non descript
- Karan Fries: H.F. X Tharparkar
- Karan Swiss: Brown Swiss X (Sahiwal or Red Sindhi) at NDRI Karnal
- Frieswal: 3/8 to 5/8 level of H.F. X Sahiwal
- Jerthar: Jersey X Tharparkar

# Cross Breeds

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- Jerthar: Jersey X Tharparkar

# Care and Management of Dairy animals/ large ruminants

# Calf care begins before birth

- Minimum dry period- 60 days
- Adjust dry cow ration
- Supplementation of fat-soluble vitamins
- Provide quality forage, clean and fresh water
- Watch close-up cows carefully
- Avoid:
  - ✓ Omitted or very short dry period
  - ✓ High calcium and or potassium intake
  - ✓ Heat stress in late gestation
  - ✓ Sudden changes in ration ingredient

- **Performance indicators in calf rearing**
  - ✓ Keeping calf mortality to a low level
  - ✓ Maintaining good calf growth
  - ✓ Maintaining good calf health

# Calf Management

- Calves form the future dairy herd
- Replacement: Regular replacement of 20 to 30 per cent cows with heifer cows .
- First 6 months of pregnancy, additional nutritional needs of fetus: negligible.
- During dry stage (late/advanced pregnancy) the cow often neglected and fed with inferior quality fodder results in poor growth of calf.

❖ Signs of approaching parturition in cow

1) Cow will leave the herd and seek isolation
2) Loss of appetite
3) Distention of teats and udder, dripping of milk
4) Vulva becomes enlarge and flabby
5) Restlessness
6) Relaxation of pelvic ligament one day before calving, the ligament on the sides of the tail head is loosened so that hollows appear on either side of the backbone and the tail head is raised and the quarters are dropped.

# Care of newborn calf

- Let the dam lick calf: stimulate circulation and respiration.
- Dry the calf immediately after parturition which may stimulate circulation and respiration, stimulated to lick by sprinkling handful of bran over the body of the calf.
- Mucus (phlegm) from nostrils of newborn calf should be wiped and cleaned with a dry towel.
- Assisted respiration - calf should be lifted head downward, so that the phlegm may flow off.
- Calf can also made to sneeze by tickling a twig of hay or grass inside the nostril.
- Artificial respiration: Intermittent pressing and releasing of pressure on chest wall of calf.
- Naval or umbilical chord should be ligatured with a sterile thread **one inch** from the body severed 1 to 2 cm distal to the ligature and dip in tincture iodine or povidone iodine
- Infection cause serious illness like naval ill, naval abscess and joint ill: bacterial infection in newborn calves that causes inflammation and swelling in the joint.
- Neonatal ascariasis is common in buffalo calves and deworming should be made preferably in first week of life
- Newborn calf should void meconium in 4 to 6 hours of first colostrum feeding and first faeces is normally tarry in colour and consistency.

# Colostrum feeding

- Colostrum is first secretion of mammary glan after parturition.
- Contains large amount of gama-globulins/ antibodies produced by cow against antigens.
- Antibodies provide the calf with an **umbrella of passive immunity.**
- 3 Q's of Colostrum – Quickly, Quantity, Quality.
- Antibodies must be absorbed as such across the intestinal wall into blood stream without being broken down into the constituent peptides or amino acids: Pinocytosis
- If it broken down before entering blood stream it will act as ordinary protein.
- The intestinal wall of the calf will allow the globulin to pass from inside the intestine to the blood stream for only a short period of time after the calf is born.

Colostrometer is a hydrometer that measures specific gravity and using a color-coded scale converts specific gravity to Ig concentration.

| Colostrometer reading for colostrumquality | | |
|---|---|---|
| **Color** | **Rating** | **Measurement** |
| Red | Poor | Less than 20 grams Ig per liter |
| Yellow | Fair | 20–50 grams Ig per liter |
| **Green** | **Good** | **50–140 grams Ig per liter** |

- Absorptive epithelium of small intestine are immature at birth. In this stage they indiscriminately take up large molecules like immunoglobins.
- Mature type SI epithelium cannot allow large protein molecules to pass.
- Globulins pass across SI epithelial wall at the most rapid rates during first 1-2 hours of life.
- This permeability is rapidly lost after the first few hours of life.
- This phenomenon is called 'gut closure'. Complete gut closure by about 24 hr after birth
- Concentration of antibodies at 'closure' is directly related to disease resistance of the calf.
- It will be highly useful to feed colostrums in first 30 minutes (1-2 hours) followed by a second dose in approximately 10-12 hours.
- **Quantity of colostrum to be fed is 1/10$^{th}$ (10%) of body weight.**

- Excess colostrum can also be freeze and stored. Colostrums can also be fermented naturally and stored for 5-7 days.
  - At room temperature for up to four hours.
  - In refrigerator for up to four days.
  - Deep freeze for up to six months (for best quality) or 12 months at max.
- Colostrum substitute: in case death of mother or agalactia, colostrums can be prepared by mixing 2 whole eggs in one litre of milk and 30 ml of castor oil.

| Constituents | Colostrum of cow milk | Colostrum of buffalo milk | Milk | Diff. |
|---|---|---|---|---|
| Total solids | 28.30 | 31.0 | 12.86 | ~twice |
| Ash | 1.58 | 0.9 | 0.72 | |
| Fat | 0.15-1.2 | 4.0 | 4.0 | |
| Lactose | 2.5 | 2.2 | 4.8 | |
| Casein | 4.76 | 7.7 | 2.8 | |
| Albumin | 1.5 | 3.6 | 0.54 | |
| Globulin | 15.06 | 12.5 | -- | |
| **Total protein** | **21.32** | **23.8** | **3.34** | **~7 times** |

# General practices:

- Reticulo-rumen is non functional in calves and hence feeding of calves should be treated as non-ruminant and they are not equipped to utilize fibre/cellulose.
- To encourage the early development of rumen and reticulum the calves should be offered good quality leguminous hay and other roughages.
- The calves have little capacity to utilize non-protein nitrogenous compounds and therefore substance like urea should not be included in their ration.
- B-comp. vitamins also are dietary essential for calves in addition to vitamin A&D (rumen bacteria not developed).
- Temperature & Humidity–
  - ✓ Comfort range: 55-75$^{o}$F (12-23$^{o}$ C)
  - ✓ Humidity makes calves damp and sick: Optimal RH - 65-75%.

# Milk replacer

**Milk replacer: milk substitutes** consist basically of skim milk powder and lard or vegetable fat; although a proportion of butter milk powder and whey powder is often included with small proportion of glucose, soybean flour and cereal flour.

- Good milk replacer composition should contain spray dried skimmed milk powder of 50 parts, dried whey of 10 pars and non-milk source of 40 parts.

**Partial milk replacer:** these do not contain high proportions of milk or skim milk powder.

**Good quality milk replacers**

- Supplemented with vitamin A, E and $B_{12.}$
- Incorporated with antibiotic feed additives.
- Should contain 22-25 per cent good quality protein.
- Should not contain fibre ingredients.
- Should be readily dispersible in water.
- Optimum ratio of milk replacer (kg) and water (litre) is 1: 8.

| Name of the ingredients | Quantity (kg) |
|---|---|
| Wheat | 10 |
| Fish meal | 12 |
| Linseed meal | 40 |
| Milk | 13 |
| Coconut oil | 07 |
| Linseed oil/cotton seed oil | 03 |
| Citric acid | 1.5 |
| Molasses | 10 |
| Mineral mixture | 03 |
| Butyric acid | 0.3 |
| Antibiotic mixture | 0.3 |
| Rovimix-A,$B_2$, $D_3$ | 0.015 |

# Calf starter:

- Solid feed for accelerating the growth of calves
- **From 7-10 days of age (2nd week)**
- **CP = 23-26%, DCP = 18-19.5% and TDN = 75%.**
- A calf starter should be highly palatable.

| Calf starter ingredients | Parts |
|---|---|
| Maize | 42 |
| GNC | 35 |
| Wheat bran or rice bran | 10 |
| Fish meal | 10 |
| Mineral mixture | 2 |
| Salt | 1 |

- It can be introduced to the milk feeding bucket, at the end of feeding so that calf will lick it dry, and the quantity can be increased gradually.
- Small amount of concentrate can be rubbed on the tongue and lips of the calf which will induce it to eat.

# General care and management of heifer

1. Feed the heifer sufficiently to produce normal growth. During the early stage relatively more protein than energy is needed.
2. The amount of growth depends upon the quality of feed and forage.
3. Feed = maintenance plus growth
4. The body weight rather than the age of a dairy heifer at breeding time is important. Breeding under sized animals is never profitable.
5. Body weight at first breeding: 60-65% of mature body weight
6. Though the heifer that is bred to calve at an older age yields higher milk yield in the first lactation. Usually the cow heifer is bred to freshen at 24-30 months of age while age at first calving of buffalo heifers is 40 to 45 months.
7. Early pregnancy: can be diagnosed easily by noting the development of the udder
8. Udder development is very much visible from 3 months of pregnancy
9. Pregnancy diagnosis can also be done by rectal examination
10. Place the heifer in a separate shed about 6-8 weeks before she is due to calve.
11. Provide 2-3 kg concentrate mixture (16% DCP and 70% TDN) with 15-20 kg green fodder from $7^{th}$ to $24^{th}$ month of age.

# Milch animal

- Lactation length: cow 305 and buffalo 310 days
- Provide green succulent forage together with leguminous hay or straw to the extent of animal can consume.
- Peak milk yield: 3-6 weeks of lactation
- Extra concentrate @ 1 kg for every 2 liters (buffalo) to 2.5 liters (cow) of milk.
- Individual attention to feed each animal according to its production is a must.
- Keep up regularity of feeding. Concentrate mix is fed during milking to avoid disturbance.
- Water should be provided to drink at will.
- 4-5 litre of water per kg of milk production
- Regularity in milking is essential. Accumulation of milk in udder will reduce further secretion of milk.
- Milking thrice is better than twice since 10 - 15 % more milk can be produced.
- Continuous, dry hand milking should be done with full hand, but not with thumb and index finger.
- Rapid milking (5-7 minutes): oxytocin hormone

- Loose housing with shelter during hot part of the day should be provided.
- Grooming and washing of the cows/buffaloes before milking help in clean milk production.
- Daily brushing will remove loose hair and dirt from the coat.
- Wallowing of buffaloes or water spraying on their bodies will keep the buffaloes comfortable especially in summer.
- Vaccinate the cows- against important diseases and also guard against insects and pests.
- Milk, fat%, feed taken, breeding, drying and calving dates should be recorded.
- Check for mastitis (Subclinical mastitis) regularly – CMT test.
- Inter-calving period: Ideal: 12 months in cattle and 15 months in buffaloes.
- Service period of 60 to 90 days is considered optimum for maintaining an inter-calving period of 13 to 14 months.

# Dry and pregnant animal

- **Dry period: 60 days**
- Extra concentrate mix of 1.25 (cow) to 1.75 kg (buffalo) should be provided for pregnant animal as pregnancy allowance. Feed good quality of leguminous fodder.
- Animal should not be too lean and too fat in condition (**BCS = 3.5 at calving**).
- Provide protection from thermal stress.
- Do not allow them to mix with animals that have aborted or that are suffering from or carriers of diseases like brucellosis.
- Allow moderate exercise, which helps in calving normally. Avoid fight with other animals
- Avoid slippery conditions: causes the animal to fall receiving fractures, dislocation etc.
- If accurate breeding records are available, calculate the expected date of calving.
- Separate it **one or 2 weeks** before and shifted to individual parturition/ calving pens.
- No. of calving pens: 5-10% of breedable cows/ heifers
- Down calver/ maternity pen: near to manager room

- **Steaming up** is the feeding of a pregnant animals with a high plane of nutrition 6 to 8 weeks before calving/ giving birth. Feed one kg extra concentrate.
- Feed laxative about 3 - 5 days before and after calving (Wheat bran 3 kg + 0.5 kg of Groundnut cake + 100 gm of mineral mixture/salt).
- Symptoms of delivery may be observed. If there is any difficulty, provide veterinary help.
- After parturition external genitalia, flank should be cleaned, dried and protect the animal from chill and give warm water.
- Placenta if not removed within 12 hours after calving, take the help of a veterinarian.
- Take care of the animal after calving: Give calcium supplements. Remove the milk partially.
- Some times the udder will be swollen (edema) just before calving.
- Long Dry-period:
  - Decrease the average annual production if calving time extended beyond normal 13-14 month.
  - Causing a decrease in the lifetime production of the dairy cow.

# General care and management of bull

- **The bull is half of the herd. One bull for every 50 females.**
- Pedigree selection
- Not only the bulls should be genetically superior quality, but they also have to be in prime breeding condition by proper feeding management (Vit A,D,E,K & trace min).
- The maintenance of breeding bulls in good condition and suitable for breeding is highly essential requirement for the success of breeding programmes.
- A rising condition is better for reproduction than a falling one. Fat males may produce semen of inferior quality or they may be slow or fail at service.
- Breeding bull should receive plenty of exercise, will usually produce large ejaculation containing more sperms of higher activity.
- Breeding bull should housed separately known as "Bull Shed" with sufficient area of floor and proper covering.
- Regular grooming of the breeding bull be practiced.
- Services: below 3 year 1 service/ week and above 3 years 2 services/ week
- Separated from breed-able cows and heifer by the time of puberty, which is between 1½ to 2 ½ years in zebu and buffalo breeds and still lower in crossbreds.
- Disbudding- This practice is considered to make the bull less dangerous.

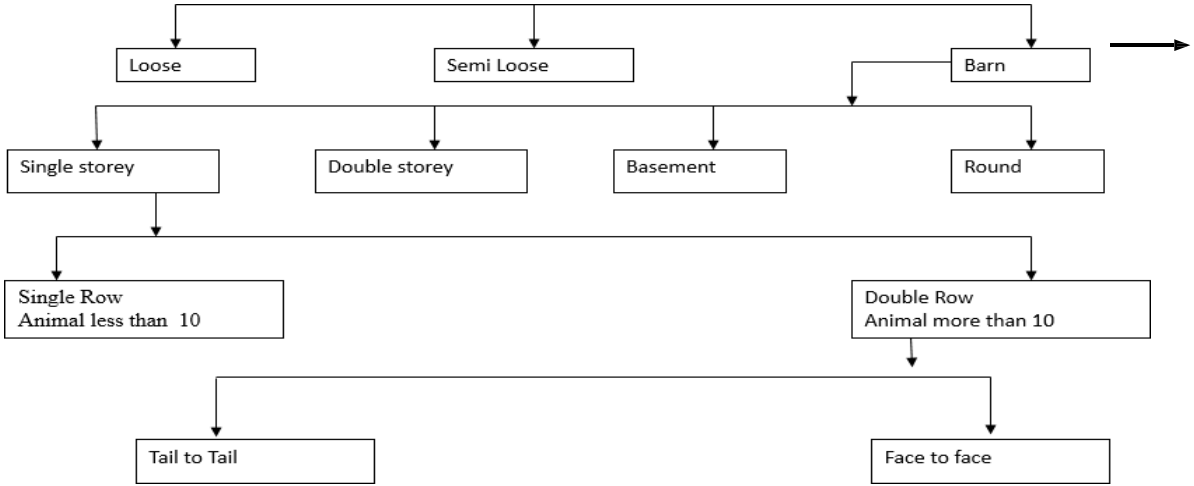
# Care and management of bullock

- Bullocks are normally used for agricultural operations and or transport purpose. Some bullocks are ferocious and so control them properly with nose rope or nose rings.
    - The working hours for bullocks are recommended as follows :
        - Normal Work - 6 hours of carting or 4 hours of ploughing.
        - Heavy Work - 8 hours of carting or 6 hours of ploughing.
- Sufficient roughages and 1-2 kg of concentrates may be provided for feeding of bullocks during break period in works, the animal may be left for free grazing.
- The bullocks are housed in separate sheds with sufficient space and protection from hot and cool conditions.
- Free access to drinking water is essential. Regular grooming of animals should be practiced.

# Registers to be maintained in a dairy farm

- Sound planning for synchronization of all the inputs and all the factors
- Day to day planning, coordination, execution and evaluation
- Manager has all the facts pertaining to the stock before him
- **Types:**
  1. Daily stock register
  2. Birth/calving register
  3. Calf / young stock register
  4. Adult stock register
  5. Breeding register/ AI register
  6. Weight/ growth register
  7. Milk yield and distribution register
  8. Sales/ disposal register
  9. Mortality register
  10. Feed stock register
  11. Fodder stock register
  12. Receipt/ Income register
  13. Herd health register

# Animal housing




**Stall barn (or stanchion barn)**

Animals are tied up in a stall

# Factors in planning a good layout of dairy (cattle & buffalo) farm

1. Topography of the land
2. Capital availability
3. Size of herd and level of milk yield
4. Stock density and feeding policy
5. Effective supervision of farm operation
6. Use of Labour saving devices
7. Strength of herd in relation to land under forages
8. Fodder conservation
9. Type of farm building

# *Dairy cow building*

  - Feeding passage
  - Manger
  - Standing space
  - Gutter or drainage channel
  - Milking passage
- ***Main building units***
  - Milking barn or parlour
  - Down calver shed / calving pen
  - Calf pen
  - Young stock or heifer shed
  - Dry animal shed
  - Bull shed
  - Isolation shed
  - Quarantine shed
- ***Accessory buildings***: Store room, Milk room, Hay or straw shed

# Milking barn/ parlour

- ***Dimensions of milking barn***
- Length of standing space : 1.5 – 1.7 m
- Width of standing space : 1.05 – 1.2m (80% of length, of standing space)
- There shall be an individual standing in the milking barns and the number of standings required should be 25% of total number of milch animals in the herd.
- Total Stall Area: About 80-88 square feet per cow when including both width and length.

# Loose Housing

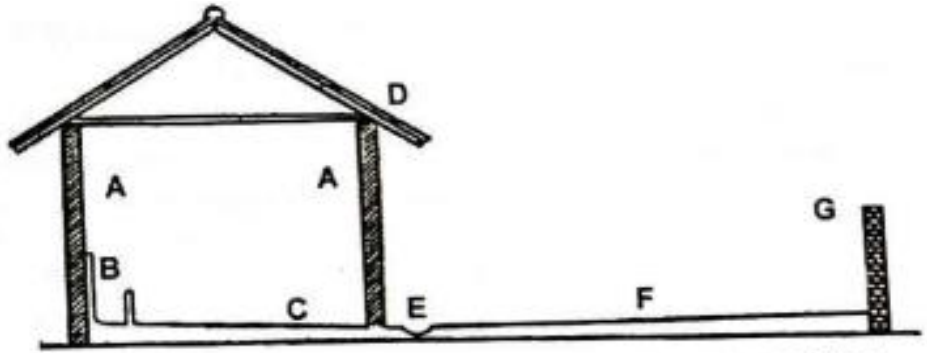



**FIG. 6.1 SECTION OF A LOOSE HOUSE SHOWING INTERNAL DETAILS**
A. Roof supporting structure, B. Manger, C. Covered Area, D. Roof, E. Gutter, F. Open area, G. Compound wall.

Open to Close- 2:1
10-15% more stock can be accommodated

| Sr. No. | Parameter | Loose | Barn |
|---|---|---|---|
| 1 | Animal confinement | Open paddock | Inside the house |
| 2 | Animal tying | At the time of milking | Throughout the day |
| 3 | Initial investment | Less | More |
| 4 | Labour saving | More | Less |
| 5 | Cow comfort | More | Less |
| 6 | Health of animal | Better | Good |
| 7 | Heat detection | Easier | Less easy |
| 8 | Sunlight Benefit to cows | More | Less |
| 9 | Animal cleanliness | Less | More |
| 10 | Exercise benefit | Yes | No |
| 11 | Scope of expansion | Easy and less expensive | Difficult and more expensive |
| 12 | Profitability | More | Less |
| 13 | **Milk quality** | **Good** | **better** |
| 14 | Spread of disease | More and fast | Less and slow |
| 15 | Place change | Possible | Not possible |
| 16 | Weather protection | Less | More |
| 17 | Animal grooming | Not possible | Possible |
| 18 | Individual animal supervision | Less | More |

| Types of animal | Floor space requirements ($m^2$) | | No. of animal/ pen | Height of shed (cm) |
|---|---|---|---|---|
| | Covered area | Open paddock | | |
| **Bulls** | **12.0** | **120** | **1** | 175 in medium and heavy rainfall area 220 in arid and semi arid areas |
| Cows | 3.5 | 7.0 | 50 | |
| Buffaloes | 4.0 | 8.0 | 50 | |
| **Down-calver** | **12.0** | **12.0** | **1** | |
| **Young calves** | **1.0** | **2.0** | **30** | |
| Older calves | 2.0 | 4.0 | 30 | |

| Types of Animals | Floor Space per Animal (Sq. feet) | | Manger Length per Animal (inch) |
|---|---|---|---|
| | Covered area | Open area | |
| Cows | 20-30 | 80-100 | 20-25 |
| Buffaloes | 25-35 | 80-100 | 24-30 |
| Young stock | 15-20 | 50-60 | 15-20 |
| Pregnant Cows | 100-120 | 180-200 | 24-30 |
| Bull Pen | 120-140 | 200-250 | 24-30 |

**TABLE 6.4. FEEDING/WATERING SPACE REQUIREMENTS FOR DIFFERENT CATEGORIES OF LIVESTOCK**

| Type of animal | Space/ animal (cm) | Total manger length[1] | Water trough length[1] | Manger/water trough dimensions (cm) | | |
|---|---|---|---|---|---|---|
| | | | | Width | Depth | Height[2] |
| Adult cattle & buffaloes | 60-75 | 6,000-7,500 | 600-750 | 60 | 40 | 50 |
| Calves | 40-50 | 4,000-5,000 | 400-500 | 40 | 15 | 20 |
| Adult sheep & goats | 40-50 | 4,000-5,000 | 400-500 | 50 | 30 | 35 |
| Lambs and kids | 30-35 | 3,000-3,500 | 300-500 | 50 | 20 | 25 |
| Adult pigs | 60-75 | 6,000-7,500 | 600-750 | 50 | 20 | 25 |
| Growing pigs | 25-35 | 2500-3,500 | 250-350 | 30 | 15 | 20 |

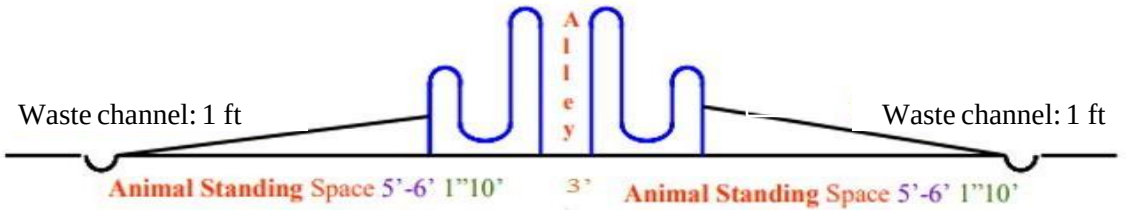
[1]Total length in the pen for 100 animals (cm)

[2]Height of inner wall of the manger/water trough, i.e. height at the throat of the animal

# Water requirements

- Drinking water requirement for Cattle/ Buffalo: 30-35L/ animal/day or 3-5L per Kg dry matter intake
- Additional requirement for per kg milk production: 4-5 L

# Head to head system:



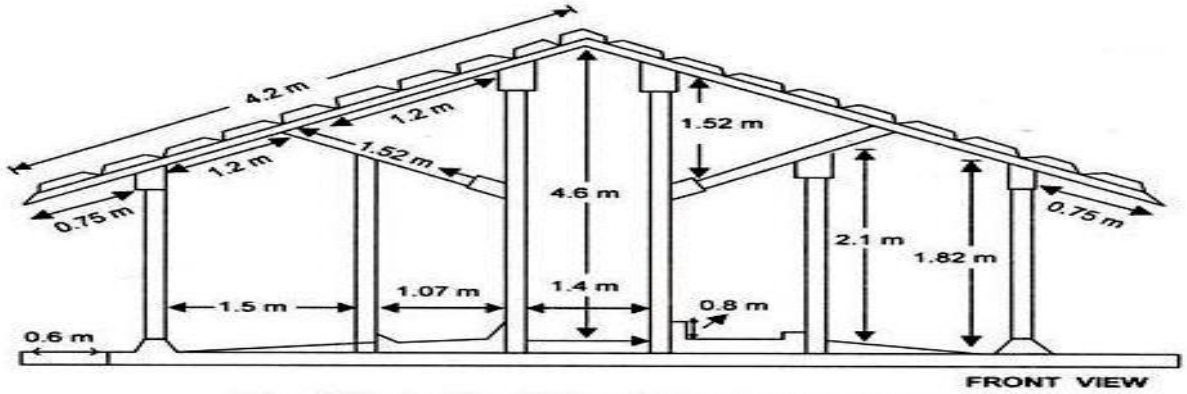
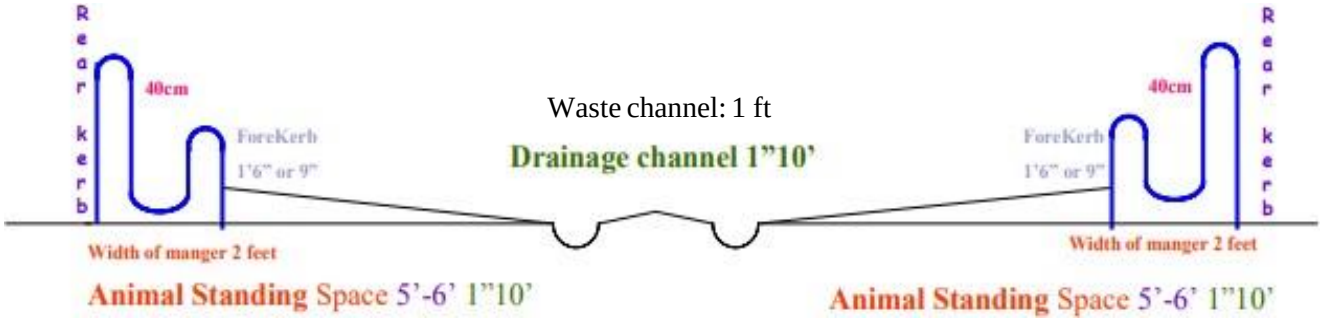




**Fig. 44.7.** Sectional View of Head to Bead Barn.

# Tail to Tail system:



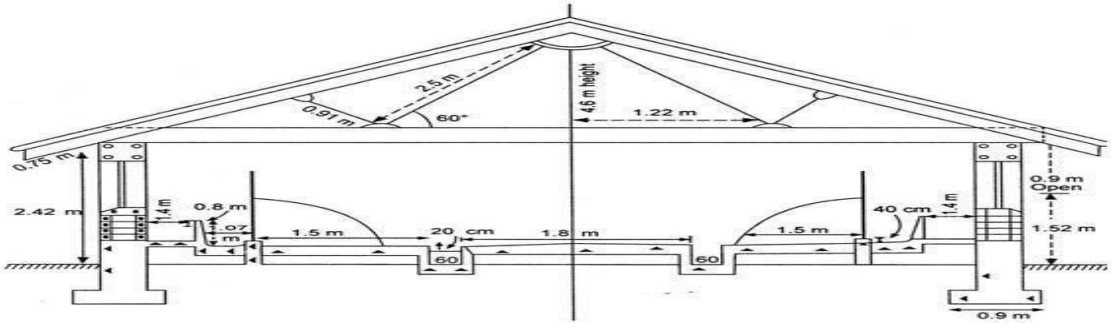
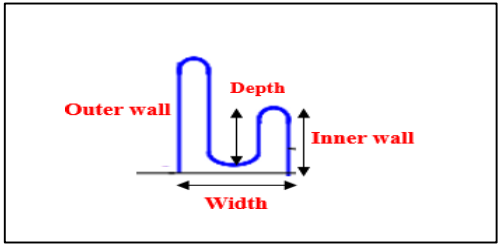




Fig. 44.4. Sectional View of Tail to Tail Barn

# Feeder and water space requirements

| Type | Space per animal (cm) | Width of manger/ water trough (cm) | Depth of manger/ water trough ( cm) | Height of inner wall of manger/water trough (cm) |
|---|---|---|---|---|
| Adult cattle and buffalo | 60-75 | 60 | 40 | 50 |
| Calves | 40-50 | 40 | 15 | 20 |




## Normal dimensions in a dairy:

- **Availability of Land**:
    - For 200 cows, a minimum of 2-3 acres is required.
    - For 2 cows, 1 acre is necessary for fodder production.
    - For 30-40 sheep or goats, 1 acre is required.
- Depreciation
  - In pucca shed: 2% per annum
  - In semi pucca shed: 5% per annum
  - Machinery and chaff cutter: 10% per annum

  Under the average conditions, 125 to 150 man hours of labour are required per cow per year

# Factors related to buildings

**Standard width of buildings:**

- Single row cow shed - 3. 80 to 4.25 metres
- Double row cow shed - 7. 90 to 8.70 metres
- Poultry and others - 20 to 30 feet.

**Standard height of the building:**

- The standard height of the building may differ according to the roofing material and agro-climatic condition.

**Orientation:** Long axis east to west the paddock side facing the north to get direct sun light during winter.

**Note:**

- The manager's house should be located at the entrance for efficient supervision.
- In mixed farming: piggery unit located away from dairy unit and manager's office.
- Quarantine shed: should be at the entrance so that new animals purchased may be kept and if they are found to be free from diseases, it can be included in the farm.

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# Construction principles of farm buildings

**Foundation**: basic structure to be put up in any construction work. It consists of two parts namely

- **Foundation wall**: height: depends on soil condition of the site.
- Deeper foundation in loose soil while shallow in firm rocky soil.
- Generally the height for light farm building will vary from 18” to 30”.
- The thickness will vary from 9” to 12”

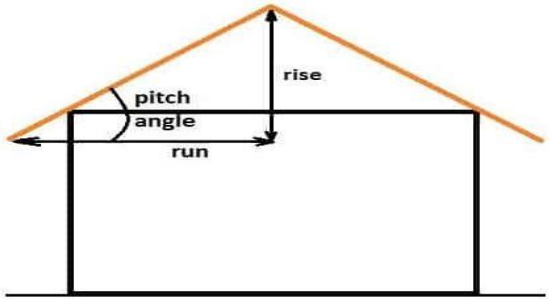
**Wall:** brick, stones or concrete with thickness of 9”, 12” and 6”, respectively.

- Height: depends upon type of animals to be housed.
- Height up to 4 feet from floor should be finished smoother with hard cement plaster and made washable for reasons of hygiene.
- Corners should be filled and rounded to prevent accumulation of dust.

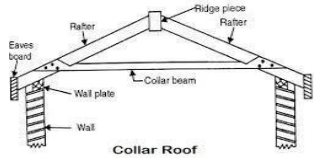
# Roof

- Protecting animals from hot sun and rain
- It should be of simple type. Cheap materials have to be used for animal buildings.
- In tropical condition: should have high insulation value.

- Slope can be expressed as its pitch angle (between slope and tie):
  - ✓ 35° for thatched roof,
  - ✓ 25°-30° for tiled roof
  - ✓ 12°-18° for sheet roof



**Roof pattern:** a/c to climatic condition and type of roof ventilation




1. **Couple closed roof and collar beam trusses**
   - ✓ 2 inclined rafters and with a horizontal collar-beam.
   - ✓ Trusses used for buildings with a span of 3-4.2 m.

2. **Lean to type roof**

   - ✓ These are simple roofs with single slope adopted for shed type of buildings.
   - ✓ Roof ventilation cannot be provided in this pattern.
   - ✓ In this type of roof one wall is carried up sufficiently higher than other wall or support to give necessary slope to the roof.

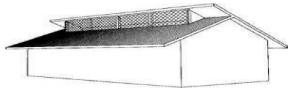
3. **Gable roof**


   - ✓ Coupled roofs with 2 slopes,
   - ✓ Roof ventilation can be provided in this pattern in the form of continuous ridge opening.

4. **Full Monitor roof**
   - ✓ Has 2 slopes, from both side, one overlaps other at the ridge of the roof with a ventilating gap of 1 feet.
   - ✓ Suitable for tropical buildings and it serves the purposes of ventilating and lighting the building.
   - ✓ Poultry sheds are constructed by this pattern.

5. **Semi/half monitor roof**
   - ✓ Roof has 2 slopes but one overlap other from one side, at the ridge of roof with ventilating gap of 1 feet. For poultry and hog housing.

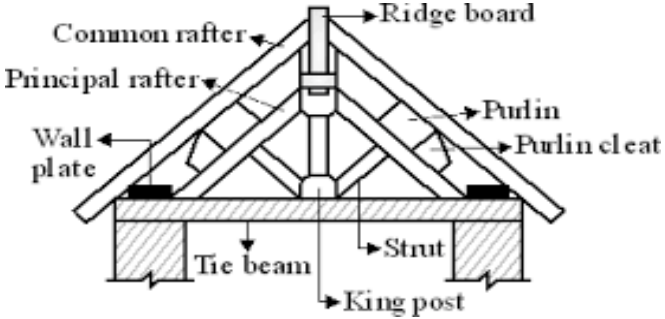
6. **Gothic arch roof**

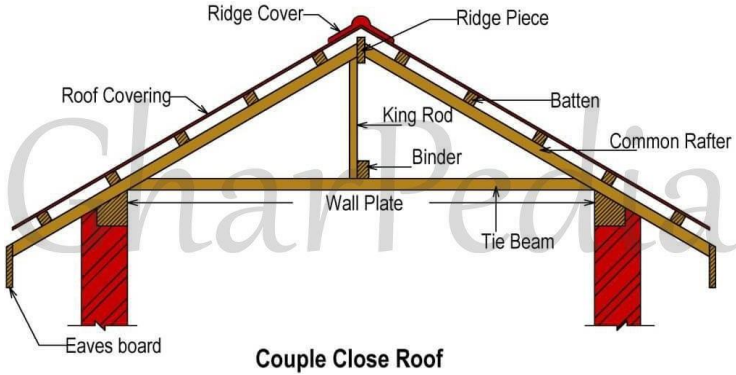


- This is an arched roof providing greater roof space used for store houses.
- Used for storage of feed and also for pig shed.

## DEFINITION

- Eaves - lower edges of the roof which is resting on the supporting wall.
- Gable - The triangular upper part of a wall formed at the end of roof.
- Purlins –wooden pieces which are placed horizontally on principal rafters to carry the common rafters.
- Rafters – These are the pieces of timber, which extend from eaves to the ridge.
- Ridge – The highest part of the building is ridge where the two slopes of the roof joints.
- Span – The horizontal distance between the internal faces of walls or supports.
- Pitch of a roof: It is the degree of slope to the side of the roof.
    - ✓ Steep pitches are necessary for thatched & tiled roof (1/4 is required for thatched & tiled roof)
    - ✓ The low pitch is suitable with aluminium asbestos and other metal sheets (1/8 to 1/10).
- Rise is the vertical height between the eave to ridge.
- Run is half of the span:



Couple Close Roof

# Roof covering or roofing materials

- It is preferable to have material with low conductivity of heat.

1. **Tiles:** conduct less heat.
2. **Asbestos sheets:**

   Commonly used in animal buildings.

   Prepared by mixing cement mixture with vegetable fibers.

   More durable than tiles, But houses under this roof: hotter during summer.
3. **Aluminum sheets**

   They are very light and can be easily fixed.

   The bright and polished surface of new sheets provides a reflective insulation and keeps the animal houses cool during summer than asbestos.
4. **Galvanized iron sheets:** standard dimension of 6 feet x 3 feet.
5. **Thatched roof:** made of either coconut, palm leaves, hay or straw.

   Best for conventional system

   Cheap and poor conductors of heat → house cool in summer.

   They are non-durable and has be removed yearly or once in two year. They are very prone for fire accident.

# Construction of floor

- Must be strong and durable to withstand the weight of hard roof of the building and movement of hard hoof of the animals.
- Flooring must facilitate hygienic feeding and effective removal of waste
- The floor should be laid on solid and compact foundation.
- A slope of 1/40 is desirable in animal standing and a slope of 1/60 is desirable towards the dung channel.
- **Material:**

1. **Cement concrete floor:** common material used in animal house. It is cheap and durable floor.
2. **Vitrified paving bricks:** It is grooved and ideal flooring for animals because of durability and damp proof condition.
3. **Stones:** Granite stones made into a block, durable, strong and cheap.
4. **Wood/ timber:** In hill station where timber is cheap.
5. **Building bricks:** They are sometimes used as a flooring material. They are not good floor materials.
6. **Gravel:** During disease outbreak disinfection is not possible.

7. **Synthetic flooring:**

1. **Composition brick:** non-conducting warmth floor, which is necessary in houses of young animals. It is a good floor for piggery and calf houses.

2. **Rubber floor:** thick mat with grooves on the surface. It is costly and fixing is difficult but is clean, soft and comfortable surface.

8. **Slatted floor:**

- ✓ Floor set with wood and reinforced concrete bars provide a required gap between them and are used in house for intensive animal production.
- ✓ Control disease by breaking the contact between animals and excreta.
- ✓ Excreta passes downward from the wooden floor immediately after it is voided through the gap provided.
- ✓ The slatted, floor is ideal for raising animals in germ free condition.

9. **Wire floor:** thick gauge wire meshes. Has same advantage as slatted floor and is easy for fixing for poultry and rabbit.

10. **Deep litter floor:** Straw, paddy husk, saw dust groundnut hulls, dried leaves as bedding material in layer of 5-6 inches. Litter material with decomposed excreta may supply B complex vitamin to birds which increase hatchability. Excessive bacterial action in the deep litter is kept controlled by addition of lime.

# Ventilation system

- For maintaining a healthy environment and productivity for livestock by controlling temperature, humidity, odor, and
air quality, which are essential for cattle health, productivity, and welfare.

**1. Natural Ventilation:** natural air movement (wind) provides a continuous exchange of fresh air.

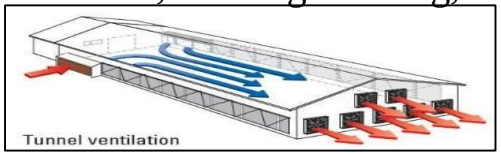
- Includes ridge vents, sidewall openings, and adjustable curtains to control airflow.
- Best for Open-sided barns or buildings in areas with moderate climates where wind and temperature fluctuations are manageable.
- Cost-effective and low maintenance.

**2. Mechanical Ventilation:** fans, ducts, and controlled openings to regulate airflow within the barn.

- Used when natural ventilation isn’t sufficient, such as in closed or heavily insulated barns.
- Best for Closed or climate-controlled barns, especially in regions with extreme temperatures.
- Provides consistent airflow regardless of weather conditions.
- Temperature and humidity levels can be more easily controlled.
- Higher installation and operational costs due to power usage.
- Requires regular maintenance.

- **3. Cross Ventilation:** Uses multiple fans on opposing walls to draw air horizontally across the barn/ lateral airflow across the barn space.
- Best for Large barns or freestall barns where cattle need consistent airflow over a wide area.
- Effective at maintaining air quality and uniform temperature across large spaces.
- Cools cattle effectively by increasing air velocity across their bodies.
- High initial cost for fans and other equipment.
- Can be less effective in extremely humid conditions.

**4. Tunnel Ventilation:** Large exhaust fans at one end of the barn, and air inlets at the other, creating a strong, unidirectional airflow across the length of the barn




- Best for Long, narrow barns.
- Higher energy costs due to large fans.

**5. Combination Ventilation:** Combines elements of natural and mechanical ventilation, often using natural ventilation when weather allows and switching to mechanical systems during extreme conditions.

- Best for areas with variable climates.
- Allows flexibility depending on outdoor conditions.

**6. Baffle Ventilation**

- **Description**: Uses baffles (large panels) strategically placed in the ceiling (rafters) to direct and control airflow within the barn, optimizing ventilation patterns and air distribution.
- Best for high-capacity, wide barns where even air distribution is critical.
- Higher installation costs compared to simpler systems.

# Drainage systems

1. **Gravity Drainage System:** sloped floors to allow manure and wastewater to flow naturally under gravity.
   - Best For: Small- to medium-sized farms or barns with simple layouts.
   - Cost-effective and low maintenance due to the absence of mechanical parts.
   - Reliable and requires minimal energy
   - Less effective for large-scale operations that produce high volumes of waste.

2. **Flush System:** Uses high volumes of water to "flush" manure and waste from barn floors into a collection pit or lagoon.
   - **Best For**: Dairy and swine facilities where frequent cleaning is needed to reduce odors and maintain hygiene.
   - Can handle high volumes of waste and reduce ammonia levels inside barns, minimizing odors, and improving animal hygiene
   - High water use, which may be costly and unsustainable in areas with water scarcity.
   - Requires adequate wastewater management, often involving lagoons or advanced treatment.

3. **Scraper System:** Mechanized scrapers move along barn floors, scraping manure and pushing it into a collection pit or channel.
    - **Best For**: Freestall barns and large facilities with solid flooring where manure accumulates quickly
    - Reduces water usage compared to flush systems, making it more sustainable.
    - Higher maintenance and repair costs due to the mechanical components.
    - Scraping works best only with solid or semi-solid manure.
4. **Vacuum System:** Uses vacuum-powered equipment to collect manure and wastewater from barn floors or open areas.
    - Highly effective for quick removal of large volumes of waste and provides flexibility for spot cleaning.
    - High energy consumption and maintenance costs for vacuum pumps.
5. **Gutter and Grate System:** Manure falls through slatted floors or grated areas into gutters, which direct waste to a collection area.
    - **Best For**: Dairy and swine barns with high animal density, where manure falls directly into a gutter system.
    - Keeps animal areas cleaner and reduces direct contact with waste.
    - Reduces labor for manual cleaning, as waste is automatically collected in gutters.
    - Regular maintenance is needed to prevent clogging in gutters.
    - Higher construction costs for slatted floors and gutter systems.

**6. Slatted Flooring with Collection Pit:**

- Floors with slats or grates allow manure to drop directly into a collection pit below the barn.

**7. Channel and Pipe System:**Manure is directed through channels or pipes to a storage tank.

- Best for: systems where waste is collected in a liquid or slurry form.
- Efficient for transferring waste over long distances to central storage areas.
- Requires frequent cleaning to avoid clogs, especially if solid waste builds up in pipes.

**8. Lagoon and Holding Pond System:** Liquid manure is channeled to outdoor lagoons (man-made outdoor earthen basin filled with animal waste that undergoes anaerobic respiration) or holding ponds.

- Best For: Large-scale livestock farms that generate substantial liquid manure, such as dairy or pig farms.
- Provides large storage capacity and allows natural breakdown of manure over time.
- Reduces the frequency of waste disposal or field application.
- Odors and potential environmental impact due to nutrient runoff, especially if not properly managed.

**9. Aerobic Treatment System:** Similar to a lagoon but uses aeration to increase oxygen levels, breaking down organic matter faster.

- Best For: Farms where odor control is a priority, or when rapid decomposition is needed.
- Reduces odors, ammonia, and methane emissions with higher-quality effluent used for irrigation.
- High energy and operational costs for aeration equipment.

**10. Solid-Liquid Separation System:** Separates solid manure from liquid components for easier handling and treatment.

- Best For: Farms where both solid and liquid waste products are needed.
- Solids can be composted or used for bedding, while liquid can be treated or applied as fertilizer.
- Higher initial investment for separation equipment.

# Classification of sewage or wastewater based on BOD values

- BOD: which is a measure of how much oxygen is consumed by microorganisms when they break down organic matter in water
- Higher the value of BOD, more polluted is the water

| Sr. No. | Types | BOD Value |
|---|---|---|
| 1 | **Strong Sewage** | Greater than 300 mg/L |
| 2 | **Medium Sewage** | 150 to 300 mg/L |
| 3 | **Weak Sewage** | Less than 150 mg/L |
| 4 | **Very Weak Sewage** | Less than 50 mg/L |

**Waste diversion for liquid manure**

- Aim: to reduce environmental impact and improve resource efficiency.

**1. Anaerobic Digestion**

- Anaerobic digesters break down organic material in manure, producing biogas (methane) that can be used as renewable energy. The left over material can be used as a fertilizer.

**2. Nutrient Recovery and Separation**

- Separated solids can be composted or used as bedding, while the liquid fraction can be treated further for irrigation or safely returned to the environment.

**3. Composting**

- Composting reduces pathogens and odors and produces a product that can enhance soil health.

**4. Irrigation and Land Application**

- Treated or diluted liquid manure can be applied to fields as a fertilizer for crops.

**5. Constructed Wetlands and Filtration Systems**

- Wetlands and other biological filtration systems can treat manure runoff by filtering and absorbing nutrients and pathogens. These systems mimic natural processes, reducing pollutants before they reach water bodies.

**6. Evaporation Systems**

- In areas with adequate sunlight, evaporation ponds can help reduce the volume of liquid manure by allowing water to evaporate, concentrating the nutrients in the remaining material.

**7. Biochar Production**

- Converting manure into biochar through pyrolysis (heating it in the absence of oxygen) creates a stable form of carbon that can be used to improves soil health, retains nutrients, and reduces greenhouse gas emissions.

# CARE & MANAGEMENT OF SMALL RUMINANTS (Sheep and Goat)

# SHEEP AND GOAT

- Sheep and goats were perhaps the first ruminants to be domesticated around 8500-9000 B.C.
- Sheep originated from their wild ancestor ***Ovis orientalis vignei.***
- Goats descended from two living races of wild goats:
  a. Bezoar or Pasang (*Capra hircus aegagrus*) breed of the high mountains of Iran and Asia minor
  b. The wild goats of Sind (*Capra hircus blythi*)
- They are less prone to extreme weather conditions, ecto-parasites as well as diseases.
- Goat: Poor man's cow.
- Because of their close grazing nature and ability to utilize very low set vegetation, often associated with creation of desertic conditions.

**Registered Goat Breeds (Total = 39) ➔** Anjori (Chhattisgarh), Andamani (Andaman & Nicobar) – newly registered

| S.N. | Breed | Home Tract | S.N. | Breed | Home Tract |
|---|---|---|---|---|---|
| 1 | Attapady | Kerala | 20 | Surti | Gujarat |
| 2 | Barbari | UP and Rajasthan | 21 | Zalawadi | Gujarat |
| 3 | Beetal | Punjab | 22 | Konkan Kanyal | Maharashtra |
| 4 | Black Bengal | West Bengal | 23 | Berari | Maharashtra |
| 5 | Changthangi | JK | 24 | Pantja | UK and UP |
| 6 | Chegu | Himachal Pradesh | 25 | Teressa | Andaman & Nicobar |
| 7 | Gaddi | Himachal Pradesh | 26 | Kodi Adu | Tamil Nadu |
| 8 | Ganjam | Orissa | 27 | Salem Black | Tamil Nadu |
| 9 | Gohilwadi | Gujarat | 28 | Sumi-Ne | Nagaland |
| 10 | Jakhrana | Rajasthan | 29 | Kahmi | Gujarat |
| 11 | Jamunapari | Uttar Pradesh | 30 | Rohilkhandi | Uttar Pradesh |
| 12 | KanniAdu | Tamilnadu | 31 | Assam Hill | Assam and Meghalaya |
| 13 | Kutchi | Gujarat | 32 | Bidri | Karnataka |
| 14 | Malabari | Kerala | 33 | Nandidurga | Karnataka |
| 15 | Marwari | Rajasthan | 34 | Bhakarwali | Jammu and Kashmir |
| 16 | Mehsana | Gujarat | 35 | Sojat | Rajasthan |
| 17 | Osmanabadi | Maharashtra | 36 | Karauli | Rajasthan |
| 18 | Sangamneri | Maharashtra | 37 | Gujari | Rajasthan |
| 19 | Sirohi | Raj. and Gujarat | | | |

# Exotic Goat breeds

| Breed | Country | Purpose | Common name |
|---|---|---|---|
| Saanen | Switzerland | Milk | Milk queen of goat |
| Alpine | France | Milk | - |
| Anglo-Nubian | England | Milk | Jersey of goat |
| Toggenberg | Switzerland | Milk | Swiss dairy goat |
| Angora | Turkey | Mohair | Sheep like goat |
| Boer | South Africa | Meat/ Broiler | Prolific goat |

# Regional Classification of Goat breeds

| **Northern temperate** | **North-western, arid and semi arid** | **Southern region** | **Eastern region** |
|---|---|---|---|
| Gaddi | Sirohi | Sangamneri | Ganjam |
| Changthangi | Marwari | Malabari /Tellicherry | Bengal |
| Chigu | Beetal | | Assam Hill |
| Bhakarwali | Jhakrana | Osmanabadi | |
| | Barbari | Kannai adu | |
| | Jamnapari | Kodi Adu | |
| | Mehsana | Bidri | |
| | Gohilwadi | Nandidurga | |
| | Zalawadi | Salem Black | |
| | Kutchi | | |
| | Surti | | |
| | Rohilkhandi | | |

**Anglo-Nubian goat: Nubian X Jamnapari**

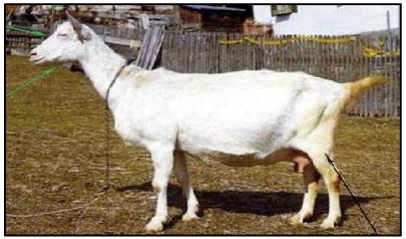
- Jersey of goat
- Roman nose
- Long, pendulous and floppy ears
- Butter fat: 4.5%

**Alpine goat:**

- Erect ears described as "alertly graceful”
- No distinct color

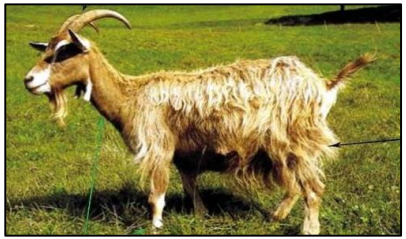
**Saanen:**

- Milk queen of goat
- Short and erect ear
- Face straight
- White coat with short hair
- Wattles are common



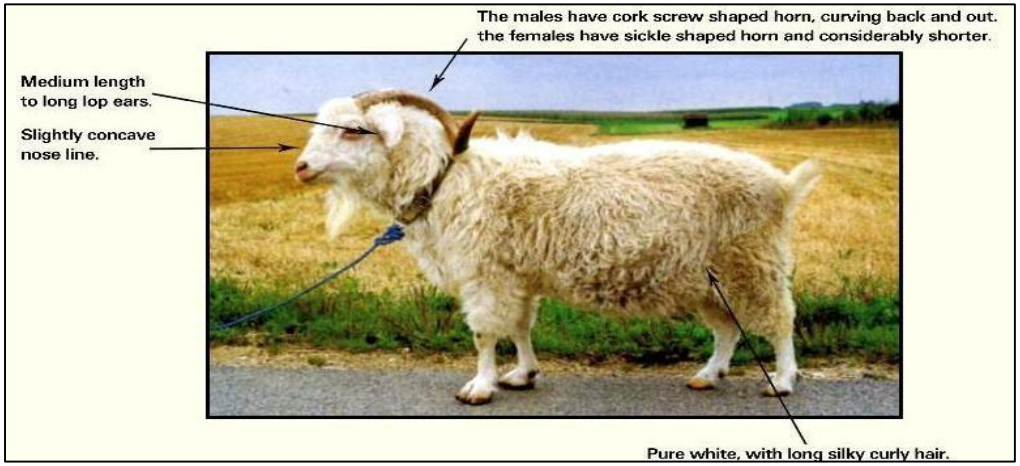
**Toggenberg**

- Swiss dairy goat
- The ears are erect and carried forward
- Polled and horned
- Long haired, brown & white color on legs



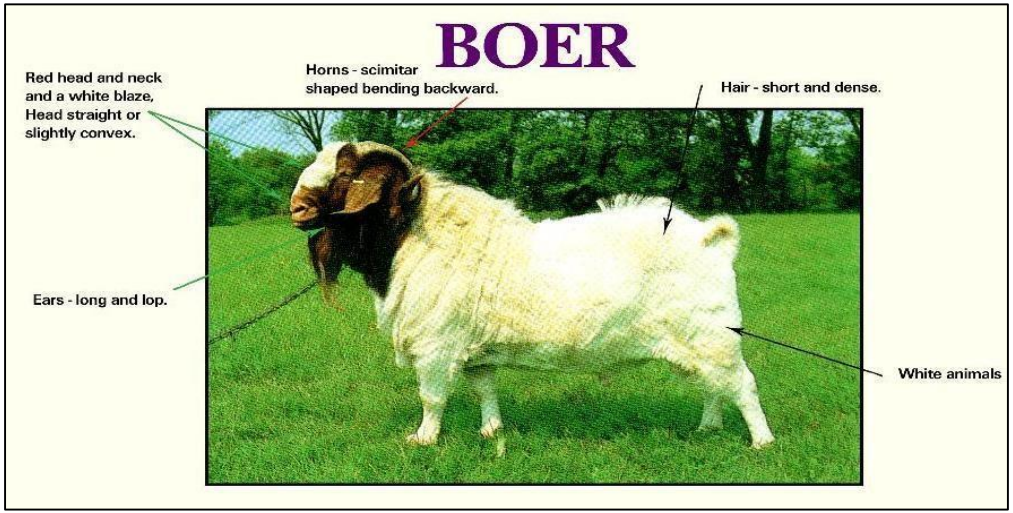
**Angora goat:**

- Mohair production;
- Goat having sheep like texture




**Boer goat:**

- High prolificacy and famous for meat production (broiler goat)



# JAMNAPARI

White with small tan patches on head and neck.

Both sexes are horned

A thick growth of hair on the buttocks is known as feathers.

Highly convex nose line with a tuft of hair, yielding a parrot mouth appearance.

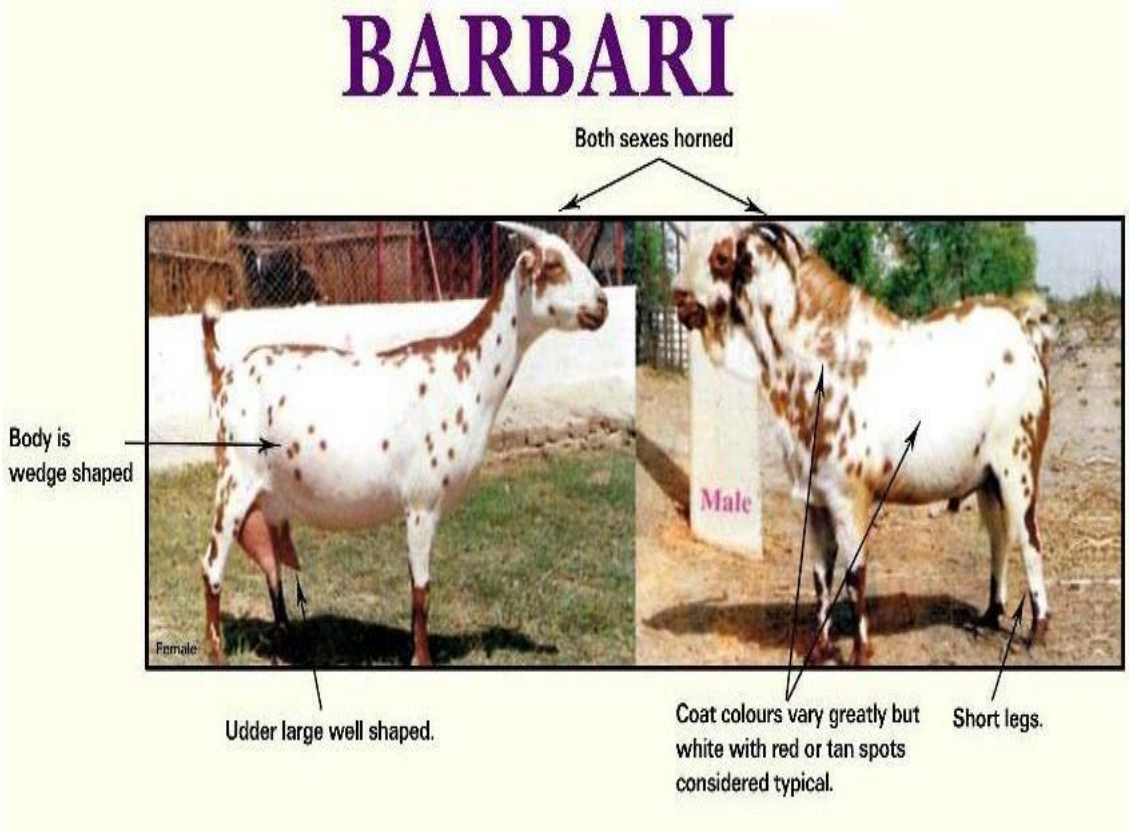
The udder is well developed.

# Jamnapari

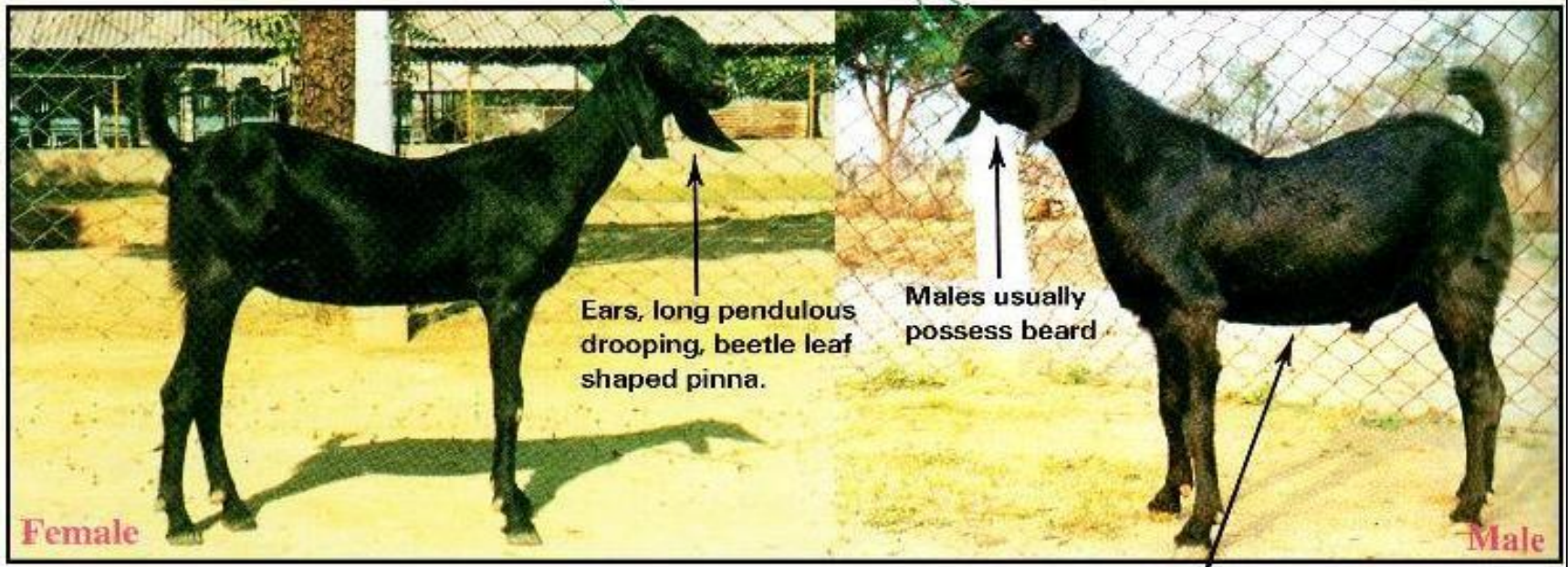
- Home tract: Uttar Pradesh
- Most majestic breed of Goat
- Roman Nose
- Most beautiful Breed

# Barbari

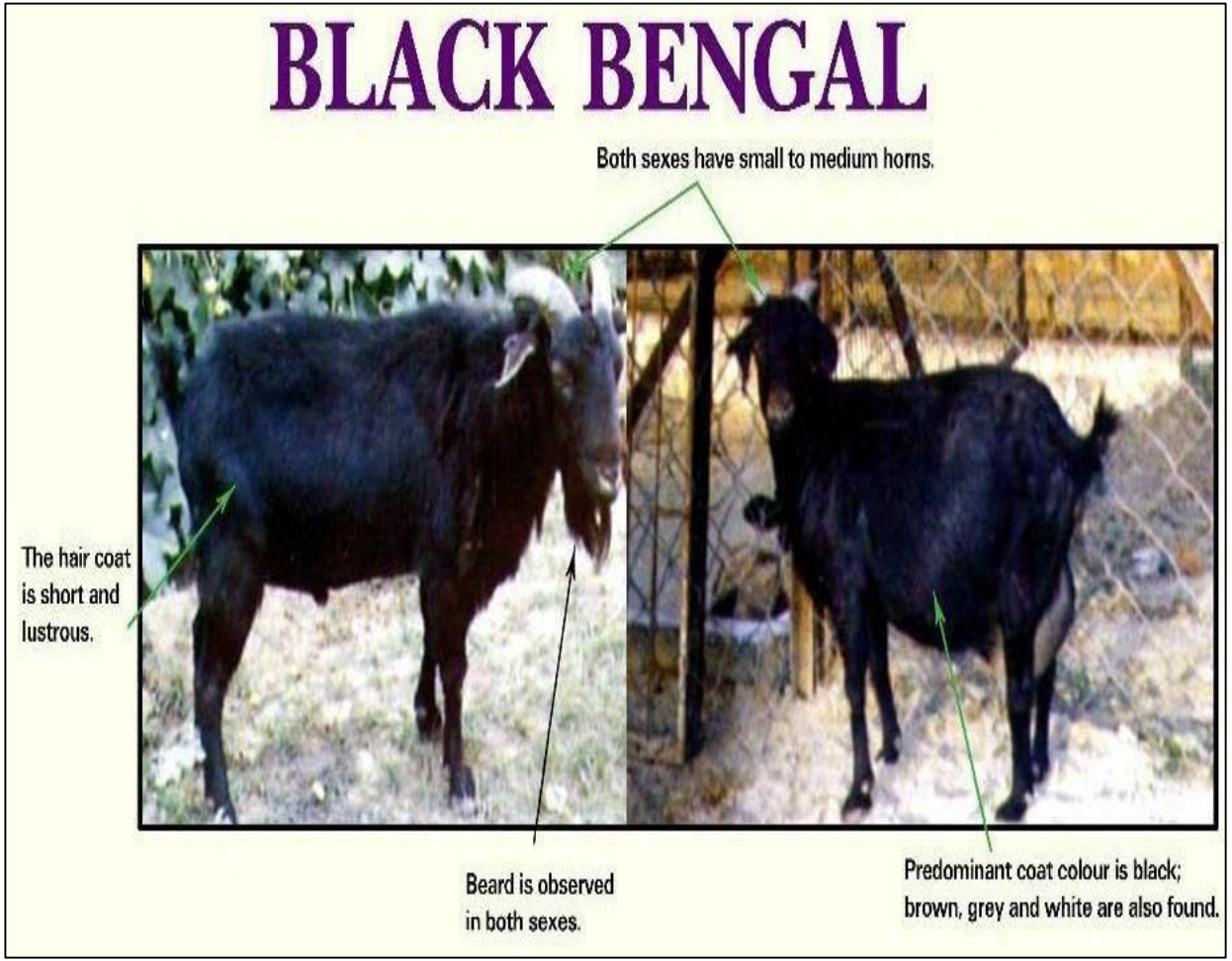
- African Origin
- Home tract: U.P. & Rajasthan
- Also known as City breed
- Suitable for stall feeding
- Milk fat: 5% - maximum in Indian goats



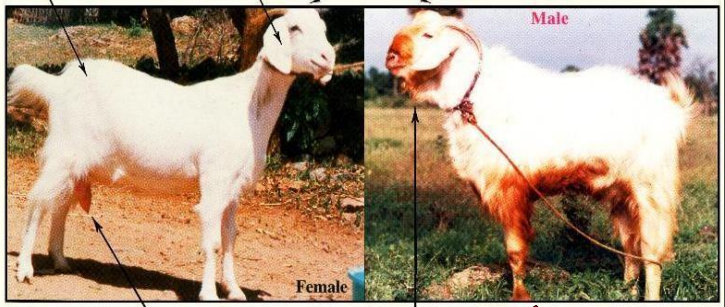
# BEETAL


Eyes blue - black with white or brownish corneal surroundings.
Face convex, lips black.
Ears, long pendulous drooping, beetle leaf shaped pinna.
Males usually possess beard
Female
Male
Predominantly black; red, tan or black, heavily spotted on white also occurs;

- Best chevon breed
- Highly prolific

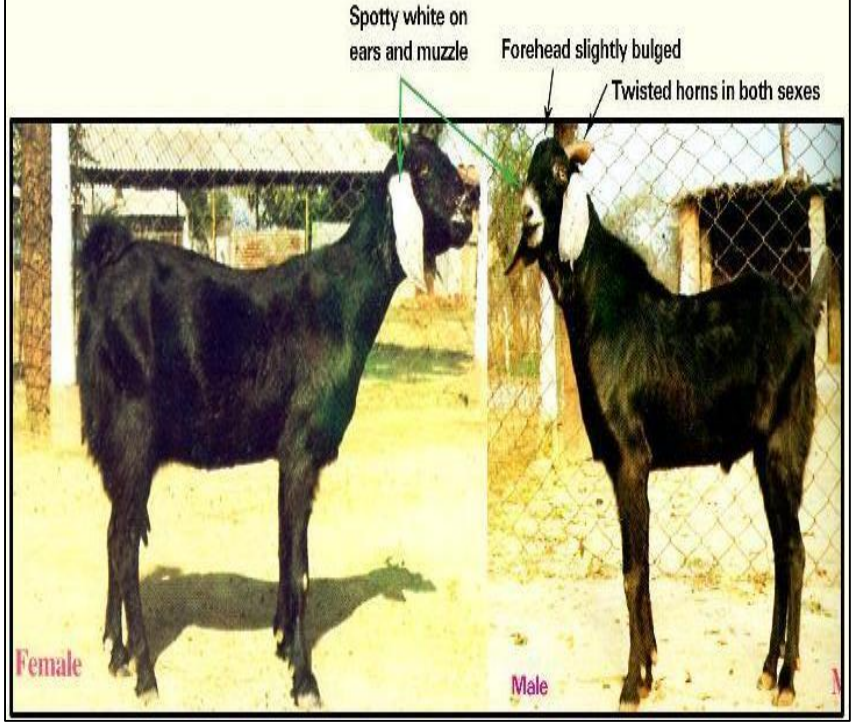


# TELLICHERRY

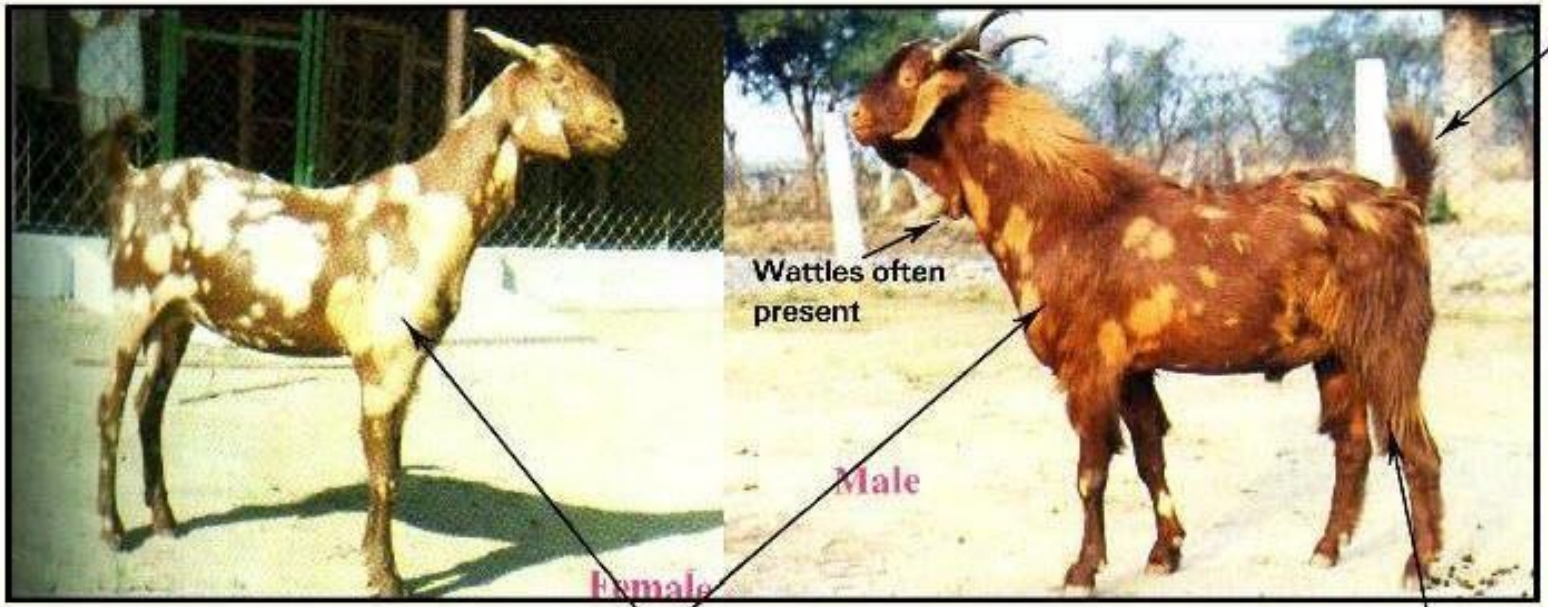



# OSMANABADI


# JHAKRANA



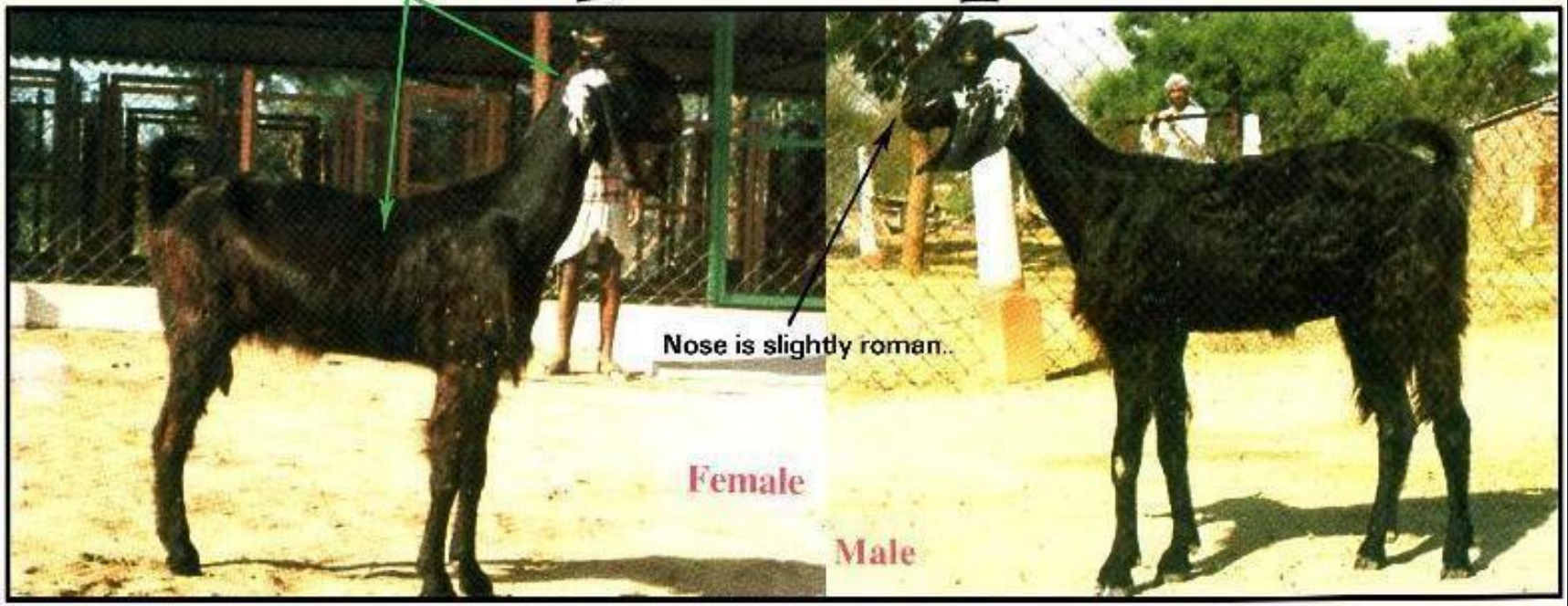
# SIROHI

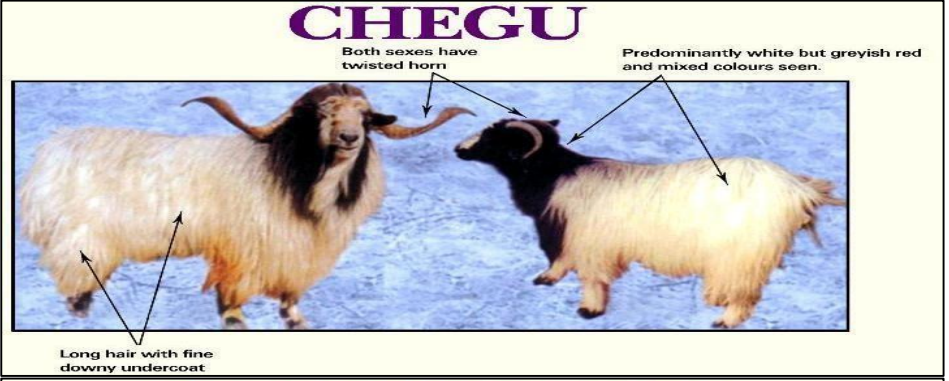

Tail twisted,
Wattles often present
Male
Female
Brown, white and admixture (common). off colours in typical patches.
Hair is coarse and short.

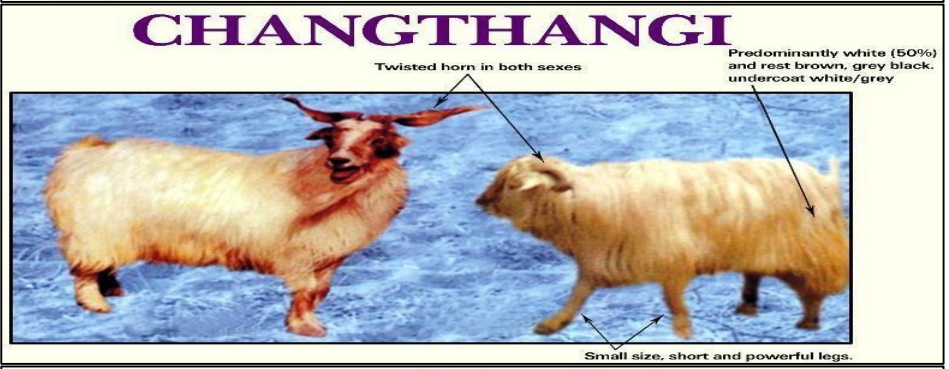
# KUTCHI

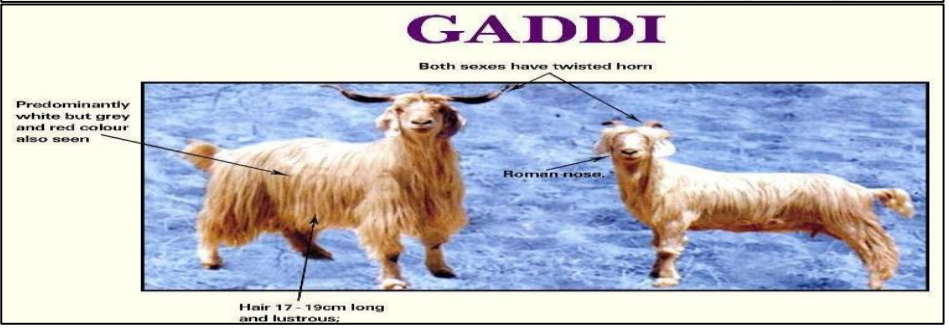
Horns are corkscrew type, pointed upwards.

Predominantly black, white or speckled at ears, neck and face.






**Pashmina goat**

**Migratory production system**

# Registered Breeds of Sheep (45) Macherla (Andra Pradesh)

| S.N | Breed | Home Tract | S.N. | Breed | Home Tract |
|---|---|---|---|---|---|
| 1 | Balangir | Orissa | 23 | Mandya | Karnataka |
| 2 | Bellary | Karnataka | 24 | Marwari | Rajasthan & Gujarat |
| 3 | Bhakarwal | JK | 25 | Mecheri | Tamilnadu |
| 4 | Bonpala | Sikkim | 26 | Muzzafarnagri | UP & Uttarakhand |
| 5 | Changthangi | JK | 27 | Nali | Rajasthan |
| 6 | Chokla | Rajasthan | 28 | Nellore | AP |
| 7 | Chottnagpuri | Jharkhand | 29 | Nilgiri | Tamilnadu |
| 8 | Coimbatore | Tamilnadu | 30 | Patanwadi | Gujarat |
| 9 | Deccani | AP and MH | 31 | Poonchi | JK |
| 10 | Gaddi | HP | 32 | Pugal | Rajasthan |
| 11 | Ganjam | Orissa | 33 | Ramnad White | Tamilnadu |
| 12 | Garole | West Bengal | 34 | Shahbadi | Bihar |
| 13 | Gurez | JK | 35 | Rampur Bushair | Himachal Pradesh |
| 14 | Hassan | Karnataka | 36 | Sonadi | Rajasthan |
| 15 | Jaisalmeri | Rajasthan | 37 | Tibetan | Arunachal Prad. |
| 16 | Jalauni | UP and MP | 38 | Tiruchi Black | Tamilnadu |
| 17 | Karnah | JK | 39 | Vembur | Tamilnadu |
| 18 | Kenguri | Karnataka | 40 | Katchaikatty Black | Tamilnadu |
| 19 | Kilakarsal | Tamilnadu | 41 | Chevaadu | Tamilnadu |
| 20 | Madras Red | Tamilnadu | 42 | Kendrapada | Odisha |
| 21 | Magra | Rajasthan | 43 | Panchali | Gujarat |
| 22 | Malpura | Rajasthan | 44 | Kajali | Punjab |

# SHEEP BREEDS: Region-wise classes

| Northern temperate region | North-western, arid & semi arid region | Southern region | Eastern region |
|---|---|---|---|
| Gaddi | Chokla | Deccani (Bellary) | Chottanagpuri |
| Rampur Bushair | Nali | Nellore | Balangir |
| Bhakarwal | Marwari | Hassan | Ganjam |
| Poonchi | Magra | Mandya | Tibetan sheep |
| Karnah | Jaisalmeri | Mecheri | Bonpala |
| Gurez | Pugal | Kilakarsal | Garole |
| Kashmir Merino | Malpura | Vembur | Shahbadi |
| Changthangi | Sonadi | Coimbatore | |
| | Pattanwadi | Nilgiri | |
| | Muzaffarnagri | Ramnad White | |
| | Jalauni | Madras Red | |
| | Hissardale | Tiruchi Black | |
| | Munjal | Kenguri | |
| | Avivastra | | |
| | Bharat Merino | | |

# SHEEP BREEDS- Utility classification

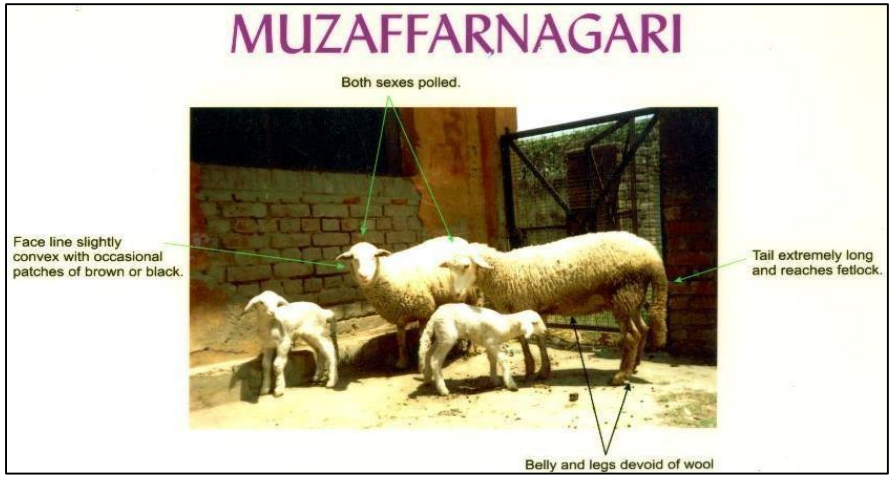
| Apparel wool | Superior carpet Wool | Coarse carpet Wool | Hairy Meat |
|---|---|---|---|
| Hissardale, Niligiri, Kashmir merino, Avivastra, Bharat Merino | Chokla, Nali, Marwari, Magra, Jaisalmeri, Pugal, Pattanwadi, Tibetan, Bonpala, Gaddi, Rampur Bushair, Poonchi, Karnah, Gurez, Changthangi | Malpura, Sonadi, Muzzafarnagri, Jalauni, Deccani, Bellary, Coimbatore, Chottanagpuri, Balangir, Ganjam, Bhakarwal, Shahabadi | Nellore, Hassan, Mecheri, Kilakarsal, Madras Red, Trichy Black, Kenguri, Mandya, Vembur |

# EXOTIC SHEEP BREEDS

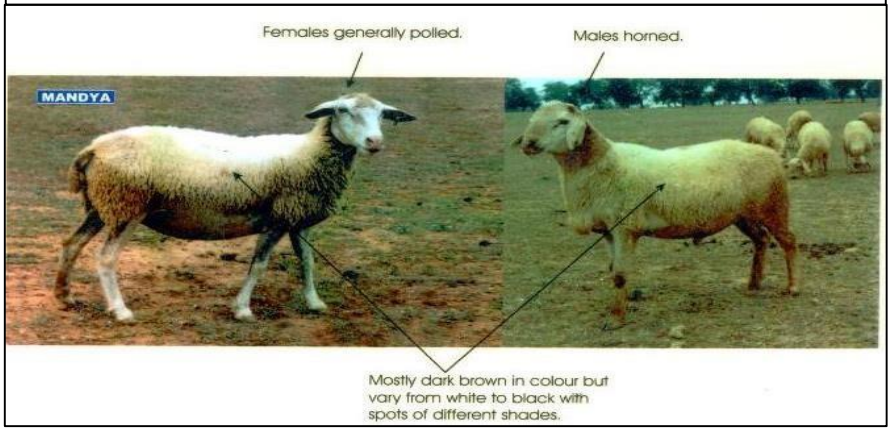
| Fine wool breeds | Mutton breeds | Dual purpose | Pelt breeds |
|---|---|---|---|
| Merino (Spain), Rambouillet (France) Polworth (UK) | Suffolk: UK Southdown: UK Dorset: UK | Corriedale: New Zealand | Karakul : USSR, Afghan., Iran, Iraq and parts of Africa |

## CROSSBRED SHEEP BREEDS

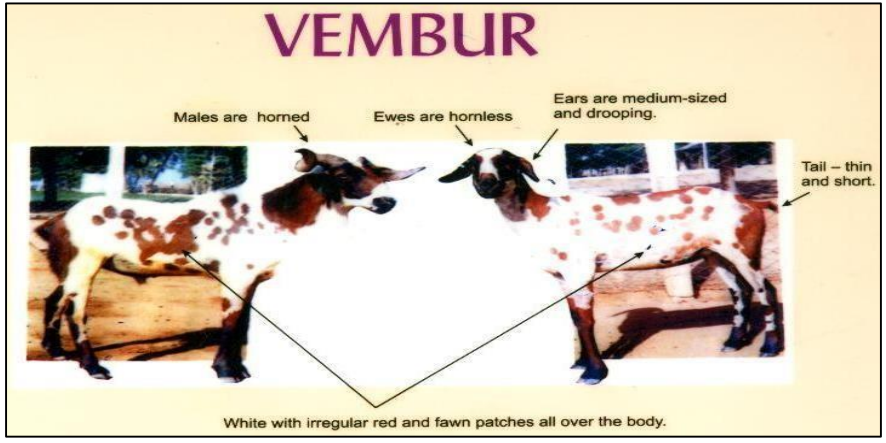
| |
|---|
| **Avikalin:** Rambouillet x Malpura |
| **Avivastra:** Rambouillet x Chokla |
| **Avimanas:** Dorset & Suffolk X Malpuri & Sondai |
| **Bharat Merino:** Rambouillet or Merino × Chokla & Nali |
| **Gaddi Synthetic:** Rambouillet x Gaddi |
| **Hissardale: Australian** Merino Ram × Bikaneri sheep |
| **Indian Karakul**: Marwari, Malpura & Sonadi X Karakul |
| **Kahmiri Merino:** Gaddi, Bhakarwal, Poonchi X Merino & Rambouillet |

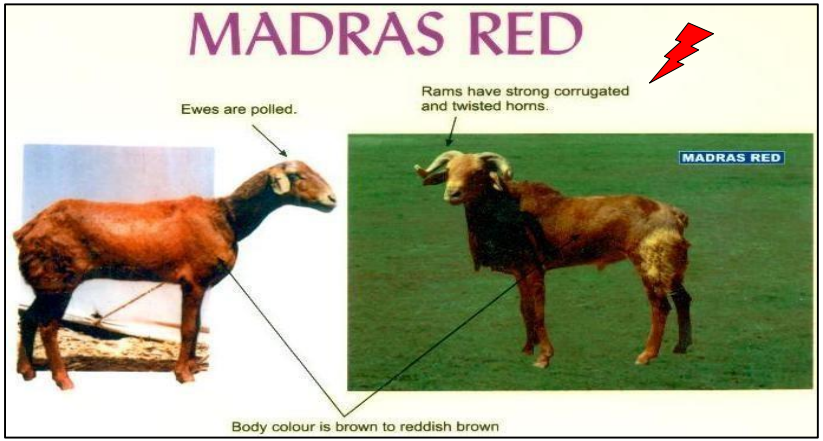



**Mandya - shortest (Bannur or Bandhur)**



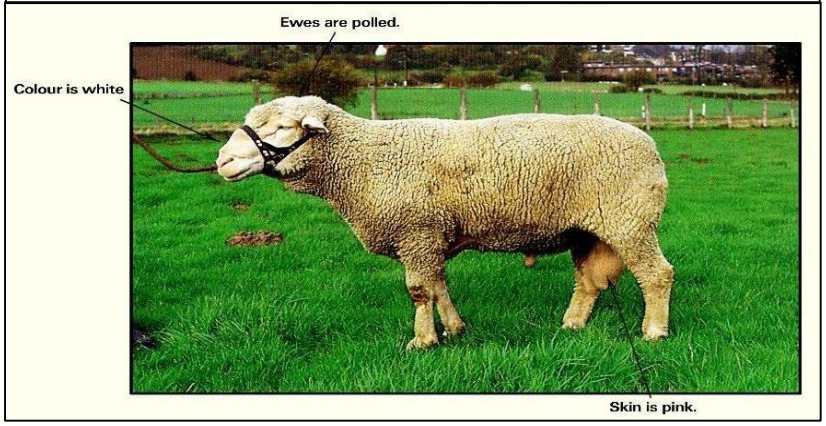

**Nellore - tallest breed, Best mutton breed & looks like goat**



Merino sheep: Best wool breed Rams have heavy spiral horns

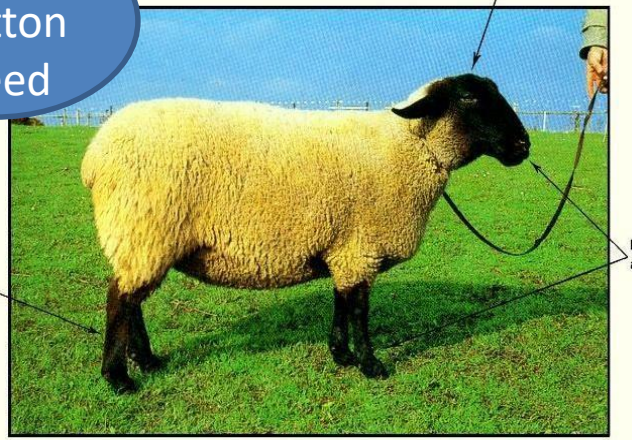



## Polworth

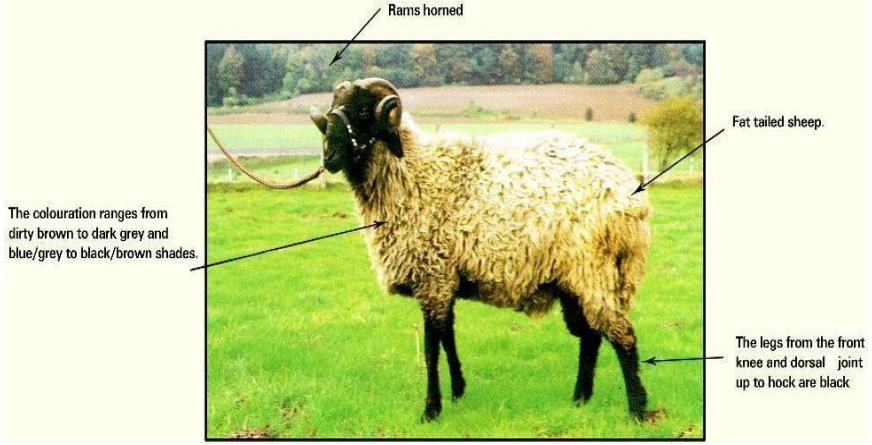
- Cross of Lincoln ewes and Merino Rams in U.K.
- Horned or polled
- Wool quality comparable to Merinos

Best Mutton Breed

# SUFFOLK




# KARAKUL:Pelt breed




Lincoln: Heaviest Breed of Sheep

- Indian Merino: Chokla
- Canary colored wool: Nali
- Triple purpose sheep breed: Marwari
- Most Prolific Breed: Garole

# Care/ management of pregnant and parturient ewes/does

- **Following steps are recommended:-**
- They should not be handled frequently.
- Ewes/does should be separated from the flock to avoid injuries.
- Effective care should be taken in their feeding.
- Advanced stage: separate lambing/kidding pen 4-6 days before parturition.
- Provide maximum comfort like soft clean bedding and individual pen.
- Protection from cold and chilly weather condition
- Extra feed (**steaming up**) should be offered during later part of pregnancy (3-4 weeks before parturition).
- Steaming up helps in improving milk production and birth weight and growth of lambs/kids.

# Care at parturition (lambing/kidding)

- A ewe/doe about to lamb/kid prefers to leave the flock.
- Distended udder and flaccid external genitals.
- Precautions:
  - ✓ Observe for dystocia or difficult birth. Especially maiden ewes/does in poor condition or small-framed mated to big rams results dystocia.
  - ✓ Trim the navel to about 2-3 inches and dip it in the iodine.
  - ✓ New born lambs/kids after being licked by mother generally stand on their legs and start seeking for teats and suckle milk.
  - ✓ If they are unable to do so, help them in suckling colostrum.
  - ✓ Protect the new born from cold, wind and rain.
  - ✓ Artificial milk feeding or arrangement of foster mother should be done for disowned or orphan lambs.
  - ✓ Goats can serve as excellent foster mother, but ewes which have lost their lambs early after birth may also be utilized.
  - ✓ Ensure feeding colostrum within 1-2 hours of birth @1/10th of body weight for more resistance against diseases.
  - ✓ Ligate, sever and antiseptically dress the navel cord.
  - ✓ Give a teaspoonful of castor-oil or liquid paraffin preferably mixed with little milk curd/butter milk to lamb/kid to facilitate defecation and passing out of meconium easily and prevention of E. coli infection.
  - ✓ Lambs/kids should not be handled too frequently.
  - ✓ First 1 to 2 hrs after birth is the vital period for establishment of bond between the newborn and mother (**imprinting**). Hence keep the dam in a calm place without disturbance from stray dogs and other animals.
  - ✓ Feed sufficient quantity of good quality hay and concentrate to the lactating ewes/does with plenty of clean fresh drinking water.

# Care of suckling lambs/kids

- ✓ Proper care during early period of life to ensures better survival and growth.
- ✓ Ensure proper suckling of young ones. Examine the udders for blindness of teats or mastitis.
- ✓ Take care of indifferent mothers and arrange suckling of lambs/kids by restraining such type of ewes/does.
- ✓ Creep feed: in addition to milk suckling form 2nd week onwards.
- ✓ Provide green leg. fodders or fresh tree leaves to lambs/kids to nibble during sucking period.
- ✓ Ear-tagging or tattooing for identification.
- ✓ Do tail docking (in lambs) in 1st week (with in 6 weeks of age).
- ✓ For docking put elastrator at inter vertebral space or use sterilized and clean knife.
- ✓ Castration: best 6 month with Burdizzo and within 3 month with surgical method,
- ✓ For castration use sterilized and clean knife and do antiseptic dressing properly.
- ✓ To avoid tetanus keep the lambs/kids on perfectly dry, clean and hygienic site during castration.
- ✓ Salt lick or mineral block should be kept in the lamb/kid pen to avoid licking of soil/floor.

# Weaning of lamb and kids

The following steps are important in proper care and management of weaners:-

- ✓ Weaning should be done at **90 days**, although in breeds with low milk production or where re-breeding is to be done, wean around 60 days.
- ✓ Provide supplementary feeding and good clean pasture.
- ✓ Drench against gastro-intestinal parasites by first month and vaccinated against enterotoxaemia and pox.
- ✓ Protect the weaner against adverse climate and predators.

# HOUSING

- Normally sheep/goat do not require elaborate housing facility, but minimum provisions require to increase productivity especially protection against inclement weather conditions (sun, rain, winds).
- Provision of simple shade with low cost housing materials is enough.

| Sr. No | Type of animals | Floor space/ animal ($m^2$) |
|---|---|---|
| 1 | Ram or buck in groups | 1.8 |
| 2 | Ram or buck individual | 3.4 |
| 3 | Lamb or kids in group | 0.4 |
| 4 | Weaner in groups | 0.8 |
| 5 | Yearling or goatlings | 0.9 |
| 6 | Ewe or doe in groups | 1.0 |
| 7 | Ewe/doe with lamb | 1.5 |

# Feedstuff used in feeding of sheep/goat

- **Feeding on field while grazing**
- Natural grass pasture or grasses
- Legumes pasture
- Shrubs
- Crop residues/stubbles
- **Supplement**
- Cultivated fodders-maize or sorghum fodder
- Grains (barley, maize, oats, etc.)
- Oil cakes- groundnut cake
- Wheat bran
- Legume hay , Sorghum silage.
- Molasses
- If the availability of pasture is good and no-long distance travelled, no need to supplement with concentrate mixture.
- In poor grazing condition animals may be supplemented with 150 – 200 g of concentrate / sheep or goat/day.

# Feeding management of sheep

- Sheep possesses a unique ability to survive on natural grasses, shrubs and crop residues or stubbles.
- Sheep have small muzzle and split upper lip helping them to nibble small blades of grass on pasture.
- In India, sheep are raised on roughages/grazing, so lower cost of production.
- Extensive grazing- common: Grazing on crop stubbles, weeds and grasses.
- Supplement cultivated fodders, grains and oil cakes during pre-breeding season, last 1 month of pregnancy and early 1 month of lactation.
- Intensive system: confinement, energy saving
- Maintenance requirement in confinement is about 10-30% less as compared to those on grazing pasture/ extensive system.
- For wool production: ration with 10% protein is adequate for wool production.
- Methionine - first limiting amino acid for wool production.
- Sulphur must be added to urea containing ration = N:S = 10:1 to 15:1
- Sulphur deficiency in ration leads to poor wool production as well as quality.

# Feeding before and during breeding

- **Flushing:- better nutrition about 2-3 weeks before onset of breeding season.**
- Flushing brings ewes into heat earlier and increases the lambing rate and incidence of multiple birth.
- Flushing increases the lambing rate by 10 to 20 per cent
- Different flushing rations:-
  - ✓ A good mixed pasture legumes and grasses.
  - ✓ Grass pasture + 250g grains.
  - ✓ Legume hay + 100g wheat bran + 150 to 200g of grain.
  - ✓ Green fodder @ 10% of BW and 150-200g of concentrate/ head/ day.
- Flushing period is usually during the latter half of May in India.
- **Over-fat ewes:**
  - ✓ Over-fattening results reduction of fertility. Over-fattening should be checked 1.5-2.0 months before onset of breeding season.
  - ✓ Reduce the ration and take for exercising.
- **Feeding during breeding season:** Ration provided during flushing s/b continued during breeding season.

# Feeding during early and mid-pregnancy

- This period is less critical nutritionally, but provide balanced ration.
- Increases number of strong, healthy & live offspring.
- Prolongs the productive life of the dam.
- Increases milk yield & resulting in healthier weanlings.
- Improves the wool productivity in sheep.
- Extra nutritional requirements due to pregnancy are not much during early and mid-pregnancy and daily needs can be met entirely by grazing.

**Ration:**

- ✓ Grazing: On a good pasture.
- ✓ Sorghum silage + legume hay half to one kilogram/ head/ day.
- ✓ Ad libitum supply of maize or sorghum fodder + 50g of oil cakes/ head/ day.
- ✓ Grazing on stubbles and harvested fields supplemented with 100 g of oil cakes/ head/ day.

# Feeding during late pregnancy

- Late pregnancy (6 wks prior) is most critical period nutritionally.
- During first part (15 days) ewes are allowed to graze on crop stubbles, wild grasses & weeds with green fodder @ 5 kg/ head/ day.
- During last one month: fetus grows rapidly in the uterus.
- Deficiency of energy causes pregnancy toxaemia or ketosis in ewes. Therefore, offer molasses or grains @ 200-250g/ head/ day.
- Ewes should receive green fodder @7kg/ head/ day.
- About 600g of legume hay or 300 g of concentrate with 12 to 14 % DCP and 65 to 70% TDN during last 45 days of pregnancy should be offered.

# Feeding at lambing time

- As lambing time reduce grain feeding but offer good quality green.
- After parturition gradually increase daily ration
- Offer bulky & laxative feeds during first few days.
- Give wheat bran and barely/oats/maize @ 50 : 50.
- Soon after lambing give sufficient amount of lukewarm water.
- As soon as first lamb is born, formulate the creep feed.

## Feeding lactating ewes

- Daily ration is required to maintain milk production.
- Provided good pasture to meet the requirements.

**Supplementary feeding:**

- ✓ Pasture requirements can be replaced 50% by 450g of good hay or 1.4kg silage or 250g of grain.
- ✓ Cultivated green fodder: 10kg/ head is sufficient or 400g of conc. or 800g of quality legume hay per day in addition to 8 hours of grazing.

**Feeding of ewes from weaning to flushing time:**

- ✓ Least critical period as per nutrient requirements.
- ✓ Ewes are maintained entirely on pasture grazing.

# Feeding management of goat

- Feeding habit of goat is browsing.
- Goat has mobile upper lip and very prehensile tongue, helps to eat short grass and to browse on foliage.
- Goats are fastidious and are more selective feeder.
- Double-sided portable hay-racks are most suitable for stall feeding.
- They are very fond of leguminous fodder/ hay.
- A mature goat consumes about 5 kg greens/ day and browse for about 7-9 hours/ day.
- At least 6% protein s/b provided in feed, otherwise feed intake will be reduced.
- Give molasses or jaggery mixed lukewarm water for drinking, after kidding to doe. After this give warm bran mash containing small amount of oat meal, ginger, a pinch of salt, mineral mixture and jaggery to eat.
- 2-3 days after kidding normal lactation ration should be adopted.
- The amount of concentrate per day should not be more than 500g
- A good fed goat must return in heat after 40-45 days of kidding.

- **Maintenance ration:** Goat has higher basal metabolic rate than cattle; thus requires about 25-30% higher nutrients than maintenance requirement of cattle.

- **Lactation ration:**

  - ✓ Requirement of lactating doe varies with milk yield.
  - ✓ Give 400g of conc. mix or 500g hay or 1kg of good quality green fodder for every additional kg of milk produced.
  - ✓ A goat weighing 50kg and yielding 2 lt of milk requires 400g of conc. and 5kg of berseem or Lucerne. The ration should have 12 to 15% protein.

- **Late pregnancy**:

  - ✓ During this period: 250-700g concentrate mixture/days/ doe.
  - ✓ A week before kidding, provide more succulent type of food and concentrate s/b reduced to 200-300g and add bran mash to make it bulk.
  - ✓ During 3-4 days after kidding, ration s/b more fibrous which is necessary to minimize the shock to the goat's udder and metabolism of sudden flow of milk.

# Feeding kids

- Colostrum feeding: within 1 hour and s/b continued for 3 days (@ 1/6th of BW).
- After 3rd day up to weaning feed them with milk at 2 to 3 times a day (1/6$^{th}$ BW up to 1 months and then 1/8th of BW in 2nd month and 1/10$^{th}$ - 1/12$^{th}$ BW during 3rd month).
- Milk feeding completely stopped after 3$^{rd}$ month (weaning @ 90 days).
- 2 weeks of age: eat green roughages and hay with creep/starter feed for rapid growth.

✓ Creep feed: It has 20-22% CP and 70% TDN.

✓ It also contains antibiotics @ 15 to 25 mg/kg of feed.

✓ Feed @ 50-100g/animal/d and as they eat more, reduce milk allowance.

✓ Starter feed s/b given up to 2-3 months of age (until weaning)

# Feeding of grower kids (3-12 m)

- Grazing on good pasture/roughage (9-10% CP and 60-65% TDN) for about 7-8 hours per day.
- If low quality fodder, then supplement conc. mixture of 16-18% CP @ 100-200g/animal/day.
- Dry fodder during night in summer months and during rainy days should be given.
- Yearling doe s/b offered 200-700 g of concentrate in addition to browsing.
- Finisher goats ration should have 30-40% of DM from roughage and rest from concentrate having 12-14% protein and 60-65% TDN.

# Feeding breeding buck

- Conc. mixture of @ 450-900g/ day depending on BW s/b fed.
- **Mineral mixture:-** s/b included in concentrate mixture @ 2%.
- **Common salt:-** Salt @ 1-2 per cent of concentrate feed
- **Vitamins:-** Goats need vit A, D & E. But rumen microbes synthesize others. Vitamin A - green forage and yellow maize. Vit-D - sunlight. Vit-E - present in normal rations. Synthetic vitamins A and D may be fed to growing kids.
- **Antibiotics:-** Feeding of Aureomycin or Terramycin increases the growth rate of young kids, and reduces the incidence of scours and other infectious diseases.

## General care and management of breeding bucks / rams

- Breeding bucks should not be tethered or tied. They must be housed separately having enough space for movement and exercise.
- Sufficient green fodder and concentrate mixture @ 500g/day must be given during breeding season. They should not be over- or under-fed.

## Breeding of sheep/goat

- Bred at 7 to 10 months old @ 70 to 75% of her mature weight.
- The male female ratio is 1:20.

| CHARACTERISTICS | SHEEP | GOAT |
|---|---|---|
| Tail | Generally long, hanging, broad | Short, Thin and upright. |
| Presence of beards | No beard | Beard is present |
| Face glands | Present just below the eyes | Absent |
| Hind Foot/hoof Glands - scent | Present | Absent |
| Nature of horns | Mostly homogenous | Heterogeneous in nature |
| Activity | Walk shorter distance | Bipedal stance and walk longer distance |
| Feeding pattern | Grazing, less selective | Browsing, more selective |
| Variety in feeds | Preference is lesser | Preference is greater |
| Dehydration in Faeces | Relatively higher water loss | Less water loss |
| Urine | Less concentrated | More concentrated |
| Water in take | Higher | Lower |
| Length of oestrus cycle | 16-17 days | 19-21 days |
| Duration of oestrus | 24-36 hours | 34-38 hours |
| Time of ovulation | 25-30 hours after onset of oestrus | 30-36 hours after onset of oestrus |

- Breeding age- 6-8 months
- Comes to heat after lambing – 21 days after
- Length of pregnancy - 147 days (ranges between 144 and 152 days)
- Male female ratio - 1:20
- Estrous period is repeated every 16-17 days on average in ewes (range 14-19 days).
- Estrous period is 19-21 days in does (range 17-24 days).
- The estrous period lasts for about 24-36 hours in ewes and 34-38 hours in does.

# General activities at Sheep/ Goat farm

**Shearing:** Removal of wool from sheep
**Clipping:** removal of hair from animals
**Purpose:**

- To obtain complete wool and hair fibre easily and quickly without any injury to any part of animal.
- To minimize discomfort to animal by decreasing heat load.
- Accommodation of more number of animals in same space for a temporary period.

**Materials:**

- Hand shearer/clippers (for the flock of 150 sheep): 1.2 X 1 X 0.5m
- Power shearer/clippers (for the flock of more than 150 sheep): 1.5m deep and 1m wide

**Season of shearing:**

- Twice a year- (a) March – April and (b) September – October

- Ringing: removal of wool around penis
- Crutching/ Dagging: Removal of wool around the perennial region and base of the tail of an ewe is known as crutching.
- Tagging:  removal of soiled wool from sheep's hind quarter
- Wigging: Removes wool around the face so the sheep can see

**Dipping**

- Dipping of sheep and goats in an insecticide will kill eternal parasites, fungus and pests and prevent disease (scabies).
- The points to be considered while dipping are as follows:
  - ✓ Dip the animal with insecticide once in six months (before each shearing, wound) or after 3 weeks of shearing. Also at the time when there is high incidence of ecto-parasites.
  - ✓ Never dip thirsty sheep
  - ✓ Dipping should be done during sunny days.
  - ✓ Water the animal before dipping.
  - ✓ Care should be taken to avoid contact of eyes and mouth with the solution.
  - ✓ After dipping place the animal in the open place for quick drying.

**Dipping method:**

1. Hand bath: It is used for small flock.
2. Swim bath: It is used for large size flock.

**Dip solution:** 0.5% concentration-

- ✓ Organophosphates: e.g. Malathion, chlorfenvinphos, chlorpyrifos, coumaphos, diazinon, ethion.
- ✓ Amidines: mostly amitraz
- ✓ Synthetic pyrethroids: e.g. cypermethrin, deltamethrin, flumethrin.

**TABLE 9.13. COMMON CHEMICALS USED IN DIPS**

| *Chemical* | *Concentration in dip* | *Remarks* |
|---|---|---|
| Lindane dip | 0.031% gamma isomer concentrate | For young stock |
| | 0.05 % " | For adult stock |
| DDT dips | 0.5 % DDT | To get this concentration mix 20 kg of 25% DDT wettable powder or 10 kg of 50% DDT wettable powder in 1000 litres. |
| Pyrethrin Arsenic – suphide powder dips | 0.2% total arsenic | Including 0.13% soluble arsenic. |
| Coal-tar creosote or Phenol dip | 0.76% total tar oil | Including 0.36% tar acids. |
| Nicotine & tobacco | 0.1 % Nicotine | Or soak 15 kg of tobacco leaves in 500 l water |

**Pouring**

- When an individual sheep is affected with scab or badly affected with maggots and has open wounds, dipping is not advisable. In such animals, a small quantity of dip is poured into the fleece along the back, sides and belly to achieve the objectives of dipping.

**Spraying:**

- Spraying is followed for small flock size.
- Fly repellent solution is sprayed into a roomy tunnel in which a series of nozzles are fixed
- Animals are forced to pass through this tunnel.
- Smaller quantities of dip solution are required for spraying.
- It is not as economical or efficient as dipping, because it is difficult to thoroughly wet the wool and skin of animals.

**Hoof trimming:** In general trim the feet once in six months

# HOUSING OF SHEEP AND GOATS

- Provision of simple shade with low cost housing materials is enough.
- **Type of shed:**
  - ✓ Open type housing with a covered area and run space
  - ✓ Covered area: shelter of animals during night/adverse climatic conditions.
- **Orientation**
  - ✓ East-west orientation with ventilation to dry the floor will be suitable one.
- **Roofing materials and pattern**
  - ✓ In Indian conditions: thatched roof is best suited for cheaper cost and durability. Corrugated asbestos sheets for organized farms to minimize the recurring costs and longer durability.
- **Floor space:**

| AGE GROUPS | COVERED SPACE ($m^2$) | OPEN SPACE($m^2$) |
|---|---|---|
| Up to 3 months | 0.20-0.25 | 0.4-0.5 |
| 3 months to 6 months | 0.50-0.75 | 1.0-1.5 |
| 6 months to 12 months | 0.75-1.0 | 1.5-2.0 |
| Adult animal | 1.50 | 3.00 |
| Male, Pregnant or lactating ewe/doe | 1.5-2.0 | 3.0- 4.0 |

- **Flock shed**
  - ✓ Shed shall be 15 x 4 x 3 m high and accommodate not more than 60 ewes or nannies.
- **Ram or buck shed**
  - ✓ Shed shall be 4 x 2.5 x 3 m high and accommodate not more than three animals.
- **Lamb or kid shed**
  - ✓ The shed shall be 7.5 x 4 x 3 m high accommodate not more 75 animals.
- **Lambing/ kidding shed:**
  - ✓ 1.5m x 1.2m x 3m
- **Sick animal shed:**
  - ✓ 3 x 2 x 3 m
- **Shearing and storeroom**
  - ✓ 6 x 2.5 x 3 m

# Livestock production system and grazing system

# Livestock production system

1. **Pastoral livestock farming:** form of agriculture aimed at producing livestock, rather than growing crops. Examples dairy farming.
   Arable farming: concentrates on crops rather than livestock
2. **Mixed crop-livestock farming:**
   - Crop production is combined with rearing of livestock.
   - More than 10% DM fed to animals comes from agriculture crop by-products.
   - At least 10% of its gross income contributed by livestock with upper limit 49%.
3. **Landless livestock farming:** Livestock production systems in which less than 10% DM fed to animals is farm-produced
4. **Solely livestock production systems:** More than 90% DM fed to animals comes from rangelands, pastures, annual forages and purchased feeds and less than 10% incomes from non-livestock farming activities.
5. **Grassland-based systems:** More than 10% DM fed to animals is farm-produced
6. **Rain-fed mixed-farming systems:** More than 90% value of non-livestock farm production comes from rain-fed land use.
7. **Irrigated mixed-farming systems:** More than 10% value of non-livestock farm production comes from irrigated land use.

- **Specialized farming:** A specialized farm is one on which 50% or more income receipts are derived from one enterprise. Income is sale of product plus produce used at home. Enterprise can be crops, livestock, poultry, apiculture, sericulture.
- **Diversified farming:** A farm on which no single product or source of income equals as much as 50% of the total receipt.
- **Mixed Farming:** A farm where at least 10 per cent and maximum 49% of its income is contributed by livestock is called a mixed farm.

# Grazing methods

1. **Continuous grazing:** grazing a pasture for an extended amount of time with no, or infrequent rest to plants from grazing. Uncontrolled continuous grazing results in depletion of all the desirable plant species.
2. **Controlled continuous grazing:** No. of livestock is limited and acc. to carrying capacity of pasture. Grazing is continuous but stops when pasture reaches a minimum level.
3. **Deferred grazing:** applicable where perennial grasses do not have sufficient density. Grassland is divided into three compartments. One compartment is completely closed to grazing to increase the groundcover, and grazing is allowed in other two compartments.
4. **Rotational grazing:** animals are allowed for grazing into different sub units/ plots of the grassland area in rotation at suitable intervals so as to bring about uniform grazing. Change over from one compartment to another provides advantages of giving animals a nutritive herbage and at same time provides a period of rest to other compartment for growing. Disadvantages is that it takes more labor with no chance for seed formation.

4. **Deferred-rotational grazing:** pasture land is divided in to 3 plots at least and fenced. At least one plot is usually rested for the season for seeding with rotational grazing in others. Next season, rested plot will be rotated.

5. **Hohenheim System:** improved system of rotational grazing developed in Germany. Pasture into several equal sized plots or paddocks and applying large quantities of nitrogenous fertilizers in these paddocks. Cattle are separated into 3 groups high, medium and poor milker and are let into the paddocks in rotation, so that the best milkers will get the youngest and most nutritious grazing.

6. **Switchback:** using two separate paddocks and moving the animals from one to the other.

7. **Strip Grazing:** allow the herd access to one piece of land to graze for a short amount of time, usually just one to a few days in length.

8. **Merrill three-herd/four-pasture system:** split herd into 3 smaller herds and grazes them across 4 pastures. One pasture is in rest and recovery while the other three are grazed. Every four months a herd is moved to the rested pasture and the pasture that has been grazed the longest goes into a four month period of rest.

# Clean milk production

## Milking

- Milking is a labour intensive operation requiring 50-60 per cent of the total man-hours on the dairy farm.
- One milker, depending on his skill may milk 10 to 15 cows including activities connected with milking like cleaning the cows, udder and feeding concentrates by hand milking while with machine milking one milker can easily milk 20-25 cows.
- Length and width of standings in milking parlor: 1.5 to 1.7 m in length and 1.05 to 1.20 m in width
- Milk secretion: neuro-humoral reflex known as milk ejection or ‘milk let-down’.
- This reflex is activated by nervous stimuli with suckling by calf or palpation by the milker. These sensory stimuli cause the liberation of the neuro-hormone oxytocin and to a lesser extent vasopressin into the blood stream.
- Under normal situations, milk production increases during the first six weeks of lactation, then persist and gradually decreases thereafter.

# Milking methods

1. **Machine milking:** partial vacuum: open the teat, massage the teat

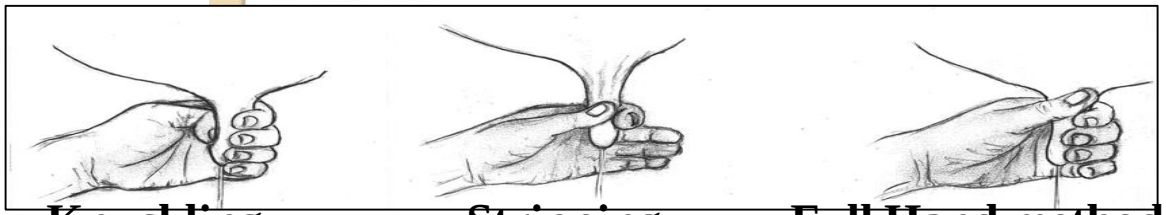
   Pulsation rate: No. of cycles of alternate vacuum and atmospheric air per minute. It is about 40 - 60 cycles per minute in most machines.

   Vacuum pressure: 280-320 mm hg for cow and 340-380 mm Hg for buffalo.

   Milking or Pulsation ratio: The proportion of time spent under vacuum and atmospheric air is called as pulsation ratio and is usually approximately 60:40 or 50:50.

2. **Hand method** →

   1. Stripping
   2. Fisting (Knuckling)
   3. Full hand milking
   4. Full hand milking followed by stripping



**Knuckling** **Stripping** **Full Hand method**

# Factors Affecting Milk attributes

- Species
- Breed
- Age: Fat and lactose generally reduce @ 0.2-0.4% over the first five lactation
- Stage of lactation
- Lactation no.: max. in 4$^{th}$ lactation
- Dry-period and BCS: cow maintained in good BCS generally give 25% higher yield than the one in poor condition.
- Pregnancy: start declining after 20 weeks of pregnancy.
- Seasonal differences
- Maintenance conditions
- Feed and water supply
- Milking intervals
- Milking frequency: twice milking yields at least 40 % more milk than once a day while Milking thrice- 10-15 % more milk.
- Initial or final milk: beginning: 1-2 % fat while final 6-7 % fat
- Diseases: Ketosis reduces milk yield and also markedly increase the fat content of the milk.
- Stress
- Management factors

**Stage of Lactation:** As lactation progresses and milk yield increases, there is rapid reduction in fat. The size of fat globules is bigger during the first few months and again becomes smaller during the last month of lactation.

**Day to day variations:** First drawn milk or foremilk may contain low milk fat. Morning milk contains less milk fat as compared to evening milk. Day to day variation of fat is more (0.1-2.0%).

**Age of cow:** Protein, fat and SNF declines with age.

**Interval between milking:** The ideal interval between milking should be at 12 hours which is hardly followed by any dairymen. With a long interval, the milk will be lower in fat and lactose, it will be slightly higher in protein and as a result of counterbalancing, the SNF content will remain stable.

**Pregnancy:** There is an increase of SNF and protein in late lactation which must be associated with pregnancy, since open (non pregnant) cows do not show increase in these components with advancing lactation. Pregnancy has no apparent effect on the fat content of milk. Milk production starts declining after around 20 weeks of pregnancy.

**Environmental temperature:** Temperature above 21 °C and below -1.1 °C cause an increase in the fat content of milk , whereas protein and SNF quantities decline at higher temperature and increase at lower temperature.

# Pregnancy and milk production

- Pregnancy: inhibitory effect on milk yield. Due to the increase in estrogen and progesterone level.
- Most of the reduction in milk yield: after the fifth month of pregnancy.
- Pregnant animals: milk production declines after 20 weeks of pregnancy
- By the 8th mounth: 20 % less milk (compared with the non-pregnant cow)

## Feed and water supply

- Inadequate feed nutrients → limit the secretion of milk
- Galactopoiesis: closely related to an adequate feed intake by the lactating animal
- High temp→ low Feed intake → decreased milk production
- The most dramatic effect is brought about by shortage of water as the cow has no means of storing water.
- Withholding access to water, or insufficient supply of water for few hours will result in a rapid drop in milk yield.

# CLEAN MILK PRODUCTION

- **Clean milk**: Milk drawn from the udder of healthy animals, which is collected in clean & dry milking bucket/pails, and free from extraneous matters like dust, dirt, flies, hay and pathogen.
- Has a normal composition, possesses natural milk flavour and is safe for human consumption.

**Benefits of Clean Milk Production**

1. **Producers benefit:**
   - Prevent spread of mastitis.
   - Prevent establishment of milk born disease.
   - Improve keeping quality of raw milk.
2. **Manufacturers benefit:**
   - High quality products with better keeping quality.
   - Increases sale and consumption of milk products.
   - Manufacturers get more benefits
3. **Consumers benefit:**
   - Provides better keeping quality.
   - Minimizes chances of spoilage.
   - Gives protection against milk borne infectious diseases.

# Source of Contamination

- **Major categories of contamination:** 2 types

## 1. Internal factors

- ✓ Udder infection -mastitis
- ✓ Fore-milk - more bacteria

## 2. External factors

- ✓ Cow/animal's body
- ✓ Udder and teats
- ✓ Milker hygiene and habits
- ✓ Methods of milking
- ✓ Milking utensils
- ✓ Milk storage utensils
- ✓ Feed and water
- ✓ Milking environment

## Steps for Clean Milk Production

- Use "strip cup" for mastitis detection
- Discard milk from affected quarters.
- Post milking teat dipping (Povidone iodine- 0.5% W/V)
- Avoid wet hands milking.
- Dry thoroughly cleaned milking utensil after milking.
- Use stainless steel or aluminium milk cans for milking.
- Practice "full hand" milking method
- Filter fresh milk using clean dry muslin cloth.

# Control Measures for Clean Milk Production

**Control measures (4 categories):**

1. **Animal management at farm level:** Feeding, Housing, Animal health: free of FMD, TB, Brucellosis, Mastitis.
2. **Cleanliness of milking equipment and utensils:** Thermal disinfection with hot water, boiling water or steam. Chemical disinfection with chlorine, iodophors, hydrogen peroxide before 15 min of milking.
3. **Hygienic milking practices**
   - ✓Milker- Free from diseases, trim nail, wear clean clothes and wash hands with soap and water before milking.
   - ✓Follow milking at regular intervals, fast but gentle and complete milking and sanitary methods during milking.
   - ✓Avoid floor sweeping just before milking & feeding roughage during milking.
   - ✓Allow suckling of calf at the beginning of milking.
   - ✓Wash udder and teats for at least 30 sec and dry before milking.
   - ✓Examine fore-stripping in separate utensil/cup.
   - ✓Milker should not wipe his/her hands on the animals' body
   - ✓Follow post milking teat dipping using $KMnO_4$ or iodine solution (Povidone iodine- 0.5% W/V).

## 4. Storage, transport and cooling:

- ✓ Cool milk as soon as possible to a temp below 5 °C.
- ✓ Cooling retard bacterial growth within 2 hours.
- ✓ Before storage filter the milk with a clean cloth.
- ✓ If chilling is not feasible, add preservatives (lactoperoxidase).
- ✓ Store/ transport milk in clean container with lid and keep in a cool and shady place.
- ✓ Take minimum transport time to avoided rancidity.

# Swine management

**Facts about pig and pig farming**

- Early puberty: 6-8 months.
- Breeding age of gilt- 10-12 Month
- Farrowing interval: 6-8 month
- Prolificacy: can farrow twice a year 8-12 piglets in each farrowing.
- Shortest generation interval among meat livestock: quick yield and higher returns
- Market age- 6 month and marketable weight of 70-100 kg (90 kg)
- Dressing - 65-80% (ratio of total consumable meat & total body weight is higher)
- Best: feed conversion ratio (1:3 to 1:5)
- Religious taboos & prejudices
- Male: Female- 1:4 (small holding), 1:8-10 (large enterprise) = **1:10 ideal**
- Selecting replacement stock: select boars and sows from different lines (inbreeding).
- Sows after 6 farrowing may be culled as litter size decline after this
- Estrous cycle- 21 days
- Estrous period 2-3 days
- Ovulation – After 48 hours from onset of estrous
- Best mating time 2$^{nd}$ day of standing heat
- Sow: Have 12 functional teats
- Gestation period- 114 days (3 month, 3 week, 3 days)

# Biological Data of pig:

| Parameter | Value |
|---|---|
| Age at Maturity | 7-8 months |
| Breeding Age of Gilts | 8-11 months |
| Weight at Breeding | 90-110 kg |
| Estrus Cycle | 21 days |
| Heat Period | 2-3 days |
| Gestation Period | 111-114 days |
| Suckling Period | 56-60 days |
| Average Litter Size | 8-12 pigs |
| Market Age | 6 months |
| Market Weight | 70-100 kg |
| Volume of Ejaculate | 200-500 ml |

# Exotic breeds of pig

| Breed | Origin | Color | Characteristics | Boar Weight | Sow Weight |
|---|---|---|---|---|---|
| **Large White Yorkshire** | England | Solid white, occasional freckles | Prolific breeder, excellent mother, good carcass quality, bacon type, good for crossbreeding | 300-400 kg | 230-320 kg |
| **Middle White Yorkshire** | England | White, no wrinkles or spots | High lean meat-to-bone ratio, upturned dished face, short snout, hardy, grows rapidly | 250-340 kg | 180-270 kg |
| **Berkshire** | England | **Black with six white points** | Dished face, erect ears, long arched back, good pork quality, used in upgrading programs | 270-380 kg | 200-290 kg |
| **Landrace** | Denmark | White, occasional freckles | Long body, lop ears, less back fat, high feed efficiency, known for prolificacy | 270-360 kg | 200-320 kg |
| **Hampshire** | USA | Black with white belt | Upright ears, dished snout, excellent carcass quality, leaner meat | 320 kg | 280 kg |

- ✓ **Large White Yorkshire**: Most extensively used exotic breed in India, excellent for crossbreeding.
- ✓ **Middle White Yorkshire**: Known for high lean meat-to-bone ratio, medium size, upturned snout.
- ✓ **Berkshire**: known for its six white points and dished face. Popular for the upgrading programme.
- ✓ **Landrace**: Noted for prolificacy and feed efficiency, less back fat, characterized by lop ears. Highest quality bacon in the world.
- ✓ **Hampshire**: Known for excellent carcass quality, black with white belt.

| Breed | Origin | Color | Characteristics | Boar Weight | Sow Weight |
|---|---|---|---|---|---|
| Duroc | USA (New York, New Jersey) | Cherry red (light to rich) | Two-thirds ear lop, arched back, excellent mother, large size, fast growth rate | 400 kg | 350 kg |
| Tamworth | England | Golden red | Long snout, large erect ears, good bacon type, prolific and careful mothers, excellent foragers | 350 kg | 250-300 kg |
| Chester White | USA (Pennsylvania) | White, bluish spots | Good growth rate, prolific breeder, used for bacon production | - | - |
| Hereford | USA (Missouri) | Two-thirds red, white face | Similar to Hereford cattle, good meat quality, white must appear on feet and extend above hoof | - | - |
| Poland China | USA (Ohio) | Black with six white points | Quiet temperament, good carcass quality, drooping ears, large size, criticized for smaller litter size | **Heaviest pig breed (Big Bill: 1,158 kg)** | - |

- ✓ **Duroc**: Large frame, cherry red color, excellent mothering ability, fast growth.
- ✓ **Tamworth**: Excellent foragers, Golden red, bacon type, long snout and erect ears, prolific.
- ✓ **Chester White**: White with bluish spots, good for bacon production.
- ✓ **Hereford**: Two-thirds red in color with a white face, similar to Hereford cattle.
- ✓ **Poland China**: Black with six white points, good carcass quality, drooping ears.

# Native Breeds of Pig

| Breed | Home tract | |
|---|---|---|
| Ghoongroo | West Bengal | Mostly black coloured with typical 'Bull dog' face appearance |
| Niang Megha | Meghalaya | Reared for pork and bristle purpose. |
| Agonda Goan | Goa | -- |
| Tenyi Vo | Nagaland | -- |
| Nicobari | Andaman& Nicobar | Symbol of pride; Socio-cultural activity/ ceremony |

Andamani (Andaman & Nicobar)

# Care of new born piglet

- Cut the umbilical cord 2-3 inch long and apply antiseptics
- Do not clip the umbilical cord immediately after expulsion: done about 20 to 23 minutes after birth (failure in blood clotting mechanism and umbilical artery keeps beating) – bleeding and death. Cut 3-5 cm from the body, and dipped in 2% iodine or 70% ethyl alcohol for disinfection.
- Castration: Can be done at 4-8 weeks, but
- Early Castration: Best done at the age of 5-10 days: Reduces the boar odour (**boar taint**) from the animals and prevents premature mating in mixed-sex groups of fattening hogs.
- Provide clean, dry, draft free environment with temp of 30-32°C
- Extra care during 1st 3-5 days: Minimize crushing, Assist piglets to suckle
- Supplement feed or do fostering
- Solid feed as early as possible
- Weaning age: 56 days (8 weeks)
- Weaning weight – 10 kg and above
- Post weaning gain – 250 gm or above per day
- Needle teeth -Piglets are born with 4 pairs sharp canine teeth (2 pairs on each jaw): **Cut on the 1st day** to prevent injuries

- **Piglet anemia prevention:**
  - ✓ Add small amount of iron and copper in pigs diet @ 25 mg of iron and 5 mg of copper/day/pig.
  - ✓ **Iron sulphate** – 1 g Ferrous sulphate in 25 ml of water
  - ✓ **Udder Paint**: Iron sulphate - 500 g, Copper sulphate - 70 g, Sugar - 500 g, Water - 10 lit
  - ✓ IM inj. 150-200 mg iron-dextrose compound: 3 days (4 and 14$^{th}$ day): stressful

1.

- **Feeding of pigs:**
  1. Creep feed/ Prestarter: 24% CP, from 14 to 56 days (2$^{nd}$ weeks); end of 3rd week the weight should be 5 kg
  2. Starter: 20-22% CP, from 5 kg to 20 kg BW or till 8th week of age
  3. Grower: 18% CP, from 20 kg to 35 kg
  4. Finishers: 16% CP, growth from 35 to marketable weight (70-75kg)

# General care and management

- Simple low cost houses constructed with locally available materials as per above guidelines are preferred in rural areas. Multipurpose pens, which can be used, for all categories of pigs can also be designed meeting the floor space requirement.
- Boars, pregnant and dry sows, gilts and growing pigs are usually kept in open yards with partially sheltered area. Farrowing sows are housed in completely enclosed houses or pens.
- Individual or group housing in cages made up of vertical G.I. pipe and also farrowing crates can be adopted in large high-tech farms.
- Uncastrated males and females should not be housed together beyond the age of four months.
- Flushing: special feeding during breeding season before mating or service
- Ridding test: for standing heat. Female pig that are in standing heat will allow a person to sit on their back and will stand rigidly along with erection of ear. This immobility of sow when manual pressure is applied on back is called as ridding test.

**Vaccination and deworming**

| Vaccination | Age at first dose | Booster | Time | Route |
|---|---|---|---|---|
| Swine fever | 2 month | 6 months | Annually | I/m |
| FMD | 2 months | 6 months | 6 months | S/c |
| Swine erysipelas | After weaning | 3-4 weeks | 1 year | Oral |

| Deworming (every 6 months and 2-3 wks before farrowing) | |
|---|---|
| Ivermectin | 1mg/ 33 kg b wt. |
| Fenbendazole | 5mg/ kg b wt. |

# Pig rearing system

1. Scavenging system: cheapest, Most traditional system, reared with kitchen and agricultural waste. But, high rate of parasite, poor growth rate, high piglet mortality
2. Extensive systems: outdoor system, less expensive
3. Semi-intensive system: Backyard system with confinement
4. Intensive system: indoor system → commercial/ large-scale pig production
5. Integrated system: Combines pig production with other enterprises.

# Floor space, feeding and Watering space requirement of different category of Pigs

| Type of animal | Floor space requirement ($m^2$ per animal) | | Maximum number of animal/pen | Feeding / Watering Space/animal (cm) | Feed mangers (Width x Depth x Height of inner wall ) | Height of the shed (cm) |
|---|---|---|---|---|---|---|
| | Covered space | Open paddock | | | | |
| Fattener (3-5 m) /Weaner | 1 (0.9-1.2) | 1 (0.9-1.2) | **30** | 25-35 | 30 x 15x 25 | 200-250 |
| Grower (> 5 m) | 1.5 (1.3-1.8) | 1.5 (1.3-1.8) | **30** | 25-35 | 30 x 15x 25 | |
| Sow / Gilt | 2.5 (1.8-2.7) | 1.5 (1.4-1.8) | **3-10** | 60-75 | 50 x 20 x25 | |
| Boar | 6 (6.0-7.5) | 10 (9.0-12.0) | **Individual** | 60-75 | 50 x 20 x25 | |
| Farrowing pen / Lactating sow | 8 (7.0-9.0) | 10 (9.0-12.0) | **Individual** | 60-75 | 50 x 20 x25 | |

| Category | Covered ($ft^2$) | Open ($ft^2$) |
|---|---|---|
| Weaner | 10-15 | 15-20 |
| Grower | 12-20 | 20-30 |
| Boar | 35-50 | 50-70 |
| Lactating sows | 70-100 | 70-100 |
| Dry sow | 20-30 | 30-50 |

**Culling Practices for swine:** As litter size typically increases up to the fifth or sixth pregnancy, it is advisable to cull sows after the sixth litter as their productivity declines.

# Reproductive Management:

| Management | Details |
|---|---|
| Boar Selection | Healthy, good libido, 18-24 months, 300-400 kg, **1 boar per 10 sows** |
| Sow Selection | Good mothering ability, 8-11 months, 90-110 kg at first breeding, 12 well-spaced functional teats |
| Estrus Detection | Swollen vulva, restlessness, vocalization, standing heat |
| Estrus Cycle | 21 days |
| Heat Duration | 2-3 days, peak on the second day |
| Gestation Period | 111-114 days (3 months, 3 weeks, 3 days) |
| Mating Management | First day for gilts, second day for sows |
| Piglet Care | Navel disinfection, needle teeth clipping, iron supplementation, castration |
| Weaning | 6-8 weeks, gradual transition to solid feed |
| Temperature Control | 30-35°C for newborn piglets |
| Breeding age | Farrow at 12-14 months |

**Systems of Farrowing:**

- **Two-Litter System:**
  - **Advantages:** Maximum use of capital investment in buildings and labor with two litters produced per year.
  - **Disadvantages:** Higher maintenance costs for sows throughout the year and increased piglet losses.
- **One-Litter System:**
  - **Advantages:** Reduced management and capital requirements. Gilts are weaned and finished for market after their first litter.
  - **Disadvantages:** Lower overall production, with less efficient use of facilities and uneven distribution of labor.
- **Multiple Farrowing System:**
  - **Advantages:** Ensures a continuous flow of pigs to the market and better use of labor and facilities. The sow herd is divided into groups farrowing multiple times per year.
  - **Disadvantages:** Higher risk of disease outbreaks and the need for consistent skilled labor.

# Methods of Mating

**1. Hand Mating:** The practice of bringing the sow to the boar for individual service when in standing heat.

- Efficient use of boar power; Accurate farrowing dates; Detection of repeat breeders and breeding defects.
- Hand mating allows for controlled breeding, improves conception rates, and ensures accurate farrowing dates.

**2. Pasture Mating:**

- Boar is allowed to run freely with the sows. An aggressive boar can serve 15-20 sows in a pasture.
- Pasture mating is less controlled but can be effective in systems where boars are allowed free access to sows.

**3. Artificial Insemination:**

- AI allows efficient use of semen, with one ejaculate potentially breeding 15-20 sows when suitable methods for storage and extension are used. AI enhances boar efficiency and is particularly useful in large-scale breeding operations.

# Breeds of camel

- **Old world camels:**

1) Arabian camel/ dromedary: one-humped camel: *Camelus dromedaries* → 94% of the world's camel population
2) Bactrian camel: double humped camel: *Camelus bactrianus*
   - **Wild Bactrian camel** is a separate species and is now critically endangered.

- **New world camels** (South American Camels): Llama, Alpaca, Vicuna, Guanaco.

**Classification of Indian camels:**

A)Baggage camels are heavier, hence are suitable for the plains and other hilly areas, with sturdy musculature of legs. Good for riding at 3 years of age and can carry 2-3 qt load. E.g Bikaneri, Marwari, Jalori, Mewari.

B)Riding camels are strong, sturdy, having thinner legs and their muscles are comparatively less developed. Good for racing and carrying load and can cover 95- 115 km at a stretch, speed10-11 kmph. E.g. Jaisalmeri (30 Km/hr.)

# Common terms related to camel

- **Raikas** – People living in jungles which breed camel.
- **Jheephras**- Animals (Bikaneri) which have luxuriant growth of black hairs on their eyebrows, eyelids and ears.
- **Pangal**- People of Jaisalmer call camel by name of pangal.
- **Jhool** – blanket put over camel at night to protect camel from cold.
- **Trinkets** – trinkets are made of bronze as ornaments are tied to fore arm and knee joint of camel.
- **Glandular sacs-** 2 extra compartments in rumen of camel supposed to be reservoir
  of water.
- **Jhooling/ jhoolak** – contagious disease of camel.
- **Kapali**- camel disease that causes inflammation of facial vein and tissues behind the eye.

- **Windgall of fetlock joint-** painless enlargement of synovial bursa at the back of fetlock of fore leg or hind leg.
- **Poll glands-** glands in pole region whose secretion become hyperactive during breeding season.
- **Stop** - it is well developed temporal fossa in certain breeds of camel just above the eye.
- **Pedestal**- chest pad in came is known as pedestal.
- **Front seat-** area from wither to hump.
- **Back seat** - area from hump to rump.
- **Knee callosity** – a callosity (thickened area) at knee joint.
- **Stifle callosity-** a callosity at stifle joint.
- **Rut or Musth-** both male and female have well defined period of breeding is known as rut. November to February
- **Gulla/ Dulla**- At the time of rut male constantly swallows air. During belching out, diverticula of soft palate gets ballooned out with expired air on one side of mouth like pink bladder which is withdrawn after few seconds is known as gulla.

- **Cocking of tail**- Two to three weeks after service she camel which has conceived can be distinguished by way that she develops tendency to raise tail upward whenever approached by male or handed by a man.
- **Rama**- Hybrid of camel and Llama is known as Rama.

## Peculiarities of camel:

1. Pseudoruminant/Special Ruminant: 3 compartments of stomach, walk on the pads of the two last digits (soft padded feet) instead of on the sole of the foot, no horns. Omassum absent.
2. Hump: Reservoirs of fatty tissue, not water. This fat metabolizes to release energy.
3. Nostrils: When the camel exhales, water vapor becomes trapped in their slit like nostrils and is reabsorbed into the body as a means to conserve water. Withstand water up to **30%** of body weight loss and recoup up to 96% of lost body weight after single rehydration. Camels lose only 1.3 liters of fluid intake every day while the other livestock lose 20 to 40 liters per day.
4. RBCs: Unlike other mammals, camels' RBCs are oval rather than circular in shape. This facilitates the flow of red blood cells during dehydration and makes them better at withstanding high osmotic variation without rupturing when drinking large amounts of water.

4. Body temperature: Camels are able to withstand changes in body temp.
5. **Rete mirabile**: Maintaining the brain temperature within certain limits is critical for animals. To assist this, camels have a *rete mirabile*, a complex of arteries and veins lying very close to each other which utilizes countercurrent blood flow to cool blood flowing to the brain.
6. No sweating: Camels rarely sweat, even when ambient temp. reach 49°C, to conserve water.
7. Thick body coat: thick coats insulate from intense heat radiated from desert sand. During the summer the coat becomes lighter in color, reflecting light as well as helping avoid sunburn.
9. Long legs: camel's long legs help by keeping its body farther from the ground, which can heat up to 70°C (158 °F).
10. Pedestal: Dromedaries have a pad of thick tissue over the sternum called the *pedestal*. When the animal lies down in a sternal recumbent position, the pedestal raises the body from the hot surface and allows cooling air to pass under the body.

10. Camel pads: keratinized skin areas i.e. one pad on each knee, elbow, stifle and hock.
11. Mouth: Camels' mouths have a thick leathery lining, allowing them to chew thorny desert plants.
12. Protection from sand: Long eyelashes and ear hairs, together with nostrils that can close, form a barrier against sand. If sand gets lodged in their eyes, they can dislodge it using their transparent third eyelid. The camels' gait and widened feet help them move without sinking into the sand.
13. Kidneys and intestines: The kidneys and intestines of a camel are very efficient at reabsorbing water. Camel urine comes out as a thick syrup, and camel faeces are so dry that they do not require drying when using as fuel fires.
14. Sexual Behavior: Male camels exhibit little sexual activity outside a specific rutting season. The male dromedary camel has an organ called a dulla in its throat, a large, inflatable sac he extrudes from his mouth when in rut to assert dominance and attract females. It resembles a long, swollen, pink tongue hanging out of the side of its mouth. During rutting, the soft palate of the camel increases in length. It then hangs out of mouth on one side and is called ‘Dulaa
15. In contrast to other ruminants, camel is hornless and has no gall bladder. Udder is four quartered.
16. Dentition differs from other ruminants in that there is a pair of well developed and pointed canine teeth in each jaw. There are long conical papillae on inside of the cheeks directed backwards, thus the camel can browse at the thorny plants without any harm. The canine teeth help the camel to take into grip the twigs and remove them from the trees.
17. Physiological Parameters: Body Temperature changes from 34ºC in morning to 41ºC in the afternoon. Normal Resting Heart Rate: 34 (24-48)/ Minute. Respiration rate: from 6-11 to 8-18 breaths per minute.

# Utility of camel:

**A. Working animal (Pack animal):**

- Camels can produce one horse power energy for long duration of work.
- Camel can carry load to 25-40 % of their body weight depending on the distance traveled and speed for load carrying operation.
- Camel can travel 100-120 Km in a day with a speed of 25-30 Kms per hour; bearing a load of 200-250 Kgs.

**B. Milk Animal:**

- Indian camels yield 3.5 kg to 10 kg of milk per day. The constituents of camel milk are, Fat 4.8 % Protein 3.8 % Lactose 5.1 % Ash 0.9 %
- The taste of camel milk depends upon availability of plants for grazing. Milk is salty, contains more insulin, hence useful for diabetic patients.
- Camel milk has medicinal value and is useful in curing some of the human diseases like jaundice, TB, asthma due to diversified type of grazing.
- Curd and ghee cannot be prepared from this milk as it contains more of salt and less fat

**C. Meat animal:**

- Camel meat is coarse and tough. It is consumed by many people in the Gulf and South Asian countries.

**D. Byproducts from camel:**

- Camel hair has important value utilized for preparation of blankets, rugs, fabrics, painting brushes, ropes, bags, mats etc. Camel leather is useful for making shoes and toys.
- Camel gut is useful for making handicrafts and suturing material.
- Skin is used for making handles for various fancy articles such as knives, powdered bone is used as “fertilizer”.
- The bones of the legs are used as pegs for tents by the desert dwellers where wood is not available.

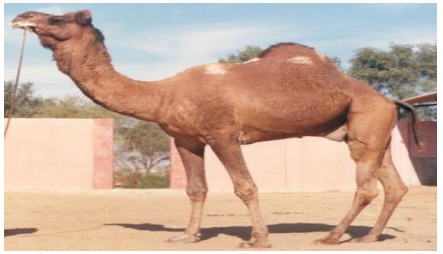
# Important Indian breeds of camel:

| | Breed | Home Tract |
|---|---|---|
| 1 | Bikaneri | Rajasthan |
| 2 | Jaisalmeri | Rajasthan |
| 3 | Jalori | Rajasthan |
| 4 | Kutchi | Gujarat |
| 5 | Malvi | Madhya Pradesh |
| 6 | Marwari | Rajasthan |
| 7 | Mewari | Rajasthan |
| 8 | Mewati | Rajasthan and Haryana |
| 9 | Kharai | Gujarat – Swimming Camel – Tolerant to high salt water |
| 10 | Double humped | Ladakh (Nubra valley) |

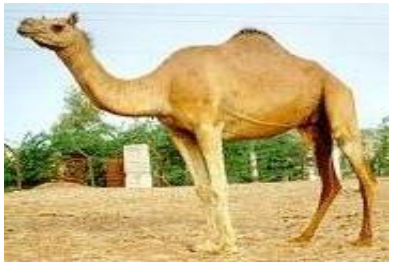
## Exotic breeds of camel:

1. Afghan
2. Iranian
3. Egyptian

**Bikaneri:**



- It is a multi purpose breed, classified on weight as heavy and is slow in work.
- They have no stop, muzzle is loose. Lower lip droops and teeth are visible from a distance. Their colour varies from dark brown to light brown and dark red to brown red.
- Some animals have jeepras.



**Jaisalmeri:**

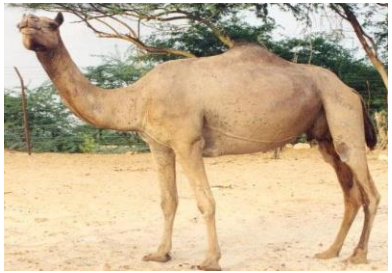
- Well known for riding and race potential (30 Km/hr).
- No "Stop“ and Jheepra.
- Camel Corps constitutes an important wing of the BSF of Indian para-military service.

**Sindhi:**

- Heavy breed and can walk in marshy land without sleeping.
- Good for pack purpose.
- The camels of this breed have short, less curved smaller neck.
- Two types: a. Muhri- riding camel , b. Laddu – Baggage camel

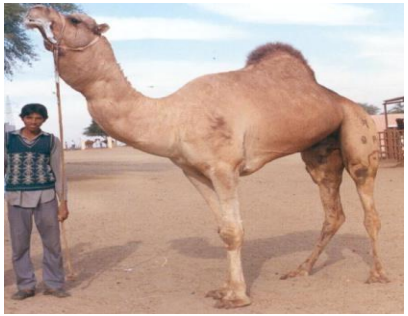
**Kutchi:**

- Dark brown or red color.
- Absence of hair on eyelids and ears.
- Lethargic in work and mostly used as a companion animal or maintained for fancy purpose.



**Marwari:**

- Long massive legs, mainly used for transport.
- Well known for milk production potential.
- Head is small. The face is long and narrow and devoid of stop.
- The muzzle is slightly loose and lower lip drops a bit.



**Jalori:**

- It is a crossbred between Marwari and Jaisalmeri, having origin the southern part of the river Luni.
- The breed is smaller in size and mainly used for transport.

# Equine management

## Zoological Classification

- **Horse:** *Equus caballus*
- **Donkey:** *Equus asinus*
- **Mule:** Equus caballus x Equus asinus (sterile).

**Uses of Equines**: Pack Animals (transportation), Racing and Sports, Military and Police, Donkeys for the economy of landless laborers and small farmers, Mules by military and for heavy-duty civilian work and; medical Use (Horses for producing antitoxins e.g., tetanus).

## Types of Horses

- **Thoroughbred Horse:** Racehorse with a registered pedigree (Jockey Club), mainly used for racing.
- **Half-bred Horse:** Racehorse without a registered pedigree.
- **Purebred Horse:** Horse entered in the studbook of a breed society.
- **Light Horse:** Horses used for riding, racing, and driving; height 14.2-17 hands, weight 408-635 kg.
- **Cob:** A short-legged, stocky horse used for riding and driving.
- **Aged Horse:** A horse over 8 years old.

## Ponies and Donkeys

- **Pony:** Small horse measuring under 14.2 hands, weight 136-400 kg.
- **Ass (Donkey):** Smaller than horses with long ears, short erect mane, and a gestation period longer by one month than horses (i.e. 12 months).
- **Jack:** Male donkey used to produce mules when bred with a mare.
- **Jennet:** Female donkey; produces a hinny when bred with a stallion.

## Horse Movements and Gaits:

- Walk: A slow, four-beat gait.
- Trot: A two-beat diagonal gait where the opposite front and back legs move together.
- Canter: A three-beat gait.
- Gallop (Run): A fast, four-beat gait.

## Classification of Horses

| Character | Ponies | Light Horse | Draught Horse |
|---|---|---|---|
| Height (M) | < 1.47 | 1.47 to 1.52 | 1.47 to 1.52 |
| Weight (Kg) | 200 to 400 | 400 to 600 | 600 and above |
| Uses | Pack work | Riding and pack | Riding & Heavy work |

# Breeds of horse

| Utility Type | Breed | Region | Characteristics |
|---|---|---|---|
| Riding/Endurance | Marwari | Rajasthan, Gujarat | Known for distinctive inward-turning ears, hardy, excellent stamina and endurance, often used for riding and ceremonial purposes |
| | Kathiawari | Gujarat | Close relative of Marwari, known for endurance, adaptable to arid conditions, used for riding and cavalry |
| | Bhutia | Sikkim, West Bengal | Small, sturdy, sure-footed, well-suited for mountainous terrain, often used for riding and pack purposes in hilly regions |
| Cavalry/War | Marwari | Rajasthan | Historically used in battle due to bravery, agility, and loyalty; still used in ceremonial roles and equestrian sports |
| | Manipuri | Manipur | Small, strong, and agile, traditionally used in warfare and for playing polo, one of the original breeds for polo sports |
| Pack/Work | Spiti | Himachal Pradesh | Strong, resilient, suitable for carrying loads in mountainous terrain, adapted to cold climates |
| | Zanskari | Ladakh, Jammu & Kashmir | Tough and resilient, adapted for high-altitude and cold regions, used for pack work and transportation |
| Polo/Sports | Manipuri | Manipur | Known for agility and stamina, primarily used in polo due to their speed and maneuverability, small but powerful |
| | Marwari | Rajasthan | Used in equestrian sports and ceremonial riding, prized for its stamina and unique appearance |
| Ceremonial/Parades | Marwari | Rajasthan | Often used in royal ceremonies and parades, distinctive appearance with inward-facing ears, known for its majestic presence |
| | Kathiawari | Gujarat | Frequently used in ceremonial events due to its elegance, distinct facial structure, and endurance |

# Colors of horses

- **Albino:** Skin is un-pigmented and covered with white hairs
- **Bay brown**: Predominant color is brown with bay muzzle, black limb, mane and tail
- **Black**: The black melanin pigments in general is seen throughout the coat of the body, limbs, mane and tail.
- **Black brown:** The predominating color is black with muzzle and sometimes flank have brown or tan color.
- **Brown:** It is Mixture of black and chocolate colored hairs on the body coat, limbs, mane and tail are black.





- **Grey:** Skin is black with admixture of black white hairs
- **Study grey:** Black hairs are predominant in the neck, head, shoulder and rump.
- **Chestnut:** Body and legs are covered by yellow colored hair. The sheds very from bright chest to gold red dark chestnut to liver which is darkest of all. The mane and tail are chestnut, sometimes lighter and sometimes darker than body colour but never black.

- **Skewbald:** The body coat consists of large irregular patches of white and any other colour except black.
- **Piebald (black and white):** Body coat consists of large irregular big patches of black and white.

# Marking of horses

- Star: A white mark on the forehead either large or small

- Blaze: A white marking covering almost the whole of the forehead between the eyes and extending down the front of the face beyond the width of the nasal bone and usually involving the muzzle

- Stripe: A thin or broad narrow white marking running down the face

- Interrupted stripe: Star and stripe appears as two distinct spots

- Wall eye: It is due to the lack pigment either partial or complete, it gives bluish white or pinkish white appearance to the eye

- White face: White colour covers the whole of the forehead and front of the face, extending laterally top the mouth either unilaterally or bilaterally

- White muzzle: Both lips will be white and extends to the region of the nostrils

## Dentition and Ageing of Horses

- The **age** of a horse can be estimated by examining its incisor teeth. This method is valuable for non- pedigree animals. The information is crucial for:
- **Issuing soundness certificates**
- **Valuation of livestock**
- **Selection and purchase** decisions

## Dental Formula of Horses

- **Temporary:** 3/3, 0/0, 3/3, 0/0
- **Permanent:** 3/3, 1/1, 3/3, 3/3. Sometime, (3/3, 1/1, 4/4, 3/3 ) if wolf premolars teeth are present.

**Dental star:**

- Yellowish-brown mark that appears on a horse's tooth as it wears down, and is used to estimate the horse's age.
- Dental star will appear in the central incisors at 8 years, intermediates at 9 years & corners at 10 years.

**Bishoping:**

- Fraudulent practice of attempting to make an old horse's teeth appear younger by rashping and leveling. A false mark is gouged into the tooth and blackened with chemicals like silver nitrate.
- Clues to spot bishoping include the angle of teeth, absence of enamel, and signs of rasping.

## Dimensions of Stalls

| Size of Animal | Length (m) | Width (m) | Height (m) |
|---|---|---|---|
| Small horse | 3.0 | 2.5 | 1.9 |
| Light/average/medium | 3.5 | 3.0 | 1.9 |
| Large | 4.0 | 3.5 | 1.9 |

- Stallion Boxes: 14 ft x 14 ft (4.27 m x 4.27 m)
- Mare Boxes: 12 or 14 ft x 14 ft (3.66 m x 4.27 m)
- Foaling Boxes: 14 ft x 16 ft (4.27 m x 4.88 m).

**Note:**

- Sex Ratio: 1 stallion can cover 30-40 mares
- Foal Heat (Post-Parturient Estrus): Foal heat typically occurs 9-11 days after foaling. Covering during foal heat is common but should be avoided if complications occurred during foaling, such as retained placenta or birth trauma.
- Horses are seasonal breeders:
    1. Spring Season (Primary): February to June is the ideal breeding season
    2. Autumn Season (Secondary): September to November

- **Doping in Horses:** administration of any substance, drug, or food designed to alter an animal's performance in competitions or races. Also called ergogenic aid e.g. Sod. Bicarbonate, thiamine.

# Preparation of animals for Show

- About 2600 livestock fairs and shows every year throughout India.
- All India cattle show society, started in 1939, with a grant of Rs.2,25,000/- which conducts the All India Cattle show every year in various parts of the country.
- Two unique cattle fairs: Cattle fair at Rohtak, Haryana and Sonepur cattle fair in Bihar, during November-December.

**Preparation of animals:**

**1. Selection of animals**

- Select only competitive animals to have a chance to win their respective age class in the competition. General musculature of the body should be given due consideration with well developed firm udder in females.
- Selection of show animals should be made well in advance.

**2. Conditioning the animals**

- Proper feeding of show animals is very important for a fair amount of flesh.
- Linseed meal popular feed to give gloss to the hair and quality to the hide.
- Animals should be on same feeding practices that they will receive during the show period.

**3. Training the animal for show**

- The animal must be trained to lead and stand properly.
- Train to walk slowly taking short steps with head up and alert, to stand with its weight evenly distributed on all the four feet and with their feet in proper position and to respond to a light touch from the leader. Avoid physical abuse for training.

**4. Clipping**

- Enhance the appearance of the animal.
- Main areas: head, ears, neck, tail, udder and mammary gland.
- clipping some of the hairs from the hocks, leg and brisket enhance the appearance.
- Clip about one month before the show, but, can be re-clipped within a few days of the show.

**5. Hoof trimming**

- Long toes and misshaped hooves detract the appearance of the animals and make it difficult for them to walk and pose properly.
- Done at least 2 to 4 weeks earlier of the show.

**6. Brushing**

- Stimulates the circulation of blood and help a glossy coat of hair. Also removes dirt, dust and loose hair.

**7. Washing**

- The hairs should be washed thoroughly.
- Keep the animals, lightly blanketed to avoid exposing them to cold until they dry.
- Animals should be washed and dry before clipping. They should be rewashed within 12-18 hours of show time.

**8. Blanketing**

- Helps keep the coat clean and smooth.

**9. Transporting**

- Avoid feeding large amount of concentrates and succulent feeds within 12 hours of transportation to avoid defecating during transport and are clean on arrival.
- Reach the destination at least 2-3 days ahead of the actual time of show to allow the animals to adjust to new surroundings and to get in best shape before show.

**10. Final preparation**

- The rules and methods of particular show should be studied carefully.
- The timing of last milking before the show should be determined by milking interval at which the udder looks a best. It is very important to anticipate the approximate time when a particular class will be shown.
- Perform the pre-show milking in accordance with the show time so that the correct amount of milk will be in the udder at the show time.
- Most showmen prefer to feed liberal amount of hay but to withheld water, concentrate and succulent feeds for a period starting from 12-15 hours before the show time. This helps to ensure a good appetite during the show time.

**11. Showing**

- The exhibitor should do brushing, cleaning and haltering nearer to the place where the class is called for show.
- He should lead his animal around the ring in a clockwise direction, holding the halter strap on his left hand and walking backward. This enables him to see both his animal and the judge.
- The cow normally stand with the left rear leg nearest to the judge slightly ahead of the other rear leg and with the front feet evenly spaced wide apart.

**12. Showing ethics**

The following things should not be done to maintain the showing ethics:

1. Misrepresenting the age and / or milking status of the animal for class in which it is shown.
2. Balancing the udder by any means by leaving naturally producing milk in any or all quarters
3. Blocking the nerves to the foot to prevent limping, by injecting drugs.
4. Striking the animal to cause swelling in a depressed area
5. Insertion of foreign material under the skin.
6. Changing the colour of hair at any point/ spot on the animal body
7. The use of alcoholic beverages in the feed or through a drench
8. Criticizing or interfering with the judge, show manager or other exhibitors.

**Advantages of fairs, and shows:**

1. Provides opportunity to the breeders to exchange ideas with fellow dairymen.
2. It develops a healthy spirit of competition among the farmers and provide them incentive for development of cattle.
3. It encourages uniform standard of the husbandry practices.
4. Maintaining the dairy interest of many youngsters.
5. Attending fair or show can be a valuable learning experience.
6. Provide opportunity to field and extension workers to understand the local problems of husbandry and it will also educate the farmers in newer techniques of dairy farming.
7. Excellent means of advertising cattle and contacting prospective buyers.

# Preparation of birds for show

**1. Selection of Show Birds**: Choose birds that meet the breed standard and birds with good temperament,

**2. Health Check and Nutrition**

- Provide a balanced diet, administer deworming and parasite control treatments several weeks before the show to prevent signs of infestation.

**3. Grooming and Cleaning**

- Begin conditioning feathers weeks in advance by bathing birds in lukewarm water with mild soap or bird shampoo.
- Trim beaks, nails, and spurs carefully, avoiding over-trimming to prevent discomfort.

**4. Feather Conditioning**

- Avoid handling the birds roughly to prevent feather damage. Regularly check for and remove broken or damaged feathers.
- For birds with white feathers, avoid sunlight that might cause yellowing..

**5. Training for Handling and Posing**

- Spend time handling the birds daily to accustom them to human contact, which reduces stress on show day.
- Train them to stand calmly and display well, mimicking show conditions to reduce anxiety.

**6. Final Touches Before the Show**

- Transport birds in a clean, secure crate with sufficient ventilation and bedding.
- Upon arrival, clean any dirt from the journey, especially around the beak, legs, and feet. Do a final check to ensure feathers are smooth.

**7. Presentation and Etiquette**: Present birds confidently but handle them gently and respectfully.

# Poultry science
# &
# Lab animals

# Laboratory animals

An animal which has more or less similar physiological and body composition with various biological systems as human beings, which are tiny, easy to handle, less expensive and co-operative are called as laboratory animals.

## Types of Laboratory animals:

Mice, Rats, Hamster, Guinea Pigs, Rabbits are popular Laboratory animals.

- Gnotobiotic animals: -

  Animals with known microbes such as virus, bacteria, fungi and protozoa is said to be gnotobiotic animals. This animal has to be bred in controlled environment in the equipment called isolator. They are foundation stocks for producing specific pathogen free animals.

- **Specific Pathogen Free Animals: -**

  An animal which is made free from specific or particular microbe is known as SPF animals.

- **Germ free animals: -**

  An animal which don’t have any demonstrable microbe is known as germ free animal.

- **Institutional Animal Ethics Committee (IAEC):** a group of people who review and approve research proposals that involve the use of animals. Constituted in 2006.
- CPCSEA: Committee for the purpose of control & supervision of experiments on animals under rule. It is statutory Committee of Department of Animal Husbandry and Dairying (DAHD).
- “Laboratory Animal Bureau” was set up in India in 1947.
- 24$^{th}$ April World laboratory day

- Mice: *Mus musculus*
- Rat: *Rattus norvegicus*
- Guinea Pig: *Cavia porcellus*
- Hamster: *Mesocricetus auratus*
- Rabbit: *Oryctolagus cuniculus*

# Biological & Physiological data of laboratory animals:

| Parameters | Mice | Rat | Guinea Pig | Hamster Syrian/Chinese | Rabbit |
|---|---|---|---|---|---|
| Birth Weight (gm) | 1-1.5 | 6-7 | 70-100 | 20 | 50-70 |
| Body weight (adult gm) | 30-40 | 250 | 800 | 80-90/35-40 | 1500-5500 |
| Daily feed consumpt.(gm) | 5-6 | 15-20 | 45-50 | 10-15/10 | 200-250 |
| Age of first mating (M) | 1.5-2 | 2.5-3 | 3 | 2-3/2-3 | 6-7 |
| Age for experiment(M) | 45(days) | 1.5 | 3 | 1/1 | 6 |
| Heart rate (beat/min.) | 330-750 | 310-500 | 250-400 | 315-410/310-400 | 150-300 |
| Respiration rate /min. | 85-230 | 70-180 | 70-110 | 35-130/30-125 | 40-60 |
| Sex ratio (Male : Female) | 1:3 | 1:5 | 1:6 | 1:1 | 1:1 |

| Parameters | Mice | Rat | Guinea Pig | Hamster Syrian/Chinese | Rabbit |
|---|---|---|---|---|---|
| Blood Volume (% of Body Wt.) | 7-10 | 5-7 | 6-12 | 6-9/6-10 | 5-8 |
| Life span (Years) | 1.5-2.5 | 2-3 | 3-5 | 2-3/2-3 | 5-6 |
| Gestation period (Days) | 20-21 | 21-22 | 65-67 | 16/21 | 31-32 |
| Litter size | 7-12 | 8-10 | 3-4 | 5-7/4-5 | 6-8 |
| Age at Weaning (Weeks) | 3 | 3 | 2-3 | 3½/3 | 7 |
| Litter/year | 8-10 | 7 | 4-5 | 10/7 | 4-5 |
| Rest period for females in between 2 mating(days) | 15 | 15 | 15 | 18/15 | 20 |
| No. Of pairs of mammary gland | 5 | 5 | 1 | 6-7/4 | 3-4 |

## Mice and Rat:

Nature: - Prolific breeder

Puberty: - 4 to 6 weeks

Mating: - 8 to 9 weeks, early mating reduces fertility.

Estrous duration: - 4 to 5 days.

Gestation period: - 20 to 22 days.

Birth weight of young ones: - 1 to 1.5gm

Litter size: - 10 to 12

Weaning weight: - 10 to 12gm and age 21 days.

Detection of successful mating: Presence of sperm in vagina smear or copulatory plug (solidified semen) in vagina.

## Hamster:

Puberty: - 4 to 6 weeks.

Mating age: - 8 to 12 weeks.

Weight at mating: - Syrian- 80 to 90gm

Chinese- 35 to 40gm

Estrus duration: - 4 to 5 days.

Mating: - Hand mating is followed.

Gestation period: - 16 to 18 days.

Litter size: - 5 to 7

Weaning age: - 20 to 25 days and weight 15gm.

Male and female housed in separate quarters, brought together only at the time of mating and separated again immediately after mating, otherwise female may cause serious injuries to tail and testes of male.

## Guinea Pig:

Puberty: - 4 to 5 weeks.

Mating age: - 9 to 11 weeks.

Weight at mating: - Male- 900 to 1500 gm

Female- 700 to 1300gm.

Estrous sign: - Hip swaying, mounting activity, unsteady movements.

Mating: - Polygamous

Furrowing: - Communal i.e., group of females farrows in common pen.

Gestation: - 60 to 75 days.

Birth weight: - 45 to 50gm.

Litter size: - 5 to 6.

Weaning weight: - 160 to 230gm.

Guinea pigs can not synthesize Vitamin as they lack the enzyme (L-gulonolactone oxidase) that converts L-gulonolactone to L-ascorbic acid

# Rabbit

- Class: Mammalia
- Super order: Glires
- Order: Lagomorpha
- Family: Leporidae (Hares, Rabbits)
- Genus: Oryctolagus
- Species: Cuniculus

All domestic rabbits originated from the European wild rabbits. Today Europe accounts for 85% of total world output. China comes next.

## Common terms related to rabbits:

**Doe: -** A mature female rabbit used for breeding.

**Buck: -** A mature male rabbit used for breeding.

**Kit: -** A young rabbit whose eyes are not yet opened.

**Bunny: -** A young rabbit below 20 weeks of age.

**Fryer: -** 10 to 12 weeks old rabbit ready for market.

**Roaster: -** Culled rabbit.

**Kindling: -** Act of parturition.

**Litter: -** Kits born in a single kindling.

**Weaner: -** A newly weaned rabbit.

**Fur: -** Wool.

**Pelt: -** Skin.

**Rabbitry: -** Place where domesticated rabbits are kept.

**Caecotrophy/Copropargy: -** Consumption of own feceal matter.

**Broiler: -** Rabbits which grow very fast for meat purpose (2kg body wt. In just 12 weeks).

**Fostering: -** Transfer of bunny/bunnies to another doe for nursing usually due to death of original doe or abandoning of young rabbit.

**Tattooing: -** Identification marks put in the ear of rabbit with tattoo ink and punch.

**Cannibalism: -** Eating of own bunnies by mother doe after kindling, noted usually due to inadequate water supply to pregnant doe.

**Nest box: -** A wooden box to be kept in the cage of pregnant doe, 5-6 days prior to kindling.

**Shearing: -** Cutting wool from rabbit at an interval of 85-90 days. When it grows to the length 4-6 cm.

**Matting: -** If shearing is not done in time, staple get entangled with each other, which is called as matting.

**Hutch:** Housing of rabbit

- Rabbits are chiefly nocturnal, although they are sometimes seen in the day time.

# Rabbit production system: -

- It differs from country to country but there are 3 main systems of production:

**The backyard small scale rabbitry:** A few female and one or two male rabbits are kept in a house built rabbitry and are fed on greens, weeds and vegetables kitchen scraps. It provides enough meat to supplement the family need.

**The small commercial rabbitry:** It may have the 10-50 breeding does in a purpose built rabbitry. The aim of this type of rabbit production is to sell rabbit meat for profit. Rabbits are usually fed on concentrate as well as bulky leafy vegetables.

**Large commercial rabbitry:** This type is more common in Europe & U.S. there are some examples of large rabbit units in the tropics, but to support such rabbitry it is necessary to have reliable market outlets for the carcasses, source of good quality commercial feed and expert veterinary services.

# Breeds of rabbits:

- There are many breeds of domestic rabbits in the world and all have different qualities. There are 38 breeds and 87 varieties of rabbits which are recognised and well established worldwide. These breeds/varieties vary in colour, size, type of hair coat and other characteristics.

**For wool production: -** Angora rabbit is reared for wool production. It is usually white & albino but some coloured varieties have been developed for the utilization of colour wool. Normally the main demand of Angora wool is of white colour and long staple of uniform dying & processing.

The following strains/breeds of Angora rabbit are commonly being reared by Indian farms-

1. **German Angora: -** Origin Germany, wool yield 700-1000gm/year, white fine quality, 2-4% guard hair, adult body weight 3-4kg.

2. **British Angora: -** origin U.K., wool yi
lustrous fine quality, guard hair 2-4%
4.5kg.

3. **Russian Angora: -** Origin Russia, 300-400gm/year, white, medium fine wool, 10-20% guard hair, body wt. 3.5-5.5kg.

4. **Crossbred Angora: -** Origin India, well adapted to Indian conditions, wool yield 500-600gm/year, wool is white, medium fine, guard hair is of 4-8%, adult body wt. 3-5kg.

**For meat/Fur skin production: -** The most common breeds for this purpose are New Zealand white, White Californian, Soviet Chinchilla, Grey Giant, White Giant, Black Brown, Dutch, Argente Champagne etc. The adult body weight of these breeds ranges from 3-6kg in females & 2.5-5.5kg in males.

New Zealand white

White Californian

Soviet Chinchilla

Grey Giant

White Giant

Black Brown

Dutch

Argente Champagne

- The Rex and Satin breeds of rabbit are mainly raised for quality fur skin and meat production. In our country, at the CSWRI, Garsa (Kullu) the following meat breeds were experimented for meat & fur skin

Rex

Satin

- **For fancy/hobby purposes: -** The most important breeds under this class are Polish, Palmino, Havana, Beveren, New Zealand Red, English Spot white, Dutch etc. These animals are lighter in weight ok

Polish

Palmino


Havana

Beveren

New Zealand Red

English Spot white

| Commercial characters of rabbits | Backyard producers | Commercial producers |
|---|---|---|
| Young born per Litter | 4-9 | 6-12 |
| Young reared per litter | 3-5 | 6-8 |
| No. Of litter per Doe per year | 3-4 | 5-8 |
| No. Of young reared per Doe per year | 9-20 | 30-60 |
| Weaning weight per litter at 8 weeks | 3-6 kg | 9-14 kg |
| Live wt. Gain (No. Of weeks to reach 2kg body wt.) | 12-24 weeks | 8-10 weeks |
| Feed conversion ratio | 5:1 to 4:1 | 4:1 to 3:1 |

# Environmental requirement of rabbit:

**Temperature: -** The comfortable zone of temperature for maximum production is 10° to 26°C if temperature is more than 28°C and above decreases feed consumption and increases water intake. Due to which-

- Growth rate slowed down in growers.
- Productive efficiency in females adversely affected with reduced fertility and temporary sterility in males.

**Humidity: -** Rabbits are sensitive to low humidity. Comfortable humidity ranges from 55 to 70%.

**Ventilation: -** Ventilation requirement depends upon weather, cage type and population density. Free movement of air is always needed in rabbitary especially in hot weathers. Air must be free from dust and smoke.

**Light: -** About 8hrs in males and 16hrs in females exposure to light is must for sexually active and fertile. For growing rabbits, 1-2 hrs additional artificial light is sufficient.

# Pregnancy, kindling and care:

**Pregnancy: -** the gestation period in rabbit is 30-32 days.

**Pregnancy diagnosis: -**

1. **Test mating:** It is also called layman's method in which doe is subjected to mating and acceptability of buck is tested.

- Usually pregnant does will not accept the buck.

2. **Palpation:** Developing embryos in pregnant doe can be easily felt after 12 to 14 days of mating.

- The embryos beads are around 1 to 2 cm at this stage.
- Embryos can be felt by exerting gentle pressure with thumb and fore fingers on either side of uterus.
- Further during late pregnancy i.e. $4^{th}$ and $5^{th}$ week, abdomen of doe gets swollen with teats.

# Breeds of camel

- **Old world camels:**

1) Arabian camel/ dromedary: one-humped camel: *Camelus dromedaries* → 94% of the world's camel population
2) Bactrian camel: double humped camel: *Camelus bactrianus*
   - **Wild Bactrian camel** is a separate species and is now critically endangered.

- **New world camels** (South American Camels): Llama, Alpaca, Vicuna, Guanaco.

**Classification of Indian camels:**

A)Baggage camels are heavier, hence are suitable for the plains and other hilly areas, with sturdy musculature of legs. Good for riding at 3 years of age and can carry 2-3 qt load. E.g Bikaneri, Marwari, Jalori, Mewari.

B)Riding camels are strong, sturdy, having thinner legs and their muscles are comparatively less developed. Good for racing and carrying load and can cover 95- 115 km at a stretch, speed10-11 kmph. E.g. Jaisalmeri (30 Km/hr.)

# Common terms related to camel

- **Raikas** – People living in jungles which breed camel.
- **Jheephras**- Animals (Bikaneri) which have luxuriant growth of black hairs on their eyebrows, eyelids and ears.
- **Pangal**- People of Jaisalmer call camel by name of pangal.
- **Jhool** – blanket put over camel at night to protect camel from cold.
- **Trinkets** – trinkets are made of bronze as ornaments are tied to fore arm and knee joint of camel.
- **Glandular sacs-** 2 extra compartments in rumen of camel supposed to be reservoir
  of water.
- **Jhooling/ jhoolak** – contagious disease of camel.
- **Kapali**- camel disease that causes inflammation of facial vein and tissues behind the eye.

- **Windgall of fetlock joint-** painless enlargement of synovial bursa at the back of fetlock of fore leg or hind leg.
- **Poll glands-** glands in pole region whose secretion become hyperactive during breeding season.
- **Stop** - it is well developed temporal fossa in certain breeds of camel just above the eye.
- **Pedestal**- chest pad in came is known as pedestal.
- **Front seat-** area from wither to hump.
- **Back seat** - area from hump to rump.
- **Knee callosity** – a callosity (thickened area) at knee joint.
- **Stifle callosity-** a callosity at stifle joint.
- **Rut or Musth-** both male and female have well defined period of breeding is known as rut. November to February
- **Gulla/ Dulla**- At the time of rut male constantly swallows air. During belching out, diverticula of soft palate gets ballooned out with expired air on one side of mouth like pink bladder which is withdrawn after few seconds is known as gulla.

- **Cocking of tail**- Two to three weeks after service she camel which has conceived can be distinguished by way that she develops tendency to raise tail upward whenever approached by male or handed by a man.
- **Rama**- Hybrid of camel and Llama is known as Rama.

## Peculiarities of camel:

1. Pseudoruminant/Special Ruminant: 3 compartments of stomach, walk on the pads of the two last digits (soft padded feet) instead of on the sole of the foot, no horns. Omassum absent.
2. Hump: Reservoirs of fatty tissue, not water. This fat metabolizes to release energy.
3. Nostrils: When the camel exhales, water vapor becomes trapped in their slit like nostrils and is reabsorbed into the body as a means to conserve water. Withstand water up to **30%** of body weight loss and recoup up to 96% of lost body weight after single rehydration. Camels lose only 1.3 liters of fluid intake every day while the other livestock lose 20 to 40 liters per day.
4. RBCs: Unlike other mammals, camels' RBCs are oval rather than circular in shape. This facilitates the flow of red blood cells during dehydration and makes them better at withstanding high osmotic variation without rupturing when drinking large amounts of water.

4. Body temperature: Camels are able to withstand changes in body temp.
5. **Rete mirabile**: Maintaining the brain temperature within certain limits is critical for animals. To assist this, camels have a *rete mirabile*, a complex of arteries and veins lying very close to each other which utilizes countercurrent blood flow to cool blood flowing to the brain.
6. No sweating: Camels rarely sweat, even when ambient temp. reach 49°C, to conserve water.
7. Thick body coat: thick coats insulate from intense heat radiated from desert sand. During the summer the coat becomes lighter in color, reflecting light as well as helping avoid sunburn.
9. Long legs: camel's long legs help by keeping its body farther from the ground, which can heat up to 70°C (158 °F).
10. Pedestal: Dromedaries have a pad of thick tissue over the sternum called the *pedestal*. When the animal lies down in a sternal recumbent position, the pedestal raises the body from the hot surface and allows cooling air to pass under the body.

10. Camel pads: keratinized skin areas i.e. one pad on each knee, elbow, stifle and hock.
11. Mouth: Camels' mouths have a thick leathery lining, allowing them to chew thorny desert plants.
12. Protection from sand: Long eyelashes and ear hairs, together with nostrils that can close, form a barrier against sand. If sand gets lodged in their eyes, they can dislodge it using their transparent third eyelid. The camels' gait and widened feet help them move without sinking into the sand.
13. Kidneys and intestines: The kidneys and intestines of a camel are very efficient at reabsorbing water. Camel urine comes out as a thick syrup, and camel faeces are so dry that they do not require drying when using as fuel fires.
14. Sexual Behavior: Male camels exhibit little sexual activity outside a specific rutting season. The male dromedary camel has an organ called a dulla in its throat, a large, inflatable sac he extrudes from his mouth when in rut to assert dominance and attract females. It resembles a long, swollen, pink tongue hanging out of the side of its mouth. During rutting, the soft palate of the camel increases in length. It then hangs out of mouth on one side and is called ‘Dulaa
15. In contrast to other ruminants, camel is hornless and has no gall bladder. Udder is four quartered.
16. Dentition differs from other ruminants in that there is a pair of well developed and pointed canine teeth in each jaw. There are long conical papillae on inside of the cheeks directed backwards, thus the camel can browse at the thorny plants without any harm. The canine teeth help the camel to take into grip the twigs and remove them from the trees.
17. Physiological Parameters: Body Temperature changes from 34ºC in morning to 41ºC in the afternoon. Normal Resting Heart Rate: 34 (24-48)/ Minute. Respiration rate: from 6-11 to 8-18 breaths per minute.

# Utility of camel:

**A. Working animal (Pack animal):**

- Camels can produce one horse power energy for long duration of work.
- Camel can carry load to 25-40 % of their body weight depending on the distance traveled and speed for load carrying operation.
- Camel can travel 100-120 Km in a day with a speed of 25-30 Kms per hour; bearing a load of 200-250 Kgs.

**B. Milk Animal:**

- Indian camels yield 3.5 kg to 10 kg of milk per day. The constituents of camel milk are, Fat 4.8 % Protein 3.8 % Lactose 5.1 % Ash 0.9 %
- The taste of camel milk depends upon availability of plants for grazing. Milk is salty, contains more insulin, hence useful for diabetic patients.
- Camel milk has medicinal value and is useful in curing some of the human diseases like jaundice, TB, asthma due to diversified type of grazing.
- Curd and ghee cannot be prepared from this milk as it contains more of salt and less fat

**C. Meat animal:**

- Camel meat is coarse and tough. It is consumed by many people in the Gulf and South Asian countries.

**D. Byproducts from camel:**

- Camel hair has important value utilized for preparation of blankets, rugs, fabrics, painting brushes, ropes, bags, mats etc. Camel leather is useful for making shoes and toys.
- Camel gut is useful for making handicrafts and suturing material.
- Skin is used for making handles for various fancy articles such as knives, powdered bone is used as “fertilizer”.
- The bones of the legs are used as pegs for tents by the desert dwellers where wood is not available.

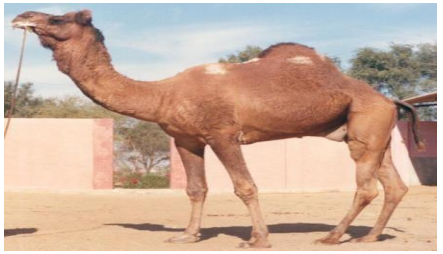
# Important Indian breeds of camel:

| | Breed | Home Tract |
|---|---|---|
| 1 | Bikaneri | Rajasthan |
| 2 | Jaisalmeri | Rajasthan |
| 3 | Jalori | Rajasthan |
| 4 | Kutchi | Gujarat |
| 5 | Malvi | Madhya Pradesh |
| 6 | Marwari | Rajasthan |
| 7 | Mewari | Rajasthan |
| 8 | Mewati | Rajasthan and Haryana |
| 9 | Kharai | Gujarat – Swimming Camel – Tolerant to high salt water |
| 10 | Double humped | Ladakh (Nubra valley) |

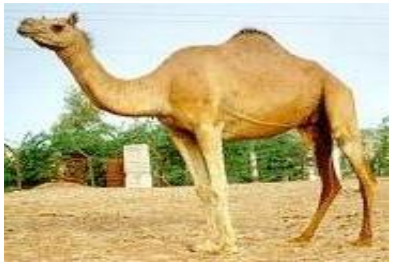
## Exotic breeds of camel:

1. Afghan
2. Iranian
3. Egyptian

**Bikaneri:**



- It is a multi purpose breed, classified on weight as heavy and is slow in work.
- They have no stop, muzzle is loose. Lower lip droops and teeth are visible from a distance. Their colour varies from dark brown to light brown and dark red to brown red.
- Some animals have jeepras.



**Jaisalmeri:**

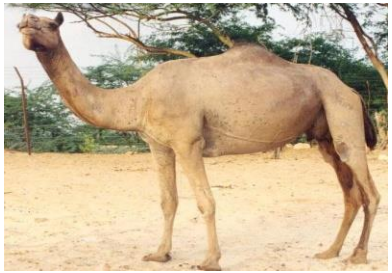
- Well known for riding and race potential (30 Km/hr).
- No "Stop“ and Jheepra.
- Camel Corps constitutes an important wing of the BSF of Indian para-military service.

**Sindhi:**

- Heavy breed and can walk in marshy land without sleeping.
- Good for pack purpose.
- The camels of this breed have short, less curved smaller neck.
- Two types: a. Muhri- riding camel , b. Laddu – Baggage camel

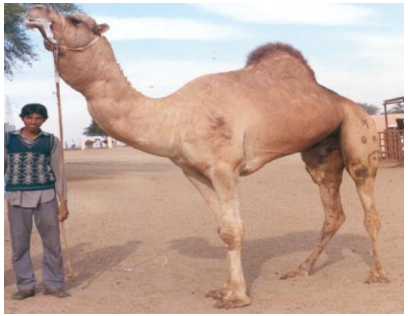
**Kutchi:**

- Dark brown or red color.
- Absence of hair on eyelids and ears.
- Lethargic in work and mostly used as a companion animal or maintained for fancy purpose.



**Marwari:**

- Long massive legs, mainly used for transport.
- Well known for milk production potential.
- Head is small. The face is long and narrow and devoid of stop.
- The muzzle is slightly loose and lower lip drops a bit.



**Jalori:**

- It is a crossbred between Marwari and Jaisalmeri, having origin the southern part of the river Luni.
- The breed is smaller in size and mainly used for transport.

# Equine management

## Zoological Classification

- **Horse:** *Equus caballus*
- **Donkey:** *Equus asinus*
- **Mule:** Equus caballus x Equus asinus (sterile).

**Uses of Equines**: Pack Animals (transportation), Racing and Sports, Military and Police, Donkeys for the economy of landless laborers and small farmers, Mules by military and for heavy-duty civilian work and; medical Use (Horses for producing antitoxins e.g., tetanus).

## Types of Horses

- **Thoroughbred Horse:** Racehorse with a registered pedigree (Jockey Club), mainly used for racing.
- **Half-bred Horse:** Racehorse without a registered pedigree.
- **Purebred Horse:** Horse entered in the studbook of a breed society.
- **Light Horse:** Horses used for riding, racing, and driving; height 14.2-17 hands, weight 408-635 kg.
- **Cob:** A short-legged, stocky horse used for riding and driving.
- **Aged Horse:** A horse over 8 years old.

## Ponies and Donkeys

- **Pony:** Small horse measuring under 14.2 hands, weight 136-400 kg.
- **Ass (Donkey):** Smaller than horses with long ears, short erect mane, and a gestation period longer by one month than horses (i.e. 12 months).
- **Jack:** Male donkey used to produce mules when bred with a mare.
- **Jennet:** Female donkey; produces a hinny when bred with a stallion.

## Horse Movements and Gaits:

- Walk: A slow, four-beat gait.
- Trot: A two-beat diagonal gait where the opposite front and back legs move together.
- Canter: A three-beat gait.
- Gallop (Run): A fast, four-beat gait.

## Classification of Horses

| Character | Ponies | Light Horse | Draught Horse |
|---|---|---|---|
| Height (M) | < 1.47 | 1.47 to 1.52 | 1.47 to 1.52 |
| Weight (Kg) | 200 to 400 | 400 to 600 | 600 and above |
| Uses | Pack work | Riding and pack | Riding & Heavy work |

# Breeds of horse

| Utility Type | Breed | Region | Characteristics |
|---|---|---|---|
| Riding/Endurance | Marwari | Rajasthan, Gujarat | Known for distinctive inward-turning ears, hardy, excellent stamina and endurance, often used for riding and ceremonial purposes |
| | Kathiawari | Gujarat | Close relative of Marwari, known for endurance, adaptable to arid conditions, used for riding and cavalry |
| | Bhutia | Sikkim, West Bengal | Small, sturdy, sure-footed, well-suited for mountainous terrain, often used for riding and pack purposes in hilly regions |
| Cavalry/War | Marwari | Rajasthan | Historically used in battle due to bravery, agility, and loyalty; still used in ceremonial roles and equestrian sports |
| | Manipuri | Manipur | Small, strong, and agile, traditionally used in warfare and for playing polo, one of the original breeds for polo sports |
| Pack/Work | Spiti | Himachal Pradesh | Strong, resilient, suitable for carrying loads in mountainous terrain, adapted to cold climates |
| | Zanskari | Ladakh, Jammu & Kashmir | Tough and resilient, adapted for high-altitude and cold regions, used for pack work and transportation |
| Polo/Sports | Manipuri | Manipur | Known for agility and stamina, primarily used in polo due to their speed and maneuverability, small but powerful |
| | Marwari | Rajasthan | Used in equestrian sports and ceremonial riding, prized for its stamina and unique appearance |
| Ceremonial/Parades | Marwari | Rajasthan | Often used in royal ceremonies and parades, distinctive appearance with inward-facing ears, known for its majestic presence |
| | Kathiawari | Gujarat | Frequently used in ceremonial events due to its elegance, distinct facial structure, and endurance |

# Colors of horses

- **Albino:** Skin is un-pigmented and covered with white hairs
- **Bay brown**: Predominant color is brown with bay muzzle, black limb, mane and tail
- **Black**: The black melanin pigments in general is seen throughout the coat of the body, limbs, mane and tail.
- **Black brown:** The predominating color is black with muzzle and sometimes flank have brown or tan color.
- **Brown:** It is Mixture of black and chocolate colored hairs on the body coat, limbs, mane and tail are black.





- **Grey:** Skin is black with admixture of black white hairs
- **Study grey:** Black hairs are predominant in the neck, head, shoulder and rump.
- **Chestnut:** Body and legs are covered by yellow colored hair. The sheds very from bright chest to gold red dark chestnut to liver which is darkest of all. The mane and tail are chestnut, sometimes lighter and sometimes darker than body colour but never black.

- **Skewbald:** The body coat consists of large irregular patches of white and any other colour except black.
- **Piebald (black and white):** Body coat consists of large irregular big patches of black and white.

# Marking of horses

- Star: A white mark on the forehead either large or small

- Blaze: A white marking covering almost the whole of the forehead between the eyes and extending down the front of the face beyond the width of the nasal bone and usually involving the muzzle

- Stripe: A thin or broad narrow white marking running down the face

- Interrupted stripe: Star and stripe appears as two distinct spots

- Wall eye: It is due to the lack pigment either partial or complete, it gives bluish white or pinkish white appearance to the eye

- White face: White colour covers the whole of the forehead and front of the face, extending laterally top the mouth either unilaterally or bilaterally

- White muzzle: Both lips will be white and extends to the region of the nostrils

## Dentition and Ageing of Horses

- The **age** of a horse can be estimated by examining its incisor teeth. This method is valuable for non- pedigree animals. The information is crucial for:
- **Issuing soundness certificates**
- **Valuation of livestock**
- **Selection and purchase** decisions

## Dental Formula of Horses

- **Temporary:** 3/3, 0/0, 3/3, 0/0
- **Permanent:** 3/3, 1/1, 3/3, 3/3. Sometime, (3/3, 1/1, 4/4, 3/3 ) if wolf premolars teeth are present.

**Dental star:**

- Yellowish-brown mark that appears on a horse's tooth as it wears down, and is used to estimate the horse's age.
- Dental star will appear in the central incisors at 8 years, intermediates at 9 years & corners at 10 years.

**Bishoping:**

- Fraudulent practice of attempting to make an old horse's teeth appear younger by rashping and leveling. A false mark is gouged into the tooth and blackened with chemicals like silver nitrate.
- Clues to spot bishoping include the angle of teeth, absence of enamel, and signs of rasping.

## Dimensions of Stalls

| Size of Animal | Length (m) | Width (m) | Height (m) |
|---|---|---|---|
| Small horse | 3.0 | 2.5 | 1.9 |
| Light/average/medium | 3.5 | 3.0 | 1.9 |
| Large | 4.0 | 3.5 | 1.9 |

- Stallion Boxes: 14 ft x 14 ft (4.27 m x 4.27 m)
- Mare Boxes: 12 or 14 ft x 14 ft (3.66 m x 4.27 m)
- Foaling Boxes: 14 ft x 16 ft (4.27 m x 4.88 m).

**Note:**

- Sex Ratio: 1 stallion can cover 30-40 mares
- Foal Heat (Post-Parturient Estrus): Foal heat typically occurs 9-11 days after foaling. Covering during foal heat is common but should be avoided if complications occurred during foaling, such as retained placenta or birth trauma.
- Horses are seasonal breeders:
    1. Spring Season (Primary): February to June is the ideal breeding season
    2. Autumn Season (Secondary): September to November

- **Doping in Horses:** administration of any substance, drug, or food designed to alter an animal's performance in competitions or races. Also called ergogenic aid e.g. Sod. Bicarbonate, thiamine.

# Preparation of animals for Show

- About 2600 livestock fairs and shows every year throughout India.
- All India cattle show society, started in 1939, with a grant of Rs.2,25,000/- which conducts the All India Cattle show every year in various parts of the country.
- Two unique cattle fairs: Cattle fair at Rohtak, Haryana and Sonepur cattle fair in Bihar, during November-December.

**Preparation of animals:**

**1. Selection of animals**

- Select only competitive animals to have a chance to win their respective age class in the competition. General musculature of the body should be given due consideration with well developed firm udder in females.
- Selection of show animals should be made well in advance.

**2. Conditioning the animals**

- Proper feeding of show animals is very important for a fair amount of flesh.
- Linseed meal popular feed to give gloss to the hair and quality to the hide.
- Animals should be on same feeding practices that they will receive during the show period.

**3. Training the animal for show**

- The animal must be trained to lead and stand properly.
- Train to walk slowly taking short steps with head up and alert, to stand with its weight evenly distributed on all the four feet and with their feet in proper position and to respond to a light touch from the leader. Avoid physical abuse for training.

**4. Clipping**

- Enhance the appearance of the animal.
- Main areas: head, ears, neck, tail, udder and mammary gland.
- clipping some of the hairs from the hocks, leg and brisket enhance the appearance.
- Clip about one month before the show, but, can be re-clipped within a few days of the show.

**5. Hoof trimming**

- Long toes and misshaped hooves detract the appearance of the animals and make it difficult for them to walk and pose properly.
- Done at least 2 to 4 weeks earlier of the show.

**6. Brushing**

- Stimulates the circulation of blood and help a glossy coat of hair. Also removes dirt, dust and loose hair.

**7. Washing**

- The hairs should be washed thoroughly.
- Keep the animals, lightly blanketed to avoid exposing them to cold until they dry.
- Animals should be washed and dry before clipping. They should be rewashed within 12-18 hours of show time.

**8. Blanketing**

- Helps keep the coat clean and smooth.

**9. Transporting**

- Avoid feeding large amount of concentrates and succulent feeds within 12 hours of transportation to avoid defecating during transport and are clean on arrival.
- Reach the destination at least 2-3 days ahead of the actual time of show to allow the animals to adjust to new surroundings and to get in best shape before show.

**10. Final preparation**

- The rules and methods of particular show should be studied carefully.
- The timing of last milking before the show should be determined by milking interval at which the udder looks a best. It is very important to anticipate the approximate time when a particular class will be shown.
- Perform the pre-show milking in accordance with the show time so that the correct amount of milk will be in the udder at the show time.
- Most showmen prefer to feed liberal amount of hay but to withheld water, concentrate and succulent feeds for a period starting from 12-15 hours before the show time. This helps to ensure a good appetite during the show time.

**11. Showing**

- The exhibitor should do brushing, cleaning and haltering nearer to the place where the class is called for show.
- He should lead his animal around the ring in a clockwise direction, holding the halter strap on his left hand and walking backward. This enables him to see both his animal and the judge.
- The cow normally stand with the left rear leg nearest to the judge slightly ahead of the other rear leg and with the front feet evenly spaced wide apart.

**12. Showing ethics**

The following things should not be done to maintain the showing ethics:

1. Misrepresenting the age and / or milking status of the animal for class in which it is shown.
2. Balancing the udder by any means by leaving naturally producing milk in any or all quarters
3. Blocking the nerves to the foot to prevent limping, by injecting drugs.
4. Striking the animal to cause swelling in a depressed area
5. Insertion of foreign material under the skin.
6. Changing the colour of hair at any point/ spot on the animal body
7. The use of alcoholic beverages in the feed or through a drench
8. Criticizing or interfering with the judge, show manager or other exhibitors.

**Advantages of fairs, and shows:**

1. Provides opportunity to the breeders to exchange ideas with fellow dairymen.
2. It develops a healthy spirit of competition among the farmers and provide them incentive for development of cattle.
3. It encourages uniform standard of the husbandry practices.
4. Maintaining the dairy interest of many youngsters.
5. Attending fair or show can be a valuable learning experience.
6. Provide opportunity to field and extension workers to understand the local problems of husbandry and it will also educate the farmers in newer techniques of dairy farming.
7. Excellent means of advertising cattle and contacting prospective buyers.

# Preparation of birds for show

**1. Selection of Show Birds**: Choose birds that meet the breed standard and birds with good temperament,

**2. Health Check and Nutrition**

- Provide a balanced diet, administer deworming and parasite control treatments several weeks before the show to prevent signs of infestation.

**3. Grooming and Cleaning**

- Begin conditioning feathers weeks in advance by bathing birds in lukewarm water with mild soap or bird shampoo.
- Trim beaks, nails, and spurs carefully, avoiding over-trimming to prevent discomfort.

**4. Feather Conditioning**

- Avoid handling the birds roughly to prevent feather damage. Regularly check for and remove broken or damaged feathers.
- For birds with white feathers, avoid sunlight that might cause yellowing..

**5. Training for Handling and Posing**

- Spend time handling the birds daily to accustom them to human contact, which reduces stress on show day.
- Train them to stand calmly and display well, mimicking show conditions to reduce anxiety.

**6. Final Touches Before the Show**

- Transport birds in a clean, secure crate with sufficient ventilation and bedding.
- Upon arrival, clean any dirt from the journey, especially around the beak, legs, and feet. Do a final check to ensure feathers are smooth.

**7. Presentation and Etiquette**: Present birds confidently but handle them gently and respectfully.

# Poultry science
# &
# Lab animals

# Laboratory animals

An animal which has more or less similar physiological and body composition with various biological systems as human beings, which are tiny, easy to handle, less expensive and co-operative are called as laboratory animals.

## Types of Laboratory animals:

Mice, Rats, Hamster, Guinea Pigs, Rabbits are popular Laboratory animals.

- Gnotobiotic animals: -

  Animals with known microbes such as virus, bacteria, fungi and protozoa is said to be gnotobiotic animals. This animal has to be bred in controlled environment in the equipment called isolator. They are foundation stocks for producing specific pathogen free animals.

- **Specific Pathogen Free Animals: -**

  An animal which is made free from specific or particular microbe is known as SPF animals.

- **Germ free animals: -**

  An animal which don’t have any demonstrable microbe is known as germ free animal.

- **Institutional Animal Ethics Committee (IAEC):** a group of people who review and approve research proposals that involve the use of animals. Constituted in 2006.
- CPCSEA: Committee for the purpose of control & supervision of experiments on animals under rule. It is statutory Committee of Department of Animal Husbandry and Dairying (DAHD).
- “Laboratory Animal Bureau” was set up in India in 1947.
- 24$^{th}$ April World laboratory day

- Mice: *Mus musculus*
- Rat: *Rattus norvegicus*
- Guinea Pig: *Cavia porcellus*
- Hamster: *Mesocricetus auratus*
- Rabbit: *Oryctolagus cuniculus*

# Biological & Physiological data of laboratory animals:

| Parameters | Mice | Rat | Guinea Pig | Hamster Syrian/Chinese | Rabbit |
|---|---|---|---|---|---|
| Birth Weight (gm) | 1-1.5 | 6-7 | 70-100 | 20 | 50-70 |
| Body weight (adult gm) | 30-40 | 250 | 800 | 80-90/35-40 | 1500-5500 |
| Daily feed consumpt.(gm) | 5-6 | 15-20 | 45-50 | 10-15/10 | 200-250 |
| Age of first mating (M) | 1.5-2 | 2.5-3 | 3 | 2-3/2-3 | 6-7 |
| Age for experiment(M) | 45(days) | 1.5 | 3 | 1/1 | 6 |
| Heart rate (beat/min.) | 330-750 | 310-500 | 250-400 | 315-410/310-400 | 150-300 |
| Respiration rate /min. | 85-230 | 70-180 | 70-110 | 35-130/30-125 | 40-60 |
| Sex ratio (Male : Female) | 1:3 | 1:5 | 1:6 | 1:1 | 1:1 |

| Parameters | Mice | Rat | Guinea Pig | Hamster Syrian/Chinese | Rabbit |
|---|---|---|---|---|---|
| Blood Volume (% of Body Wt.) | 7-10 | 5-7 | 6-12 | 6-9/6-10 | 5-8 |
| Life span (Years) | 1.5-2.5 | 2-3 | 3-5 | 2-3/2-3 | 5-6 |
| Gestation period (Days) | 20-21 | 21-22 | 65-67 | 16/21 | 31-32 |
| Litter size | 7-12 | 8-10 | 3-4 | 5-7/4-5 | 6-8 |
| Age at Weaning (Weeks) | 3 | 3 | 2-3 | 3½/3 | 7 |
| Litter/year | 8-10 | 7 | 4-5 | 10/7 | 4-5 |
| Rest period for females in between 2 mating(days) | 15 | 15 | 15 | 18/15 | 20 |
| No. Of pairs of mammary gland | 5 | 5 | 1 | 6-7/4 | 3-4 |

## Mice and Rat:

Nature: - Prolific breeder

Puberty: - 4 to 6 weeks

Mating: - 8 to 9 weeks, early mating reduces fertility.

Estrous duration: - 4 to 5 days.

Gestation period: - 20 to 22 days.

Birth weight of young ones: - 1 to 1.5gm

Litter size: - 10 to 12

Weaning weight: - 10 to 12gm and age 21 days.

Detection of successful mating: Presence of sperm in vagina smear or copulatory plug (solidified semen) in vagina.

## Hamster:

Puberty: - 4 to 6 weeks.

Mating age: - 8 to 12 weeks.

Weight at mating: - Syrian- 80 to 90gm

Chinese- 35 to 40gm

Estrus duration: - 4 to 5 days.

Mating: - Hand mating is followed.

Gestation period: - 16 to 18 days.

Litter size: - 5 to 7

Weaning age: - 20 to 25 days and weight 15gm.

Male and female housed in separate quarters, brought together only at the time of mating and separated again immediately after mating, otherwise female may cause serious injuries to tail and testes of male.

## Guinea Pig:

Puberty: - 4 to 5 weeks.

Mating age: - 9 to 11 weeks.

Weight at mating: - Male- 900 to 1500 gm

Female- 700 to 1300gm.

Estrous sign: - Hip swaying, mounting activity, unsteady movements.

Mating: - Polygamous

Furrowing: - Communal i.e., group of females farrows in common pen.

Gestation: - 60 to 75 days.

Birth weight: - 45 to 50gm.

Litter size: - 5 to 6.

Weaning weight: - 160 to 230gm.

Guinea pigs can not synthesize Vitamin as they lack the enzyme (L-gulonolactone oxidase) that converts L-gulonolactone to L-ascorbic acid

# Rabbit

- Class: Mammalia
- Super order: Glires
- Order: Lagomorpha
- Family: Leporidae (Hares, Rabbits)
- Genus: Oryctolagus
- Species: Cuniculus

All domestic rabbits originated from the European wild rabbits. Today Europe accounts for 85% of total world output. China comes next.

## Common terms related to rabbits:

**Doe: -** A mature female rabbit used for breeding.

**Buck: -** A mature male rabbit used for breeding.

**Kit: -** A young rabbit whose eyes are not yet opened.

**Bunny: -** A young rabbit below 20 weeks of age.

**Fryer: -** 10 to 12 weeks old rabbit ready for market.

**Roaster: -** Culled rabbit.

**Kindling: -** Act of parturition.

**Litter: -** Kits born in a single kindling.

**Weaner: -** A newly weaned rabbit.

**Fur: -** Wool.

**Pelt: -** Skin.

**Rabbitry: -** Place where domesticated rabbits are kept.

**Caecotrophy/Copropargy: -** Consumption of own feceal matter.

**Broiler: -** Rabbits which grow very fast for meat purpose (2kg body wt. In just 12 weeks).

**Fostering: -** Transfer of bunny/bunnies to another doe for nursing usually due to death of original doe or abandoning of young rabbit.

**Tattooing: -** Identification marks put in the ear of rabbit with tattoo ink and punch.

**Cannibalism: -** Eating of own bunnies by mother doe after kindling, noted usually due to inadequate water supply to pregnant doe.

**Nest box: -** A wooden box to be kept in the cage of pregnant doe, 5-6 days prior to kindling.

**Shearing: -** Cutting wool from rabbit at an interval of 85-90 days. When it grows to the length 4-6 cm.

**Matting: -** If shearing is not done in time, staple get entangled with each other, which is called as matting.

**Hutch:** Housing of rabbit

- Rabbits are chiefly nocturnal, although they are sometimes seen in the day time.

# Rabbit production system: -

- It differs from country to country but there are 3 main systems of production:

**The backyard small scale rabbitry:** A few female and one or two male rabbits are kept in a house built rabbitry and are fed on greens, weeds and vegetables kitchen scraps. It provides enough meat to supplement the family need.

**The small commercial rabbitry:** It may have the 10-50 breeding does in a purpose built rabbitry. The aim of this type of rabbit production is to sell rabbit meat for profit. Rabbits are usually fed on concentrate as well as bulky leafy vegetables.

**Large commercial rabbitry:** This type is more common in Europe & U.S. there are some examples of large rabbit units in the tropics, but to support such rabbitry it is necessary to have reliable market outlets for the carcasses, source of good quality commercial feed and expert veterinary services.

# Breeds of rabbits:

- There are many breeds of domestic rabbits in the world and all have different qualities. There are 38 breeds and 87 varieties of rabbits which are recognised and well established worldwide. These breeds/varieties vary in colour, size, type of hair coat and other characteristics.

**For wool production: -** Angora rabbit is reared for wool production. It is usually white & albino but some coloured varieties have been developed for the utilization of colour wool. Normally the main demand of Angora wool is of white colour and long staple of uniform dying & processing.

The following strains/breeds of Angora rabbit are commonly being reared by Indian farms-

1. **German Angora: -** Origin Germany, wool yield 700-1000gm/year, white fine quality, 2-4% guard hair, adult body weight 3-4kg.

2. **British Angora: -** origin U.K., wool yi
lustrous fine quality, guard hair 2-4%
4.5kg.

3. **Russian Angora: -** Origin Russia, 300-400gm/year, white, medium fine wool, 10-20% guard hair, body wt. 3.5-5.5kg.

4. **Crossbred Angora: -** Origin India, well adapted to Indian conditions, wool yield 500-600gm/year, wool is white, medium fine, guard hair is of 4-8%, adult body wt. 3-5kg.

**For meat/Fur skin production: -** The most common breeds for this purpose are New Zealand white, White Californian, Soviet Chinchilla, Grey Giant, White Giant, Black Brown, Dutch, Argente Champagne etc. The adult body weight of these breeds ranges from 3-6kg in females & 2.5-5.5kg in males.

New Zealand white

White Californian

Soviet Chinchilla

Grey Giant

White Giant

Black Brown

Dutch

Argente Champagne

- The Rex and Satin breeds of rabbit are mainly raised for quality fur skin and meat production. In our country, at the CSWRI, Garsa (Kullu) the following meat breeds were experimented for meat & fur skin

Rex

Satin

- **For fancy/hobby purposes: -** The most important breeds under this class are Polish, Palmino, Havana, Beveren, New Zealand Red, English Spot white, Dutch etc. These animals are lighter in weight ok

Polish

Palmino


Havana

Beveren

New Zealand Red

English Spot white

| Commercial characters of rabbits | Backyard producers | Commercial producers |
|---|---|---|
| Young born per Litter | 4-9 | 6-12 |
| Young reared per litter | 3-5 | 6-8 |
| No. Of litter per Doe per year | 3-4 | 5-8 |
| No. Of young reared per Doe per year | 9-20 | 30-60 |
| Weaning weight per litter at 8 weeks | 3-6 kg | 9-14 kg |
| Live wt. Gain (No. Of weeks to reach 2kg body wt.) | 12-24 weeks | 8-10 weeks |
| Feed conversion ratio | 5:1 to 4:1 | 4:1 to 3:1 |

# Environmental requirement of rabbit:

**Temperature: -** The comfortable zone of temperature for maximum production is 10° to 26°C if temperature is more than 28°C and above decreases feed consumption and increases water intake. Due to which-

- Growth rate slowed down in growers.
- Productive efficiency in females adversely affected with reduced fertility and temporary sterility in males.

**Humidity: -** Rabbits are sensitive to low humidity. Comfortable humidity ranges from 55 to 70%.

**Ventilation: -** Ventilation requirement depends upon weather, cage type and population density. Free movement of air is always needed in rabbitary especially in hot weathers. Air must be free from dust and smoke.

**Light: -** About 8hrs in males and 16hrs in females exposure to light is must for sexually active and fertile. For growing rabbits, 1-2 hrs additional artificial light is sufficient.

# Pregnancy, kindling and care:

**Pregnancy: -** the gestation period in rabbit is 30-32 days.

**Pregnancy diagnosis: -**

1. **Test mating:** It is also called layman's method in which doe is subjected to mating and acceptability of buck is tested.

- Usually pregnant does will not accept the buck.

2. **Palpation:** Developing embryos in pregnant doe can be easily felt after 12 to 14 days of mating.

- The embryos beads are around 1 to 2 cm at this stage.
- Embryos can be felt by exerting gentle pressure with thumb and fore fingers on either side of uterus.
- Further during late pregnancy i.e. $4^{th}$ and $5^{th}$ week, abdomen of doe gets swollen with teats.

# Poultry Science

- Ornithology: Scientific study of birds
- Poultry: domesticated birds reared for egg, meat, feathers which includes Chicken, ducks, turkey, Guinea fowl, Quail etc

## Zoological Names of Different Bird Species

| *Common name* | *Zoological name* | *Common name* | *Zoological name* |
|---|---|---|---|
| Chicken | *Gallus gallus domesticus* | Pheasant | *Phasianus colchicu* |
| Duck | *Anas platyrynchos* | Pea fowl | *Pavo cristatus* |
| Turkey | *Melleagris gallopavo* | Ostrich | *Struthio camalus* |
| Goose | *Anser anser* | Pigeon | *Columbia livia* |
| Japanese quail | *Coturnix coturnix japonica* | Dove | *Columbia oenas* |
| Bobwhite quail | *Colinus virginianus* | Parrot (*i*) African | *Psittacus erithacus* |
| Guinea fowl | *Numida meleagris* | | |
| Patridge | *Perdix perdix* | (*ii*) Indian | *Lovius rotatus* |

## Terms Used for Different Birds

| *Species* | *Male* | *Female* | *Young* |
|---|---|---|---|
| Fowl | Cock | Hen | Chick |
| Duck | Drake | Duck | Duckling |
| Goose | Gander | Goose | Gosling |
| Turkey | Tom turkey | Hen turkey | Poult |
| Quail | Quail cock | Quail hen | Quail chick |
| Guinea fowl | Male guinea fowl | Female guinea fowl | Keet |
| Pigeon | Male pigeon | Female pigeon | Squab |
| Swan | Male swan | Female swan | Signet |

| Family | Common name | Scientific name | Chromosome Number |
|---|---|---|---|
| Meleagridiae | Turkey | *Meleagris gallopoava* | 80 |
| | Japanese quail | *Coturnix japonica* | 78 |
| Phasianidae | Pheasent | *Phasias colchics* | 82 |
| | Fowl | *Gallus domesticus* | 78 |

| Family | Common name | Scientific name | Chromosome Number |
|---|---|---|---|
| Antidae | Gosse | *Aser anaser* | 80 |
| | Muscovy | *Cairina maschata* | 80 |
| | Duck | *Anas platyrhynchos* | 80 |

# Breeds and variety of chicken

- Poultry raising farming is the domesticated process of birds such as chickens, ducks, turkeys and geese for the purpose of farming meat or eggs for food.
- **Class**: group of birds developed in certain regions or geographical areas.
- **Breed**: group of birds within a species related by breeding, possessing a distinctive shape, conformation, plumage colour, comb type, general body weight and breeds true. E.g. RIR, Leghorn
- **Variety**: sub-group of breed differentiated by plumage colour, pattern and comb type. Ex White Leghorn, Black Leghorn, Brown Leghorn.
- **Strain**: sub-group of a variety, normally named after the person who has evolved them or the institution/ breeder who has introduced certain economic characters in the bird. They are developed duly giving importance to certain specific traits like egg production, early maturity, better feed efficiency, egg weight etc. e.g. Meyer strain of White Leghorn, Forsgate strain of White Leghorn, Sterling strain of Rhode Island Red.
- **Lines**: Sub classes of a strain developed such that the gene(s) responsible for a particular trait is fixed so as to be utilized for production of commercial hybrids.

# Combs and their types

- Comb: fleshy, red outgrowth on top of a chicken's head.
- **Function:**
- Help chickens regulate their body temperatures.
- The bigger the comb the warmer the environment since more heat is released with a larger comb.
- A chicken's combs is also a useful way to check on their health. This is also connected with sexual attraction between chickens. Female chickens will be attracted to a male chicken with a vibrant and large comb because it implies that the male chicken is very healthy.

**1. Cushion Combs**

- They begin at the peak of the beak and don't extend very high above the head; there are no ridges
- They are great for hens who live in colder regions because they assist to avoid frostbite. Ex.: Chantecler (Dual purpose Canada breed)

**2. Pea Combs/ Triple comb**

- Pea combs are extremely small.
- They have three ridges with the middle ridge being slightly taller than the other two. Each of the ridges has tiny bumps on them for texture.
- Ex.: Cornish, Brahma, Aseel, Sumatra

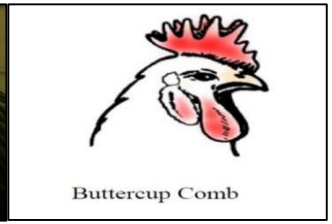
**3. Single Combs** Most common type of chicken comb.

- Thinly shaped and has five or six serrations (points) resembling mountains.
- Ex.: IRI, New Hamphsire, Plymouth Rock, Australorp, Cochins,, Minorcas, and Orpingtons, white leghorn

**4. Duplex comb:** multi-allelic trait, meaning there are multiple alleles that can affect the comb's morphology.

i. V-shaped/ devil's horns. E.g. Sultan.

ii. Buttercup


**5. Walnut Combs**

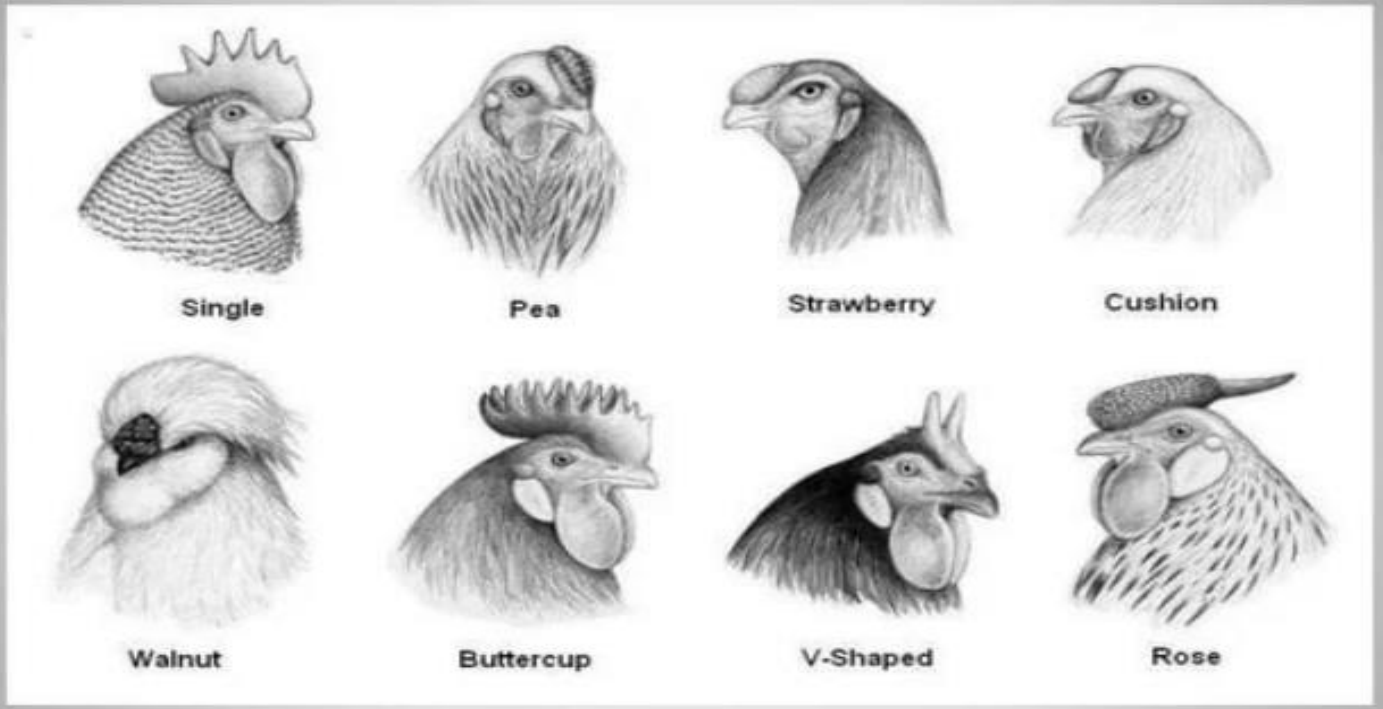
- Deep wrinkles: resembles walnut shell.
- Ex.: Silkie chickens and Orloff chickens

**6. Rose Combs**

- Many small bumps on it and ends in a spike like shape.
- This is a small comb: are well suited to cold climates and are unlikely to get frostbite.
- E.g.: Wyandotte and Dominique

**7. Strawberry comb**

- This comb is egg-shaped, with a bumpy surface similar to a strawberry.
- E.g.: Malay and Yokohama chicken breeds




# POULTRY COMB TYPES

## Classes of chicken




**TABLE 12.4. IMPORTANT CHARACTERISTICS OF MODERN BREEDS OF CHICKEN**

| *Breed* | *Comb type* | *Colour of ear lobe* | *Colour of skin* | *Colour of shank* | *Egg shell colour* | *Shank feathers* |
|---|---|---|---|---|---|---|
| | | | ***Class*: AMERICAN** | | | |
| Plymouth rock | Single | Red | Yellow | Yellow | Brown | No |
| Wyandotte | Rose | Red | Yellow | Yellow | Brown | No |
| Rhode Island Red | Single/Rose | Red | Yellow | Yellow | Brown | No |
| New Hampshire | Single | Red | Yellow | Yellow | Brown | No |
| Jersey Black giant | Single | Grey/Red | Yellow/Black | Brown | Brown | No |
| | | | ***Class*: ENGLISH** | | | |
| Australorp | Single | Red | White/Black | Black | Brown | No |
| Cornish | Pea | Red | Yellow | Yellow | Brown | No |
| Dorking | Single | Red | White | White | Tinted brown | No |
| Orpington | Single | Red | White | Bluish | Brown | No |
| Sussex | Single | Red | White | White | Tinted Brown | No |
| | | | ***Class*: MEDITERRANEAN** | | | |
| Leghorn | Single/Rose | White | Yellow | Yellow | White | No |
| Minorca | Single | White | Black/Blue/White | Black/Blue | White | No |
| Ancona | Single/Rose | White | Yellow | Yellow | White | No |
| Andalusian | Single | White | White | Black | White | No |
| | | | ***Class*: ASIATIC** | | | |
| Brahma | Pea | Red | Yellow | Yellow | Brown | Yes |
| Langshan | Single | Red | Brown/Black | Yellow | Brown | Yes |
| Cochin | Single | Red | Yellow | Blue/Black | Brown | Yes |

## Important Classes, Breeds and Varieties of Chicken/Fowl

| Class | Breed | Variety |
|---|---|---|
| ❑ American | • Rhode Island Red | Single comb, Rose comb. |
| | • New Hampshire | - |
| | • Plymouth Rock | White, Buff, Barred, Silver pencilled, Patridge, Columbian, Blue. |
| | • Wyandotte | White, Buff, Black, Silver laced, Golden laced, Silver pencilled. |
| ❑ English | • Australorp | - |
| | • Cornish | White, Buff, Dark, White laced, Red. |
| | • Sussex | Light, Red, Speckled. |
| | • Orpington | White, Buff, Black, Blue. |
| ❑ Mediterranean | • Leghorn | White, Buff, Black, Silver, Red, Black tailed, Red Columbian, Rose comb (White, Brown), Single comb (White, Black, Buff). |
| | • Minorca | Black, White, Buff, Rose comb (Black, White). |
| | • Ancona | Single comb, Rose comb. |
| ❑ Asiatic | • Brahma | Light, Buff, Dark. |
| | • Cochin | White, Buff, Black, Patridge. |
| | • Langshan | White, Black. |
| Indigenous Fowl of India | • Aseel (Andhra Pradesh, Uttar Pradesh, Rajasthan) | Nhurie (white), Peela (golden yellow), Khagar (black), Yakuth (black and red), Chitta (black and white), Subja (white and golden), Reza (light red). |
| | • Kadaknath (Madhya Pradesh) | - |
| | • Bursa (Gujarat, Maharashtra) | - |
| | • Chittagong/Malay (Chittagong hills) | - |
| | • Naked neck (Maharashtra) | - |

**Crossbreed Poultry developed by ICAR**

- Vanraja
- Gram Priya
- Cari Gold
- Giriraj
- Krishna-J
- Yamuna
- Kalinga Brown
- Gram Lakshmi
- Nandanam
- Cari –Nirbhik
- Cari-Shyam
- Upcari
- Hitcari

# Cross Breeds at ICAR- DPR, Hyderabad

- **CARI NIRBHEEK:** cross of Indian native breed Aseel with CARl Red
- **CARI SHYAMA:** cross of Kadakanath breed of Indian native chicken with CARl Red
- **UPKARI:** Indian native chicken with Frizzle plumage has been crossed with CARI Red
- **Hitcari:** Hitcari birds have been developed by crossing the Indian native Naked neck with exotic breed CARI Red

# Chicken breeds based on utility

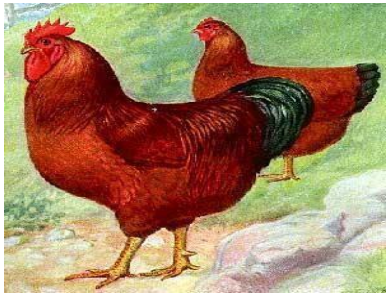
| Class | Examples | Primary Purpose | Characteristics |
|---|---|---|---|
| **Egg Layers** | White Leghorn, Rhode Island Red, Ancona, Sussex | Egg production | High egg production; lean body structure; usually more active and light-weight to maximize energy efficiency in egg production. |
| **Meat Birds** | Cornish Cross, Jersey Giant, Brahma | Meat production | Fast growth rate; larger body size; high feed efficiency; lower egg production; tend to be calm and less active. |
| **Dual-Purpose** | Plymouth Rock, Orpington, Wyandotte | Eggs and meat | Moderate body size; good egg production with decent meat yield; hardy, adaptable to various environments; slower growth rate. |
| **Bantams** | Sebright, Silkie, Dutch Bantam | Exhibition, pets | Small body size; produce small eggs; often decorative and ornamental; variety of colors; typically have calm temperaments. |
| **Ornamental** | Polish, Phoenix, Sultan | Show and aesthetics | Unique physical traits (crests, plumage, colors); generally lower egg production; raised for beauty and exhibitions. |
| **Game Birds** | Old English Game, Malay | Show, historical fights | Lean and muscular; generally aggressive; raised for show purposes and historical interest in gamefowl breeding. |
| **Heritage Breeds** | Delaware, New Hampshire, Sussex | Sustainability, diversity | Slower growth; natural breeding ability; good adaptability; contribute to genetic diversity; resilient to environmental changes. |

# Classification based on commercial value & Utility

- Dual purpose - Rhode Island Red
- Meat-type - Cornish
- Egg-type - White Leghorn
- Fancy/Exhibition type - Bantams, Silky
- Game type - Aseel
- Desi type - Chittagong, Kadaknath

**Rhode Island Reds**

- Skin Color -red
- Egg Color –Brown
- Comb type: single and rose
- Origin -New England
- Characteristics: Dual Purpose.
- Best egg layer among dual purpose breeds (250)
- Cock: 3.8kg
- Hen: 3.0 kg
- Used for upgrading the local/ deshi stock



**New Hamphsire**

- Skin Color -Yellow
- Egg Color –Brown
- Comb type: single, five-pointed com
- Origin -Massachusetts
- Characteristics: Rapid growth, Early maturing, Fast Feathering
- Use: dual
- Cock: 3.8kg
- Hen: 3.0 kg

**Wyandotte:**

- Egg shell color: brown
- Skin: yellow
- Origin: America
- Comb: single
- Use: dual purpose
- Characteristics: docile and show broodiness

**Plymouth Rock:**

- Skin Color -Yellow
- Egg Color –Brown
- Comb: single
- Ear lobe: red
- Shank color: yellow
- Feathers on shank Absent
- Origin –America
- Use: meat and egg
- Characteristics: Docile, Deep full breast

White PlyMouth Rock

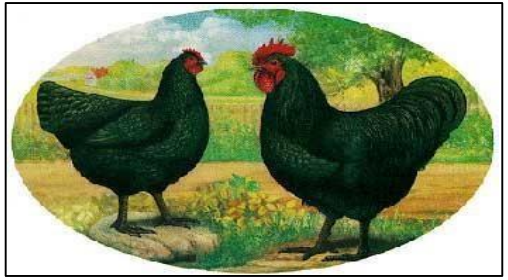
Barred Plymouth Rock

**White leghorn:**

- Italy
- Most popular: No. one egg producer → 280/year
- Egg shell: white
- Comb: single
- Skin: yellow
- Ear-lobe: yellowish white
- Cock 2.7 kg
- Hen 2.0 kg

**Australorp**

- Origin: Australia.
- Variety: Black.
- Comb: single
- Egg Shell Color: Brown
- Use: mainly egg production but dual
- Cock: 3.8kg
- Hen: 3.0 kg



**Cornish (Meat)**

- Comb type-Pea
- Ear lobe-Red
- Shank Col-Yellow
- Feathers on shank-Absent
- Skin Color: Yellow
- Egg Color: Brown

**Minorca**

- Red faced
- Heaviest of Mediterranean breeds
- Egg color: white
- Skin: white but legs black
- Cock: 3.6 kg
- Hen: 3.0 kg

**Kadaknath or kalamasi**

- Black pigmentation on external and internal surface
- Kalamasi: meaning a fowl with black flesh. The black pigment has been due to deposition of melanin
- A medium layer, lays about 80 eggs per year.
- The bird is resistant to diseases in its natural habitat.
- The comb, wattles and tongue are purple.

**Aseel:**

- Game bird with fighting quality and biggest in size among native breeds
- High stamina, majestic gait and dogged fighting qualities.
- Well-known for their meat qualities.
- Broodiness is most common.

**Naked nake**

- Naked nake which make them well adopted to high temperature due to heat dissipation in hot humid costal region and north east region

**Punjab brown:**

- Origin -Punjab, Hariana
- Utility: meat
- Plumage colour is mostly brown and the pattern is usually solid but is sometimes spotted or striped.

**Chittong or malay:**

- Native Tract: North Eastern states of India bordering Bangladesh
- Cock: 3.5 –4.5 kg
- Hen: 3 -4 kg.
- Good game bird
- long mane and tail, high headset when in action

- Heaviest Breed: Jersey Black giant
- Best layer Breed: White Leghorn
- Best Broiler Breed: Cornish
- Andalusian: Blue shelled eggs
- Feathered Shanks: Asiatic Breed
- Fighting/ Game breed: Aseel

# Duck Breeds

**Meat Type**

- White pekin
- Aylesbury
- Muscovy
- Rouen

**Egg type**

- Khaki campbell
- Indian runner

# Turkey

- Broad Breasted Bronze
- Broad Breasted large white
- Beltsville small white

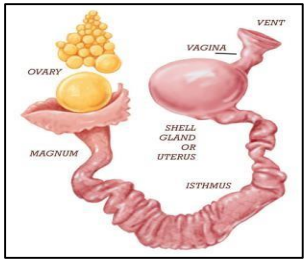
# Reproductive system of poultry

**Female reproductive system:**

- Two parts: 1) ovary, 2) oviduct
- At time of early embryonic development two ovaries and two oviducts are present
- Only left pair ovary and oviducts are persist in all species of adult bird Except in kiwi both ovaries are functional but only left oviducts remain functional

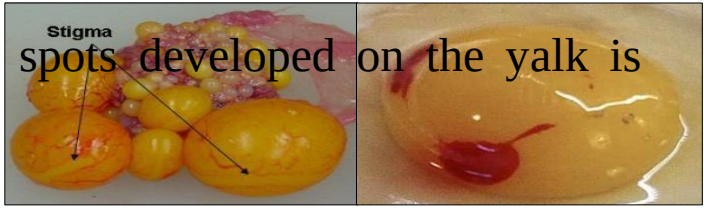
**Ovary:**

- Before maturity size is small
- Mature ovary consist of numerous developing follicle appears like cluster of grape
- Left ovary is situated at dorsal part of abdominal cavity at fore end of kidneys
- Attached to abdominal wall by help of mesovarium ligament
- Ovary have developing eggs or ova
- A pullet chick have 10,000-20,000 potential eggs
- Most of them never developed to point of ovulation




- Vitelline membrane: Multilayered structure that surrounds the yolk of an egg and separates it from the egg white
- As ovum develops yolk is added
- Color of yolk is yellow comes due to yellowish fat soluble pigment called as Xanthophyll
- Hens fed yellow maize or allow to range on grass , typically have dark yellow yolk
- Hens fed on diets with white maize , sorghum, millet or wheat typically have pale yolk
- Color of yolk can be improved by adding marigold petal ( xanthophyll)

- Liberation of ovum from follicle is called ovulation
- Ovulation normally occur 14-75 minutes after oviposition ( laying of fully formed egg)
- Yolk size in the egg –up to 40 mm (1.5 to 2 inches) in diameter
- On distal surface of mature follicle has a area which is devoid of blood vessels called as stigma from where follicle splits to release yolk in to oviduct.
- If follicle splits from place other than stigma numerous blood vessels will rupture and result in blood spot in eggs.
- Occasionally vitelline membrane is damaged and pale spots developed on the yalk is called as mottling.




- A high incidence of yalk mottling due to:

✓ Use of antibiotics like nicarbazin and dibutyline

✓ Cotton seed cake ( gossypol) and sorghum diet ( tannin)

✓ And in a calcium deficient diet

**Meat spot:**

- When some piece of wall of oviduct are sloughed off when egg is passing in through oviduct

## Oviduct

- Is a long zig zag tube ( 25-27 inches long)
- Consist of glandular and muscular part
- Oviduct extend from ovary to cloaca
- 5 parts:
  i. Infundibulum ( 9cm)
  ii. Magnum ( 33cm)
  iii. Isthmus ( 10 cm )
  iv. Uterus ( 10-12 cm)
  v. Vagina (10-12 cm)

| Part | Length | Time spend | Function |
|---|---|---|---|
| Infundibulum | 9 cm | 18 min | Reservoir for spermatozoa and fertilisation |
| Magnum | 33 cm ( longest part) | 2 hr 54 min | Thick white or albumen is added |
| Isthmus | 10 cm | 1hr 15 min | Some albumen and inner and outer shell membrane is added |
| Uterus or shell gland | 10-12 vm | 20 hr 40 min | Shell Ca CO3 over egg 47% calcium from her bone , pigment deposition ( porphyrin – brown color ) |
| Vagina ( muscular part ) | 12 cm | | Cuticle is added help in easy oviposition |
| Total | 74 cm | 25-26 hr | |

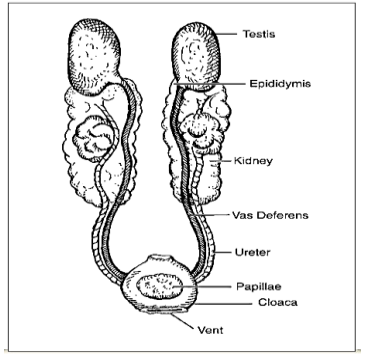
Shell pigment ( porphyrin brown color) are added 5 hour before oviposition

**Process of egg formation:**

- Yolk is not true reproductive cell
- When female attain sexual maturity (FSH) mature ovum rapidly inside graffian follicle
- Yolk weight also increases 7 day prior to ovulation due to deposition of yalk material over the ovum in alternate layer of white and yellow (esult of periodic intake of differing amounts of xanthophyll)
- White layer –night time
- Yellow layer –day time
- Due to deposition of yolk nucleus migrates from center to periphery and lies underneath vitelline membrane
- The nucleus of infertile egg called as germ spot and nucleus of fertile egg is called as germ disc
- FSH = growth of maturity of grafian follicle
- LH= release ovum by rupturing of graffian follicle
- Ovulation
- Oviposition ( broad end first comes out )
- In emu one egg formation required 3 d.
- Laying of egg occur through contraction of uterus
- Oxytocin and vasotocin are required for oviposition

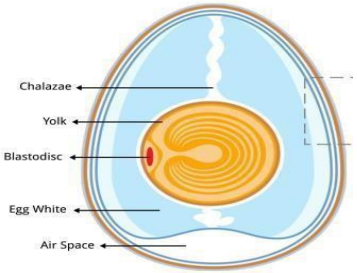
**Male reproductive system:**

- Include a pair of testis , vas deferens, cloaca and rudimentary copulatory organ & no penis.
- Testis: bean shaped bodies against backbone in front of kidney
- Size is not constant, Become larger when birds are constantly mating
- Usually left testis are larger than right one.
- Epididymis in birds are smaller than mammals
- Testis: numerous seminiferous tubule →spermatogenesis.
- Testis opens into epididymis
- Epididymus of each sides continue down as vas deferens and terminates in to cloaca
- Vas deferens transport sperm
- On median ventral portion of cloaca is a small button shape structure called as copulatory papillae



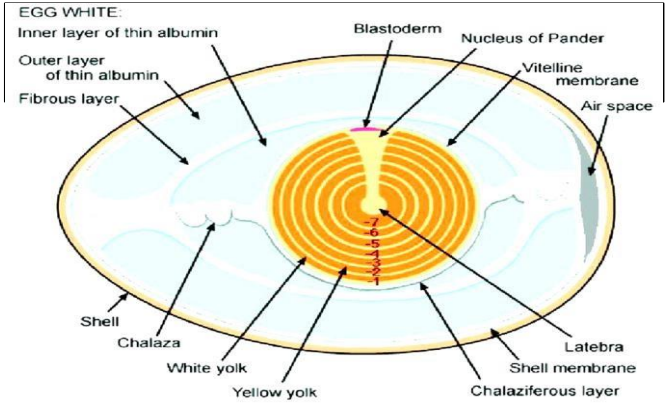

- During copulation, papillae of male and female are press together so that sperm are ejected directly in to female reproductive system.
- Semen volume 0.3 ml contain on average 3-5 x $10^9$ sperm per ml
- Ph of semen : 7.45-7.63
- Androgen influence secondary sex character such as comb growth and male behavior and mating

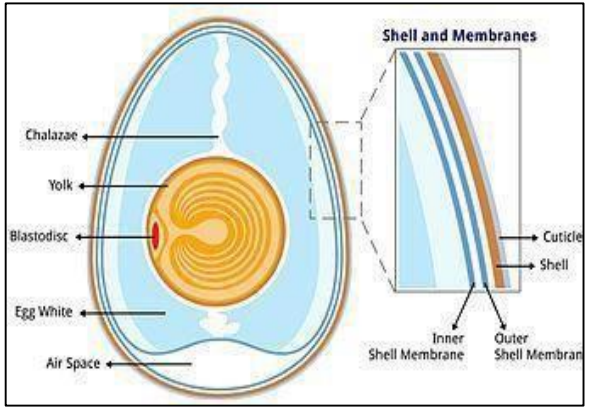
**Fertilisation:**




- In infundibulum
- With in 5 minutes of ovulation
- On surface of yolk there is a tiny, whitish spot called as blastodisc.
- When a yolk enter in infundibulum, a sperm penetrate the blastodisc and fertilization occur
- After fertilization, blastodisc become blastoderm
- Hen continue to lay eggs even if egg is not fertilized.
- Complete shell formation takes 24-26 hours.
- Hens body temp during egg formation 104-106$^{o}$F
- There is synchronization between ovulation and oviposition→ Next ovulation occur 30 min after oviposition.

- Egg shell
- Shell membrane
- Albumen
- yolk




## EGG SHELL

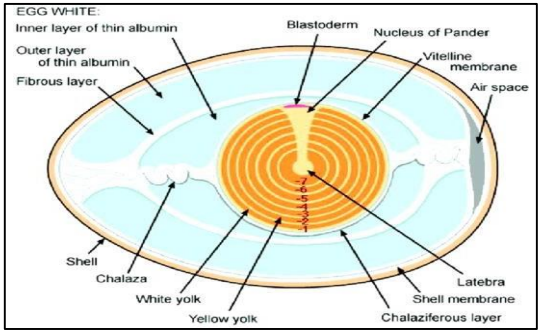
- Cuticle
- Spongy or calcarious layer
- Mammillary layer or matrix and pores
- Microscopic Pores- 8,000-10000 per egg, distributed unevenly over the shell surface (more at broad end than narrow end).
- Exchange of volatile compounds between the shell membrane and cuticle.
- CaCo3

## SHELL MEMBRANE

- Air cell
- Outer shell membrane
- Inner shell membrane
- Air cell is situated in between the two membranes at the broad end
- Air cell - formed as a result of contraction of the egg contents, soon after oviposition, due to differences in the temperatures exposed to by the egg prior to and after oviposition
- The outer shell membrane is attached to the shell.
- The inner shell membrane closely surrounds the albumen

**Albumen:** 4 layers

1. Outer thin albumen layer (23%)
2. Inner thin albumen layer (17%)
3. Outer thick or dense albumen (57%)
4. Chalaza or inner thick albumen (3%)



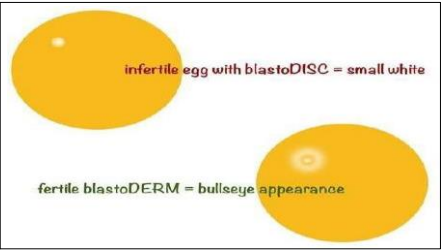

- Chalaza layer: very close to yolk/ immediate surround vitelline membrane
- Twisted into two cord due to rotational movement of egg in oviduct
- Function of Chalazae:
- Anchor for yolk → hold the yolk in central position
- Lysozyme → antimicrobial properties to avoid microbial spoilage of egg (ageing and microbial spoilage makes the albumen watery)

**Yolk:**

- Latebra: center of the yolk, which is a small circular core of light colored fluid , which does not harden on boiling.
- Nucleus of pander: a cup shape structure, which is an extension of neck of latebra, connecting base of germinal disc
- Germinal disc: located on surface of yolk from here embryo formation begins
- Vitelline membrane is a semi permeable elastic membrane which separate yolk material from albumen.
- Doubled-yolk eggs:
  - ✓ Hen-age related and genetic factors → a byproduct of rapid ovulation.
  - ✓ More often in spring and with young or very old birds

# Fertile vs Infertile egg:

- In an *infertile egg* it is unicellular (ovum) and contains haploid number of chromosomes, called "Blastodisc". It is circular in shape, with a diameter of **about 3.5 mm and with vacuoles** in it.
- Where as in a *fertile egg,* it is a multicellular structure having diploid number of chromosomes, called "Blastoderm". It is oval in shape, with an average diameter of **about 4.5 mm and with no vacuoles in it.**




## Clutches

- Birds lay eggs in clutches
- Eggs laid on successive days are called a clutch.
- Clutch size is an individual characteristic and may vary from 2 up to 100 eggs.
- However, the normal clutch size is from 3-8 eggs.
- The larger the clutch size – good layers
- Small clutch size indicates an inferior layer.

- ovulation usually occurs in the morning and almost never after 3:00 PM.
- Ovulation of a yolk for the next egg in a clutch occurs within an hour of laying the previous egg.
- and so that each day the hen gets later and later in her timing.
- Since hens do not typically ovulate after 3:00 PM, the next ovulation is delayed until at least the next day and egg laying is interrupted.
- This delay results in the break between clutches and the cycle repeats itself a day or so later. PHUSE

## Composition of egg of various birds

| Birds | Egg weight (g) | Yolk (%) | Albumin (%) | Shell (%) |
|---|---|---|---|---|
| Chicken | 50 | 31 | 58 | 11 |
| Quail | 10 | 32 | 48 | 20 |
| Turkey | 65 | 32 | 56 | 12 |
| Duck | 72 | 35 | 53 | 12 |
| Pigeon | 18 | 18 | 74 | 8 |

## Nutrient composition % of chicken egg

| Nutrients | Whole egg | Albumin | Yolk |
|---|---|---|---|
| Water | 65 | 84 | 48 |
| Protein | 12 (6.4g) | 11 (2.8g ) | 17.5 (2.8g) |
| Fat | 11(5.5g) | 0.2(0.5g) | 32.5 (5g) |
| Carbohydrate | 01 | 1 | 01.0 |
| Ash | 11 | 0.8 | 1 |

**One egg**

- Calories : 67.4 Kcal
- Protein : 6.4 grams
- Carbohydrates : 0.3-0.6 grams
- Total Fat : 5.0 grams
- Monounsaturated fat : 2.0 grams
- Polyunsaturated fat : 0.7 grams
- Saturated fat : 1.5 grams
- Cholesterol : 213 milligrams (210-250 mg/egg)
- Sodium : 63 milligrams

**Nutritive value of egg white and egg yolk:**

- The white or egg albumen contains more than half the egg's total protein, niacin, riboflavin, chlorine, Mg, K, Na, and S and all the egg's zinc.
- The yolk contains all of the fat, fat-soluble vitamins and a little less than half of the protein.
- Egg yolks are one of the few foods naturally containing vitamin D.
- Yolk also provides vitamin $B_{12}$, choline and folic acid, and the minerals iron, calcium, copper and phosphorus.
- Eggs have biological value of 93.79 % (94%).

**Egg protein:** different proteins

- Ovalbumin: 55% of the proteins of egg white.
- Conalbumin: 13% protein of the egg albumin.
- Ovamucoid: 10% of the egg white proteins.
- Ovomucin: 2% of the egg white. Responsible for the jelly like character of egg white and the thickness of the thick albumen.
- Lysozyme: 3.5%. This is an enzyme capable of lysing or dissolving the cell wall of bacteria.
- Avidin: 0.05% of the egg white protein. It binds biotin and makes the vitamin unavailable.
- Ovoglobulin: two components G1 and G2 and both are excellent foaming agents.
- Ovoinhibitor - It is another protein capable of inhibiting trypsin and chymotrypsin.

# Grading of eggs:

**Parameters**

1. Haugh unit: $HU = 100 \times \log_{10} (h - 1.7w_{0.37} + 7.6)$
   - Most significant measures of egg quality.
   - Measure the height of the thick albumen.
   - The Haugh unit value ranges from 0-130 .
   - The higher the number, the better the quality of the egg
   - **Eggs can be ranked according to their HU rating:**
     1. Grade AA: HU rating 72 or more
     2. Grade A: HU rating 72 to 60.
     3. Grade B: HU rating 59 to 31.
     4. Grade C: HU rating 30 0r less.
2. Eggshell thickness.
3. Eggshell strength.

- In India eggs are graded according to the weight.
- There are 5 grades.

# Grades according to USDA

- **3 grades: AA, A & B**

| Quality Factor | AA | A | B |
|---|---|---|---|
| Air Cell | 1/8 inch or less in depth | 3/16 inch or less but > 1/8 inch in depth | More than 3/16 inch in depth |
| White | Clear<br>Firm | Clear<br>May be reasonably firm | Clear<br>May be weak and watery |
| Yolk | Outline slightly defined | Outline may be fairly well-defined | Outline clearly visible |
| Blood or meat spot | None | None | Blood or meat spots totaling no more than 1/8 inch in diameter |

# Egg preservation

**Purpose:** increase shelf life of egg

**General recommendation for production of quality egg on farm:**

- 3 time egg collection daily
- Quickly cooling of egg to 50°F or less @7 5-85% relative humidity
- Marketing of egg twice a week
- Egg shell carries micro organism which is mainly responsible for spoilage
- Additionally loss of water content also responsible for spoilage of egg

**Methods of preservation**

1. **Earthen Pot:** The eggs can be kept in an earthen pot embedded in soil having sand bed in lower temp.
2. **Refrigeration/ cold storage:** Best method of storage.
   - Temp : 30-32 F (0°C) and 85 90% RH for 5-10 month
   - Temp : 50-55 F and 60 70% RH for 2-3 month
3. **Immersion liquid:** Long term store (2-3 months) → limewater, 10% Sod. silicate sol (water glass method).
4. **Thermo-stabilization:** Good for fertile egg as it killed embryo (defertilisation method). Hot water immersion: 130°F X 15 min; 142°F X 2 min.; 212°F X 5 sec.
5. **Egg-shell treatment:** sealing of egg shell pores by Oil Coating Oil Water Emulsion. It prevents the escape of moisture and $CO_2$ from the egg content.
6. **Over wrapping:** over wrapped in cellophane. Effective in maintaining egg albumen quality. Compared to oil coated eggs, overwrapped eggs peel easily.
7. **Radiation:** gamma rays or X-rays to kill pathogens like salmonella
8. Pasturization: in warm water at 63°C for 2.5 minutes or 64°C for 1.5 - 2 minutes

# Incubation

- Process of developing an embryo inside an egg under favorable conditions

**Principles:**

- Temperature
- Humidity
- Ventilation (oxygen and carbon dioxide level and air velocity)
- Position of eggs
- Turning of eggs

**1. Temperature**

- Temperature is the most critical environmental concern during incubation.
- Embryo starts developing when the temperature exceeds the physiological zero. Physiological zero is the temperature below which embryonic growth is arrested and above which it is reinitiated.
- The physiological zero for chicken eggs is about $70^{o}$ F ($21.1^{o}$ C).
- The optimum temperature for chicken egg in the setter (for first 18 days) ranges from $99.5^{o}$ F to $99.75^{o}$F ($37.7^{o}$ C )and in the hatcher (last 3 days) is $98.50^{o}$F. ($36.7\text{-}37.2^{o}$ C)

**2. Humidity**

- Determines the rate of moisture loss from eggs during incubation.
- Recorded by wet-bulb and dry-bulb thermometers.
- For the first 18 days ranging between 55 and 60% in setter (60%)
- For the last 3 days ranging between 65 and 75% in hatcher (70%).
- Higher humidity during hatching period is given to avoid dehydration of chicks.

**3. Ventilation**

- Oxygen needs → small during the first few days compared to the latter stages.
- Generally the oxygen content of the air in the setter remains at about 21%.
- For every 1% drop in oxygen there is 5% reduction in hatchability.
- The tolerance level of $CO_2$ for the first 4 days in the setter is 0.3%.
- $CO_2$ levels above 0.5% in the setter reduce hatchability and completely lethal at 5.0%.

## 4. POSITION OF EGGS

- Under normal circumstances eggs are set with large end up for the first 18 days (in setter) and in horizontal position for the last 3 days (in hatcher). It is natural for the head of the chick to develop in the large end of the egg near the air cell, and for the developing embryo to orient itself so that the head is uppermost.
- When the eggs are incubated with the small end up, about 60% of the embryos will develop with the head near the small end.

## 5. Turning of eggs

- Similarly eggs to be turned at least 8 times a day to mimic their natural nesting habit.
- It prevents the developing embryo adhering to the extra embryonic membranes and reduces the possibility of embryo mortality.
- In large commercial incubators the eggs are turned automatically each hour.
- Most eggs are turned to a position of $45^{o}$ from vertical, and then reversed in the opposite direction to $45^{o}$ from vertical.
- Turning is not required in hatcher (no turning in last 3 days)

- High incubation temperature: embryonic mortality, small chicks, crooked toes, straddled legs while lower temp. causes poor hatchability and late hatching
- Low humidity during incubation: excessive water loss from eggs causing piped eggs and embryo that are dried out in shell or dead in shell while high humidity result in soggy and large chick

# Incubation period for different birds

- Quail : 16-17 days
- Pigeon : 18-21 days
- Chicken : 21 days
- Guinea fowl : 26-28 days
- Duck, turkey: 28 days
- Ostrich : 42 days

# Method of incubation

- Natural method : with help of broody hens(Healthy, quiet, a good sitter, have good body size), 10-15 eggs can be placed under one birds
- Artificial methods

1. Still air incubators : experimental purpose
2. Forced-draft types: used in all the country

# Selection and care of hatching eggs

1. Egg size : 50-55gm
2. Shaped of egg : Oval, Shape index does effect the hatchability of egg.
3. Shell quality : Sound shell, clean, thick
4. Interior quality

| | |
|---|---|
| Small size egg | 80% hatchability |
| Extra-large eggs | 71% |
| Cracked eggs - | 53% |
| Misshapen eggs – | 49% |
| Rough/thin shell | 47% |

# Hatchery operations

Receiving cleaned hatching eggs

⇓

Fumigation of eggs for sanitation
(3x concentration for 20 minutes)
(3x means 60g $KMnO_4$ and 120 ml formalin for 100 cu.ft.)

⇓

Storage in egg holding room
(65°F temperature and 75% R.H.)

⇓

Pre-incubation warming at Room temperature
(4 to 6 hours)

⇓

Loading eggs in the setter
(For first 18 days)

⇓

Candling of eggs for removing infertile eggs

⇓

Transfer to the hatcher
(last 3 days)

⇓

Pulling out the chicks
(at 90% dry condition)

⇓

Sexing
(only for layer chicks) (Vent sexing / feather sexing)

⇓

Grading

⇓

Vaccination
Marek's

# Handling of hatching eggs and storage

- The quality of hatching egg cannot be improved after lay but one can reduce the loss in hatching egg quality by adopting some standard procedures.

**Maintaining egg quality in the breeder House:**

- Use of enough clean, dry and mold-free nesting material can avoid cracked and dirty eggs.
- Provide sufficient number of nest boxes well in advance before the laying starts.
- Hatching eggs should be collected at least 3 times a day.
- Effort must be made to reduce the microbial load/ contamination.
- Wash and sanitize hands before collecting eggs from the nests or egg belts.

**Selection of hatching eggs:**

- Not all eggs laid by a breeding flock are set.
- Eggs that are cracked, dirty or misshapen are usually not used for hatching.
- Very small or very large eggs do not hatch as well as eggs in the middle size range.
- Eggs with thin or very porous shells are not likely to hatch well because of excessive losses of water during incubation.

# Sequences of operation:

1. **Securing hatching eggs**
   - From own breeder flock
   - From other breeder flocks
   - From other hatcheries
2. **Traying hatch eggs**
   - Eggs should be transferred to the egg setter trays immediately after receiving.
3. **Storage of hatching eggs**
   - Generally, eggs are not set immediately after they are laid.
   - Many hatcheries set eggs once or twice in a week.
   - If hatching eggs are stored up to 1 week, hatching eggs should be kept in an egg holding room with the temperature of 65$^{o}$F and the RH of 75%.
   - If eggs are held for less than 10 days, store them with the large end up.
   - If eggs are held for 10 days or more, stored with small end up.

**4. Fumigation of hatching eggs**

- After traying, eggs are to be kept in the fumigation chamber for fumigation.
- Fumigating with 3x concentration of formaldehyde for 20 minutes will kill about 97.5 to 99.5% of the organisms on the shells.
- One 'x' concentration means 20 g of $KMnO_4$ with 40 ml of formalin for 100 cubic feet (3x means 60 g of $KMnO_4$ + 120 ml of formalin for 100 cubic feet).

**5. Warm eggs prior to setting**

- Approximately 6 hours prior to placing eggs in the setter they should be moved from the egg-cooler room to normal room temperature.
- Here, atmospheric air condenses over eggshell and form water droplets over eggshell: '*sweating*'.
- It is advantageous to warm eggs before placing them in the incubator by avoiding creation of low temperature in the machine by placing cool eggs directly.

**6. Loading of eggs**

- Placing of eggs in the setter is called 'loading of eggs' eggs can be set in the setter either all in all out basis or batch basis.

**7. Candling**

- Candling is a process in which eggs are kept in front of a light source to find out the defects in eggshell, embryonic development etc.
- Candling can be done at 5-7$^{th}$ day of incubation (to discard the infertile egg, if any) and again on 18-19$^{th}$ day of incubation
- Avoid candling of hatching eggs between days 11 and 14 of incubation, as this disrupts embryo movement along the egg's length axis.
- **Methods:**

1. Use of a table or mass candler: fastest method. An entire tray of hatching eggs may be placed on the mass candler and examined with one observation.
2. Candling with a spot candler or individual candler is a little slower, but it is more accurate.

## 8. Transfer of eggs

- In modern incubators, eggs are transferred from setter to hatcher at 19th day of incubation (for chicken egg) or when approximately 1% of the eggs are slightly pipped.
- In general, one-seventh of total incubation period is needed to keep eggs in the hatcher.

## 9. Pulling the hatch

- The process of removing the chicks from the hatcher is often called pulling the hatch.
- Chicks should be removed from the hatcher as soon as all are hatched and about 95% are dry.

## 10. Hardening the chicks

- When the chicks are first placed in the chick boxes they are soft in the abdomen, are not completely fluffed out, and do not stand well.
- They must be "hardened" by leaving them in the boxes for 4 or 5 hours.
- Such hardening makes it easier to grade the chicks for quality, and the chicks are more easily vent sexed.

## 11. Grading the chicks

- ✓ No chick deformities
- ✓ No unhealed navels
- ✓ Above a minimum weight

**Types:**

1. **Grading by sex:**
2. **Grading by quality**

## 12. Sexing the chicks

- Layer type day-old chicks are need to be sex separated.
- In case of meat-type day-old chicks sexing is not practiced.
- **Methods of sexing:**

1. Proctoscope method/ Instrument sexing: Keeler instrument → observe gonads.
2. Vent sexing/ Japanese sexing: visual examination of cloaca: Most popular
3. Auto sexing: sex-linked characteristics (male XX while female XY)
4. Color sexing: female are gold/ buff colored while male light yellow/ white
5. Feather sexing: length of Primary & secondary feathers.
   - ✓ Male: wing feathers shorter than female
   - ✓ Male: covert feathers similar or longer than primary feathers.
   - ✓ Female: covert feathers always shorter than primary feather

## 13. Vaccination

- Most chicks are vaccinated against marek's disease in hatchery before delivery.

# Brooding of chicks

- The care and management of chicks during early part of their life up to four or six weeks of age is called brooding
- Brooding period: 4- 5 weeks of age .

**Types:**

1. Natural brooding: by the broody hens after hatching, up to three to four weeks of age.
2. Artificial brooding:
   - Chicks hatched artificially from incubators are kept in brooder to provide the needed temperature.
   - Chicks are provided with an adequate and constant source of heat with heating unit called Brooder.

**Hovers:** light reflectors used to provide heat for chicks.

a) Flat type: mounted with stands on all corners and usually not hung from the roof.

b) Canopy type are concave in shape.

- Not more than 500 chicks should be placed per brooder or hover.
- **Systems of brooding**
- 1) Hot room brooding: central heating system → hot water in pipe or under floor heating or by blowing hot air. Ventilation is easier, litter will be dry/ not get damp.
- 2) Cold room brooding: heating only the area under the brooder canopy and a small area beyond the canopy. Feathering of chicks is better with cold room brooding. It is commonly used in tropical countries.

# DIFFERENT TYPES OF BROODERS

- Infra red bulbs
- Heating coils
- Gas brooders (hung 3 to 5 feet above the chicks)
- Kerosene stove
- Coal/charcoal stove
- Centralized heating system
- Battery brooders : two or more cages stacked on each other
- Biogas brooders

**Chick guards or brooder guards:**

- The chick guard should be 30 cm high.
- Should be at a distance of 30 to 40 cm from the brooder .
- They help to restrict the movement of chicks, the chicks will be closer to brooders.
- Use of chick guards is important when atmosphere is cool.
- Chick guards may be removed after a week

# Brooding requirements

**Temperature**

- One infra red bulb of 250 Watts is used for every 250 chicks.
- Position the bulb 50 cm above the litter
- The warmth is measured by a thermometer daily, placing it at 5 cm above the floor level
- **Note:** Electrical brooder: One brooder for 300 to 400 chicks.
- In first week it is 95 F(33 C) and reduced by 5 F each week till to room temperature 21 C.
- The distribution of chicks under the hover is a better indication of warmth.

**Ventilation: 3-5 exchange/hour**

**Humidity:**

- 50-60%

| Age in weeks | Temperature under hover( degree Celsius) |
|---|---|
| 0-1 | 35 |
| 1-2 | 32 |
| 2-3 | 29 |
| 3-4 | 26 |
| 5-6 | 23 |

**Lighting:**

- 24 hrs for first 3 days
- 100 lux unit at bird s'eye level for day old chick → 100 watt bulb at 2 ft height
- After brooding: 20 lux is enough → 40 watt bulb at 6 ft height

## Space requirement

- In case of electric hover, 65.5 $cm^2$ (0.22 $ft^2$) per chick.
- 9.3 $m^2$ brooder: about 200 chicks up
- On the deep litter: 700 $cm^2$ floor area per chick till 8 wk.

## Feeder and water:

- Feeders and waterers should be 5 cm in height from the level of the litter
- Chicks should have 2 cm linear watering space per chick.
- 2 waterers of 5L capacity are sufficient for 100 chicks.

Average feed and water intake of chicks

| Age in weeks | Feed intake in gram per bird per day | Water intake in ml per bird per day |
|---|---|---|
| 1 | 13.2 | 155 |
| 2 | 16.3 | 155 |
| 3 | 24.5 | 193 |
| 4 | 31.8 | 193 |
| 5 | 36.3 | 208 |
| 6 | 38.1 | 208 |

| Age | Feeder space |
|---|---|
| Up to the age of 6 weeks | 5 cm |
| From 6 to 12 weeks of age | 7 cm |
| Above 12 weeks | 10 cm |

| AGE | Floor space per bird | Feeder space per bird | Waterer space per bird |
|---|---|---|---|
| Up to 18 days | 0.5 sq.ft | 3 cm | 1.5 cm |
| 19 to 42 days | 1 sq.ft | 6-7 cm | 3 cm |

# Space

- First week – 100 - 120sq.cm/chick
- 2-4 weeks – 250 - 300sq.cm/chick
- 5-8 weeks – 700 - 820sq.cm/chick

- **Ventilation**
- To remove Carbon dioxide and Carbon monoxide, Ammonia and to keep the litter dry.
- Strong odor of Ammonia: poor ventilation. Max conc of Ammonia 25ppm
- If concentration of CO is more than 0.01 %, it is poisonous to chicks.
- Excess Ammonia will retard the growth of chicks.
- VACCINATION FOR LAYER CHICKS

| Age | Disease | Vaccine | Route |
|---|---|---|---|
| Day one | Marek's disease | HVT vaccine | s/c |
| 5 to 7 days | RD | Lasota/F | Occulonasal |
| 10 to 14 days | IBD | IBD live | Drinking water |
| 24-28 days | IBD | IBD live | Drinking water |
| Eighth week | RD | $R_2B$ or RDVK | Subcutaneous |

VACCINATION FOR BROILER CHICKS

| *Age* | *Disease* | *Vaccine* | *Route* |
|---|---|---|---|
| 0- 5 days | RD | Lasota/F | Occulonasal |
| 10 to 14 days | IBD | IBD Live | Drinking water |

## Different types of poultry houses

1. **Brooder/chick house -**it is used to brood and rear egg-type chicks from 0 to 8 weeks of age.
2. **Grower house -**it is used to grow egg-type birds from 9 to 18 weeks of age.
3. **Brooder cum grower house -**here, the birds are reared from 0 to 18 weeks of age (entire brooding and growing period of egg-type chicken).
4. **Layer house -**in which birds over 18 weeks of age are reared, usually up to 72 weeks of age.
5. **Broiler house -**in which broilers (meat-type birds)are reared up to 6 weeks of age.
6. **Breeder house -**in which both male and female breeders are maintained at appropriate sex ratio.

**Poultry housing systems**

1. Free range or extensive system
2. Semi intensive system
3. Intensive system
   - Deep litter system
   - Slatted floor system
   - Slat cum litter system
   - Cage system

**Free range system:**

- Only when adequate land is available
- Rear about 250 adult birds per hectare
- This system is most preferred for organic egg production.

**Semi-intensive system**

- Half-way reared in houses and half-way on ground or range, i.E. Birds are confined to houses in night or as per need
- The feeding and watering facilities are provided in the pen.
- Stocking density rate on an average for adult birds is 750 per hectare.
- This system is usually adopted for duck rearing

Intensive system

- Birds are totally confined to houses either on ground / floor or on wire netting floor in cages Or on slats.
- It is the most efficient, convenient and economical system for modern poultry production with huge numbers.

**Deep litter system**

- The birds are kept on suitable litter material of about 3” to 5” depth.
- Litter materials: paddy husk, saw dust, ground nut hulls, chopped paddy straw or wood shavings.
- The litter is spread on the floor in layers of 2” height every fortnightly till the required depth is achieved.
- Deep litter or built up litter is accumulation and decomposition of litter material and excreta until it reaches a depth of 8” to 12”, after an original start of 3” to 5” depth.
- After one year, the litter is changed and the decomposed litter is used as good quality manure.

**Slatted (slotted) floor system**

- In a slatted floor, iron rods or wood reapers are used as floor, usually 2-3 feet above the ground level to facilitate fall of droppings through slats.
- Wooden reapers or iron rods of 2” diameter can be used on lengthwise of the house with interspaces of 1” between rods.

**Slat (slot) cum litter system:**

- This system is commonly practiced for rearing birds for hatching eggs production, particularly meat type breeders.
- Here, a part of the floor area is covered with slats.
- Usually, 60% of the floor area is covered with slats and rest with litter
- Feeders and waterers are arranged in both slat and litter area.

**Cage system**

- Rearing of poultry on raised wire netting floor in smaller compartments, called cages
- It has been proved very efficient for layers.
- At present, 75% of commercial layers in the world are kept in cages
- Feeders and waterers are attached to cages from outside except nipple waterers, for which pipeline is installed through or above cages

## TYPES OF CAGES

- Based on the number of birds in a cage, it is classified as
- Single or individual bird cage (Only one bird in a cage)
- Multiple bird cage (From 2 to 10 birds, usually 3 or 4 birds per cage)
- Colony cages (Holding birds more than 11 per cage)

## BASED ON THE NUMBER OF ROWS

- Single-deck
- Double-deck
- Triple-deck
- Four-deck

## BASED ON ARRANGEMENT OF CAGES

- Stair-step cages :- M-type cages & L-type cages
- Battery cages (Vertical cages)

## BASED ON THE TYPE OF BIRD REARED

- Brooder / Chick cages/Battery brooders
- Grower cages
- Layer cages
- Breeder cages
- Broiler cages

# Broiler management

**Debeaking**:

- To reduce cannibalism and feed wastage.
- Advised at day Old or 6 to 8 days of age.
- About one half of the upper and lower beak is removed.
- The lower beak is kept slightly longer than the upper beak

**Dubbing:**

- Removal of comb.
- Can be trimmed at day old age
- Prevent injury to comb, and avoids damage due to frost bite under cold climate

**Toe-clipping:**

The inside and back toes of all breeding males are clipped to prevent damage to the back of the femal.e during mating done at day old or at 6-8 days of age

- **Economic traits**
- Growth traits-body weight and growth rate
- Feed efficiency: FCR of 1.7 to 1.8 is optimum.
- Liveability at market age: 95- 96 liveability (Death rate not exceed 4-6%)
- Carcass traits –dressing percentage: 72 to 76%

**Housing:**

1. Wire floor or cages: for layers
2. Slat system is commonly used for broiler breeders.
3. Deep litter system is most commonly used for broiler:
   - 2 - 4 inch deep layer of dry saw dust, shavings, straw may be used.
   - 1 sq. Ft of floor space Should be provided per bird under deep litter system.

# Rearing systems for broilers:

**1. All in all out system:**

- The most commonly adopted system.
- All the birds will belong to same hatch.
- All the chicks will be purchased on the same day, reared together and sold together

**2. Multiple batch system:**

- Rearing of more than one batch of chicks at any time.
- Batch interval is 1 to 4 weeks
- Farmer buys day old chicks and sells broilers at weekly or fortnightly intervals

# Layer management

- Mortality should not exceed 3 %
- Floor space : 1.4 $ft^2$ per grower bird/ and 2 $ft^2$ per layer bird
- Feeder space : 6-8 cm (2.25-3.25”) per grower bird and 5” per layer bird.
- One linear feeder of 120 cm (4ft) length and 8 cm depth: for 40 growers.
- Waterer space : 2 cm per bird and half of feeder space for layers.
- A circular waterer of 36 cm and 8 cm depth with capacity of 6 lt: for 50 growers
- No artificial lighting is given for growers. Only natural daylight (9 hrs/ day).
- More exposure to light will start laying eggs early and the eggs will be small.
- Daily feed intake is 60-80 g feed per grower bird per day
- Restricted feeding programme (20-30 % restriction ) may be adopted to delay sexual maturity and will improve egg quality.
- Shell grit. 1.5 kg grit for 100 growers for one week.
- Debeaking may be done at 15 weeks of age
- Deworming should be done before transferring the birds to the layer house
- Litter: 6” thick; shake litter at least once in a week

**Nest for layers:**

a) Individual nest: One nest box is sufficient for 4-5 birds

b) Community nest: This will accommodate 50-60 birds

c) Trap nest This will accommodate 1 bird at a time and is used for academic and breeding studies.

➢ During night hours the nest should be closed to prevent sitting of birds in the nest

**Lighting Management for layers:**

- Provide Light stimulation at 18 wks of age starting with a minimum of 13 hr of day length
- Increase light by 15-30 min/ wk until **16 hrs of light is reached**
- Light Intensity: 0.9-1.2 foot candle
- Never decrease day length and light intensity during laying period
- Lighting stimulation not provided until the flocks reach the optimum body weight of 1270-1360 g.
- Light stimulation at sub-optimal body weight may lead to prolapse

**Egg production**

- 2 phases: 21-45 wk and 46-72 wk
- Starts at 20$^{th}$ week and the percentage of production increases every week to reach a level of 90% and above after 28 wks of age.
- Maintained up to 36 wks of age even up to 40-42 wks
- Peak egg production: 28-36 wks
- Afterwards It slumps down slowly to reach 70 or below by 72 wks
- Average feed consumption during laying period ranges from 100-110 gram
- Deworming of layer: interval of 6 8 weeks.

# Role of lights in poultry

For chickens there are three major functions of light:

- To facilitate sight, To stimulate internal cycles due to day-length changes To initiate hormone release.

**Wavelength or color of light:**

- Birds sense light through their eyes (retinal photoreceptors) and photosensitive cells in the brain (extra retinal photoreceptors).
- Long wavelengths (towards red end of the spectrum) penetrate the skin and skull more efficiently.
- Reproduction- linked to extra retinal photoreceptors while growth and behavior are linked to retinal photoreception
- Blue light has a calming effect on birds and stimulates growth .
- Red has been used to reduce cannibalism
- Orange red stimulates reproduction.

**Lighting the layers**

- Threshold intensity for photo-stimulation is about 0.15 foot candle.
- Maximal egg production has been achieved at intensities between 0.5 and 1.0 foot candle.

**Duration of light stimulation:**

- Never Increase: the duration or intensity of light during the growing period.
- Never Decrease: the duration or intensity of light during the production period.
- Duration depends upon the age of the chicken and type of housing you use.
- Chicks can be exposed to 21-23 hrs of continuous light at one and two days of age and then reduced to 15 or 16 hrs of light until the birds are 3 weeks of age .
- At 3 weeks of age, reduce the hours of light to 10-12 hours or as dictated by natural day length
- In summer for open housing use decreasing hours of light up to 6 weeks of age and then hold constant to avoid delays in maturity
- After 18 week Jump to 13 hours and then add 15-30 min per week until 16 hrs of light is reached.
- Light stimulation should continue until peak production is achieved.

**Lighting the broiler**

- **Intensity:** broilers can be exposed to 1 to 2 foot candle from day one to day three and then placed on 0.5 to 1 foot candle to processing
- **Duration:** 24 **(**20-23) hrs of continuous light for 1st 3 days and then reduced to 18-20 hrs of light until processed.
- **Lamp/ bulb placement:**
  - ✓ Such that the darkest areas have at least 0.5 -0.75 foot candle of light.
  - ✓ The distance between bulbs should be 1½ times the distance from the bulb to the bird level.
  - ✓ The distance from bulbs to the outer edges of the house should be only half the distance between bulbs.
  - ✓ The distance between bulbs should be 1.5 times the distance from the bulb to the birds.
  - ✓ Clean reflectors increase the light intensity at bird level by 50% compared with no reflector.
  - ✓ Avoid cone shape reflectors since they confine the light rays to limited area. Better to use flat type reflector with rounded edge.
  - ✓ In case of deep litter system, the bulb is to be placed at 7-8’ (ft) height.
  - ✓ Very dirty bulbs emit about 1/3 less light than clean bulbs.
  - ✓ Light bulbs should be cleaned once in two weeks.

# Selection

- Choosing the best parent for next generation so that farmer may achieve his goal in shorter period of time

**Depends upon following:**

1. Individual: record body conformation, production efficiency, brother and sister
2. Ancestral record
3. Progeny record

- **Method of selection:**
  - **Individual selection:** based on individual or group productive efficiency used in broiler
  - **Pedigree selection:** parent, grand parent, great grand parent, collateral relatives Productive performance is good the bird are selected
  - Use for traits which are expressed after sexual maturity
  - **Family selection:** based on productive ability of the family ,which is dependent on the record of individual, brothers, sisters in the pedigree
  - Used for sex limited traits

# Culling

- Removal of sick, injured, unproductive and poor producing birds from the flock

**Purpose of culling:**

- To remove unproductive uneconomical birds
- To improve performance of flock
- To increase or maintain good efficiency of the flock
- To reduce cost of maintenance of flock
- To increase the profit from the flock

**The advantages derivable from culling of birds are**

- ✓ Prevention of spread of diseases
- ✓ Increase in the quality of the stock
- ✓ More space is allowed for the remaining birds
- ✓ Increase in profits principally by reducing feed required to produce a dozen eggs

**Factors to be considered in culling**

- ✓ Poor growth/ stunted
- ✓ Poor feathering
- ✓ Lack of vigour
- ✓ Poor body shape and fleshing
- ✓ Low egg production-non layer/inferior layer
- ✓ Layer above 19 months of age
- ✓ Broody hens
- ✓ Low feed conversion efficiency
- ✓ Improper head development
- ✓ Delayed maturity
- ✓ **Value of Yellow Pigment In Culling:**
  - ✓ Vent, eye ring, beak, skin, and shanks are colored yellow similar to yolk. As the hen starts laying this yellow pigment begins to disintegrate and disappear.
  - ✓ After production: loss of yellow color ➔ vent (first) → eyelids, the earlobes, the beak, and lastly the shanks.
  - ✓ When a hen stops laying, the color returns in the same order that it leaves.
  - ✓ The loss of yellow color in the shanks indicates a long laying period, which varies from three to six months.
  - ✓ Absence of yellow pigment in the vent, eyelids, earlobes, and beak denotes a shorter laying or resting period, varying from a few days to four or five weeks.

✓ **Value of Moult in culling**

- Good layers not only Moult late but also complete the moulting period quickly and sometimes Continue to lay even during moulting.
- Poor layers on the other hand moult early, take a long Time to complete the process and do not lay any eggs during the moulting period.
- Mature bird normally undergoes one complete Moult a year, usually in autumn
- Some lose a few feathers and grow them back in as quickly as 3-4 weeks. Other chickens lose a lot of feathers and take 12-16 weeks to grow them back.
- The first plumage is lost from the head and neck → from the saddle, breast and Abdomen (body), then the wings and then from the tail.
- When the wing feathers begin to drop, laying usually ceases.
- When the wing Moults , primary feathers are shed first.

✓ **Value of body changes in culling:**

- The laying hen has a large, moist, dilated vent as contrasted with a round, dry, puckered vent in the case of a hen not laying.
- When a hen starts laying the entire abdomen and the pelvic bones becomes dilated.
- When a hen stops laying the measurements are materially reduced

| Character | Laying hen | Non-laying hen |
|---|---|---|
| Comb and wattle | Full, red, waxy, warm and velvet like | dry, hard cold, coarse and shrunken with white scabs |
| Beak | Stocky, well curved, worn -out and less yellow | Very long, thin and sharp pointed, yellow |
| Eyes | Bright and alert | Dull and sleepy |
| Ear lobes | Full, waxy and velvet like | Shrunken, wrinkled and coarse |
| Pelvic bones | Usually spread apart more than 2 fingers, thin and pliable | practically close together thick and stiff |
| Abdomen | Large, spread 3 to 5 fingers, soft and less of fat | Small usually less than 2 fingers, hard and more of fat |
| Vent | Full, large and moist | Small, dry and puckered |