Welcome

“ LIVSTOCK PRODUCTION AND MANAGEMENT”

AHDS-111 (1+1)=02

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Terminology Used in Livestock Production

- **Type:** It is a commonly accepted standard that combines those characteristics essential in adopting an animal for a particular purpose e.g. milk, meat wool or work.

- **Breed:** It is groups of animal that are result of breeding & selection have certain distinguishable characteristics.
  Or
- A group of animals related by decent & which are similar in most of the characters like general appearance, size, colors, horns it is called breed.

  Or
- A breed may be defined as a cluster domestic animal of a species where individuals are homogenous in certain distinguishable characteristics which differ from one to other group of animals.

- **Species:** A group of individuals which have certain common characteristics that distinguish them from other group of individuals with in species the individuals are fertile when in different species they are not.
- **Sire:** The male parent of the calf.
- **Dam:** Female parent of the calf.
- **Calf:** Young one of cattle or buffalo below the age of six months is called calf.
- **Heifer:** The younger female of cattle above age of six months to first calving.
- **Cow:** The adult female of cattle from the date of first calving is called cow.

- **Bull:** It is uncastrated of cattle used for breeding or covering the cows.
- **Bullock:** It is the castrated male of cattle used for work.
- **Service:** The process in which mature male covers the female i.e. in heat with the object to deposit spermatozoa in the female genital tract is called service.
- **Conception:** The successful union of male and female gametes & implantation of zygote is known as conception.

- **Gestation:** It is the condition of female when developing foetus in present in the uterus.

- **Gestation period:** The period from the date of service (actual conception) to the date of parturition is termed as parturition period or pregnancy period. This period varies according to species of animals e.g. is cows 279-283 days, in buffalo 310 days, sheep 148-152 days, goat 150-152 days.

- **Parturition:** The act of giving birth to young one is called parturition.
- **Lactation period:** The period after parturition in which the animal produces milk.
- **Dry period:** The period after lactation in which the animal does not produce milk.
- **Calving interval:** The period between two successive calving is calving interval.
- **Average:** It is the sum of production divided by No. of animals.
- **West average:** It is the average daily milk yield of a cow is lactation.

$$\text{W.A} = \frac{\text{Total milk yield. of a lactation (kg or Lt).}}{\text{Lactation period (days)}}$$

- **Half sib:** Half brothers or half sisters
- **Full sib:** Full brothers or full sister.
- **Heredity:** The occurrence of genetic factors derived from each of its parent in an Individual.
- **Heritability:** The percentage of variation in individual characteristics between related individuals which is due to true genetic difference.
- **Repeatability:** It is the expression of the same trait at different times in the life of the same individual or the tendency of an individual to repeat its performance e.g. dairy cow in successive lactation.
- **Allele:** One or two or more alternative forms of a gene. Alleles are those genes which may appear at same locus in homologues chromosomes.
- **Gene:** It is the unit of inheritance, which is transmitted in gametes or reproductive cells. It is the physical basis of heredity.

- **Herd Average:** It is average daily milk yield of milling animal in a herd.

$$\text{H. A.} = \frac{\text{Total milk yield of a day}}{\text{No. of milking animals}}\text{--}$$

Overall average: It is average daily milk yield of the animal in the period of calving interval.

$$\text{O.A.} = \frac{\text{Total milk yield of lactation}}{\text{Calving interval (days)}}$$

- **Environment:** The sum of all external influences to which an individual is exposed.

- **Genotype:** The complete genetic make up of an individual- or its combination of genes it possesses which influences its characters. Several different genotypes may.

- **Phenotype:** The external appearance or some other overall or measurable characteristics of an individual or it is the actual expression of the character as determined by his genes & the environment in which he has lived.

- **Lethal:** (Deadly) A gene or genes that cause death of an individual which are possessed by them during pregnancy or at the time of birth.
- **Prepotency:** The ability of certain individuals to stamp or impress their characters upon their offspring or prepotency is the ability to transmit characteristics to offspring to a marked degree.
- **Fertility:** Ability of an animal to produce large number of living young.
- **Fecundity:** It is the potential capacity of the female to produce functional ova regards of what happens to them after they are produced.
- **Sterility:** Inability to produce any offspring.
- **Free martin:** A sterile heifer born twin with the male.

- **Cryptorchids:** The failure of testes to descend fully into the scrotum. If one testes is in scrotal position the male is usually fertile but if both are retained in the abdominal cavity sterility usually reported.
- **Atavism:** The reappearance of a character after it has not appeared for one or more generation.
- **Buller:** Cow always in estrus condition.
- **Teaser:** A vasectomized (castrated) bull used to detect the heat or estrus of female (cow).
- **Herd:** It is a group of cattle or buffalo.
- **Flock:** It is the group of sheep, goat or poultry birds.
- **Steer:** The male cattle that is castrated when he is still a calf or before the development of sexual maturity is called steer.
- **Veal:** The meat of calf below the age of 3 months.
- **Beef:** The meat of- cattle past calf stage.

- **Pork:** The meat of swine.
- **Mutton:** The meat of sheep & goat.
- **Chevon:** The meat of goat
- **Wedder:** A castrated sheep is called wedder.
- **Prolificacy:** Ability to produce large number of offspring's. The animal is said to be prolific.
- **Variation:** The degree to which individuals differ with respect to the extent of development of expression of characteristics.
- **Puberty:** It is the period when reproductive tract & secondary sex organs/characteristics start to acquire their mature form. Before on set of puberty the reproductive tract of heifer grows proportionately to body growth but beginning at about 6 months age growth rate of these organs is much grater than body growth. At about 10 months of age the rapid growth phase of the reproductive tract ceases & this signifies the end of puberty. Heifer reaches puberty earlier than bull.
- **Inheritance:** Transmission of genetic factors from parent to offspring’s.
- **Germplasm:** The material on the basis of heredity taken collectively. The sum of gene constitution of an individual.
- **Foetus:** A term for developing young one during last quarter of pregnancy.

SCOPE OF LIVESTOCK INDUSTRY

- Livestock sector has been playing important role in Indian economy and is an important sub-sector of Indian agriculture.
- The India's population of livestock are 218.8 million cows, 115.9 million buffaloes, 75.5 million sheep, 160.0 million goat, 0.96 million of poultry birds population (F.A.O, 2012).
- India has the largest cattle and buffalo population and holds ranks first in cattle population and accounts 50 % of buffalo population.
- Dairy sector has been instrumental in bringing socio-economic transformation. There exists a symbiotic relationship between agriculture and livestock farming.
- The agriculture byproducts provide feed and fodder for cattle whereas cattle provides manures, draught power for various agriculture operations.
- Besides draught power livestock sector contributes to national income from various industries such as Dairy. Poultry, Leather, Feed, Wool and Fur. Organic fertilizers, Bio-fuel sector and Bioresearch etc.

IMPORTANCE OF LIVESTOCK IN RURAL INDIA

1. Basically India is an agricultural country and livestock sector is an integral part of India.
2. It is the back bone of India's economy in the forms of income, employment, and foreign exchange earning.
3. It is estimated that dairying sector alone contributing 15 % of the Gross National Income (Raju, 2001).
4. In our country nearly 80 % of people live in villages and 69 % of them are engaged in agriculture, and 43 % of them are cultivators having a bit of cultivable land.
5. Remaining 26 % are agriculture labourers who are having one or two milch animals.
6. For small farmers, landless and agriculture labourers, the livestock sector is giving sustained for their lives.
7. It is providing security to the people living draught areas like Rajasthan etc. in terms of their income.

LIVESTOCK POPULATION IN INDIA

Table. 1 Although the population of livestock during last 10 years has been stable around 485 million, the buffalo population has increased by 8.91%, while the cattle population has reduced by 6.89%. There has been a significant increase in the livestock in the year of 2016-17.

Sr. No	Species	Livestock census (Millions)	
		(1997)	(2017)
1	Cattle	198.9	218.8
2	Buffalo	89.9	115.4
3	Sheep	57.5	75.5
4	Goat	122.7	160.0
5	Poultry	-	0.96
	Total Livestock	485.4	568.96

Source: Livestock Census, Dept. of Animal Husbandry & Dairying, Ministry of Agriculture, and (FAO, 2016-17).

MILK PRODUCTION:

India, the largest producer of milk in the world, is set to produce over 146.33 million tonnes milk during 2016-17. Several measures have been initiated by the Government to increase the productivity of milch animals, which has resulted in increasing the milk production significantly. It has been the only source of sufficient energy, minerals, vitamins and animal proteins. A 60% of the total milk production enters in to the market in the form of dahi, butter, ghee, khoa and shrikhand and various dairy by-products.

Table 2 : Expected Growth of Livestock Population and Milk Yield

Year-	2006-07			2021-22		
Types of Animals	Population (mill.)	Production (mill. tons)	Wet Average (kg/day)	Population (mill.)	Production (mill. Tons)	Wet average kg/ day)
Indigenous	28.15	20.26	1.98	31.26	26.248	2.28
crossbred	2.58	18.68	6.75	12.347	44.703	7.98
Buffalo	32.86	53.98	4.50	40.061	97.78	5.94
Goat	--	4.073	--	--	6.512	--

Source: Livestock Census, Department AH & Dairying, Ministry of Agriculture, 2016.

EGGS,WOOL AND MEAT PRODUCTION IN INDIA

Eggs Production : Poultry development in the country has shown steady progress Annual Report 2012-13 over the years. Currently egg production is around 66.45 billion in 2011-12 which is about 5% over the previous year production of about 63.02 billion eggs. The poultry meat production is estimated to be about 2.47 million tonnes. The current per capita availability of eggs is around 55 eggs per year. Exports of poultry products are currently at around 457.82 crore in 2011-12 as per the report of Agricultural and Processed Food Products Export Development Authority (APEDA).

Wool Production : Wool production declined marginally at the end of Eleventh Five Year Plan (2011-12) to 44.7 million kg. from 45.1 million kg.in the Tenth Five Year Plan (2006-07). The Annual growth rate for production of wool is about 4% in 2011-12 compared to previous year.

Meat Production : The meat production has registered a healthy growth from 2.3 million tonnes at the end of Tenth Five Year Plan (2006-07) to 5.5 million tonnes at the end of the Eleventh Five Year Plan (2011-12). The Annual growth rate for meat in 2011-12 was about 13%.

Annexure-II, Annual Report., 2012-13.

Present Trends;

- As a result of various dairy development programmers the country is having presently 233 processing plants and 46 milk products factories. The cooperative public sector plants and organized private plants have an estimated handling capacity of 8.65 million liters per day (MLPD).
- Various cattle improvement project have been-started in 600 community blocks. The country has now 122 Intensive cattle development programmes (ICDP) 140 cattle breeding farms, 40 Exotic cattle farms and 48 frozen semen banks in operation. These activities has resulted in enhancing the milk production by 494.11% in the past three decades although increase in breedable cows and buffaloes 22-23% during the same period.
- Through a net work of over 4200C milk producers cooperative organized under the operation flood. Programme, a National milch grid has been successfully established.
- This grid covers besides the four-metropolitan cities. Nearly 200 cities and towns.
- The fallen and slaughtered cattle and buffaloes also contribute hides and skins, bones and hooves etc. The hides and skins, from cattle and buffalo are estimated at 0.82 million tons annually.

Employment generation

- Animal Husbandry & Dairying may be regarded as a source to create the employment in rural areas all round the year. Indian Agriculture is mainly dependent on monsoon and hence agriculture field faces certain bottlenecks to provide employment during such periods.
- On an average Agriculture sector may provide 200 days employment to the rural persons. This means they have to find alternate source of employment for income during the rest of the year.
- Dairy farming, sheep and goat rearing, poultry production, pig farming rabbit rearing are the alternate sources of mix farming.

- It may be possible to generate the employment for the farmers as well as land less laborers who can do this job themselves, or it may be possible to employ young and the old family persons as a side business.
- Many of the operations in Animal Husbandry and Poultry Farming can be done by the rural women. It is estimated that on an average 35 million human years/annum employment generation has been potential through this sector.

Feed and Fodder Development for Livestock

India, with only 2.29% of the land area of the world, is maintaining about 10.71% of the world's livestock population. The area under fodder cultivation is estimated to be about 4% of the gross cropped area which has remained static for the last four decades.

For production and propagation of superior varieties of Fodder crops, the Government has established 7 Regional Stations at Mamidipally, Hyderabad (Andhra Pradesh), Gandhinagar (Gujarat), Hissar (Haryana), Suratgarh (Rajasthan), Sahema (Jammu & Kashmir), Alamadhi (Tamil Nadu), Kalyani (West Bengal) and one Central Fodder Seed Production Farm at Hessarghatta.

(Annual Report, 2012-13. India)

FEED INDUSTRY

An efficient animal management is the result of better breeding, balanced feeding, health care and hygienic managerial practices. Milk production is doubled if animal is given quality of feed and fodder. By giving proper attention on feeding and utilization latest innovation in nutrition we can ensure healthy growth with high economic yields from livestock.

Dry Matter Availability From Different Feed Resources In India (million tonnes)

Sr. No.	Particulars	2012 (Million tonnes)
1	Crop residues i.e. Fine straw, Coarse straw, Leguminous straw	355.93
2	Concentrates i.e. Cotton cake, G-nut cake, turchuni, grains, bran etc.	49.71
3	Green i.e. Cultivated crops, Forests, and others	168.66
Grand Total		574.3

Source: Computed From Feed Base Compact Disc, NIANP, 2013.

LIVESTOCK DEVELOPMENT PROGRAMMES

State government initiated many cattle developments programmes like ;-

- Key Village Scheme (1951)
- Intensive Cattle Development Project (1964-65)
- Integrated Rural Development Programmes (IRDP)
- National Rural Employment Programme (NREP)
- Rural Landless Employment Guarantee Programme
- Special Livestock Breeding Programme.
- Central Herd Registration Scheme (CHRS)
- All India Co-ordinated Research Project (AICRP)
- Gaushalas
- Technology Mission on Dairy Development
- National Project for Cattle and Buffalo Breeding (NPCBB)
- Indian Council of Agriculture Research (ICAR)
- National Dairy Development Board (NDDB)
- National Dairy Research Institute (NDRI)
- National Milk Grid Scheme (NMGS)
- Indian Dairy Association and N.A.B.A.R.D. at national levels.
- Food and Agriculture Organization (FAO)
- World Food Programmes
- U.N.I.C.E.F. and other similar organization at International levels.

Dairy development programmes

- Integrated Dairy Development Programme (IDDP) in Non-operation flood and hilly and backyard areas.
- Strengthening Infrastructure for quality and clean milk production.
- Assistance to Co-operatives.
- Venture capital fund for dairy and poultry sector.
- Central fodder development organization scheme.
- Livestock health and disease control scheme.
- National dairy plan.
- Rashtriya Krishi Vikas Yojana (RKVY)

DAIRY DEVELOPMENT PROGRAMMES

FORMATION OF MILK CO-OPERATIVES

THREE- TIER STRUCTURES OF ANAND PATTERN CO-OPERATIVES

Primary Milk Producers Co-operative Society

Objectives;

I. Providing credit facilities
II. Supply of feeds on subsidy rates
III. Provision of free Vet. Aid and AI.
IV. Welfare of farmers

District Milk Producers Co-operatives Union (DCS)

Collection, transportation, processing, and product manufacturing

State Milk Co-operatives Federation

I. Marketing of products
II. Controls on dairies
III. Control over the marketing of milk and milk products
IV. Training and Research

ESHTABLISHMENT OF NATIONAL DAIRY DEVELOPMENT BOARD (NDDB)

NDDB was set up under the Societies Registration Act in **1965.** Later it acquired distinct identity as a body corporate through Parliament Act in **1987.**

The main objectives are ;

- To monitors the various development programmes.
- To promote the co-operative dairy development programmes.
- To make Operation Flood Programmes success.
- To increase research and extension work in the field of dairy.

DAIRY DEVELOPMENT UNDER " OPERATION FLOOD PROGRAMMES "

NDDB initiated certain development programmes. These are called " Operation Flood Programme" . It was launched in different phases. It was started By **Dr. Verghese Kurinen** in **1970**.

1. **OPERATION FLOOD PHASE- I (1970 -71) :** The first phase of operation flood programmes was launched in **1970-71** following an agreement with World Flood Programme.

The following objectives this programme were:

- Organizing the dairy co-operatives at the village levels.
- Providing the physical and institutional infrastructure for milk procurement, processing, marketing and
- Production enhancement services at the union level and establishment of city dairies.

OPERATION FLOOD PROGRAMME PHASE-II (1981-85)

This IInd phase was launched in **1981** and this programme was approved by Government of India.

Funds:

- Government of India provided Rs. 273 crores in Sixth 5-Year Plan.
- A financial aid of Rs. 235.2 crores was provided by World Bank.
- EEC provided by a Food aid of 1,88,000 tonnes of SMP and 76,200 tonnes Butter oil.
- NDDB itself financed Rs. 77.3 crores.

Achievements :

- The numbers of village level co-operatives reached to 34,500 covering 36 lakh farmers in 136 rural milk sheds.
- The peak milk procurement increased to a levels of 79 lakh liters per day and marketing to 50 lakh liters per day.

OPERATION FLOOD PROGRAMME PHASE- III (1985-96)

Objects:

- This IIIrd phase mainly focused on the strengthening of dairy co-operation.
- Institutional strengthening in the form of training , research market, promotion, monitoring, and evaluation.
- To expand the infrastructure in all major markets ; linking them to milksheds through the National Milk Grid (NMG).

OPERATION FLOOD PROGRAMME PHASE- IV (1996-2001)

This Fourth phase of operation flood programme was started with an following objectives :

- To create infrastructure and strengthening the democratic values.
- Strengthening the co-operatives by providing funds on 50:50 basis from Central and State Government.
- Increase the extension work in the fields of co-operative education, personal, training, marketing support, product development and improving standards.

DAIRY DEVELOPMENT PROGRAMMES

I. KEY VILLAGE SCHEME (KVS)

It was launched at the end of **1951** in First Five- Year Plan. This scheme provided an equal attention being paid to the cattle and its owner. Through this scheme a key village block have an AI centre.

The objects of this scheme were as follows :

- Best utilization of superior germplasm through AI-technique.
- Prophylatic measures against contagious diseases.
- Provide adequate market facilities.

INTENSIVE CATTLE DEVELOPMENT SCHEME (I.C.D.S.)

I.C.D.S. was an extension to Key Village Scheme was initiated under Third 5- year plan in various breeding tract of cattle and buffalo under each project. It is estimated to cover 1 lakh breedable cows and buffaloes with following programmes :

- Propogation of good varieties of fodder.
- Proper health cover against contagious diseases.
- AI sevice and incorporation of milk collection centres.

At the end of IIIrd Five-year plan there were 30 I.C. D. S. projects which covers bovine population of 2.7 million. In 1973 its 63 and in 78-79 it reached to 114. Now there are 122 I.C.D.S. projects throughout the country.

ALL INDIA CO-ORDINATED RESEARCH PROJECT (A.I.C.R.P.) ON CATTLE

It was launched in **1968 at I.V.R.I**., Hissar for breeding Hariane type with T/F and Hersey. In this connection 5 units were eshtablished for :

- Hariana …… Izatnagar and Hissar
- Ongole …… Lam, Prakashan (dt.), A. P. (A.P.A.U.)
- Gir …… M.P.K.V.V. and J.N.K.V.V., Jabalpur

The other objectives of this project were:

I. Cultivation of fodder production around sources of irrigation.

II. Proper health cover against diseases and extensive breeding programme.

(A.I.C.R.P.) ON BUFFALOES

Indian Council of Agriculture Research (I.C.A.R) launched this A.I.C.R.P. on buffaloes in **1970** at N.D. R.I., Karnal. Then it was extended to Punjab Agriculture University Ludhiana and Sukhadia University, Udaipur.

- The breeding programmes are in progress with Murrah in north and in south Surti/ Mehsana breeds.
- In this connection a Central Institute for Buffaloes Research was established in **1984** at Hissar, Haryana.

DRAUGHT PRONE AREAS PROGRAMME (D. P. A. P.)

This programme was launched during 5th Five- year Plan.

- The main aim of this project was to create infrastructural facilities in utilizing land, man power and other physical sources.
- In U.P., it was launched in the 40 blocks initially then it was expanded to 87 block in 10 districts.

Small Farmers Development Agency (S. F. D. A.)

On the recommendation of National Commission on Agriculture, Government of India started this Small Farmers Development Agency in 1978-79 for the development of weaker section by providing credit facilities. These programmes are monitored by District Rural Development Agencies.

Small Farmers Development Agency (S. F. D. A.)

The following programmes have been launched under S. F. D. A.

1. Heifer Rearing Scheme :

Through this schemed crossbred heifers aged between 4 to 32 months are provided balanced feed. This comes about 1350 kg. during the entire period of which 50 to 66.66 % subsidy is given on the cost of feed or in other way provision of finance aid to the beneficiaries to rear their heifers.

Particular	Subsidy	Maximum Rs.
Small farmer	50 %	3,000
Agriculture labourers	50%	3,000
SC/ST	66.66%	5,000

2. Sheep Rearing Scheme:

In sheep rearing a subsidy of 25 % to small farmers (Maximum Rs.3000/-) and 50% to ST/SC (Maximum Rs. 5000/-) is provided per beneficiary on either 20 ewes + 1 ram or 30 ewes +1 ram unit.

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3. Pig Rearing Scheme :

For pig production 25-30 % subsidy to small farmers (Maximum Rs. 3000/-) and 50 % to ST/SC (Maximum Rs. 5000/-) is provided on Sows + 1 boar unit. In 1988-89 the total amount Rs. 126.42 lakh was provided for all the above schemes.

4. Intensive Mini Dairy Scheme :

Through this scheme maximum aid of Rs. 2000/- or 5% of the total cost is given, which is to be recovered in two years. The other facilities are free veterinary
aid, and supply of concentrate feeds at subsidized rates.

5. Model Village Development Scheme:

Through this scheme two animals were given per beneficiary. Landless farmers got self employment in this scheme.

6. Special Component Plan :

Government had directed all the development sectors to spend more on weaker section. As such development sector, Animal husbandry of U.P quantified Rs.226.54 lakh and the State Govt. quantified an outlay of Rs.1071 lakh.

INTEGRATED RURAL DEVELOPMENT PROGRAMME (I.R.D.P.)

I.R.D.P. was an extension programme to Integrated Cattle Development Programme (I.C.D.P). This programme was launched in **1978-79.**

Objectives:

- To improving the economic condition of weaker section of society with a view to achieve the objectives.
- Loan was granted through banks for supplying necessary inputs.
- There were a provision of subsidy of 25 % for small farmers and 33.3 % for ST/SC.

I. Silk With Milk Scheme :

In order to develop the agriculture and dairying by using some green fodder (mulberry plants), the Department of Agriculture and Department of Animal Husbandry jointly planned this " Silk With Milk Scheme". For this, credit facilities will be provided with subsidies under IRDP scheme.

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II. Women Dairy Programme :

There several innovative Five states took up specific task "All Women Dairy Co-operative Societies" formation in selected milk sheds.

Sr. No	State	No. of all women dairies
1.	Andhra Pradesh	210
2.	Bihar	280
3.	Rajasthan	408
4.	Uttar Pradesh	1228
5.	Gujarat	350

Source: Indian Dairyman 48 (2) : 157-162.

Complete Profile of Women in Dairying :

- Total membership of women in DCU's – 70,000
- No. of All women dairy co-operatives- 2476
- Total membership in village level co-operatives – 16.33 lakh.
- No. of women participated in education programmed by NDDB - 8.58 lakh

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III. Progeny Testing Scheme : (1965-66)

This scheme was launched by the Government of India with an aim to stimulate the superior germplasm in indigenous cattle, in **1965-66.**

Initially a Central Frozen Semen centre was established in Hissarghata in Karnataka.

Later through Danish bilateral programme 15 more frozen semen centre were established. Today there are 48 Frozen semen centres all over the country. The number throughout the country is 40,000 covering just 40% of our cattle (Joseph, 2000).

IV. Bhartiya Agro Industrial Federation (BAIF) Scheme:

It was launched in 1974-75 by BAIF for improving the superior in germplasm in indigenous cattle. It was started in U.P.

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V. Cross- Breeding Programmes in Collaboration with Foreign Agencies

a. **Indo- Swiss Project :** It was started during sixties at Munoul in collaboration with the Govt. of Switzerland.
This resulted in developing a high yielding strain of cattle **" Sunandini".**

The project was also started in Patiala where the cross- breeding programmes is in progress of Hariana and Sahiwal with Brown Swiss strain.

b. **Indo Danish Project :** It was launched in **1963** at Hissarghata in Karnataka. In this project cross- breeding programme is going on with Red Dane bull.

c. **Indo German Project :** It was in progress in Mondi and Almoda of U.P where cross- breeding programme with Brown Swiss strain was going on.

d. **Frieswal Project :** In order to improve the genetic efficiency of our indigenous cattle, a massive cross- breeding programme has been initiated joined by Project Directorate on Cattle, U.P and 43 military organization of the Ministry of Defence, Govt. of India.

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VI. Cross Breeding Programme Under Private Agencies

a.) J. K. Trust : Gram Vikas Yojana (G .V .Y) :

This belong to Raymond Company started a programme called " Gram Vikas Yojana" .

Through this programme they established Integrated Livestock Development Centre (ILDC) in villages by engaging NGO's to facilitate the AI service at doorsteps.

b.) URLIKANCHAN BAIF : Pune adopted BAIF schemes as BAIF Institute of Rural Development.

As a sequence of crossbreeding programmes, certain strain crossbred cattle have been developed by some research institutes.

1. N.D.R.I., Karnal developed two strain namely;
   a) Karan Fries (Holstein Friesian x Tharparkar)
   b) Karan Swiss (Brown Swiss x Sahiwal)
2. Allahbad Agricultural Institute (Deemed university) developed
   a) Jersind (Jersey x Red Sindhi)
   b) Brown Sind (Brown Swiss x Red Sindhi)
3. Frieswal has been developed at Millitary dairy Farm, Meerut.
   Frieswal (Holstein Friesian x Sahiwal)

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VIII. Embryo Transfer Technology

Embryo transfer Technology has been used successfully at National Institute of Immunology, N.D.D.B. at Bidej- Research Laboratory and Regional Embryo Research Centre at Bikaspur and I.V.R.I., Izatnagar.

- It resulted in successful calving in buffaloes.
- The best successful achievement made by N.D.D.B research centre, Bidej obtaining male buffalo calf through EBT.
- They uses different types of hormones like, FSH, PMSG, GnRH, and F2 alpher for superovulation. It would be possible to exploit the high yielding female animals through this technology.

IX. Establishment of CIRB

ICAR established the Central Institute for Research on Buffalo on 1st February, **1985** at Hissar.

Objectives:

- The qualities like efficient converter of low quality feeds, high milk production potential, quick adaptability to climatic variation and greater disease resistance made buffalo sustainable and economically attractive dairy.

FINANCIAL ASSISTANCE FOR DEVELOPMENT

Financial assistance by National co-operatives development corporation . NCDC provides financial assistance in establishment of integrated dairy project through co-operative federation.

Patterns of NCDC Financial assistance

From	State From NCDC to State Government	State Government to co-operative societies
1. Co-operatively developed state	70 % of total cost of subsidy	70 % as loan 30 % subsidy
2. Co-operatively under developed state	60 % as loan, 25% of subsidy	60 % as loan 40 % subsidy
3. Co-operatively least development state	70 % as loan, 20% subsidy	60 % as loan 40 % subsidy

Source: Indian Social Institute, ‘ Dairy Co-operatives.’

Central Sheep Breeding Farm, Hissar (Haryana)

The farm was established during the Fourth Five Year Plan with the objectives of producing acclimatized exotic rams for distribution to various State Sheep farms and training of personnel in mechanical sheep shearing. In course of time and in accordance with recommendation of experts, the breeding programme of the farm was changed to produce crossbred rams (Nali X Rambouilett and Sonadi X Corriedale) as well as Beetal goats.

During 2011-12, the farm supplied 950 rams and 85 bucks. A total of 1216 farmers were trained in mechanical sheep shearing / sheep management. During 2012-13, up to December 2012, the farm supplied 500 rams and 94 released to NABARD, against which 1066 beneficiaries were assisted for establishment of sheep & goat rearing units in various States during the year.

(Annual Report, 2012-13 India.)

Development of Poultry

- Poultry Development is a household activity in India.
- Scientific poultry production in India gained momentum during the last 4 decades due to concerted efforts of the Government of India through policies, institutions and focused research and initiatives taken by the private sector.
- The poultry sector has emerged from entirely unorganized farming practices to the commercial production system with state of the art technological interventions.
- Poultry sector, besides providing direct or indirect employment to people, is also a potent tool for subsidiary income generation for many landless and marginal farmers and also provides nutritional security especially to the rural poor.

Poultry Development

- The Centrally Sponsored Scheme on Poultry Development implemented by the Department of Animal Husbandry, Dairying & Fisheries (DADF) has 3 components namely (i) Assistance to State Poultry Farms, (ii) Rural Backyard Poultry Development and (iii) Poultry Estates (new component).

Poultry Development

Assistance to State Poultry Farms:

- Aims to strengthen existing state poultry farms so as to enable them to provide inputs, mainly in terms of providing improved stocks suitable for rural backyard rearing.
- Sharing pattern of funds between center & state is 80 : 20 (except for NE states for which 100% central funding is provided)
- The components of the scheme could include strengthening of infrastructure, feed mixing plants & equipment for feed analytical laboratory, in house disease diagnostic laboratory, revolving fund for purchase of hatching eggs, parent stock, feed ingredients, marketing, consultancy etc.

Poultry Development

Rural Backyard Poultry Development:

- This component aims to cover BPL beneficiaries enabling them to gain supplementary income and nutritional support.
- Funding is in the form of grant to state government and fully funded by Government of India except for loan subcomponents for mother units which will be provided to NABARD.

Rural Backyard Poultry Development:

- This component aims to cover BPL beneficiaries enabling them to gain supplementary income and nutritional support.
- Funding is in the form of grant to state government and fully funded by Government of India except for loan subcomponents for mother units which will be provided to NABARD.

CONSTRAINTS BEFORE DEVELOPMENT OF DAIRYING

1. Poor management.
2. Majority of stock of poor genetic quality.
3. Inadequate inputs.
4. Poor credit facilities.
5. Lack of Vet. Extension service.
6. Insufficient nutrients and green fodders.
7. Poor quality semen.
8. Inadequate and improper breeding.
9. Lack of vaccination facilities.

STRATEGIES TO ACHIEVE THE HIGHER PRODUCTIVITY

1. Selection of superior bulls and their wide spread use.
2. Rapid extension in coverage under breeding programmes.
3. Focus on higher percentage of animals in milk.
4. Area wise priority approach.
5. Participation of all agencies.
6. Quality feeding.
7. Self sustainable inputs delivery.

CONCLUSION

Livestock development programme has been achieve higher production in milk, meat, eggs and wool. By means of the livestock development programme it improve the superior quality of bull for future generation of livestock in India.

It improve the livestock and livelihood macro-benefits like healthy and clean environment, sustained soil fertility, saving of conventional energy, less cutting of trees for fuel, new employment opportunities generation etc. for the human being.

Sr. No	Species	Female	Male	Young one	Act of parturition	Ave. Life Years
1	Cattle	Cow	Bull	Calf	Calving	16-20
2	Local buffalo	Buffalo	Buffalo Bull	Calf	Calving	16-20 .
3	Goat	Doc	Buck	Kid	Kidding	12-15 .
4	Sheep	Ewe	Ram	Lamb	Lambing	12-15 .
5	Swine	Sow	Bore	Litter	Furrowing	8- 10
6	Horse	Mare	Stallion	Foal	Whelping	18-22
7	Ass	Jennet	Jack	Foal	Whelping	14-18
8	Fowl	Hen	Cock	Chick	Hatching	3 - 4
9	Duck	Duck	Drake	Chick (Duckling)	Hatching	4 - 5

Care and Management of Newly Born Calf

- All dairy operations must be planned with due regard to the comfort the animal.
- After calving the cow will usually be up and will begin to dry the calf, if for some reason the cow is unable to get up then the calf should be dried with a towel or other suitable material.

1. Make sure that all mucus is removed from the nose and mouth. If the calf does not start to breathe, artificial respiration should be used by alternately compressing and relaxing the chest wall with the hands after laying the calf on its side.
2. Naval cord should be cut (5cm) with sterilized scissors leaving "form the body and them entire naval cord be disinfected by Deeping it into a cup containing tincture of iodine.

4. Normally the calf will be on its feet and ready for suckling the dam within an hour. Some assistance in this stage is useful. Clean the udder before the calf starts sucking.
5. Feed the calf with first milk i.e. colostrum at least for 48 hours. The colostrums should be fed within half an hour after birth. Delay in its feeding causes the calf to loose the ability to absorb antibodies across its inertial walls.
6. The antibodies present in colostrum protect the calf against diseases and it has a laxative effect the rate of feeding should be about 10% of the calf s weight per day up to a maximum of 5-6 liters per day.
7. The colostrum is the first secretion of cow after calving. It is thick and yellow in color. It contains 4 to 5 times more protein and 10 to 15 times more vitamin-A than normal milk. Protein of colostrums contains much higher proportion of globulins.
8. The globulins are to be the source of antibody presumed developing the defense mechanism in the calf for many infections. Colostrum is also rich in minerals like Cu, Fe, Mg and Mn. It also contains several other vitamins like Riboflavin, Cholin, Thiamine, Pantothenic acid etc., which are for growth of calf.

9. The calf is best maintained in an individual pen or stall for the first few weeks. After about eight weeks it may be handled with a group.

10.Take body weight of the calf and identify the calf by tattooing.

11. At the age of 15 days 32-40 CC of H.S. serum should be inoculated.

12. Dehorn the calf preferably within 15 days after birth.

13. Teats of the udders of heifers in excess of four should be removed.

14. At the age of 3 months the calf should be vaccinated against Anthrax and fifteen days there after it should be vaccinated against B.Q

15. The future of any herd depends upon how calves are raised. One has to raise one's own calves to make a good herd. So the calf rearing should be taken upon scientific lines and it should be achieved economically.

Management calf up to six months:

1.Provide fresh, clean water all times, particularly when milk feeding is induced discontinued

2.Giving of identification mark which is necessary for keeping proper records, proper, feeding, better ore and management.

3.Dehorning the calves: at the age of 2-3 weeks, bull calves should be castrated suitably.

4.Castration of bull calf: At age of 2-3 months, bull calves should be castrated suitably.

5.Removal of extra least: In female calves, the following points to be noted

6.Housing: While housing the calves/ the following points to be noted.

7.Calf pen should be close to cow shed.

8.Pen should provide sunlight; good ventilation floor should not be slippery.

9.After 6-8 weeks, calves may be grouped according to age, sex.

10.The feed boxes & watering equipment should be provided in the pen.

System of Calf Rearing

1. Sucking method:

In this method, the calf is allowed to stay with its mother and allowed to suckle only a little before and after of milking the cow. The calf gets whole milk throughout lactation.

Advantages:

i) This is natural system of feeding.
ii) The calf gets contamination free milk.
iii) No much care is required to take during feeding.
iv) The mother-calf affection developed.

Disadvantages:

i) If calf dies, the cow refuses to let the milk.
ii) It can not be ascertained about over feed or under feeding of the calf.
iii) If milk is infected the infection may be to calf.
iv) The actual quantity of milk yield of cow can not be calculated.
v) The post partum heat is late.

2. Weaning method:

In this system, the calf is taken away from its mother either just after the birth or after 2-3 days of birth, sometimes it is allowed till the period of colostrum feeding. After that, the calf rearing is entirely by isolation system

1.Nipple system: Used for 3-4 days-aged calves. A pail containing milk equipped with rubber nipple used which the calf sucks.

2.Hand feeding: When the calf develops appetite insert two fingers of right hand into the mouth while holding milk in left hand at convenient height for the calf. While calf suckles the fingers, the muzzle is gradually pressed down into milk pan. This way calf learns to drink milk.

Advantage:

i) Cow continues to give milk whether calf is alive or not.
ii) The calf can be culled at an early stage.
iii) It can be fed scientifically as per requirements no problem of under feeding and over feeding.
iv) The actual amount of milk produced by cow can be determined.
v) Milking without calf is more hygienic & sanitary.
vi) Cow becomes regular breeder; the calving interval is less than the unweaned calves.

Oestrus Cycle

Definition:

•The interval from the first signs of sexual receptivity at Oestrus (heat) to the next estrus is called estrus cycle.

•The chain of physiological events that begins at one Oestrus period and ends at next is called as Oestrus cycle.

The cycle is of 20 + 2 days in cows for normal female in quite regular cycles. This cycle may be studied in four distinct phases as designated by Marshall i.e. Proestrum, Oestrum, Metestrum and Dioestrum.

- **Phases of oestrus;**
- Proestrus
- Oestrus
- Metaestrus
- Di-estrus

1. Proestrum: (Pre-estrus)

This phase is indication of animal coming in heat. The ovary is surrounded by follicular fluid containing high level of estradiol. The Graafian follicle within ovary grows. The increased level of estradiol is absorbed into blood making effect to oviduct causing growth of cells lining the tube & increasing in the number of cilia which are shortly helpful to transport ova to uterus. Also, epithelial wall of vagina increases in thickness to accommodate smooth coitus this period is of 8 hrs to 2 days.

2. Oestrum: (Estrus)

This is period of sexual desire. The Graffian follicles are mature or ripe in this stage. This phase period comes to close by rupture of follicle of ovulation i.e. release of Ovum. This period lasts for 12-24 hours in cow while 1-2 days in ewe. The symptoms exhibited during this period by cow are it bellows frequently, mounts other animals, excited, licking to other animals and stands to be ridden by other animals. This period is called period of standing heat. The proper period to breed is 8 to 9 hrs, for getting high fertility rate.

3. Metostrum: (Meta-estrus)

Period during which reproductive organs return to normal condition. The phase is of 1-5 days in which the cavity of the Graafian follicle from which ovum had been expelled becomes reorganized and forms new structure known as corpus leteum (C.L.) which secretes progesterone hormone having following functions:

- Prevents maturation of further Graffian follicles which prevent occurrence of further estrus period for a time.
- It is essential for implementation of fertilized eggs.
- It initiates the development of mammary gland.

4. Dioestrum: (Di-Estrus)

This is the longest phase of cycle. The corpus luteum is fully grown, making its effect on uterine wall to accommodate the embryo.

The muscles of uterus develop. The uterine milk is produced to nourish embryo. If pregnancy succeeds, this stage is prolonged throughout gestation remaining C.L. intact for the period.

In absence of fertilized eggs, the C.L. undergoes retrogressive changes the cell becomes vaculated in the lipid droplets. Since the C.L. got reabsorbed, the level of progesterone is declined and the level of estradiol increases, bring the animal in heat and the cycle is repeated in case of failure of fertilization.

Chapter- Pregnancy

The period from the date of conception to the day of parturition is called "gestation period" and the condition of the female of carrying the foetus during this period is called "Pregnancy".

OR

"The period of pregnancy is the duration of time which elapses between conception and parturition".

Importance of Pregnancy Diagnosis:

Whether animal is pregnant or not is directly related to economy of dairy management

Pseudo-pregnancy may lead to loss of valuable time period in the life of animal. Pregnant animals need to change their feeding schedule as well as the management from early stage.

An early detection of pregnancy becomes an indispensable job for herd owner.

Methods of Pregnancy Diagnosis:

- Signs of Pregnancy - exhibited and and detected extrenally.
- Symptoms of Pregnancy - per rectum / vaginum examination.
- Laboratory Tests - Presence of certain hormones tested in laboratory.

A. Signs of Pregnancy:

1. Cessation of Oestrus cycle.
2. Sluggish temperament
3. Tendency to fatten.
4. Gradual drop in milk yield.
5. Gradual increase in weight
6. Increase in size of udder.
7. Waxy - appearance of teats in last month of pregnancy

Chapter - Parturition

Definition:

Parturition is the expulsion of the foetus and its membranes from the uterus through the birth canal by natural forces and in such a state of development that the foetus is capable of independent life

or

it is process of giving birth to a young one. This process of cattle is called 'calving'. It is an absolutely normal physiological process.

Parturition and their stages

- **Stages of Parturation:**

  The act of Parturation is a continuous process but for the sake of understanding, the process is explained in four stages as:

- **The preliminary stage:** Stage continuous for some hours to even days. External symptoms - swelling of udder, entire external genital organ becomes swollen & becomes reddish, clear, straw Coloured mucus secreted. The quarters droop/ slackening of muscles & ligaments of pelvic region. Behavior signs - animal looks for solitary place, cow feels uneasy, bellow and get excited.
- **Dilation of Cervix Stage:** This lasts for 30 minutes to 3 hrs. The uneasiness increases and followed by labour pain, animal show signs of pain in its abdomen. It may lie and rise again several times. Labour pains become more acute with short intervals. The pulse quickened, breathing distressed and rapid. The water bag7 appear at vulva followed by fore feet of young one. At this time cervix is fully dilated.

- **Expulsion of foetus stage:** It is period from complete dilation of the osuteri to the delivery of foetus. The back of cow arched, chest expanded, and muscles of abdomen became broad with each labour pain. At each contraction, water bag protrudes further from vulva till front hoof of young one is visible. Water bag bursts & fluid thrown off. When hoofs and nose are at genital, the head of calf is at pelvic which will have to pass through small pelvic opening; this moment is of supreme effort & greatest point of labour pain. At least, uterine contractions, combined with additional abdominal force on uterus, results in driving away the foetus through cervix, vagina & vulva.

- **Expulsion of the after birth:** After expulsion of calf, the uterus tends to throw out the placental membrane which is now merely a foreign body. As a result of uterine contraction, the placenta separates from the cotyledons & passes into the vagina, where from it is expelled. Early expulsion of placenta is desirable to avoid putrefaction causing infection of uterus. Expulsion within 6-8 hrs is normal, beyond that manual removal is advised.

Male Reproductive System of cattle

- The primary, secondary and accessory sex organs are collectively termed as reproductive system
- i.e. Primary sex organs - Testis.
- Secondary sex organs - Vasa efferentia epididymis, the vasa deferentia & penis.
- Accessory sex organs - prostate gland, seminal vesicles, bulbourethral glands (Cowper's glands).
- **The Testis:**
- **Anatomy:** Two in numbers suspended vertically within sac known as scrotum, ovoid in shape. Length is 10 - 16 cm & 8 Cm width.
- **Histology:** Each testis composed of several crypts enclosed in serous layer called tunica vaginalis. Each crypt has several numbers of seminiferous tubules. The wall of seminiferous tubules consists of basement membrane & multilayered sperm producing epithelium having two types of cells i.e.

- (i) Germ cells -spermatozoa produced
  (ii) Sertoli Cells - sperms get matured. The space between seminiferous tubules occupied by interstitial cells (Leydig's cells) produces male hormone.
- **Epididymis:**
- **Anatomy:** is considered in three parts i.e.
  (i) Caput (head),
  (ii) Corpus (body),
  (iii) Cauda (tail).
- It arises from efferent ducts testis. Throughout of its length epididymal tube is lined with secretary cells.
- **Histology:**
- In caput, tube is lined with ciliated pseudo stratified epithelium, the flagella of which whip in direction of efferent flow.

- **Physiology:**
- Spermatozoa produced in testis accumulate & mature during their journey through epididymis which is 30-35 meters in bull.
- **Transport:**
- Sperms transported from rete testis to efferent duct by the fluid pressure of testis & by active beating of cilia. It lakes 7-9 days for any sperm to travel from germinal epithelium to cauda
- **Concentration:**
- Dilute sperm concentration originated in testis- water absorbed into epithelial cell of epididymis mainly in caput & highly concentrated sperm left in cauda (tail)
- **Maturation:**
- In the course of migration of sperm cells get matured as; it result of secretion from epididymal cell.
- **Storage:**
- Cauda (tail) is .store depot for sperms where (hey remain viable up to 60 days

- **Vas deferens: Anatomy:**
- It is slender tube with thick cord like wall originating from tail of epididymis ending into urethra. It is paired and is with spermatic arteries, veins, nerves. It passes through the inguinal ring and pelvic cavity.
- **Histology:** It is abundantly supplied with nerves & by voluntary contractions of musculature/ it is involved in ejaculation.
- **Uretha:** It is common passage way for product of testes, accessory glands & for excretion of urine. It extends through penis to the glands penis.

- **Penis:** It is male organ of copulation arid composed of erectile tissue attached and held by sigmoid flexure. It has function of ejaculation & excretion of urine.
- The accessory sex organs mainly provides bulk of seminal plasma which is rich in carbohydrates, salt of citric acid, proteins, amino acids, enzymes, vitamins which are secretions of accessory glands, i.e. Seminal vesicles - two in number located on either side of ampulla the secretion contains mainly fructose & citric acid contributes to seminal plasma.
- **Prostage Glands:**
- Consist two joined parts. It is surrounded by urethral muscles. Secretion is high in mineral content.
- **Cowper's gland:**
- Are paired, round - compact of walnut size, located above urethra. Secretion is viscid & mucus like.

Female Reproductive System

- **It consists of organs, namely**

- **Ovaries** : Reproductive glands
- **Fallopian Tubes** : Conveys ova from ovary to uterus.
- **Uterus** : In which fertilized ovum develops.
- **Vagina** : dilatable passage from uterus to Vulva
- **Vulva** : Terminal segment of system

- **Ovaries:**
- **Anatomy:**
  Two in number laying in the abdominal cavity sizes are 0.5 to 1.5 Inch diameter and 0.5 to 1.5 inch width & thickness.
- **Function:**
  Dual purpose - production of eggs or ova and production of female hormone i.e. estrogen

- **Oviduct (Fallopian Tube):Anatomy:**
  Are slender, zigzag lubes attached to ligament 20-25 cm in length, close to ovaries in such a way that eggs / ova released by ovary area cached through funnel shape wide end called as "Infundibulum".
- **Function:**
  The epithelial lining of oviduct is cliated of which ciliary motion helps to conduct ova from ovaries to uterus. The fertilization occurs in the ampullary region.
- **Uterus: Anatomy:**
  It consists of short medium body, pair of spirally twisted internally cavity connecting two horns known as body of uterus. The uterus has three layers i.e. outer servosa, middle muscular is & inner mucosa. In non-pregnancy period uterus lies in the pelvic cavity which descends into abdomen during pregnancy.
- **Function:**
  Fertilized ovus /embryo develop into uterus until the time of birth. To nourish the developing foetus through cotyledons of inner layer

- **Cervix:Anatomy:**
  It is thick walled portion which lies between uterus and vagina having muscle layers forming longitudinal folds forming spiral passage way through it. It is 4 inch long & 1 inch or more thick.
- **Function:**
  It is tightly closed during pregnancy and anoestrus period and refoxen during estsus and parturition.
- **Vagina: Anatomy:**
  It is between cervix to vulva in cow. It is 8-10 inch long. Highly elastic organ.
- **Functions:**
  Responsible for secretion of mucus, serves as birth canal dung parturition & admits male organ during copulation.
- **Vulva: Anatomy:**
  It is external vertical opening of genital tract just below anus. Diameter is larger than that of vagina.
- **Function:**
  Vulva walls supplied with glands which are active during excitement,

- **Organic Livestock Farming (Importance)**
- **Definition- organic farming-** organic is labeling term indicates that the food or other agricultural products has been produced through approved method and certification is called as organic farming
- Based on production guidelines, organic livestock farming has set itself the goal of establishing environmentally friendly production, sustaining animals in good health, realizing high animal welfare standards, and producing products of high quality. By striving for these goals, organic livestock farming meets the demands of an increasing number of consumers who are critical of conventional production methods.
- Concerning environmental protection, the basic standards of organic farming are suited to reduce environmental pollution and nutrient losses on the farm level markedly.
- With reference to the health situation of dairy cows in both organic and conventional dairy farms, comparative studies show that currently there seem to be no fundamental differences between the production methods.
- In relation to animal welfare, organic livestock farming, based on minimal standards that go beyond the legislation standards, provide several preconditions for good living conditions of farm animals.

- Concerning product quality, there is little evidence for a system-related effect on product quality due to the production method.
- It is concluded that the benefits of the basic standards are primarily related to environmentally friendly production and to the animal welfare issue while the issues of animal health and product quality are more influenced by the specific farm management than by the production method.
- There is evidence to support the assumption that organic livestock farming creates stronger demands on the qualification of the farm management, including the higher risk of failure.
- As a consequence, quality assurance programs should be established to ensure that the high demands of the consumers are fulfilled.

Standards of set of Organic production

- Avoidance of synthetic chemical inputs (Ex., Fertilizer, Pesticides, antibiotic, food additives, irradiation etc
- Avoidance of genetically modified seed
- Used of farmland that has been free from prohibited chemicals inputs for no. of years
- For livestock ,adhering specific requirements for feed, housing, and breeding
- Keeping details of written production and sales records
- Maintaining strict physical separation of organic products from non-certified products
- Undergoing periodic on site inspection

Chapter- A1 and A2 Type of milk of cattle's

- **Definition of A1 and A2 milk;**
- **A2 milk-** A2 milk is the milk that obtained from indigenous breed especially contains only the A2 type of beta-casein protein in milk composition is known as **A2 milk**
- **A1 milk-** A1 milk obtained from exotic or Foreign breed contains only A1 beta casein protein and it is harmful impact on health.
- **Economical Importance of A1 and A2 milk;**
- Most common economically important milk constituents traits include fat, protein, SNF, lactose and ash. These
- characteristics and associated benefits have made milk an important part of the diet. Amongst the milk constituents, beta-casein
- has gained importance and popularity amongst the health conscious people due to its recent health related issues.

- Beta casein composition of milk and milk products has become an important economic trait of dairy animals. Our
- indigenous dairy animals produce A2 milk and India is endowed with rich A2 dairy animals since our civilizations,
- protecting the masses from ill effects of A1 milk. It is a matter of great concern for the health of people in India. There is a
- urgent need to go through our breeding policies to stop producing A1 milk.

- **What is actually A1 and A2 milk;**

- Milk contains about 85% water. The remaining 15% is the
- milk sugar lactose, protein, fat and minerals. Beta-casein is
- about 30% of the total protein content in milk. A2 milk is
- the milk that contains only the A2 type of beta-casein
- protein whereas A1 milk contains only A1 beta casein or A1A2 type variant. A1 protein variant is commonly found in milk from crossbred and European breeds of cattle.
- A2 milk is found basically in indigenous cows and buffaloes
- of India (Asia as a whole). A2 milk is branded by the A2
- Milk Company like A2 Corporation and sold mostly in
- Australia, New Zealand, United Kingdom and other developed countries.

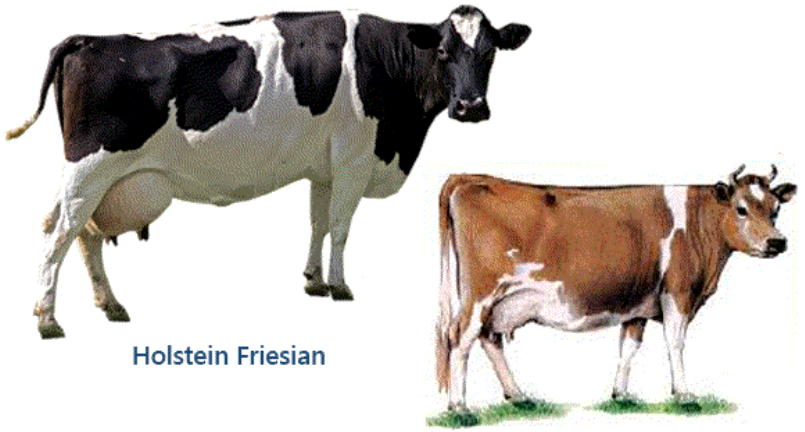
- **History of A1 and A2 Milk**
- A2 beta-casein is the beta-casein from cows that have been produced since before they were first domesticated over 10,000 years ago.
- It has no known negative effects on human health. In the past few thousand years, a natural mutation occurred which has resulted in a proportion of cows of European breeds producing a casein variant called A1 beta-casein.
- Slowly, these protein variant became dominant in milk which producing A1 milk.
- The gene encoding beta-casein was changed such that the 67^{th} amino acid in the 209 amino proteins was switched from proline to histidine.
- This new kind of beta-casein that was created is known as A1 beta-casein which is found in the milk of many crossbred cows such as Holstein, jersey and Friesian.

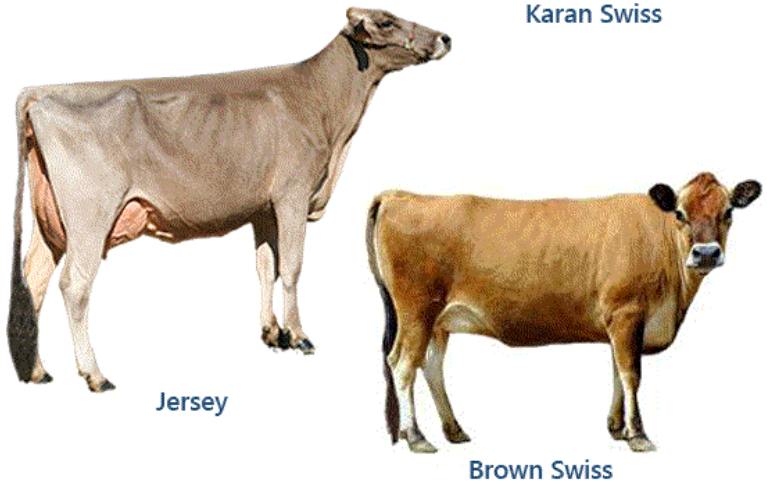
Difference between A1 and A2 milk

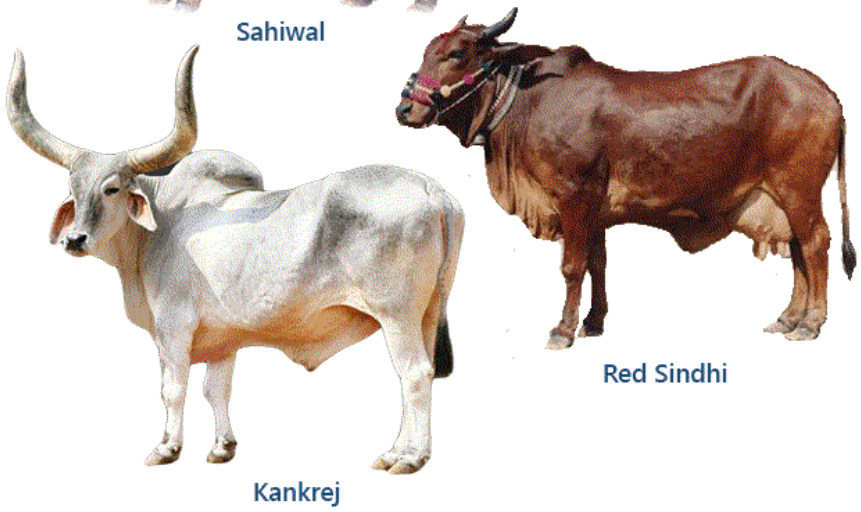
Desi Cow milk **A 2**	Ordinary milk **A1**
Indian Desi cows produce A2 milk which contains A2 Beta casein.	Jersey cow produce A1 milk which contains A1 Beta casein.
Desi cow milk only contains the A2 protein and no A1.	All ordinary milk has a mixture of A1 and A2 proteins.
High level of Omega 3 that cleans the cholesterol deposits of blood vessels	Harmful to human body.
Cerebrosides present in A2 milk increases brain power.	Autism, Schizophrenia, Stomach Ulcer, Type 1 diabetes and cardiac disease
Strontium of A2 milk enhances the body immunity and protects from harmful radiation.	Holsteins and Friesians are not native breeds of India.

Difference between A1 and A2 milk Producing breeds;

A1 Milk Producing Cow Breeds (Cross Breed - Bos Taurus)	vs	A2 Milk Producing Cow Breeds (Pure Indian Breed - Bos Indicus)







- **Basic genetics of A1 and A2 milk**
- The A1/A2 status of a cow is determined by a pair of genes on the sixth chromosome (Rijnkels, 2002). There are two major alleles of the gene i.e A1 and A2 betacasein alleles. A cow carries two copies of the beta-casein gene; she can carry either of A2A2 (homozygous), A1A2 (heterozygous) or A1A1 (homozygous) alleles.
- Neither allele is dominant over the other rather; they are codominant i.e. additive in their effect. Therefore, an A1A2 cow will produce A1 and A2 beta-casein in equal amounts. An A2A2 cow will only produce A2 beta-casein and an A1A1 cow will only produce A1 beta-casein.
- The Northern European breeds of cows such as the Friesian and Holstein carry the A1 and A2 allele at about equal levels. The Southern European breeds and the Jersey carry the A1 allele at about 35% and 2/3 of A2.

- Exceptionally, Jersey breed appears to carry the A1 allele at less than 10% and the Scottish Ayrshire breed appears to be well over 50%.

- In addition, individual herds may carry the allele at levels that are quite different to the average for the breed. If a cow is A2A2 then she is guaranteed to pass on the A2 allele to her progeny.
- Similarly, an A1 cow is guaranteed to pass on the A1 allele. For an A1A2 cow there is a 50% chance of passing on either of the allele.

Impact of A1 and A2 Milk in human health

- By relying on A1 cow's milk for calcium, we will have magnesium deficiency and imbalance, but A2 milk does not cause such imbalances. Magnesium relaxes us, helps improve digestion, is antiinflammatory in action, involved in nerve and muscle function, de-toxifier, increases alkalinity of the blood and flexibility of the tissues. Magnesium is required for the body to produce and store energy.
- Without magnesium there is no energy, no movement, no life. So, A1 milk will lower magnesium levels whereas A2 milk does not.
- The inflammation from A1 milk casein causes lymphatic congestion and metabolic suppression. A1 milk worsens acne, eczema, upper respiratory infections, asthma and allergies.
- It causes digestive problems, not because of the lactose but because of massive histamine release fromcasomorphin.
- Ear infections, bronchitis, tonsillitis areA1 milk casein causes endometriosis because of its inflammatory and immune-disruptive effect. Endometriosis is a gynecological condition in which cells from the lining of the uterus (endometrium) appear and flourish outside the uterine cavity, most commonly on the membrane which lines the abdominal cavity.
- Many women with infertility may suffer from endometriosis and other reproductive complications.

Chapter- Effect of Climate change in Livestock

- **Introduction;**
- Livestock play a major role in the agricultural sector in developing nations, and the livestock sector contributes 40% to the agricultural GDP. Global demand for foods of animal origin is growing and it is apparent that the livestock sector will need to expand (FAO, 2009). Livestock are adversely affected by the detrimental effects of extreme weather. Climatic extremes and seasonal fluctuations in herbage quantity and quality will affect the well-being of livestock, and will lead to declines in production and reproduction efficiency.
- Climate change is a major threat to the sustainability of livestock systems globally. Consequently, adaptation to, and mitigation of the detrimental effects of extreme climates has played a major role in combating the climatic impact on livestock. There is little doubt that climate change will have an impact on livestock performance in many regions and as per most predictive models the impact will be detrimental.

- Climate change may manifest itself as rapid changes in climate in the short term (a couple of years) or more subtle changes over decades.
- Generally climate change is associated with an increasing global temperature. Various climate model projections suggest that by the year 2100, mean global temperature may be 1.1–6.4 °C warmer than in 2010.
- The difficulty facing livestock is weather extremes, e.g. intense heat waves, floods and droughts. In addition to production losses, extreme events also result in livestock death .
- Animals can adapt to hot climates, however the response mechanisms that are helpful for survival may be detrimental to performance.

- **Direct effects of climate change on livestock**
- The most significant direct impact of climate change on livestock production comes from the heat stress.
- Heat stress results in a significant financial burden to livestock producers through decrease in milk component and milk production, meat production, reproductive efficiency and animal health.
- Thus, an increase in air temperature, such as that predicted by various climate change models, could directly affect animal performance.

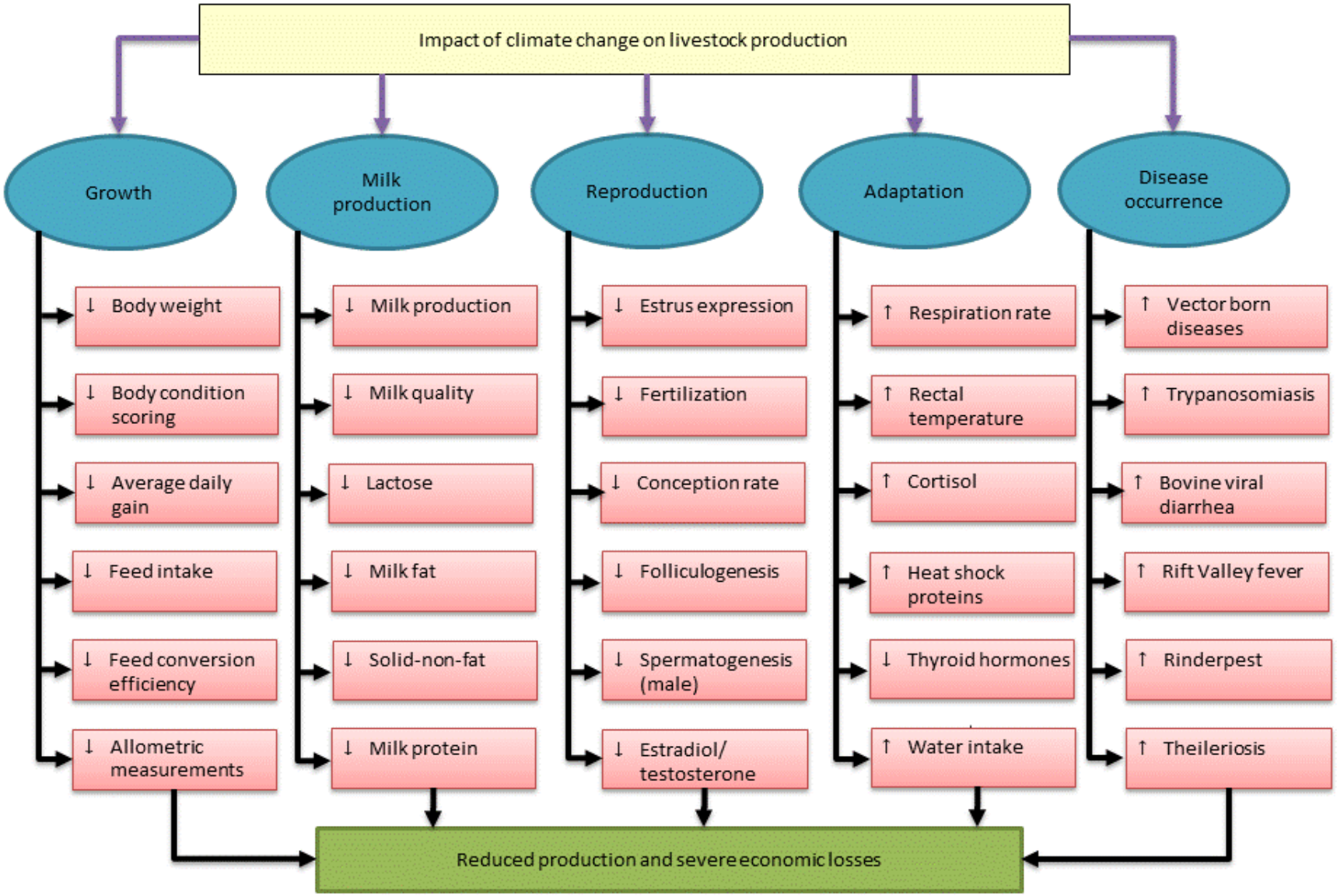


Fig. 1. Impact of climate change on livestock production

Effects of climate change on livestock

1. Growth

Ex. Body weight, Body condition, Average daily gain, Feed intake, Feed conversion efficiency, Allometric measurements etc.,

2. Milk Production

Ex. Milk production, milk quality, lactose, milk fat, SNF, milk protein

3. Reproduction

Ex. Eustrus expression, Fertilization, conception rate, folluculogenesis, Spermatogenesis, Estradiol/ Progesterone

4. Adaptation

Ex. Respiration rate, pulse rate, rectal temperature, water intake, heat sock etc.,

5. Disease Occurance;

Ex., Vector born diseaes, Trypanosomiasis, Bovine viral diareeha, Rinder pest, Theileioresis etc.,

Indirect effects of climate change on livestock

- Most of the production losses are incurred via indirect impacts of climate change largely through reductions or non-availability of feed and water resources.
- Climate change has the potential to impact the quantity and reliability of forage production, quality of forage, water demand for cultivation of forage crops, as well as large-scale rangeland vegetation patterns.
- In the coming decades, crops and forage plants will continue to be subjected to warmer temperatures, elevated carbon dioxide, as well as wildly fluctuating water availability due to changing precipitation patterns.
- Climate change can adversely affect productivity, species composition, and quality, with potential impacts not only on forage production but also on other ecological roles of grasslands

- Due to the wide fluctuations in distribution of rainfall in growing season in several regions of the world, the forage production will be greatly impacted.
- With the likely emerging scenarios that are already evident from impact of the climate change effects, the livestock production systems are likely to face more of negative than the positive impact. Also climate change influences the water demand, availability and quality.
- Changes in temperature and weather may affect the quality, quantity and distribution of rainfall, snowmelt, river flow and groundwater.
- Climate change can result in a higher intensity precipitation that leads to greater peak run-offs and less groundwater recharge. Longer dry periods may reduce groundwater recharge, reduce river flow and ultimately affect water availability, agriculture and drinking water supply.
- The deprivation of water affects animal physiological homeostasis leading to loss of body weight, low reproductive rates and a decreased resistance to diseases.

1. Impact of climate change on livestock production

- Animals exposed to heat stress reduce feed intake and increase water intake, and there are changes in the endocrine status which in turn increase the maintenance requirements leading to reduced performance (Gaughan and Cawsell-Smith, 2015).
- Environmental stressors reduce body weight, average daily gain and body condition of livestock.
- Declines in the milk yield are pronounced and milk quality is affected: reduced fat content, lower-chain fatty acids, solid-non-fat, and lactose contents; and increased palmitic and stearic acid contents are observed. Gen-erally the higher production animals are the most affected.
- Ad-aptation to prolonged stressors may be accompanied by pro-duction losses. Increasing or maintaining current production levels in an increasingly hostile environment is not a sustaina-ble option.
- It may make better sense to look at using adapted animals, albeit with lower production levels (and also lower input costs) rather than try to infuse ‘stress tolerance’ genes into non-adapted breeds (

- **Impact of climate change on livestock reproduction**

- Reproductive processes are affected by thermal stress. Concep-tion rates of dairy cows may drop 20–27% in summer, and heat stressed cows often have poor expression of oestrus due to reduced oestradiol secretion from the dominant follicle devel-oped in a low luteinizing hormone environment.
- Reproductive inefficiency due to heat stress involves changes in ovarian func-tion and embryonic development by reducing the competence of oocyte to be fertilized and the resulting embryo (Naqvi et al., 2012).
- Heat stress compromises oocyte growth in cows by al-tering progesterone secretion, the secretion of luteinizing hor-mone, follicle-stimulating hormone and ovarian dynamics dur-ing the oestrus cycle.
- Heat stress has also been associated with impairment of embryo development and increase in embryonic mortality in cattle. Heat stress during pregnancy slows growth of the foetus and can increase foetal loss.
- Secretion of the hor-mones and enzymes regulating reproductive tract function may also be altered by heat stress. In males, heat stress adversely affects spermatogenesis perhaps by inhibiting the proliferation of spermatocytes.

- **Impact of climate change on livestock adaptation**

- In order to maintain body temperature within physiological limits, heat stressed animals initiate compensatory and adap-tive mechanisms to re-establish homeothermy and homeo-stasis, which are important for survival, but may result reduc-tion in productive potential.
- The relative changes in the various physiological responses i.e. respiration rate, pulse rate and rectal temperature give an indi-cation of stress imposed on livestock.
- The thermal stress affects the hypothalamic–pituitary–adrenal axis. Corticotropin-releasing hormone stimulates somatostatin, possibly a key mechanism by which heat-stressed animals have reduced growth hormone and thyroxin levels.
- The animals thriving in the hot climate have acquired some genes that protect cells from the increased environmental temperatures. Using func-tional genomics to identify genes that are up- or down-regulated during a stressful event can lead to the identification of animals that are genetically superior for coping with stress

Impact of climate change on livestock diseases

- Variations in temperature and rainfall are the most signifi-cant climatic variables affecting livestock disease outbreaks. Warmer and wetter weather (particularly warmer winters) will increase the risk and occurrence of animal diseases, be-cause certain species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round.
- The movement of disease vectors into new areas e.g. malar-ia and livestock tick borne diseases (babesiosis, theileriosis, anaplasmosis), Rift Valley fever and bluetongue disease in Europe has been documented. Certain existing parasitic dis-eases may also become more prevalent, or their geograph-ical range may spread, if rainfall increases.
- This may contrib-ute to an increase in disease spread for livestock such as ovine chlamydiosis, caprine arthritis (CAE), equine infectious anemia (EIA), equine influenza, Marek's disease (MD), and bovine viral diarrhea. There are many rapidly emerging dis-eases that continue to spread over large areas.
- Outbreaks of diseases such as foot and mouth disease or avian influenza affect very large numbers of animals and contribute to fur-ther degradation of the environment and surrounding com-munities' health and livelihood.

Conclusion to Reduce Climatic Strees For improovement of Livestock point t be consider……

- There is considerable research evidence showing substantial decline in animal performance inflicting heavy economic losses when subjected to heat stress.
- With the development of molecular biotechnologies, new opportunities are availa-ble to characterize gene expression and identify key cellular responses to heat stress.
- These tools will enable improved accuracy and efficiency of selection for heat tolerance. Sys-tematic information generated on the impact assessment of climate change on livestock production may prove very valu-able in developing appropriate adaptation and mitigation strategies to sustain livestock production in the changing climate scenario.
- As livestock is an important source of liveli-hood, it is necessary to find suitable solutions not only to maintain this industry as an economically viable enterprise but also to enhance profitability and decrease environmental pollutants by reducing the ill-effects of climate change.

Chapter- Various Livestock Diseaes

- **Classification of Diseases:**
- **A. According to mode of** origin
- **Hereditary diseases:** are transmitted from parents to the offspring.
- **Congenital diseases:** are acquired during intra-uterine life.
- **Acquired diseases:** are acquired after birth.

B. According to specific causes:

- **a) Specific diseases:** are produced by a specific pathogen or factor. They are subdivided into

  i) Infectious diseases: are caused by pathogenic organisms
- Viral diseases: Rinderpest (RP), Foot & Mouth disease (HMD)
  Bacterial diseases: Black quarter (BQ), Haemorrhagie septicemia (HS)
  Protozoan diseases: Surra, Thieleriosis.
- **ii) Non-infectious diseases:** are caused by physical or chemical or Poisonous agents, nutritional deficiency or disturbed metabolism. E.g.
- Deficiency diseases - Rickets.
- Metabolic diseases - Milk fever
- Poisoning - Pesticide poisoning

b) Non-specific disease: those diseases whose causes are indefinite or multiple e.g. Pneumonia

- **C. According to mode of spread:**
- **Contagious disease:** sprout by means of direct or indirect contact, e.g. FMD; HS All infections discuses may or may not be contagious but all contagious dieses are injections.
- **Non-contagious diseases:** do not spread by means of direct or indirect contact. E.g. Rickets.

- **D- According to clinical signs:**
- **Preacute disease** is characterized by very short course (few hours to 48 hours) and very server symptoms e.g. Anthrax,
- **Acute disease** is characterized by a sudden onset, short course (3-14 days) and severe symptoms e.g. FMD, RP.
- **Subacutc disease:** whose course is 1-4 weeks and severity is less than acute one. E.g. Sub acute mastitis
- **Chronic disease:** whose course is more than 4 weeks and signs are not severe in character e.g. Tuberculosis

- **E. According to intensity and spread of diseases:**
- **Sporadic disease:** affects one or few animals and shows little or no tendency to spread within the herd e.g. Johne's disease.
- **Enzootic/Endemic disease:** means are outbreak of disease among animals in a definite area or particular district. E.g. Anthrax, H.S.
- **Epizootic/Epidemic disease:** which assets a large population of animals in large area at the same time and spread with rapidity e.g. FMD, RP.
- **Panzootic** /Pandemic disease**:** is a widespread epidemic disease usual of world wide distribution e.g. Influenza
- **Zoonotic disease:** a disease which can be transmitted from animal to man and vice versa e.g. Anthrax, Brucellosis.

Enlisted Diseases of Cattle and Buffalo

1. Hemorrhagic Septicaemia (HS) - Animal Disease

- **Synonyms:** Pasturellosis, shipping fever, ghatsurp
- **Etiology:** It is caused by *Pasteurella multocida*
- **Transmission:**Ingestion of contaminated feed and water and Inhalation.
- **Symptoms:**
- High fever (106 - 107°F), Loss of appetite, Suspended rumination, Dullness and depression, Rapid pulse & heart rate, Profuse salivation and laciration., Profuse nasal discharge, Difficult/snoring respiration, Swelling of throat region (submandibular oedema), Death within 10-72 hours.
- **a) Specific treatment:**
- 1. Injection. Sulphadimidine @ 150 mg/Kg body weight IV daily for 3 days 2. Injection Oxytetracycline @ 5-10 mg/Kg body weight IV or IM daily for 3 days. 3. Alum precipitated M.S. vaccine@ 5 ml subcut every year before monsoon.

4. Use of antipyretics lo reduces body temperature

5. Use of antihistaminic e.g. Injection Avil/Cadistin5-10 ml IM.

2. Black Quarter (BQ) - Animal Disease

- **Synonyms:** Black - leg, Farrya
- It is an acute infectious and highly fatal, bacterial disease of cattle. Buffaloes, sheep and goats are also affected. Young cattle between 6-24 months of age, in good body condition are mostly affected. the disease is sporadic (1-2 animal) in nature.
- Etiology: It is caused by ***Clostridium chauvoei***
- **Transmission:** The disease spreads through Ingestion of contaminated feed and Contamination wounds.
- **Symptoms:**
- 1. Fever (106-10S°F) , Loss of appetite, Depression, dullness, Suspended rumination, Rapid pulse and heart rates, Difficult breathin(dyspnoea), Lameness in affected leg. Crepitating swelling over hip, back & shoulder. Swelling is hot & painful in early stages whereas cold and painless inter. Recumbency (prostration) followed by death within 12-48 hrs.
- **Treatment**:
- 1. Penicillin @ 10,000 units /Kg body weight 1M & locally daily for 5-6 days.
  2. Oxytetracycline in high doses i.e. 5-10 mg/Kg body weight 1M or IV
  3. Indcse the swelling and drain off
  4. B.Q. antiserum in large does, if available.
  5 Injection. Avil / Cadistin @ 5-10 ml IM

3. Anthrax - Animal Disease

- **Synonyms:** Splenic fever, fanshi, kalpuli
- It is an acute widespread infectious disease of all warm blooded animals specially cattle, buffalo, sheep, goat. It is communicable to man i.e. Zoonotic disease.
- **Etiology:** This disease is caused by bacteria called ***Bacillus authracis*****.**
- **Transmission:**
- It usually spreads through ingestion of contaminated feed and water. Sometimes, it also occurs by inhalation and biling flies.
- **Symptoms:** Sudden rise in body temperature (104 - 10S°F) ,Loss of appetite i.e. off-feed., Severe depression or dullness, Suspended rumination, Increased respiration and heart rate, Bloat or tympany, Dyspnoea - difficult breathing, Dysentery or diarrhoea, Bleeding from natural openings like anus, nostrils, vulva etc, Sudden death in peracute cases.
- **Treatment :** Treatment is effective if given in the initial stage of the disease.
- Penicillin @ 10000 units/kg body wt. IM.
- Oxytetracycline © 5-10 mg/kg body wt. IM/IV.
- Antiantrax serum @ 100-200 ml IV may be given if available.
- Supportive treatment with antipyretics, antitistammics and fluid therapy.

4. Rinder Pest – Animal Disease

- **Synonyms:** Cattle plague, Bovine typhus, Bulkandi
- It is an acute highly contagious viral disease of ruminants and pig. Crossbred and young cattle are more susceptible to this virus.
- **Etiology:** It is caused by ***paramyxo virus.***
- **Transmission:** 1. It spreads primarily through inhalation.
  2. It also spreads through ingestion of contaminated feed and water.
- **Symptoms:** Fever usually persists for 3 days. Loss of appetite (off feed), Drop in milk yield ,Suspended rumination, Conjunctiva becomes dark red i.e. congested, Ladriation.Nasal discharge, Necrotic ulcers or erosions on oral mucus membrane. Salivation, Shooting diarrhoea. Abdominal pain/colic, Dehydration, Death within 6-12 days
- **Treatment;** **a)** Antibiotics like penicillin, streptomycin, Oxytetracycline should be given to check secondary bacterial infection. Use of anti-rinderpest serum. Fluid and electrolyte therapy - Dextrose saline
- **b) Vaccination:**
- Tissue Culture Rinderpest Vaccine (TCRPV) © 1 ml /SC every a I term year.

5. Foot and Mouth Disease (FMD)

- **Causasal organism- Aphtho- virus (Asia I, II type- virus)**
- **Symptoms;** Foot and mouth disease is a highly communicable disease affecting cloven footed animals and is characterized by fever, formation of vesicles and blisters in the mouth, udders, and teats and on the skin between the toes and above the hooves. The incubation period in natural infection is about two to five days. In artificial infections, the temperature rises to 104 to 105°F. In about 24 to 48 hours and at this stage the virus occurs in the circulation, being eventually carried to distant parts of the body, where it causes the formation of vesicles.
- **Treatment:**
- No scientific evidence is obtainable in support of claims that foot and mouth disease is curable by the use of therapeutic agents. The use of drugs by field workers is only resorted to as a measure of aiding in the natural process of recovery.
- Thus, the external application of antiseptics contributes lo the healing of the ulcers and wards off attacks by flies.
- A common and inexpensive dressing for the lesions in the feet is a mixture of **coal tar and copper sulphate** in the proportion of 5: 1.

6. Enterotoxaemia -Animal Disease

- ***Causal agent- Clostridium welchii***
- Symptoms; The disease commonly occurs in England, Australia, New Zealand and certain parts of America. Lately, its occurrence has been reported from certain parts of Bombay and Madras. The term 'Pulpy Kidney' denotes a condition in which the kidney is so damaged that it decomposes soon after death, *Clostridium welchii*, Type D, infection in adult sheep usually occurs in those which are in very good condition and over resting is regarded to be a predisposing factor. The specific toxins liberated by the organisms in the intestines are absorbed very rapidly and death occurs within three to four hours after the onset the disease.
- Treatment; Anti-toxin and whole culture toxoid-vaccine arc very effective for the control of the disease

7. Mastitis - Animal Disease

- **Synonyms**: Mastitis, Dagadi
- **A. Causal agents: Bacteria - Streptococcus, Staphylococcus, E. coli**
- Viral diseases - Cow pox, FMD
- Fungus - Aspergillus, Candida, Cryptococcus, Mycoplasm
- **Transmission:** It spreads through infected water, contaminated bedding, utensils, milkers hands.
- **Symptoms: a) Acute form:** 1. Fever 2. Loss of appetite. 3. Udder is swollen, hot and painful. 4. Milk may be yellowish or brownish, 5. Milk contains flakes or clots.
- **Treatment:** Evacuate the Under , Intramammary antibiotic therapy/infusion with Vetclox plus or Pendistrin - SH or Tilox @ I tube twice daily for 3 days.
- Milk should not be used for human consumption forecast 72 hours after last infusion.
- Injections of antibiotics like penicillin, streptomycin, ampicillin, tetracycline or chloramphenicol IM.
- Hot fomentation of udder with magnesium sulphate to relieve inflammation.

Chapter -Integrated Livestock Farming

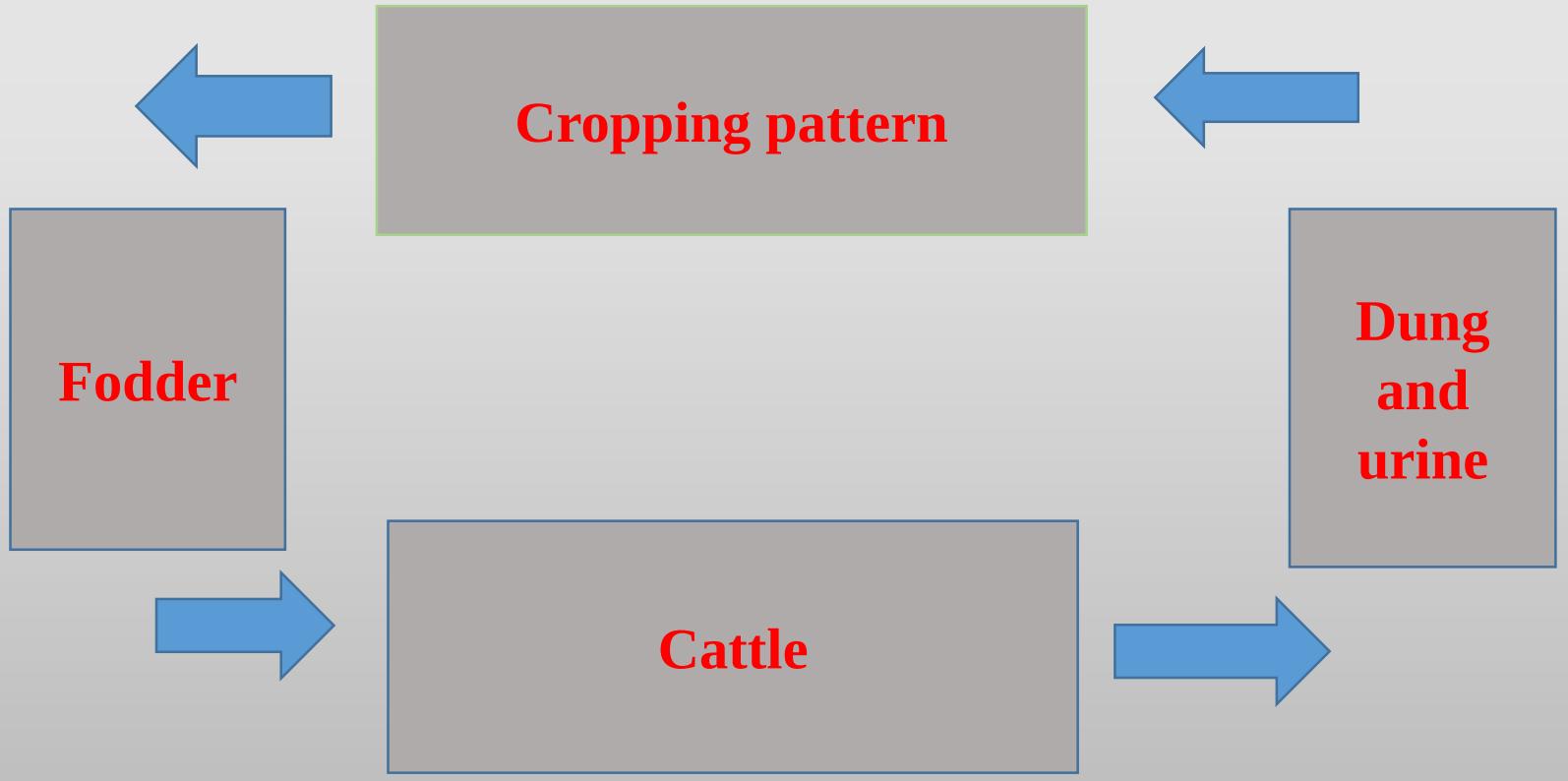
- **Integrated farming System**
- **Definition**- farming system is an integration of various farm enterprises like., crops, flowers, fruits, vegetable, dairy, goats, pig, poultry, sericulture, bee-keeping, mushroom cultivation,agroforestry etc
- Or
- Farming system is an appropriate combination of farm enterprises viz., cropping pattern and other enterprises like, livestock, forestry, sericulture, piggery, fisheries, bee-keeping etc..

Interrelationship between enterprises

- Various enterprises on the farm are related with each other
- The output or end product or waste of one enterprises are used as starter or input for other enterprises
- For examples;
- Straw obtained from crops grown in farm is used as fodder for cattle like bullock, cow, buffalo, ships and goats
- Cattles are used for different field operation for crop growing
- Buffalo, cows yield milk, dairy products and also give dung, urine as a waste or output
- The waste are given out by cattle is used as input in cropping system

Concept of Livestock farming system

- To earn more profit and dividend in different enterprises
- To preserve land productivity and preserve environment quality
- To maintained desired level of biological diversity and ecological Stability
- To combined allied enterprises with cropping to generate income



Components of farming system

Sr. no and Particulars	Examples (Models)
1. Main enterprises	**Crops and Cropping pattern**
2. Allied enterprises	**Dairy farming, Goat farming, Poultry farming, Ducks farming, Turkey farming, Pigeons for meat, Piggery, Japanese quail, Bee-keeping, Mushroom cultivation**
3.Complimentary Enterprises	**Rice-cum Fish culture** **Crop- Livestock- Fish farming** **Fish-cum -Horticulture**

Fodder production in Integrated farming system

- In integrated farming system, maintenance of cattle, realize more income; good quality of fodder production is essential.
- Fodder cultivation improves soil fertility and soil water holding capacity.
- Weeds, non- beneficial plants and sedges growth were restricted.
- Legume fodder cultivation enriches soil nutrients particularly nitrogen
- Profitable milk and meat production requires protein rich legume fodder to be fed to the animals
- Cereals and grass fodders are mixed with legume fodder will reduced the cost incurred for concentrate

Guideline for fodder production

- **In minimum land high yielding forage varieties must be selected**
- **Select forage varieties both irrigated and rainfed condition**
- **Based on soil testing forage crops could be cultivated**
- **Forage crops can be classified as;**
- **Grass fodders-** 1)Irrigated crops ex., Cumbu-napier hybrid grass and guinea grass 2) Rainfed crops- Kollukutai grass and Deenanath grass
- **Grain fodders- 1)** Irrigated crops- ex., forage maize, forage sorghum, forage cumbu etc 2) Rainfed crops- forage sorhum and cumbu grass
- **Legume fodders-** 1) **irrigated crops-** hedge legume, luern, cowpea, cluster bean, soya, centro etc

  2. Rainfed crops- hedge legume, stylo, ciratro

3) Short term crops- pigeon pea, horse gram, lablab, cowpea, cluster bean

Application of Integrated farming system or Essentiality of Integrated farming system

- Globally the demand for livestock products has been increase day by day
- So integrated farming system agriculture crops integrated with livestock , poultry, and fish farming with production of fodder
- Places where one crop in a year, scarcity in irrigation and low rainfall areas, agriculture practiced with livestock farming not only giving additional income but also given opportunity to the family members around the year
- Livestock excreta used as manures lowered the cost of fertilizers .Crop residues used as a livestock feed will reduce the feed cost
- In this method agriculture along with fodder, azolla production combined with livestock production definitely get more profit
- Effective formulation of farming system model which combined all enterprises with main/ cropping enterprises. Effective recycling of farm residues within system
- To maintained sustainable production without damaging resources and environmental quality. To formulates judicious mixture of cropping system with associated enterprises like, dairy, poultry, piggery, sericulture etc

Swot analysis

Discussion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