

VETERINARY PREVENTIVE MEDICINE (Vetm-5233)

By
Yalelet Worku (DVM, MSc, Assoc. professor of Vet. Epidemiology)
@
School of Veterinary Medicine, Wollo university

for
Undergraduate DVM program Students

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Recap

Course description

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Course objective

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Recap

Course description

Veterinary Preventive medicine deals with the epidemiology of major epizootic diseases particularly those caused by bacteria, and viruses and have a significant impact on the Ethiopian economy. Emphasis is given to the distribution within the country, diagnosis and application of appropriate control and prevention methods on epidemic and endemic diseases. This course, hence, deals with host defense mechanisms, vector borne diseases, soil borne diseases, and contact infections, epidemiology of diseases in the pastoral, small holder, ranching, feedlot, and intensive dairy farm production systems.

Course objective

By the end of this course, students will be able to:

- Know the epidemiological distribution of the most important livestock diseases in the tropics including their appropriate preventive and control methods
- Introduce the concept of tailoring animal health schemes into the existing animal husbandry practices, with major emphasis on the genetic diversity of animals and their adaptation to local environmental and management conditions.

Recap

What did you learn in the previous topics of this course?

?

What about next?

?

Recap

What did you learn in the previous topics of this course?

- ✓ Host Defense Mechanisms against Infection
- ✓ Anti-Epizootic Measures
- ✓ Vector borne diseases
- ✓ Soil borne diseases

What about next?

- ✓ **Contact diseases**
- ✓ **Production Systems and their Relevance to Animal Health**

Try to give more emphasis on the major epidemiological characteristics variation & other features of the 3 groups & each diseases

Contact diseases?

Soil born disease ?

Vector borne diseases?

Try to give more emphasis on the major epidemiological characteristics variation & other features of the 3 groups & each diseases

Vector borne diseases

- ❖ Transmitted by vectors (tick, Tsetse flies, culicids mosquito etc)
- ❖ Common diseases in Africa as well as in Ethiopia
- ❖ Exotic breeds are more susceptible than local breeds
- ❖ B/s of this improvement of livestock productivity in Africa is hindered by using exotic breeds
- ❖ Young animals are resistant than adult
- ❖ B/s here there is a phenomena called premunity
- ❖ Control will be achieved by applying vector control methods
- ❖ Control of these disease is difficult
- ❖ Complete control is possible if vector control is possible
- ❖ Protozoal diseases, AHS, RVF (epidemics)
- ❖ Other VBDs?

Soil born disease

- Source of infection is soil
- Never transmitted from infected to susceptible animal
- Control measures are mainly management measures & hygienic measures
- Most of them have no wildlife reservoirs except anthrax
- Does not occurs as an out break so they are individual problems/ not mass problem
- Affected by environmental factors
- Disease causing agent is resistant
- Not cause of international trade restriction
- Most of them are bacterial disease
- They are endemic diseases
- No carriers
- Most of them have vaccine in Ethiopia so can be prevented by vaccination

Chapter 5

Contact diseases

Introduction to contact diseases

What are contagious(contact) diseases?

- ✓ They are communicable disease that can spread rapidly from animal to animal through **direct contact** or **indirect contact** with contaminated object), or **droplet contact** (inhaling droplets made when an animal which has the infection coughs/sneezes (airborne transmission)
- ✓ Most of them can occur as epidemic diseases (**Transboundary Animal diseases-TADs**)
- ✓ Epidemics of infectious disease are generally caused by several factors including a change in the **ecology of the host population**
- ✓ Most of them affects all age groups
- ✓ The pathogens of most contact disease have serotype/strain diversity
- ✓ Most of them are **emerging or re-emerging disease (zoonotic diseases-75%)**
- ✓ They can spread quickly so they can occur as outbreak, peracute, acute/subacute, chronic diseases)
- ✓ Most of them have great social-economic impact on livestock production of tropical Africa
- ✓ Most of them are also **notifiable diseases** (viral diseases, diseases of intensification)
- ✓ Most of them cannot be prevented or controlled by normal commercial methods so they need **national disease control programs, most of them have vaccine in Ethiopia**

What are they?

Give examples of contact diseases

Viral diseases

?

Bacterial diseases

?

Give examples of contact diseases

Bacterial diseases

- Mycoplasmoses
- Tuberculosis
- Brucellosis
- Haemorrhagic Septicaemia,

Viral diseases

- Foot and Mouth Disease
- Peste Des Petits Ruminants

Cont....

Under each disease the following points will be discussed

- **Etiology**
- **Epidemiology of each disease (distribution, host range, transmission, risk factors)**
- **Pathogenesis of the disease**
- **Clinical signs/symptoms and Pathological lesions**
- **Diagnosis methods /techniques used and treatments given**
- **Socioeconomic impacts of each disease**
- **Control and prevention measures**

Chapter 6

Production Systems and their Relevance to Animal Health

Cont....

1. Pastoral Production System

- Characteristic Features of Pastoral livestock Systems
- Animals Health Schemes

2. Small-holder Livestock Production Systems

- Characteristic Features
- Animal Health Schemes

3. Ranching

- Organization
- Animal Health Schemes

Cont....

4. The Feedlot farming

- Descriptions
- Epidemiology of Diseases in Feedlot Cattle
- Specific Disease Conditions

5. The Intensive Dairy Farming

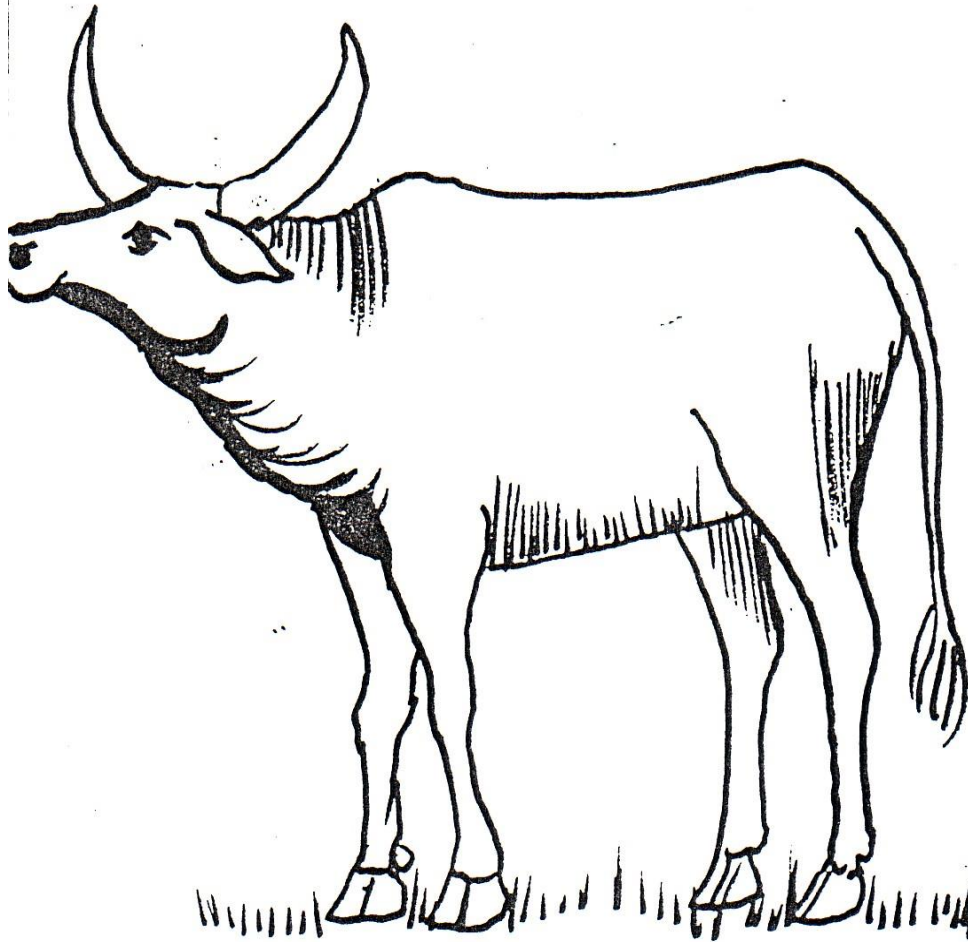
- Description of the Production System
- Trends in Dairy Farming
- Health and Production
- Diseases of Intensification
- Dairy Farming in the Tropics
- Animal Health Schemes

6. Health and Production Management of Dairy Calves

- Common causes of Calf Morbidity and Mortality
- Health Management of Dairy Calves

Diseases associated with
Mycoplasma species= Mycoplasmosis

Illustration of CBPP diseases



11.1 CONTAGIOUS BOVINE PLEUROPNEUMONIA (CBPP)

1. Def: It is an acute, sub-acute, or chronic disease characterized by formation of massive pathological changes in the lungs and pleura.

2. Etiology

- *Mycoplasma mycoides* subsp. *mycoides* (small colony type (MmmSC)) is the cause of the disease in cattle.
- The organism is extremely pleomorphic in nature.
- It is sensitive to all environmental influences, including disinfectants, heat and drying, and do not ordinarily survive outside the animal body for more than a few hours.

3. EPIDEMIOLOGY

3.1 Occurrence

✓The disease is one of the major plagues in cattle causing heavy losses in many parts of the world .

3.2 Species Affected:

- This is a primarily disease of cattle, although the organism can infect sheep and goat.
- In 2001, 17 countries in Africa declared the presence of the disease.
- In 1995, the Office des International Epizooties (OIE) reported that CBPP in Africa was causing greater losses in cattle than any other disease.

3.2 Source of infection

- ❖ The focus of infection is often provided by **recovered 'carrier'** animals in which a **pulmonary sequestrum** which may act as potential source of infection for a period as long as three years. Such cattle are called '*Lungers*'. Conditions of stress due to starvation, exhaustion or inter current disease can cause the sequestrum to break down and convert the animal into an active case.

3.3 Methods of transmission

- Transmission occurs through direct contact.
- The principal route of infection is by the **inhalation** of infective droplets from active or carrier cases of the disease.

3.4 Management risk factors

- The occurrence and incidence of CBPP is heavily influenced by management systems, disease control policies and regulations of a country, diagnostic capability of veterinary laboratories, disease-surveillance and monitoring systems, adequacy of vaccination programs, government budgets allocated to control programs, the effectiveness of education programs,

4. Economic importance

- ❖ CBPP is the most **economically important disease** of cattle in Africa.
- ❖ The direct losses are from mortality, reduced milk yield, vaccination costs, disease surveillance and research programs.
- ❖ The indirect costs are due to the chronic nature of the disease including:
 - Loss of weight and working ability
 - Delayed marketing
 - Reduced fertility
 - Losses due to quarantine
 - Loss of cattle trade.

5. PATHOGENESIS

- The pathogenesis is not well understood.
- The disease is an **acute lobar pneumonia** and **pleurisy**.
- The organism invades the lungs of cattle and causes a mycoplasmaemia.
- This results in localization in numerous other sites including the kidneys and brain, resulting in high morbidity and mortality.
- The disease causes thrombosis in the pulmonary vessels.
- The production of **hydrogen peroxide** results in lysis of erythrocytes, the peroxidation of lipids of fibroblasts and inhibition of ciliary movement in trachea.
- Death results from anoxia and toxemia.

6. CLINICAL FINDINGS

- ✓ After an incubation period of 3-6 weeks there is:
- ✓ High fever, decrease in milk yield, anorexia and cessation of rumination.
- ✓ **Coughing**, and **thoracic** pain are evident; affected animals are disinclined to move, standing with the elbows out, the **back arched and head extended**.
- ✓ Shallow and rapid respirations, accompanied by expiratory grunting.
- ✓ Edematous swellings of the throat and dewlap and joints.
- ✓ Death

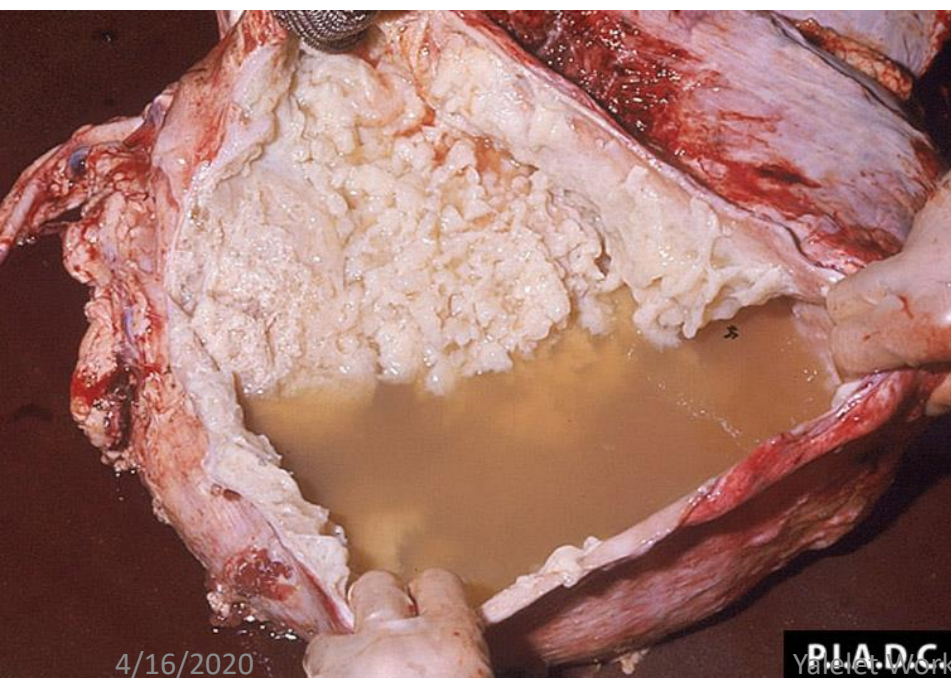
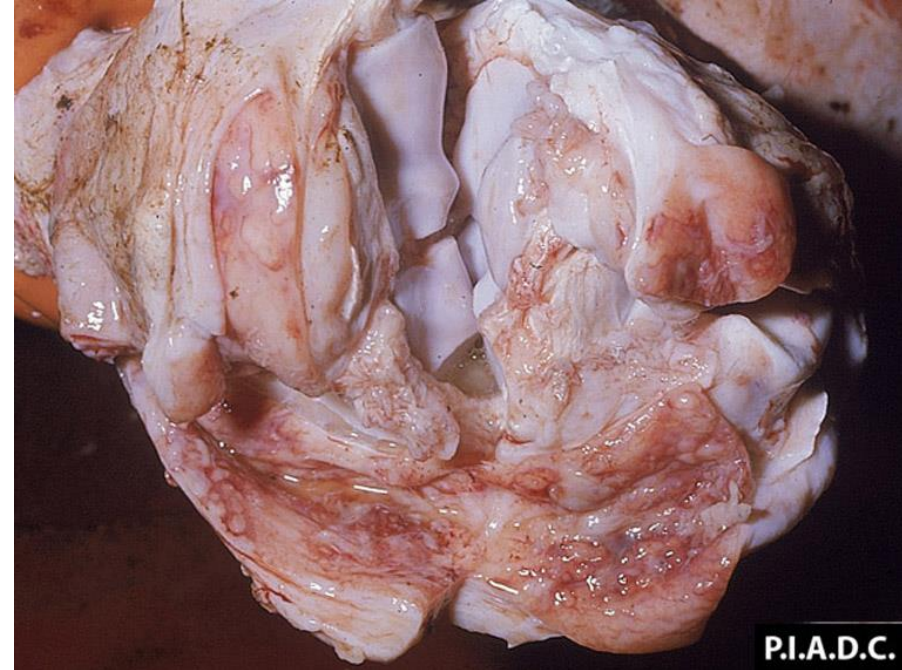
7. NECROPSY FINDINGS

- Lesions are confined to the thoracic cavity and lungs and the lesions are usually unilateral.
- **clear, yellow-brown fluid containing pieces of fibrin** in the pleural cavity.
- **Caseous fibrinous** deposits on the parietal and visceral surfaces of the lungs.
- Consolidation of the lungs with a typically characteristic marbled appearance.
- Sequestrum of necrotic lung varying size from 1-10 cm in diameter surrounded by a fibrous capsule in chronic or advanced cases.
- **Exudative peritonitis, arthritis**, bursitis and fibrinous arthritis of carpal and tarsal joints in calves.



Marbled lung due to CBPP





8. **Diagnosis:** This is based on the following consideration.

- **History** - Prolonged incubation period, history of contact with infected animals.
- **Clinical Findings**-Typical signs of respiratory involvement
- **Necropsy**-Classical marbled appearance of the lung.
- **Culture** of the organism in special media. Pleomorphic organisms are seen in culture with predominant filamentous form.

DX.....

8.1 Isolation (detection) of organism

- The organism is nutritionally very fastidious and special laboratory media is required for growth and identification.
- The PCR has been used to identify the specific organism and differentiate it from other members of the cluster.

8.2 Serological tests

- Complement fixation test (CFT)
- ELISA

9. Differential Diagnosis: Pasteurellosis and parasitic pneumonia

10. Treatment:

- No therapeutic treatment is effective.
- Treatment is usually undertaken only in areas where the disease is endemic, otherwise, eradication being the more logical practice when the diseases break out in a new area.
- Sulfadimidine and organic arsenicals are used extensively and appears to reduce the mortality rate.
- Streptomycin has some curative effect.
- Oxytetracycline and chloramphenicol have some value.
- Tylosine tartrate (10mg/kg body weight every 12hours for 6 injections IM) is highly effective

11. CONTROL

The major obstacles to the control and eradication of the disease are:

- ❑ Difficulty in controlling the movements of cattle, especially in sub-Saharan Africa
- ❑ Complications of applying quarantine and slaughter policies
- ❑ Lack of rapid diagnostic tests
- ❑ Ineffective vaccines
- ❑ Insufficient funds to implement control policies
- ❑ **Civil strife** and **drought**, which have an effect on the spread of the disease in Africa

- The possible strategies used for control in affected countries or regions are:
 - ✓ Slaughter of all sick and in-contact cattle.
 - ✓ Slaughter of all sick cattle and vaccination of in-contact cattle.
 - ✓ Vaccination of healthy cattle with slaughter of sick cattle in an epidemic and revaccination of cattle at risk.
 - ✓ The type of vaccine available in Ethiopia is freeze-dried live attenuated bacteria vaccine produced using **T144** and **T1SR strains** of mycoplasma mycoides subspecies mycoides Small colony (MmmSC). Inject 1ml of the reconstituted vaccine by using 100ml sterile cold saline water solution only through subcutaneous.
 - ✓ It gives immunity for 1 year

CONTAGIOUS CAPRINE PLEUROPNEUMONIA (CCPP)

1. Def: This is a contagious disease of goats having resemblance with CBPP. CCPP has many similarities clinically and at necropsy to CBPP, but it is not transmissible to cattle.

2. Etiology

- CCPP is a classical disease of goats caused by *Mycoplasma mycoides* var. *caprae* (Large colony type).
- The organism does not survive for long outside the animal body.

3. EPIDEMIOLOGY

3.1 Occurrence

- ❖ CCPP is a serious fatal diseases of goats.
- ❖ The disease has been reported from 38 countries, mostly from Africa and Asia.
- ❖ Infectivity is high with a morbidity of 100%, and a case-mortality rate of 60-100 %.

3.2 Transmission

- The disease is readily transmitted by inhalation, and the infection is brought into the flock by a carrier or infected animal.

4. Clinical findings

- The clinical findings in CCPP are restricted to the respiratory system and include: **The incubation period is about 4 days.**

Coughing, dyspnea, lagging, lying down a lot, fever (40.5-41.5) and in the terminal stages, mouth-breathing, tongue protrusion and frothy salivation with death in two or more days.

5. Clinical pathology

- Antigen can be detected in lung tissue and pleural fluid by PCR.
- Serological tests used to identify carrier animals include complement fixation, ELISA and a latex agglutination test.

6. Necropsy findings

- The more usual necropsy findings are similar to those of CBPP except that **sequestra are not formed** in the lungs.
- hepatization of parts of the lung and an increase in pleural fluid with a fibrinous pleuritis.

7. Diagnosis: More or less similar to CBPP

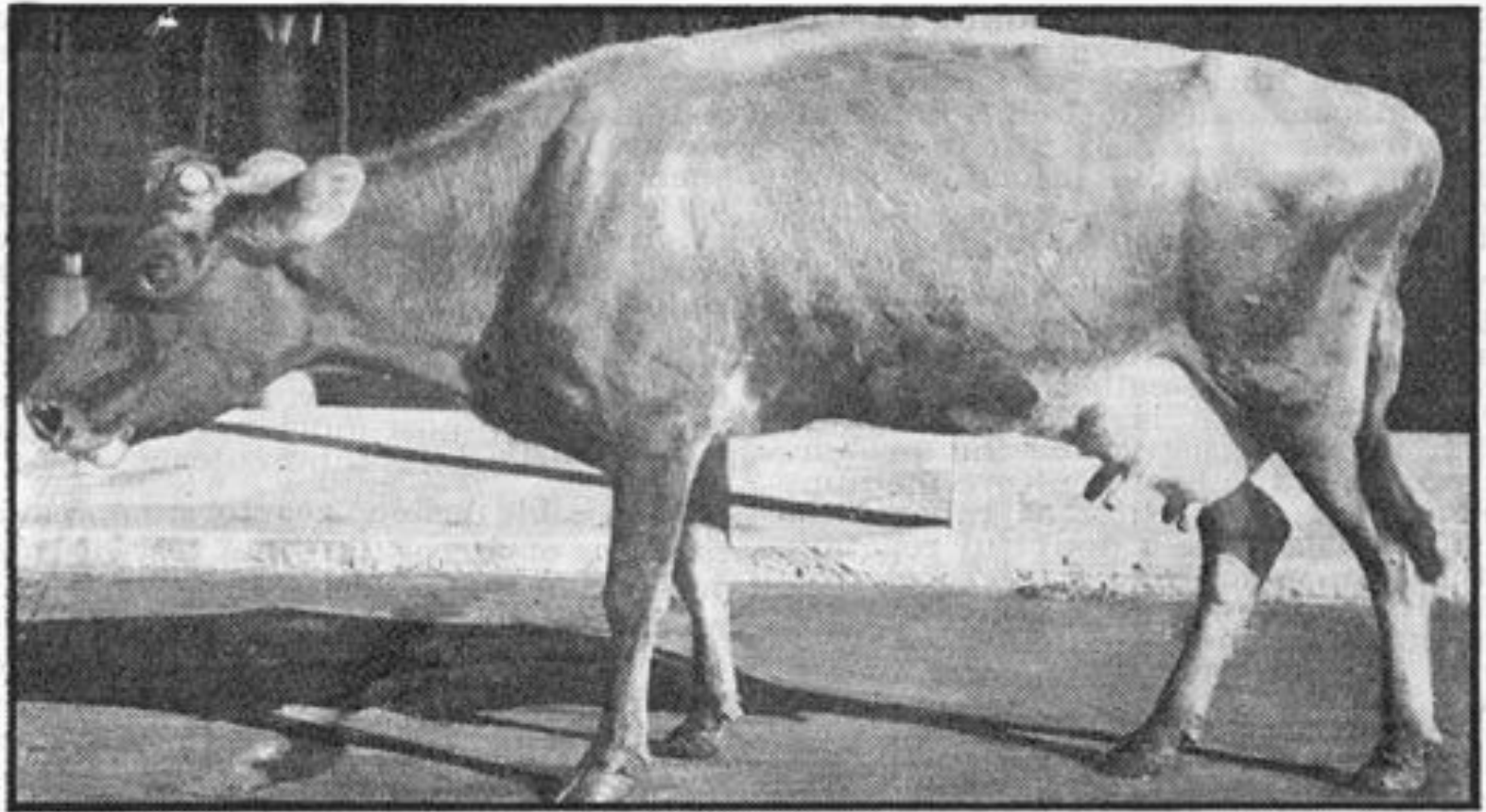
8. Treatment

- ❖ Treatment of cases of CCPP with tylosin tartrate or oxytetracycline is highly successful in limiting the severity of disease.
- ❖ The severity of the disease is reduced but treated animals are still sources of infection.

8. Control

- ❖ *Herd biosecurity* to prevent contact with infected animals is important.
- ❖ *Vaccination*: By using an inactivated mycoplasma bacteria vaccine produced using F-38 Kenya strain of *Mycoplasma Capricolum Subspecies Capri pneumonia* (MCCP) induces an immune response which is effective in reducing morbidity and mortality rates.
 - It is a well grown mycoplasma culture inactivated by formalin (0.3%) and saponin which has also an adjuvant effect. It is given at 1ml/goat subcutaneously at the thoracic wall
 - It confers immunity for 1 year.

Bovine tuberculosis (BTB)



Cows in the last stages of tuberculosis become weak and emaciated.

1. Definition: Tuberculosis (TB) is an infectious, granulomatous disease caused by acid-fast bacilli of the genus *Mycobacterium*.

2. ETIOLOGY

Pathogenic spp of mycobacterium are;

- *M. Tuberculosis* (it affects man and animal)
- *M. Bovis* (it affects animal and man)
- *M. Paratuberculosis* (it affects bovine)
- *M. Avium* (it affects birds and man)
- *M. Leprae* (it affects man)
- *M. bovis* subsp. *caprae* has been identified as a cause of infection in goats and humans in Spain and goats, cattle, deer, and swine in Europe.

Bovine tuberculosis

It is an infectious disease of cattle caused by *M. bovis* and characterized by progressive development of tubercles in any organs of the body

Occurrence

- All species, including humans, and age groups are susceptible to *M. bovis*, with cattle, goats, and pigs most susceptible and sheep and horses showing a high natural resistance.
- **Source of infection**
- **Cattle**
- Infected cattle are the main source of infection for other cattle.
- Organisms are excreted in the exhaled air, in sputum, feces, milk, urine, vaginal and uterine discharges, and discharges from open peripheral lymph nodes

3. EPIDEMIOLOGY

3.1 Occurrence: world wide in distribution

- All species, including humans, and age groups are susceptible to *M. bovis*, with cattle, goats, and pigs most susceptible and sheep and horses showing a high natural resistance.

3.2. Host affected and risk factors

- Cattle are the primary host and highly susceptible
- Pure bred and cross bred are highly affected as compared to zebu cattle.
- Dairy cattle are at higher risk since the husbandry methods allow close contact between animals at milking and when housed.
- Sheep and goats are relatively resistant to infection.
- Infected cattle are the main source for human infection.

3.3. source of infection

- Organisms are excreted in the exhaled air, in sputum, feces, milk, urine, vaginal and uterine discharges, and discharges from open peripheral lymph nodes.

Wildlife reservoirs

- A large number of wildlife and feral species are naturally infected with *M. bovis*.
- In some areas of the world certain wildlife species appear to be a significant maintenance host and reservoir for infection in cattle.

3.4. Transmission

- Mainly through inhalation of droplet nuclei from aerosol generated by infected cattle
- Ingestion, communal use of feed and water troughs
- Directly through contact with tuberculosis animals and man or their discharges like sputum,
- Calves by ingestion of contaminated milk,
- Congenital infection.
- Through artificial insemination with infected semen.

3.5.Predisposing factors

- Overpopulation in small area.
- Purely intensive rearing.
- Intercurrent infection.
- Poor sanitation.
- Inadequate ventilation.
- Vitamin A and C deficiency.
- Young age groups and malnourishment

3.6.Pathogenesis

➤ Virulent tubercle bacilli destroy the phagosome and causes failure of phagolysosomal fusion and survive in phagocytic cells, therefore, the inhaled mycobacteria get lodged in the alveolar surface of the lung and its bronchial and thoracic lymphnodes---organism reaches pharyngeal and mesenteric lymphnodes----within the corresponding lymphnodes the mycobacteria undergoes multiplication and develop small tubercles.

Cont'd....

--Through draining of lymphnodes, bacteria reach the blood circulation and spread into other body cavities
---bacteria overcome the killing effect by host immune mechanism and causes infiltration and necrosis of neutrophils-----the bacteria and the dead immune cells are surrounded by multi epitheloid cell layers called as **Langhan's giant cells** or **granulomas** surrounded by lymphocytes and fibrous connective tissues.

3.7.Clinical disease in animals

- High fever and emaciation
- Loss of body weight slowly
- Difficult in breathing
- Painful dry cough
- Abdominal pain
- Chronic bloat



TB nodules in lungs

3.8 Socioeconomic impact

3.8.1. Economic impact by causing carcass condemnation, decrease milk production, decrease body weight, abortion, culling

3.8.2. Zoonosis (public health impact)

- *M. bovis* is responsible for 5-10% of human tuberculosis.
- Children could get infected from breast milk.

3.9.Necropsy Findings

At early stages of the disease, lesion may be difficult to detect during postmortem examination.

- Granulomatous lesion in bronchial, retropharyngeal and mediastinal lymphnodes.
- Miliary abscesses in lung.
- Nodules in pleura and peritoneum.
- Lesions in placenta with chronic purulent material.
- Enlargement of supramammary lymphnode - tuberculosis lymphomatosis.

3.10.Diagnosis

- Based on clinical signs and necropsy findings.
- Palpation of supramammary lymphnodes is essential for suspected tuberculous mastitis cases.
- Skin tests (**SIDT, Short thermal, Stormont test & CIDT**)
- ELISA
- Gamma-Interferon assay
- PCR and spacer oligonucleotide typing (Spoligo typing)
- Isolation and identification of organism by culture, acid fast staining and biochemical tests.

3.10.1. Single intradermal (SID) test

- Injection of bovine tuberculin PPD into a skin fold and the subsequent detection of swelling as a result of delayed hypersensitivity.
- The reaction is read between 48 and 96 hours after injection.
- The site of injection is made into an anal or caudal fold at the base of the tail, cervical fold, a fold of skin in the center of the lateral aspect of the neck, the lip of the vulva at the mucocutaneous junction.

- Disadvantages of SID
- Lack of specificity: can not differentiate between reactions due to infection with *M. bovis* and infection with *M. avium*, *M. tuberculosis*, *M. paratuberculosis* (including vaccination), or *Nocardia farcinicus*.
- Failure to detect cases of minimal sensitivity such as may occur in the early or late stages of the disease.

3.10.2.Short thermal test

- ✓ Inject intradermal tuberculin subcutaneously into the neck of cattle with rectal temperature of not more than 39°C.
- ✓ If the temperature at 4, 6, and 8 hours after injection rises above 40°C the animal is classed as a positive reactor.

3.10.3 Stormont test

- Apply a single intradermal test in the neck.
- Another injection at the same site 7 days later.
- An increase in skin thickness of 5 mm or more, 24 hours after this second injection, is a positive result.

3.10.4.Comparative test

- Avian and bovine tuberculin are injected simultaneously into two separate sites on the same side of the neck, 12 cm apart and one above the other.
- The test is read after 72 h and greater of the two reactions indicates the organism responsible for the sensitization.

- False-positive reactions (no gross lesion reactors) may be given by:
 - Animals sensitized to other mycobacterial allergens.
- False-negative reactions may be given by:
 - Advanced cases of tuberculosis
 - Early cases until 6 weeks after infection
 - Cows which have calved within the preceding 6 weeks
 - Old cattle
 - Low-potency tuberculin or bacterial contamination of the tuberculin

Tuberculin testing in pigs

- ✓ Injecting PPD into a fold of skin at the base of the ear, but the test
- ✓ Increase in skin thickness of above 5 mm after 24-48 hours constitutes a positive reaction.

Tuberculin testing in other species (Horse)

- Subcutaneous and intradermal tuberculin tests can be applied.
- But horses are **more sensitive** and false-positive reactors are common.

3.10.5. Gamma interferon test (IFN- γ);

- It is similar to the invivo tuberculin test in principle and mechanism, except that it is done invitro
- Interferon-'Y assay (γ -IFN) is licensed and commercially available in some countries.

Procedure

- First collect whole blood by using heparinized vacutainer tube
- Add it in three separate test tubes and stimulate them by adding avian-PPD, bovine-PPD and placebo (water) with 8 hours of collection

Cont...

- Incubate it for 24 hrs at 37°C + 5%CO₂
- Collect the supernatant from each of the samples which contains the gamma-interferon released by the lymphocytes (neutrophils) present in the whole blood responsible for swelling
- Then conduct ELISA using plates coated with monoclonal antibody of bovine γ -IFN
- Then reading the optical density (thickness of the precipitated fluid) of the samples at 450nm
- Compare the values of stimulated samples with that of the control sample

Cont...

- If there is significance difference b/n the sample and the control the sample is positive. This test was developed in Australia in 1889 by a scientist wood
- Its advantage are; animals are handled once but in tuberculin test it is twice
- Result can be known within 24hrs but in tuberculin test it takes 72hrs
- Desentesis caused by tuberculin test is avoided b/s it is done invitro
- Its disadvantage are; It is expensive & requires short time for processing

3.10.6.Lymphocyte proliferation test

Procedure

- Collection & isolation of lymphocytes
- Stimulation of lymphocytes by adding Ag and incubation at 37°C and 5% CO₂.
- After incubation for 4 days add thymidine (radio active substance) on the 5th day and incubate for 18 hrs
- Harvesting of the cells using semi-automatic cell harvester
- Then counting the cells using Scintillation counter (computerized machine)
- Then this counter detects the thymidine incorporated into the DNA of newly multiplied cells the multiplication is due to stimulation by lymphocytes
- Then the result is expressed as the stimulation index (SI)
- This means $SI = \frac{\text{mean count per minute for stimulated samples (MCSS)}}{\text{mean count per minute for non-stimulated samples (MCNSS)}} = MCSS/MCNSS$
- If $SI \geq 3$ then the animal is positive, this test is used for research

3.11.necropsy findings (postmortem exam.)

Cattle, sheep, goats and deer

- Tuberculous granulomas may be found in any of the lymph nodes, but particularly in bronchial, retropharyngeal, and mediastinal nodes.
- Miliary abscesses in the lung, tuberculous nodules on the pleura and peritoneum.
- **Chronic lesions** are characteristically discrete and nodular, and contain thick, yellow to orange, caseous material, often calcified and surrounded by a thick, fibrous capsule

3.12.Samples for confirmation of diagnosis

- Bacteriology - affected lymph nodes, lung, granulomas from viscera (CULT has special growth requirements).
- Histology - formalin-fixed samples of these tissues.

3.13.DIFFERENTIAL DIAGNOSIS

- Lung abscess due to aspiration pneumonia
- Pleurisy and pericarditis following traumatic reticulitis
- Chronic contagious bovine pleuropneumonia
- Actinobacillosis
- Bovine leukosis
- Lymphadenopathy
- Other causes of mastitis

3.14.Treatment

- There is no antibiotic treatment successful in control tuberculosis.
- Supportive treatment to enhance the immune response can be done.

Prevention and control

- All animals over six months and above should be tested by tuberculin test.

- Disposal of positive reactors
- Suspicious cases must be retested by comparative test.
- Retesting: If incidence is higher, retesting should be done in 45-60 days after desensitization of intradermal injected animals.
- Annual testing of all cattle, quarantine
- Identification of individuals and wildlife reservoir.
- BCG vaccine as calf hood vaccination, but vaccinated animals react positive to the skin test and immunity is not strong and long lasting .

3.15.Control

- Disinfection of utensils with 5% hot phenol and cresol.
- Feeding of calves with milk free from infection.
- Testing while introducing new stock.
- Educating public about the significance of the disease.

4. BRUCELLOSIS

1. Definition: Brucellosis is primarily a reproductive disease characterized by abortion, retained placenta and impaired fertility in the principal animal host caused by the genus brucella.
2. It affects man so it is a zoonotic disease.

Etiologies of brucellosis in domestic animals

The species of *Brucella* and their principal farm animal hosts are:

- *Brucella abortus* (cattle),
- *Brucella melitensis* (goats)
- *Brucella suis* (pigs), and
- *Brucella ovis* (sheep)
- *Brucella canis* (dog)

- Except *B. ovis* all affect man,
- They are intracellular cocco-baccilli
- *B. abortus* and *B. ovis* require 5% CO₂ for growth
- In general, the principal manifestations of brucellosis are reproductive failure, such as abortion or birth of unthrifty newborn in the female, and orchitis and epididymitis with frequent sterility in the male.
- Persistent (lifelong) infection is a characteristic of this facultative intracellular organism, with shedding in reproductive and mammary secretions.

BRUCELLOSIS ASSOCIATED WITH *BRUCELLA ABORTUS* (BANG'S DISEASE)

2. Etiology : *Brucella abortus* is the causative organism and at least nine biotypes have been recognized including a number of strain variants.
- *B. abortus* is a facultative intracellular parasite capable of multiplication and survival within host phagocytes.
 - The organism can survive on grass for variable periods depending on environmental conditions.
 - The organism is susceptible to heat, sunlight, and standard disinfectants but freezing permits almost indefinite survival.

3. EPIDEM IOLOGY

3.1 Occurrence

- Many countries have made considerable progress with their eradication programs and some have eradicated the disease.
- In developing countries brucellosis is still a serious disease problem facing the veterinary and medical professions.
- Infection occurs in cattle of **all ages** but is most common in **sexually mature animals**, particularly dairy cattle.
- In horses the organism is often found in **chronic bursal** enlargements as a secondary invader rather than a primary pathogen. It is commonly present with *Actinomyces bovis* in fistulous withers and poll evil.

- The organism can be recovered from **pigs** and **sheep** and **dogs**.
- The infection has occurs in **wild life**, bison (*Bison bison*), elk (*Cervus elaphus canadensis*), deer, coyotes, wild opossums and raccoons, moose, and other wild ruminants.

3.2 Source of Infection

- The organism is found in the contents of the pregnant uterus, the fetus and the fetal membranes.
- Many cows that have recovered from infection act as permanent **carriers**.

3.3 Transmission

- **Ingestion**: grazing on infected pasture, or consuming other contaminated feedstuffs and water supplies.
- **Contact** with conjunctiva or the intact skin of other animals with aborted fetuses and infected newborn calves..
- **Congenital infection** may occur in calves born from infected dams but its frequency is low.
- **Intramammary** spread during milking from a cow whose milk contains the organism to an uninfected cow.
- **Artificial insemination** of semen from infected bull.

3.4 Risk factors

Animal risk factors

- Susceptibility of cattle to *B. abortus* infection is influenced by the age, sex, and reproductive status of the individual animal.
- Sexually mature, pregnant cattle are more susceptible to infection with the organism than sexually immature cattle of either sex.

Management risk factors

- The spread of the disease from one herd to another and from one area to another is almost always due to the movement of an infected animal.

4. Economic importance

- Losses in animal production due to:
- decreased milk production in aborting cows
- infertility which increases the period between lactations.
- Prolonged average intercalving period by several months.
- loss of calves.
- some deaths as a result of acute metritis following retention of the placenta.

5. Zoonotic implications

- Brucellosis is an important zoonosis causing undulant fever in humans.
- Most cases in humans are occupational and occur in farmers, veterinarians, and butchers.

- *B. abortus* has a predilection for the pregnant uterus, udder, testicle and accessory male sex glands, lymph nodes, joint capsules, and bursae.
- Localization occurs initially in the lymph nodes draining the area and spreads to other lymphoid tissues.
- *B. abortus* is phagocytized by macrophages and neutrophils in an effort by the host to eliminate the organism.
- Inside the phagocyte, *B. abortus* is able to survive and replicate.
- The phagocyte migrates via the lymphatic system to the lymph node, where *Brucella* infection causes cell lysis and eventual lymph node hemorrhage.
- Because of vascular injury, some of the bacteria enter the bloodstream and subsequent bacteremia occurs, which disseminates the pathogen throughout the body.
- If the infected animal is pregnant, *B. abortus* will colonize chorionic and fetal membrane resulting in abortion in the last trimester.
- In the adult, nonpregnant cow, localization occurs in the udder.

7. CLINICAL FINDINGS

Abortion

- Abortion after the 5th month of pregnancy.
- **Retention** of the **placenta** and **metritis**.

Orchitis and epididymitis

- In the bull, orchitis and epididymitis occur occasionally.
- Affected bulls are usually sterile when the orchitis is acute but may regain normal fertility if one testicle is undamaged.
- Such bulls are **potential spreaders** of the disease if they are used for artificial insemination.

Synovitis

- **Hygromatous swellings**, especially of the knees, and nonsuppurative arthritis of the stifle joints may occur.

Fistulous withers

- In horses, chronic bursal enlargements of the neck and withers, or with the navicular bursa, causing intermittent lameness.



8. CLINICAL PATHOLOGY

8.1 Culture and detection of *Brucella abortus*

Culture

- Culture methods are reliable and usually definitive.
- Isolation and characterization of the organism from the organs and lymph nodes of the fetus, the placenta, milk, vaginal mucus, or uterine exudate.

Detection by PCR

- *Brucella* spp. can be detected in the milk of naturally infected cattle, sheep, goats, and camels.

8.2 Serological tests

- **Presumptive diagnosis** is usually made based on the presence of antibodies in serum, milk, whey, vaginal mucus, or seminal plasma.

Agglutination tests

- Standard tube agglutination test
- Rose Bengal test (buffered plate antigen or card test)
- Complement fixation test

Primary binding assays

- Enzyme-linked immunosorbent assays
- Fluorescence polarization assay

9. NECROPSY FINDINGS

- Necrotizing placentitis and disseminated inflammatory reactions in aborted fetal tissues are the characteristic changes.
- Serohemorrhagic fluid in the body cavities and subcutis, and a pneumonia in the fetus.
- Lesions in the mammary lymph node of the female and in male, mandibular, caudal superficial cervical, subiliac, and scrotal lymph nodes.
- *Samples for confirmation of diagnosis*
- **Bacteriology** - maternal caruncle; placenta, stomach content, lung.
- **Histology** - fixed placenta, lung, spleen, brain, liver, kidney; maternal caruncle.

10. TREATMENT

- Treatment is unsuccessful because of the intracellular sequestration of the organisms in lymph nodes, the mammary gland, and reproductive organs.

11. CONTROL AND ERADICATION

- Most countries with brucellosis have programs designed to control and ultimately eradicate the infection in cattle.
- **Test and reduction of reservoir of infection**
- All breeding cattle in the herd are tested and those that are positive are culled and sent for slaughter

Quarantine

- This is a period of time during which cattle movement is restricted and the cattle are tested. This will prevent interherd transmission by infected cattle.

Depopulation

- Depopulation is slaughter of all cattle in a herd when all animals have been exposed and are capable of becoming infected and acting as a source of new infection.

Vaccination

- The strain 19 vaccine of *B. abortus* provides increased resistance against field strain infection following natural exposure.

Education

5. Haemorrhagic Septicaemia,

- *Pasteurella* spp.: commensals of the upper respiratory tract of many animal species.
- Usually secondary causes of diseases.

Name of the disease	Species affected	<i>Pasteurella</i> spp.
Septicemic pasteurellosis (hemorrhagic septicemia)	Cattle	<i>P. multocida</i> type 1 (B)
Pneumonic pasteurellosis (Shipping fever pneumonia)	Cattle	■ <i>Mannheimia</i> (formerly <i>Pasteurella</i>) <i>haemolytica</i> biotype A serotype 1 and ■ <i>P. multocida</i> biotype A
Pasteurellosis	Sheep and goats	<i>M. haemolytica</i>
Pasteurellosis	Pigs	<i>P. multocida</i>

SEPTICEMIC PASTEURELLOSIS OF CATTLE (HEMORRHAGIC SEPTICEMIA, BARBONE)

1. ETIOLOGY

- Hemorrhagic septicemia is associated with two specific serotypes of *P. multocida*.
- ✓ The Asian serotype is designated as serotype B2 or 5 and
- ✓ The African serotype is serotype E2
- Pasteurella is gram negative, cocco-baccilli, bipolar staining with blue color organism. It is susceptible to environment that is why is common in the naso-pharynx of carrier animals.

2. EPIDEMIOLOGY

- Hemorrhagic septicemia occurs in cattle, yaks, camels, and water buffalo and, to a much smaller extent, pigs and horses.
- Animals of all ages are susceptible but the most susceptible age group is 6 months to 2 years of age.
- There is no difference in susceptibility between breeds.
- Both morbidity and case-fatality rates vary between 50% and 100%, and animals that recover require a long convalescence.

- Outbreaks of the disease are often associated with wet humid weather during the rainy season.
- During intervening periods the causative organism persists on the tonsillar and nasopharyngeal mucosae of carrier animals.
- The infection originate from carriers or clinical cases, or possibly from ticks and biting insects.
- Spread occurs by the ingestion of contaminated foodstuffs,
- The saliva of affected animals contains large numbers of pasteurella during the early stages of the disease.
- The organism does not survive on pasture for more than 24 hours.

3. PATHOGENESIS

- ❖ The portal of entry of infection is thought to be the tonsils. A fulminating septicemia occurs, which is associated with the capsular material of the organism.
- ❖ The effects of the septicemia are most severe in the respiratory tract, heart, and gastrointestinal tract.
- ❖ In cattle and buffalo there is rapid translocation of bacteria from the respiratory tract to the blood, liver, and spleen, suggesting that the bacteria are able to invade via the mucosal epithelial layers.

4. CLINICAL FINDINGS

- ❖ Sudden death
- ❖ Fever
- ❖ Profuse salivation
- ❖ Severe depression and death in about 24 hours.
- ❖ Warm, painful swellings about the throat, dewlap, brisket or perineum.
- ❖ Severe dyspnea may occur if the respiration is obstructed.
- ❖ The disease in pigs is identical with that in cattle.

5. CLINICAL PATHOLOGY

5.1 Culture and detection of bacteria

- ✓ The organism can be cultured from blood or a nasal swab from an animal within a **few hours of death** because the septicemia is a terminal event.
- ✓ From older carcasses, a long bone is used for culture from the bone marrow.
- ✓ Samples of blood are injected into mice, which will die in 24-36 hours.
- ✓ Smears made from the mouse blood or cultures of mouse blood will reveal the organisms.

5.2 Serology

- A rapid ELISA is now available for the identification of the specific serotypes of *P. multocida*.

6. NECROPSY FINDINGS

- Generalized petechial hemorrhages, particularly under the serosae,
- In a few animals lesions of early pneumonia and a hemorrhagic gastroenteritis.
- Edema of the lungs and lymph nodes.
- Generalized congestion, thickening of the interlobular septa of the lung may be prominent.
- Enlarged and hemorrhagic lymph nodes of the thoracic region.

7. TREATMENT

- ❖ CAF is the best drug which acts on gram-negative bacteria.
- ❖ Oxytetracycline at high dose has been also be effective in pigs
- ❖ Sulfadimidine

8. CONTROL

Vaccination:

- ✓ For cattle *P.multocida* type-B killed organisms (20 billion germs/ml killed by formalin (0.5% final concentration) & pricitipated by 1% aluminum potassium sulphate (oil adjuvant vaccine (OAV) given at 2ml SC gives immunity up to 1 year.
- ✓ For sheep 7 goat the product contains whole culture of p. multocida type A (10 billion/ml) given at 1ml Sc for 1 year.
- ✓ The disadvantage is the development of persistent subcutaneous swellings.

6. FOOT-AND-MOUTH DISEASE (FMD) (Synonym = APHTHOUS FEVER)

- FMD is an **extremely acute**, **highly contagious** viral disease of both domesticated and wild cloven-hoofed animals (**cattle**, sheep goats, **pigs**, buffalo, camel) caused by **FMDV** (genus **picorna virus**=smallest virus known)
- It is characterized by **fever** and **vesicle formation** in the mouth, nares, muzzle, feet and on the mammary glands which later become erosions.
- This leads to **lameness**, **profuse salivation** & **smakling of the lips**
- It is also barrier of export trade.

2. ETIOLOGY

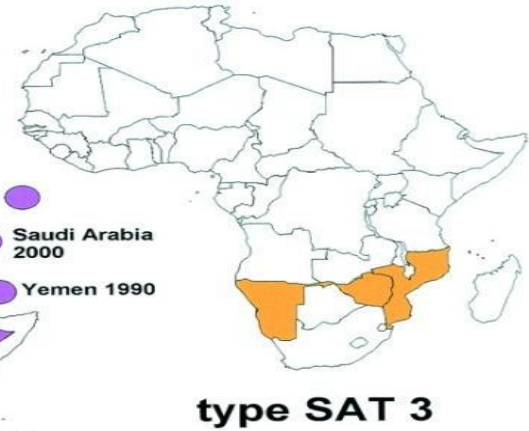
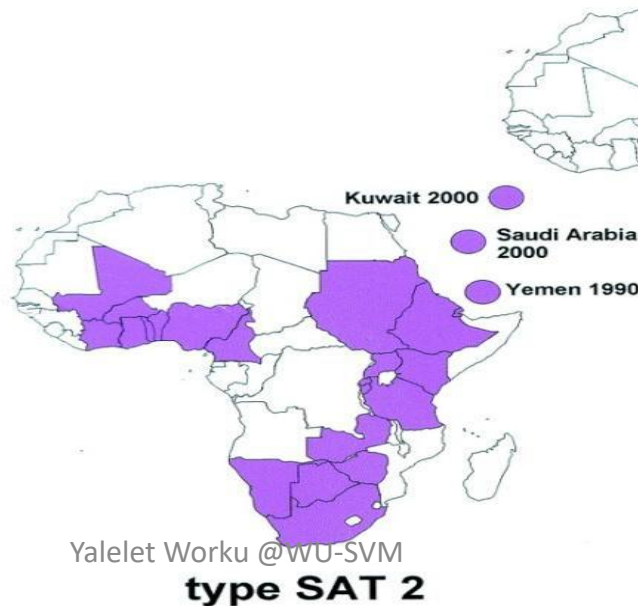
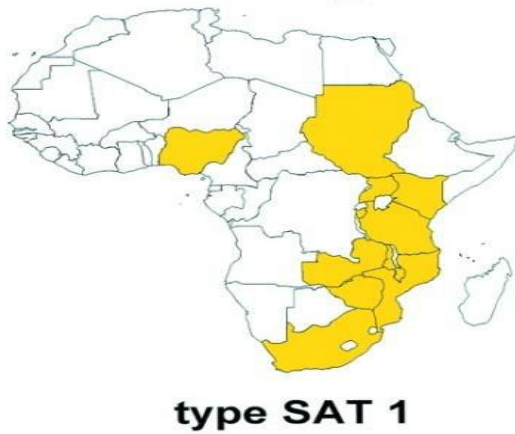
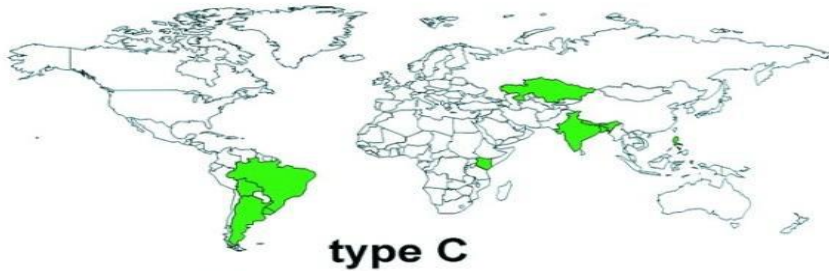
- The disease is caused by FMDV
- Under the genus **Aphthovirus** and family **Picornaviridae**
- Globally, FMDV has **seven** major **serotypes**:
A, O, C, SAT 1, SAT 2, SAT 3 and Asia 1.
- However, there are a number of **immunologically** and **serologically** distinct **subtypes** with different degrees of virulence, especially within the A and O serotypes.
- As there is **no cross-immunity** between serotypes, immunity to one type does not confer protection against the others.
- **6 serotype** in Africa,
4 serotype (A,O,C & SAT2) in Ethiopia

EPIDEMIOLOGY

1 Occurrence

- FMD affects all **cloven-footed animals** and is endemic in Africa, Asia, South America and parts of Europe, but **Japan, New Zealand and Australia are disease free.**
- The disease occurs in **outbreak** that rapidly spreads from herd to herd before.
- Of the seven serotypes, **O**, **A** and **C** are prevalent in all continents
- **SAT1** and **SAT2** and **SAT3** are limited to Africa, whereas **Asia 1** occurs only in Asia.

GLOBAL DISTRIBUTION MAP



2 Morbidity and case-fatality rate

- The morbidity rate in susceptible animals can approach 100%.
- The case fatality is generally very low, about 2% in adults and 20% in young stock.

3 Methods of transmission and pathogenesis

- FMDV can be spread either direct or indirect.
- Direct contact: between animals excreting the virus and susceptible animals.
- Indirect contact b/n animals and materials contaminated with virus containing secretions, excretions and tissues or by animal products such as milk or by air currents in which virus containing aerosols are suspended

- ✓ Airborne, especially temperate zones (up to 60 km overland and 300 km by sea)
- ✓ People, animals, vehicles and birds may serve as mechanical transmitters of infection
- ✓ Domestic pigs are the most efficient excretory of FMDV into the environment
- ✓ Incubation period 3-14 days

- ✓ Further spread between cattle is more likely to be by **airborne** means.
- ✓ The virus can persist in aerosol form for long periods in temperate or subtropical climates but not in hot and dry climates.
- ✓ The speed and direction of the **wind** are important factors in determining the rate of airborne spread.
- ✓ Pigs are the most potent excretors of airborne virus and cattle the most susceptible to airborne infections.

- ✓ The disease is spread from herd to herd either directly by the movement of **infected animals**, or indirectly by the transportation of virus on **inanimate objects**, particularly uncooked and unprocessed meat products and other animal products, including milk.
- ✓ Use of infected cattle semen for **artificial insemination** could spread the disease.

Pathogenesis

- ✓ Initial virus multiplication occurs mainly in pharyngeal area of the throat then to the circulatory system then from this it goes to the d/t sites tongue, gum, teat, interdigital space, then there will be secretion and excretion of the virus these organs and there may be recovery or complication by bacterial infection

4 Risk factors

Host factors

- ✓ The virus affects more than *70 species* of cloven-hoofed animals both domesticated and wild.
- ✓ These include cattle, pigs, sheep, goats and wild animals such as buffalos, deer and antelopes.
- ✓ Cattle and pigs are more susceptible and show greater severity of signs than sheep and goats.
- ✓ Though FMD is believed to be zoonotic very few cases of human infections have been described-usually mild short lived and self limiting disease.

Environmental and pathogen factors

- The virus is **resistant** to common **disinfectants**.
- It may persist for over 1 year in infected premises, for 10-12 weeks on clothing and feed, and up to a month on hair.
- Sunlight destroys the virus quickly but it may **persist** on **pasture** for **long periods** at low temperatures.
- The virus can survive for more than 60 days in bull **semen** frozen to -79°C .
- All uncooked meat **tissues**, including bone, are likely to remain infective for long periods.
- **Fomites**, including bedding, clothing, harness, feedstuffs and hides, may also remain a source of infection for long periods.
- The virus can pass unchanged through the alimentary tracts of **birds** which may thus act as **carriers** and **transport infection** for long distances.

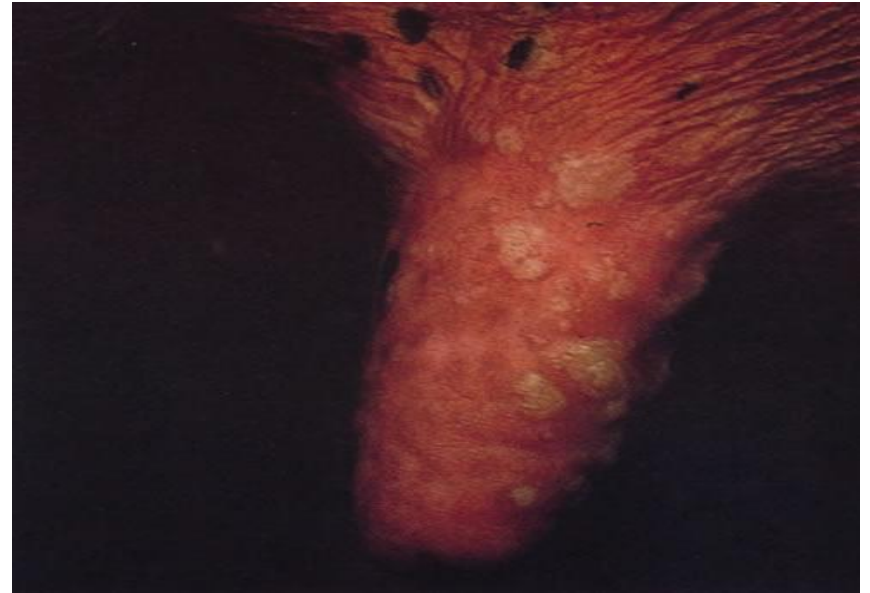
Economic importance

- Next to BSE (mad cow disease), FMD is the most feared animal disease in the developed world.
- FMD is the **most contagious disease** and has a great potential for causing **severe economic loss** in high producing animals. **Thus,**
 - FMD ranks highly among the most economically devastating animal diseases in the world
 - **Direct losses** include loss of **milk production**, **loss of cart power**, **growth retardation**, **abortion** in pregnant animals and **death** in calves, piglets and lambs
 - **Indirect losses** are attributed to the disruption of ***trade of animals*** and their products

CLINICAL FINDINGS

- ✓ Fever and depression
- ✓ Marked reduction in milk production
- ✓ Drooling of saliva commences vesicles develop on the tongue and gums
- ✓ Animal may open and close mouth in a characteristic **smacking sound and teeth grinding**
- ✓ Vesicles may also be found in the inter-digital skin and coronary band of feet and the teats.
- ✓ Lameness, disinclination to stand, serous nasal discharge

Cont....



Cont....

- ✓ Pregnant animals may **abort** or have **stillbirths**.
- ✓ Young animals may die from myocardial damage without clinical signs.

Complications:

- Tongue erosions
- Hoof deformation
- Mastitis and loss of heat control ('panthers')

LESIONS

- Vesicles soon rupture producing large denuded ulcerative lesions
- Those on the tongue heal within a few days but those on the feet and in the nasal cavities often become secondarily infected with bacteria resulting in lameness and mucopurulent nasal discharge

Cont...



CLINICAL PATHOLOGY

- Exhaustive laboratory studies are needed for diagnosis, determination of the type of the virus involved.
- Fresh vesicular fluid and surrounding epithelial tissue should be collected for laboratory tests. This is the sample of choice.
- If the vesicles are already healing, blood should be collected, along with esophageal-pharyngeal (OP) fluid samples from ruminants or throat swabs from pigs.

1. Identification of the agent in tissue or fluid.

- (a) **Virus isolation** by inoculation into cell cultures or unweaned mice, and neutralization of the virus by known antisera is highly efficient
- (b) *Immunological methods*:
 - ELISA: This is the preferred test.
 - Complement fixation test (CFT)
 - Nucleic acid recognition methods: reverse transcription polymerase chain reaction (RT-PCR).

2. Serological tests for specific antibody response to FMD structural or nonstructural proteins:

- ❖ Virus neutralization (VN), a prescribed test for international trade.
- ❖ Solid-phase competitive-ELISA: another prescribed test.
- ❖ Liquid-phase blocking ELISA

3. Experimental transmission. The propagation of the virus in white mice can be used to detect the presence of virus in suspected material, the presence of antibodies in serum and the pathogenesis of the disease.

TREATMENT

- Treatment with mild disinfectant (2% Cuso₄ protective dressings to inflamed areas and AB's to prevent secondary infection is recommended in endemic countries where a slaughter policy is not in force.
- A good symptomatic response is reported to the administration of flunixin meglumine.

CONTROL

- In developing countries, control by eradication too costly, hence, in most of African countries FMD control is mainly through regular vaccination in conjunction with the control of animal movement.
- the vaccines used must contain the representative strains of the serotype in circulation
- Vaccines used world wide are inactivated with aziride compounds usually binary ethyleneimine (BEI) and adjuvunated with aluminum hydroxide and saponin. This works well for ruminants and not pigs

- Pig vaccines use oil-based adjuvant
- Mass vaccination campaigns usually involve a bi-annual (annual) vaccination and more regularly where there's higher turnover of animals e.g pig farms
- In Ethiopia there is a **bi-valent vaccine** containing **O and A serotypes** propagated on monolayer BHK21 cell culture
- Here the virus is absorbed in to Al (OH)₃ gelconcentrated in activated with 0.3% formaldehyade and adjuvanted with salponin, It is kept at +4oc
- Dose 4ml/cattle given s/c in the dewlap region, immunity develops after 2 weeks and may last for 6 months

7. Peste des petits ruminants (PPR)

Definition

- ❖ Peste des petits ruminants (PPR) is an acute viral disease of small ruminants characterised by fever, oculonasal discharges, stomatitis, diarrhoea and pneumonia with foul offensive breath.
- ❖ It is also xed by 100% morbidity and 90% mortality

PPR cont...





Etiology

- ❖ Peste des petits ruminant (PPR), also known as goat plague, is caused by a paramyxovirus of the Morbillivirus genus.
- ❖ It was first described in 1942 in Cote d'Ivoire, West Africa and is closely related to RP virus, canine distemper virus, and human measles virus.
- ❖ The virus has the following characteristics
 - May survive at 600
 - Stable from pH 4.0 to 10.0 C for 60 minutes
 - Killed by alcohol, ether, and detergents as well as by most disinfectants (e.g., phenol, sodium hydroxide)
 - Long survival time in chilled and frozen tissues.

PPR cont.....

Hosts

- ✓ PPR is primarily a disease of sheep and goats.
- ✓ Cattle, buffaloes, camels, and pigs are also susceptible to infection but **do not exhibit clinical signs** and are **unable to transmit** the disease to other animals
- ✓ Other wild animals are also infected
- ✓ PPR is not infectious to humans.

PPR cont...

Transmission

- For PPR to spread, close contact between infected and susceptible animals is needed.
- Inhalation of aerosols produced by sneezing and coughing of infected animals is the most common route of transmission.
- The modes of transmission of the disease include: Direct contact with ocular, nasal, or oral secretions; direct contact with faeces and fomites such as bedding, water, and feed troughs. No carrier state is known to exist.
- No carrier state is also known

PPR cont...

- Outbreaks are more frequent during the rainy season or the dry, cold season.
- Severity of the disease is vary among different **age** groups, **species** and **breed** of goats
- It is economic important due to loss of production and impact on export market

Introduction cont...

- In Ethiopia, PPR was suspected in goats of Afar Region based on clinical signs in 1977
- Confirmed in 1990 from goats originated from Southern Ethiopia for live animal export
- National Sero-surveillance carried out 1999 has indicated 5.7% in sheep and goats from different regions
- Gov. promoting control strategy and intervention was done in different regions and still on application by using vaccination

Predisposing factors for PPR

- ✓ History of recent movement or gathering of sheep/ goats of different ages
- ✓ Introduction of recent purchased animals
- ✓ Sheep and goats that had been sent to market but returned in a closed village
- ✓ Stress due to change in weather such as onset of rainfall
- ✓ Contact with trade or nomadic animals near housing or watering/grazing

Clinical signs

Clinical Features of Petis des Ruminants	
Feature/Disease Form	Characteristics
Incubation period	2-10 days, most commonly 4-5
Acute	Most common form: Sudden high fever (40° - 41° C), remaining high for 5-8 days; will return to normal before recovery or drop below normal before death. Serous nasal discharge, becoming mucopurulent; can crust over and occlude nostrils. Purulent ocular discharge with congested conjunctiva; can encrust, cementing eyelids together. Bronchopneumonia, Necrosis and ulceration of mucous membrane and inflammation of gastrointestinal tract

Clinical signs cont...

- **Subclinical**

- This form is prevalent in areas where local breeds and animals have innate resistance
- Almost asymptomatic course
- Detect only by serological tests

Differential Diagnosis

- In addition to PPR, other conditions that should be considered in differential diagnoses include:
 - ✓ Pasteurellosis,
 - ✓ Contagious caprine pleuropneumonia
 - ✓ Bluetongue
 - ✓ Heartwater
 - ✓ Contagious ecthyma
 - ✓ Foot-and-mouth disease
 - ✓ Nairobi Sheep disease
 - ✓ Coccidiosis
 - ✓ Gastrointestinal helminth infestations

Diagnosis

- **Provisional diagnosis** of PPR can be made from clinical and postmortem findings
- But the disease that cause diarrhoea and pneumonia may pose a diagnostic challenge
- RP, Bluetongue, Orf, Nairobi sheep disease, viral and parasitic pneumonia and CCPP

Laboratory Diagnosis

- The following samples should be submitted for evaluation, shipped fresh (not frozen) on ice within 12 hours after collection.

- ☐ Blood in EDTA anticoagulant
- ☐ Clotted blood or serum
- ☐ Mesenteric lymph nodes
- ☐ Spleen
- ☐ Lung
- ☐ Tonsils
- ☐ Sections of the ileum and large intestine
- ☐ Swabs of serous nasal and lachrymal discharges

Laboratory Diagnosis

The following tests may be used to detect antigens :

- ✓ Immunocapture enzyme-linked immunosorbent assay (ELISA)
- ✓ Agar gel immunodiffusion (AGID): Very simple and inexpensive and gives results within 1 day, but not sensitive to mild forms of PPR
- ✓ Polymerase chain reaction (PCR)
- ✓ Culture and isolation in lamb kidney or African green monkey cell tissue cultures

Treatment

- There is **no treatment** for PPR.
- However, mortality rates may be decreased by the use of drugs that control the **bacterial and parasitic complications**.
- Specifically, oxytetracycline and chlortetracycline are recommended to prevent secondary pulmonary infections

Prevention

- The effective PPR homologous vaccine was developed in 1989
- The PPR developed vaccine recently is available
At NVI, Deberzite
- ❖ The vaccine can protect PPR for at least three years
- ❖ Currently dual thermos table recombinant PPR-capripox vaccine is under experimental trial at NAHDIC with CIRAD

Outbreak Control

- Methods applied for RP eradication may be appropriate for PPR. These include the following
 - ✓ Quarantine
 - ✓ Slaughter
 - ✓ Proper disposal of carcasses and fomites
 - ✓ Decontamination of facilities and equipment
 - ✓ Restrictions on importation of sheep and goats from infected areas

Public Health Issues

- PPR does not cause infection in humans; therefore, there are no public health issues to be considered.

Current status of PPR in Ethiopia

- PPR was suspected **clinically** in Afar region in 1997
- Confirmed by **laboratory** 1990 at holding site near Addis Ababa
- Serological survey at different time between 1981 and 2003 by different researchers shows that 3% to 53% in the counter
- Status of PPR sero prevalence under two altitude category also known as 78% and 53% at altitude below 1800 and above 1800m respectively.

The sero-prevalence of PPR in different region of Ethiopia,1999

Region	No of sample collected	No of positive	% positive
Afar	1504	238	15.8
Amaara	6643	279	4.2
B/Gumuz	253	10	3.95
Oromia	2282	22	0.96
SNNP	1902	21	1.10
Somali	465	99	21.19
Tigray	800	129	16.13
Total	13849	798	5.76

Government effort on the control of PPR

- ☐ Based on result of the 1999 serological survey the distribution of the disease across the country was known
- ☐ The control program by using vaccination was designed , starting from 2004 in those seven regional states considered as endemic for PPR
- ☐ The homologous PPR vaccine produced at DZ was used
- ☐ The vaccine confers a protective immunity for duration of at least three years

Livestock production systems and their relevance to animal health problems

By

Yalelet Worku

May, 2019/2020 G.C.

Dessie, Ethiopia

Outline of the presentation

1. Introduction
2. Factors influencing livestock sector development
3. Classification criteria of livestock production Systems (LPS)
4. Types of global livestock production systems (GLPS) (four main types of LPS)
5. Description of the different types of Livestock Production Systems of Ethiopia (4 main types with other sub-classification types)
6. Major health problems (common diseases) in each LPS of Ethiopia
7. Common animal health problems management practices (control & prevention strategies used in each LPS in Ethiopia)

What is Livestock?

- It is the common name of different species of animals that they have the ability to convert biomass unsuitable for human consumption into animal products containing amino acids, vitamins and minerals essential for human health.
- Various animals that fall under the category of livestock includes;
 - ✓ Cattle
 - ✓ Sheep
 - ✓ Goat
 - ✓ Poultry
 - ✓ Camel
 - ✓ Pig
 - ✓ Rabbit
 - ✓ Snail
 - ✓ Grass cutter

What is livestock production?

It is raising of domesticated animals in agricultural setting to produce commodities such as food, fiber, labor.

Cont...

- The term livestock is normally defined as animals raised to produce milk, meat, work, and wool.
- It includes beef and dairy cattle, swine, sheep, goats, and poultry.
- Other animals used in agriculture such as Horses, swine, bees, fish bait, etc. are considered alternative animal agriculture and are not covered here.

Livestock contribution to the world

- Contributes about 40% of the global agricultural products**
- Supports the livelihood of almost 1 billion people**
- Creates 42% of world population employment**
- Creates more than 50% of employment in developing countries**
- Contributes 50% to the NGDP in industrialized countries**
- Contributes 30% to the NGDP in developing countries**

Contribution of livestock in Ethiopia

The role of livestock at a farm level varies with the production system in which the livestock is incorporated:

- In the pastoral livestock production system livestock are **means of livelihood** and hence have multiple functions.
- Livestock products are used for **household consumption** and also are marketed to meet cash needs to purchase grains, clothing, and other commodities needed for the household and also social obligations.
- In the agropastoral production system livestock are kept mainly as a **source of income** and as a **source of draught power** to some extent. Here food crops are produced for subsistence.

Cont.....

- In the mixed crop-livestock system livestock are incorporated in the production system mainly as a source of draught power and may be sold in times of adversity to meet financial requirements.
- In the specialized type of livestock production systems, the most important function of livestock is as a source of income.
- A work carried out to investigate sources of income for smallholder dairy farm households in the central highlands of Ethiopia indicate that about 44% of the household income was from dairy sales.
- It is clear that this figure is much more higher in the urban and peri-urban areas.

For national economy of Ethiopia

Livestock contributes the following;

- ✓ 15 to 17% to the NGDP
- ✓ 35 to 49 % to the AGDP
- ✓ 37 to 87% to the household income
- ✓ Supporting the 60-70% livelihood of the human population
- ✓ 20% to the export earning
- ✓ For 85% of the activities of threshing and transportation
- ✓ For 25% cart activities
- ✓ Provide 14 million tones of manure

Cont.....

- ✓ In general livestock sector contribute much for the economy of Ethiopia and
- ✓ In particular for the improvement of peoples' livelihood **by providing**
- ✓ livestock products (milk, meat, egg etc..
- ✓ Income (national and household)
- ✓ Input for crop production
- ✓ Export earning
- ✓ Raw materials for industry to bring the required output

2.Factors influencing livestock development

The four main forces are driving change in livestock sub-sector

2.1. Population growth

2.2. Change in demand for livestock products

2.3. Change in availability of inputs and technology

2.4. Change in market infrastructure

2.1. Population growth

- It leads to symmetrical increase in demand for food
 - Creation of new markets and hence encourage development of market oriented production systems
- It has effect on availability of land, one of the production factors
 - Reduction of farm size and more intensive land use
- It is an important phenomenon in developing countries;

2.2. Change in demand for livestock products

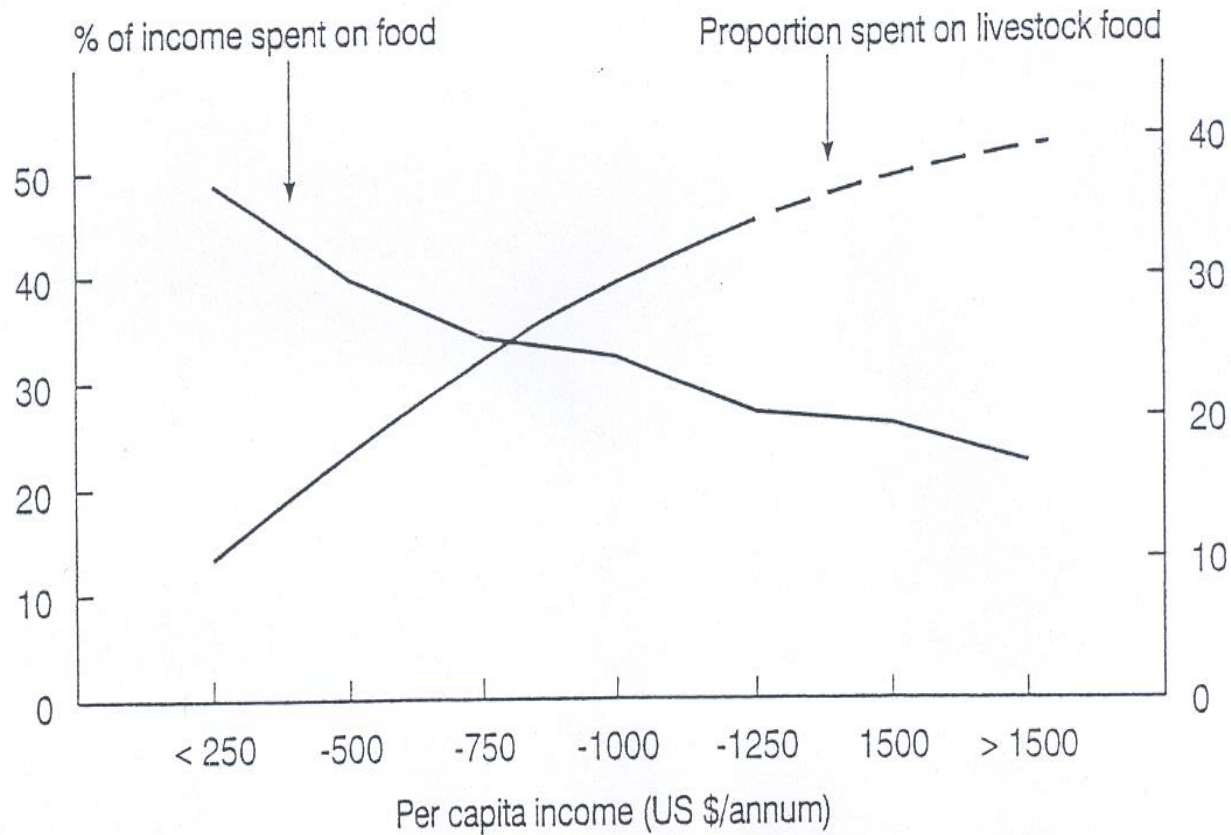
– Rising per capita income

According to World bank Atlas Methods like GNI

- Countries can be classified in to
- **Low** income countries (< 1005 USD)
- Upper middle income countries (B/n 1006 & 3955 USD)
- Lower middle income countries (3956 & 12235 USD)
- **High** income countries >12235 USD

It has been found out that at higher levels of per-capita income, the relative proportion of income spent on food decreases but the proportion spent on livestock products increases

Fig. 1 Demand for food in relation to per capita income in developing countries



(modified after Jahnke, 1984)

2.3. Change in the availability of inputs and technology

–Inputs:

- **Extension services:** health, improved management skills, AI
- Loans
- **Farm inputs:** feed, improved breeds of livestock etc.

–Technology:

- Production
- Product processing

2.4. Change in market infrastructure

- Product disposal (very important specially for perishable products like milk).
- Input acquisition: livestock feed, improved breeds, veterinary service
- Distribution of livestock out puts

3. Livestock production systems (LPS) classification criteria (System dynamics)

- To classify the livestock production systems, the following criteria should ideally be considered:
 - Intensity of production
 - ❖ intensive
 - ❖ semi-intensive
 - Integration with crops
 - ❖ Solely LPS
 - ❖ Mixed LPS
 - Relation to land
 - ❖ Landless LPS
 - ❖ Grazing LPS
 - Agro-ecological zone
 - ❖ Lowland or highland LPS
 - Based on types of livestock products (dairy farm, feedlot farm , broilers poultry production, layers chicken production, pig, etc...

4. Classification of global livestock production system (GLPS)

The major types of GLPS with their characteristics

4.1 Landless (industrialized or intensive) LPS

- It is a market driven LPS
- It is detached from their original land base
- It is specialized in specific livestock products
- It is associated with large scale enterprise
- Small scale urban based production units are also important in developing countries

4.2. Small scale landless LPS

- ✓ Small scale livestock keepers typically not owning croplands practices this LPS
- ✓ It is found in urban & peri-urban areas in high population density towns
- ✓ It is potential area for water, fodder, access for information on disease prevention & control

4.3 Grassland based (grazing) LPS

- ✓ It is typically areas of unsuitable for crop production
- ✓ Most often found in arid and semi-arid areas
- ✓ In this LPS has adaptive management practices are needed for challenging environmental conditions
- ✓ In this LPS there are traditional knowledge for animal husbandry practices, disease prevention & control practices.

4.2. Mixed LPS

- Most of the world's ruminants are found kept with crop LPS
- It is characterized by relatively low levels of external inputs
- Products of one part of the system used as input or the other
- In this LPS there is access to & control of inputs (land & water), extension services, veterinary services, training etc..

4. Classification of global livestock production system (GLPS)

Table 14.1 General Characteristics of Different Livestock Production Systems

Production system	Characteristics
Landless industrialized systems	<ul style="list-style-type: none"> • Industrial, market-driven production systems • Detached from their original land base, commercially oriented, and specialize in specific products • Generally associated with large-scale enterprises • Small-scale urban-based production units also important in developing countries <p><i>Potential areas for gender concern:</i> labor conditions, mobility, control over production, decision-making power</p>
Small-scale landless systems	<ul style="list-style-type: none"> • Small-scale landless livestock keepers typically not owning croplands or with access to large communal grazing areas • Typically found in urban and periurban areas and in rural areas of high population density <p><i>Potential areas for gender concern:</i> access to water, fodder, decision-making control, control over benefits, access to information on disease prevention, control</p>
Grassland-based or grazing systems	<ul style="list-style-type: none"> • Typical of areas unsuitable or marginal for growing crops • Most often found in arid and semiarid areas • Adaptive management practices needed for challenging environmental conditions <p><i>Potential areas for gender concern (depends on scale):</i> <i>large-scale</i> ranches: labor conditions, living conditions such as accommodation, control over decision making; <i>small-scale</i>: intrahousehold decision making, control over benefits, decision making, local knowledge, and gendered roles in animal husbandry, disease prevention, and control</p>
Mixed farming systems	<ul style="list-style-type: none"> • Most of the world's ruminants kept within crop-livestock systems • Characterized by relatively low levels of external inputs • Products of one part of the system used as inputs for the other <p><i>Potential areas for gender concern:</i> access to and control of inputs (land, water, credit); intrahousehold decision making; access to extension, veterinary services; capacities for scaling up</p>

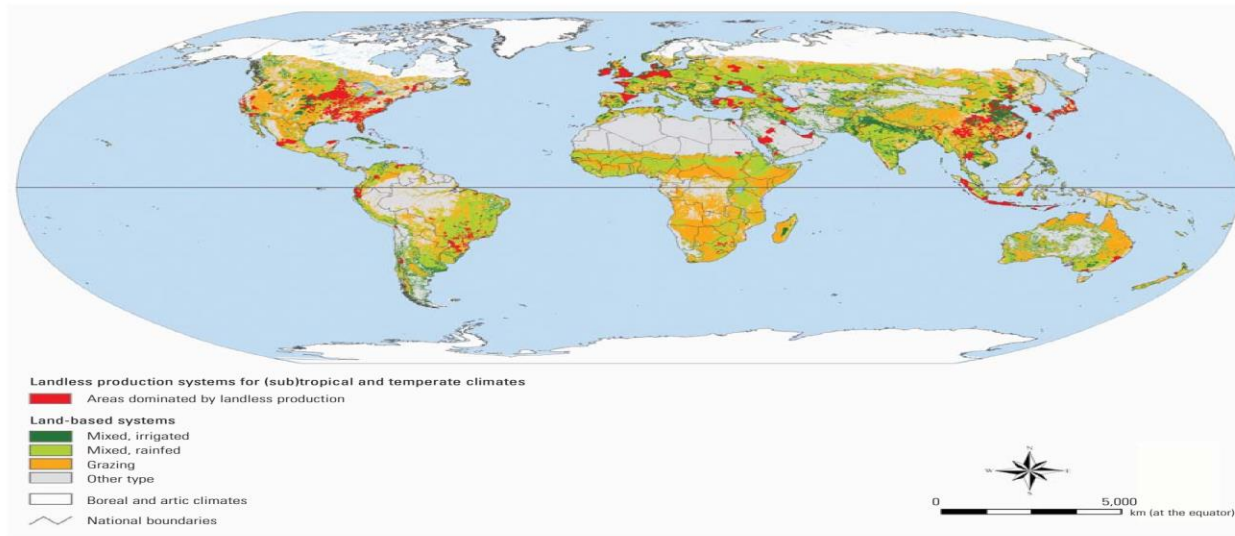


Fig. 1
Map of world livestock production systems

East Asia, Europe and North America, which also have access to ocean ports, show a high prevalence of industrial systems and import much of the necessary feed. In contrast, there are areas with ample feed supplies such as the mid-western United States of America (USA) and interior parts of Brazil and Argentina, where industrial systems rely mainly on local feed surpluses. East and Southeast Asia strongly dominate industrial monogastrics' production in the developing regions. Southern Brazil is another industrial production hot spot at world level, while important regional centres of industrial production are found, for example in Mexico, Colombia, Venezuela and Chile. Similarly there are major regional centres for the industrial production of chicken in Nigeria, South Africa and the Middle East.

Of the land-based system group, grazing systems cover the largest area and are currently estimated to occupy some

26% of the earth's ice-free land surface. This figure obviously includes a large variety of agro-ecological contexts with very different levels of biomass productivity. Grazing systems are primarily found in the more marginal areas which are unfit for cropping because of topography, low temperature or low rainfall. Mixed farming systems are prevalent in bio-climatically more favoured ecosystems. Most mixed farming systems are rain-fed, and they are particularly widespread in semi-arid and sub-humid areas of the tropics and in temperate zones. Mixed irrigated systems are found throughout the world, but in most cases are relatively small. Exceptions are the eastern parts of the People's Republic of China, northern India and Pakistan, where mixed irrigated systems extend over large areas.

Tables III and IV show the kinds of ruminant populations and animal production in the different production system groups, both globally and for the developing regions. The

GLPS.....

4.1. Solely livestock production systems (SLPS)

- More than 90 percent of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds
- Less than 10 percent of the total value of production comes from non-livestock farming activities

4.1.1. Landless livestock production systems (LL-LPS):

In this PS < 10% of the dry matter fed to animals is farm-produced and annual average stocking rates are above ten livestock units (LU) per hectare of agricultural land.

It can be broadly classified in to two (

Landless livestock production systems (LLPS)

A. Landless monogastric production system (LM-LPS).

- This system is defined by the use of **monogastric species**, mainly chickens and pigs, where **feed is introduced from outside the farm**

B. Landless ruminant production system (LLR-LPS).

- This production system is defined by the use of **ruminant species**, principally cattle, where **feed is mainly introduced from outside the farm system.**

... cont...

4.1.2. Mixed-farming systems (MFS)

Definition: Livestock systems in which more than 10 percent of the dry matter fed to animals comes from crop by-products or stubble or more than 10 percent of the total value of production comes from non-livestock farming activities.

There are two types of MFS-LPS ((RFMFS-LPS, IMFS-LPS)

Rain-fed mixed-farming systems (RFMFS-LPS).

✓ more than 90 percent of the value of non-livestock farm production comes from rain-fed land use.

Irrigated mixed-farming systems (IMFS-LPS)

✓ more than 10 percent of the value of non-livestock farm production comes from irrigated land use.

5. Types of Livestock Production Systems (TLPS) in Ethiopia

Under each LPS you are expected to know the followings:

- The Definition of LPS
- The type of dominant animal species reared in each LPS
- The area in which the LPS type mostly practiced in Ethiopia
- The functions of animals in each LPS to the societies and the national economy
- Major constraints and most common animal diseases
- Commonly practiced disease control & prevention methods in each LPS

5. Types of Livestock Production Systems (TLPS) in Ethiopia

5.1. Pastoral Livestock Production System (PLPS)

Definition: it is a pastured based LPS that in which different livestock species like cattle, sheep, goats, camels and donkeys are reared.

- The pastoral areas in Ethiopia cover about 690,000 km² (59% of the country land coverage).
- The pastoral area includes the Somali region, Afar region, Kereyu, Borena and Bale zones of Oromia, Gambella region, Benshangul-Gumuz region and part of the Southern region.

PLPS.....

- The human population is estimated to be about 5.1 million and a significant proportion of the livestock population is residing in these areas (**11 million cattle, 10 million sheep, 8 million goats, 2.5 million camels** and about a million equines).

–PLPS Characterized by

- Low and erratic rainfall,
- High risk of recurring drought,
- High rate of evapo-transpiration,
- General scarcity of surface water,
- Low and seasonal biomass production, seasonal change of forage availability and of quality

Classification of PLPS

I. Traditional pastoral systems (TPLPS) include:

- Agropastoralism: combine cropping and grazing of livestock on individually owned and communal land in the immediate vicinity of a permanent homestead for subsistence and marketing
- Sedentary pastoralism: grazing individually owned livestock on communal land in the vicinity of permanent homestead throughout the year
- Semi-sedentary pastoralism: grazing individually owned domestic stock on communal land in the vicinity of a permanent homestead for part of the year and long distance movement of herds
- Migratory pastoralism: grazing individually owned livestock on communal land and moving herds and homestead as seasonal forage supply demands

PLPS....

II. Modern pastoral systems

- » Commercial ranching: grazing domestic stock on individually owned stock for marketing
- » Group ranching: grazing domestic stock on group owned land for subsistence and marketing
- » Contract grazing: grazing individually owned domestic stock on contracted land

Functions of livestock in PLPS are...

- **The output function:** The *subsistence* function of livestock is by definition a principal characteristic of pastoral systems. By large the areas are too dry for cropping to be the sole basis of subsistence. **Ruminant livestock** are the prime vehicle of land use.
- The main product for subsistence in pastoral area is therefore *milk*. Only **rarely are large animals slaughtered for their meat**, but emergency slaughters occur. **Small ruminants constitute a more convenient quantity** and their meat finds their way into the diet more often.

Major constraints and diseases of pastoral livestock production system (PLPS)

- ❖ Seasonal, annual and spatial variability of rainfall and consequently low quantity and quality of forage
- ❖ Endemic diseases (PPR, CBPP, CCPP, Pox diseases, camel trypanosomosis, Pasteurellosis, Tick borne diseases, external parasites and losses through predators and theft
- ❖ Disasters such as shortage of rainfall can turn into drought, endemic diseases into epidemics and stock theft into tribal and civil war
- ❖ Long term constraints include increasing population pressure and constant loss of pastoral land

Adaptive strategies of PLPS.....

- Increasing stock number as a security in cases of losses
- Herd diversification as an insurance for against major disease outbreaks and better utilization of forage and pasture resources
- Herd dispersion is measure against forage shortages and raiding (looting)
- Mobility of households and herds
- With modernization, irrigation agriculture, seeking wage labor, attempts to live on famine relief, engagement in trade and business when capital allows, formal education and training

Livestock improvement and disease control strategies in PLPS

- Efforts of improving the livestock take place within the production system acting on the livestock resource directly (In principle this refers to selection, breeding, and disease control but one may also include **improved husbandry methods like** culling, castration, herding practices and supplementary feeding).
- With respect to general husbandry practices one has to assume that the pastoralists already do the best they can given the environmental conditions, the pressure on the resources and the basic production objective of subsistence.
- **Innovations** like the introduction of exotic livestock breeds or massive supplementary feeding and the like are of a purely hypothetical nature for the environment concerned.

Livestock improvement and disease control strategies in PLPS.....

- There remains disease control as the *classical approach* to improving pastoral systems. It also is a logical one given the interest of pastoralist in their livestock resource and the limitations of other approaches. Pastoral production systems are particularly *vulnerable* to certain types of disease.
- Thus long treks and frequent intermingling of different groups of animals provide ideal opportunities for the extensive spread of diseases like rinderpest, anthrax, blackleg and contagious bovine pleuro-pneumonia, the great infectious diseases of African livestock;
- The exposure to wildlife on route and concentration of stock on river and lake shore grazing's during the driest part of the year provide further opportunities for infection transmission and

Livestock improvement and disease control strategies in PLPS.....

- Internal and external parasites impair animal productivity. Tick-borne diseases.
- Others like foot and mouth disease affect most African cattle only lightly but are barriers to international trade. Given the low productivity of the system it is doubtful whether all diseases should be tackled with the same degree of intensity or not.
- In particular the disease control measures that have to be carried out in regular and short intervals like tick control or that require accompanying veterinary diagnosis to be effective (trypanosomiasis, internal parasites) require a higher level of organization.

Livestock improvement and disease control strategies in PLPS.....

- Cost reimbursement by the livestock owners deserves careful examination when expanding control to other diseases, while in the case of the potential great epizootics there is general agreement that for control to be effective the service has to be rendered *free of charge*.
- Note that, *prevention of diseases is better than treating* (managing diseases after they occur). The prevention and control of livestock diseases is not to be about running while an active outbreak occurred and consequence much lose but it should be pre-planned program depending on the disease dynamicity in a certain production system, focusing on *herd health*.
- Disease *prevention and control strategy* has to be devised for different agro-ecologies/*production system*, on the bases of dynamicity of disease *in herds*.

5.2. Mixed crop-livestock production systems (MLPS) in Ethiopia

It can be highland MLPS and **lowland MLPS**

5.2.1. Highland MLPS

- The highland MLPS is practiced in 20% of the highland, which accounts for an area of 947,630 hectare.
- About 85% of the human population and 70% of the ruminant population are part of this system.
- Most of the land in this system (86%) is used for annual and perennial crops leaving only 7% for pasture and for fallow (crop free) lands.

Highland MLPS is found

- The mixed crop-livestock production system is practiced in the
 - **high potential cereal areas** (East Gojam Zone (Amhara), Hadiya Zone (SNNPR)),
 - **low potential cereal areas** (North Shoa Zone (Amhara), parts of Southern, Western and Central Tigray Zones (Tigray), North Omo Zones (SNNPR),
 - **perennial cash crop areas** (West Wollega, parts of East and West Hararge Zones, (Oromia), parts of Gedeo and Sidama Zones (SNNPR)).

Highland MLPS is found in

- MLPS in highlands are defined as areas with a mean daily temperature of less than **20°C** during the growing period.
- It used refers to areas of **1,500 metres** or more above sea level.
- The farming systems are based on cropping and on livestock husbandry practised in association.
- There are a number of features that make the farming systems in the highlands different from those in the lowlands and justify their separate consideration.

MLPS in highland of Ethiopia.....

- It is a land use system in which livestock husbandry and cropping are practiced in association.
- In this system, crop and livestock display **pronounced and mutually beneficial interactions within a farm.**
- Generally speaking the highlands are favoured by good soils and suitable climatic conditions for farming allowing higher productivity and/or higher population densities than elsewhere.
- Fodder productivity also permits higher livestock densities than in other zones.

MLPS in highland of Ethiopia.....

- As a consequence of **high and generalized population pressure cropping intensities are high** and more or less permanent **cropping is common**, although fallow farming, ley farming and grazing systems occur.
- Unlike the lowland areas, crop husbandry and livestock husbandry in the highlands are normally **practised within the same management unit**.
- The crop-livestock association is therefore approaching **more the concept of mixed farming** although the degree of livestock integration may be less than the ideal.

MLPS in highlands of Ethiopia.....

- The cropping pattern of highland farms includes crops unsuitable for lowland areas like wheat, barley, teff (in Ethiopia), arabica coffee, pyrethrum, tea and others.
- The area is by and large free of **tsetse flies** and the farming systems unaffected by **trypanosomiasis**.
- The area provides ecologically suitable conditions of farming of the type common in temperate zones and for the introduction of high-yielding plant varieties and animal breeds from the temperate zone.

MLPS in highlands of Ethiopia

- The **highest livestock density** (livestock-land ratio) of all ecological zones is found in the highlands.
- **All the ruminant livestock species are represented.**
- Ethiopia has a particularly **high livestock population with a high proportion of sheep and equines.**
- Here the work function of livestock (**oxen for draught, equines for transport**) is predominant.
- **Meat and milk production from cattle** has often reached a significant degree of commercialization.
- **Sheep are used for meat** (subsistence and market) and wool for local industries.

MLPS in highland of Ethiopia.....

- Production and productivity of livestock in the highlands differ greatly according to farming system, population pressure and development level, but also with respect to the different livestock commodities and functions (farm output, farm input or both).
- Beef production is not a special feature of the highlands.
- The functions of livestock as farm inputs (draught, manure and transport) are more important in highland mixed farming than in other zones.
- Potential production and productivity in the highlands could be much higher than at present because a large number of yield increasing technologies are applicable here.

MLPS in highland.....

Products of the system

- **Crop production:** food crops, crop residues, pasture and forage
- **Livestock production:** milk, meat, egg, hides and skin, draught power, manure
- **Functions of components**
 - Crop production: source of food, capital and livestock feed supplements
 - Livestock production: source of food, traction power, fuel, additional income

MLPS in highland of Ethiopia.....

The determinants factors in this system are

- Increasing population density
- Intensive land use
- Security of crop enterprise
- Growing demand for crop products

MLPS in highland of Ethiopia.....

- In general it is economically and ecologically sound way to improve production and return to land, labor and capital
- Use of traction
- Use of non-marketable goods: crop residues and other byproducts
- Nutrient transfer and soil fertility: manure, forage x crop rotation
- Productive use of labor
 - Spread of labor input pattern
- Risk reduction
 - Crop livestock complementarities
 - Crop-livestock synergy

Major animal diseases of MLPS in highland of Ethiopia.....

- Diseases of intensification (mastitis's, brucellosis etc..)
- Anthrax, Blackleg, pasteurellosis, LSD, FMD, CBPP, cattle trypanosomosis

5.2.2. Mixed-livestock Production Systems in the Lowlands of Ethiopia (MLPS in lowlands of Ethiopia)

Definition and Delimitation

- Mixed crop-livestock production systems denote land use systems in which livestock husbandry and cropping are practised may be parallel activities without interaction unlike highland
- It is practice in lowlands below 1500mm a.s.l.
- This association may be close and complex or livestock husbandry and cropping may be parallel activities without interaction, possibly not even belonging to the same management unit.
- In this case the association is reduced to geographical proximity.

MLPS in lowlands of Ethiopia.....

- As the *tsetse* challenge grows it becomes increasingly difficult and eventually impossible to keep domestic stock because they succumb to trypanosomiasis, single disease in most arable lands.
- In Ethiopia the distribution pattern of the tsetse flies is or less the more negative of the livestock distribution pattern

Livestock functions MLPS in lowlands of Ethiopia

- A major characteristic of livestock systems or sub-systems in crop-livestock systems is the interaction between livestock production and cropping.
- Within one management unit livestock may provide agricultural inputs like work and manure and render the enterprise more productive and more secure by using residual capacities of production factors with low opportunity costs like **non-arable land**, excess labour and child labour, by converting crops and crop residues into high-value animal products, by balancing the production and market risk etc.
- Crop-livestock linkages also exist if cropping and livestock husbandry are practised in **different management units.**

MLPS in lowlands of Ethiopia.....

- Also in the mixed farming areas there is the tradition of communal tenure of the grazing resource.
- Since it is cropping, not livestock, that provides the *mainstay of subsistence* and income and since there is not such pressure on the land relative to its potential as in the arid zone the feature is less exacting in its consequences for land use.
- Special aspects are stubbles as a grazing resource the importance of which is outlined in the following section.
- Here the cultivator maintains a degree of individual control which enables him to use it for his own animals or to enter arrangements with livestock owners for its use in return for manure, food products from livestock or money.

Livestock management MLPS in lowlands of Ethiopia)

- Major determinants of the feed economy of livestock management are the **dry season constraint** on one side and the danger of crop damage by livestock on the other.
- The management system attempts to balance the feed requirements of livestock with the use of distant grazing resources and **stubble grazing while trying to avoid proximity of livestock to crops during the growing season**.

Tsetse Challenge MLPS in lowlands of Ethiopia)

- If livestock are present at all tsetse challenge influences livestock productivity in two ways; **directly** by reducing animal performance including the potential traction power of male animals (Ethiopia) and **indirectly** by necessitating the use of trypanotolerant animals whose productivity may be different (N'dama, Short horn African and Zebu breeds).

The ill-effects of tsetse infestation of MLPS in lowlands of Ethiopia)

- (a) Tsetse flies can also act as carriers of human trypanosomiasis (sleeping sickness). Sporadic contact with the human population may result in a level of endemicity; moreover foci of potential epidemics persist.
- (b) Tsetse-infested areas provide the possibility of sporadic contact between tsetse and cattle so that cattle trypanosomiasis may be a problem in tsetse-free areas.
- (c) Tsetse-infested areas may constitute a focus of expansion and tsetse-free areas may therefore be threatened by a tsetse invasion.
- (d) The presence of tsetse may result in over-crowding in and over-utilization of the tsetse-free areas with negative effects on their productivity.

Development Possibilities MLPS in lowlands of Ethiopia

- Mixed farming as a development venue has a more specialized meaning: The intensification of the input-output function of livestock within the farming system parallel to the development of the farm input function (work and manure) and the increased integration of livestock for the benefit of soil fertility and overall farm productivity; livestock development is viewed in the context of the farming system as a whole including the crop sub-system.
- In General, Tsetse flies and trypanosomiasis are distributed over 10 million square kilometres of Tropical Africa, essentially in the three ecological zones considered here -the semiarid, the sub-humid and the humid lowlands.
- They affect livestock productivity adversely and in many areas make the keeping of domestic, particularly ruminant livestock, impossible.

Development Possibilities ...

- Thus therefore, the focus should be to control the tsetse fly vector control in mixed crop-livestock production systems, in humid, subhumid and semi-arid agroecological zones in tropical Africa.
- In regard to Ethiopia, the MoA in collaboration with International Atomic Agency (IAA), has implemented sterile tsetse eradication project (STEP) in southern block of Ethiopia, has showed progressive result.
- More recently, to institutionalize and strengthen the effort, an institute was established, who works towards controlling and eradicating tsetse flies in country and in collaborating to the neighboring countries.

5.3. Ranching

Definition and Delimitation

- Ranching systems are range-livestock production systems like pastoral systems, but production parameters, livestock functions and livestock management are radically different.
- Ranching is labour-extensive undertaking specializing in the production from one or two livestock species of a marketable commodity, mainly live animals for slaughter, i. e. for meat, skins and hides, but also wool and milk.
- The function of livestock is therefore to provide *cash income*. Livestock management is characterized by grazing within fixed boundaries by individual tenure and by intensification possibilities for feeding and watering.

Ranching.....

- There are about six government owned cattle ranches in the country namely Abernosa, Gobe, Metekel, Yabello and Wolayta.
- These ranches are used mainly for the breeding of indigenous cattle with exotic breeds and also as research ground to evaluate the performance of cattle of different breeds. In addition, there are two sheep ranches in Debre-Birhan and Amed-Guya with same purposes as the cattle ranches.

Ranching.....

- Beef ranches are the most common ranch type in Ethiopia.
- Both reproductive performance and weight gains are essential indicators of animal productivity. But there are complex interactions with other traits and data from different locations are difficult to compare because of differences in management systems, environments etc.
- The data can be converted to two commonly used indicators: Calving rates of **80%** and daily weight gains of **300gm** are productivity levels that should be achieved by ranches even at medium levels of management and intensity.

Development possibilities in ranching

- Management requirements in ranch development are related to *capital* and *time* requirements in a double sense.
- Higher capital intensity as implied by ranch development requires higher management skills for general supervision, delegation of responsibilities, technical supervision and maintenance, herding tactics, book keeping, strategic marketing etc.
- Financing a quick ranch build-up is more likely to throw the enterprises into financial trouble than to achieve the desired development result.
- Calving rates as the most sensitive indicator of management in ranching are clear evidence. A low calving rate combined with heavy capital expenditures characterizes the management problems of African ranches and points to the trouble ranching is heading for.

5.4. Specialized livestock production systems in Ethiopia (SLPS)

✓Urban & peri-urban LPS

- The most important specialized production systems are **dairy cattle**, beef cattle and poultry production systems.
- The dairy and beef systems are located mainly in the urban and peri-urban areas and also rural areas where there are market linkages.
- The same thing holds true for the poultry production systems.
- There are also some piggery practices at commercial levels by some institutions.

5.4. Urban and peri-urban livestock production system in Ethiopia

Why ?

- The urban and peri-urban livestock production systems are developing in response to market demands and population growth and urbanization
- The animals reared are
 - Conventional: cattle, (dairy, beef) sheep, goat, poultry
 - None-conventional: guinea pig, rabbits, and others

... cont...

Why these LPS common in urban & peri-urban areas (Determinants of this LPS)?

- Easy access to market to acquire input and dispose products
- Relative closeness to population centers which create demand for livestock products
- Population growth and high rate of urbanization
- Economic capacity of consumers

... cont...

These LPS can be classified based on

- Main production aim: Commercial, semi-commercial or subsistence
- Scale of production: Large, medium, small or micro
- Intensity of production: High, medium or low level of external inputs
- Relative importance as an economic activity: Full-time or part-time

... cont...

Advantages of these LPS to cities

Generate income

- Generate income
- Provide employment
- Reduce transport and energy cost
- Supply fresh animal source food
- Provide products at cheap prices
- Waste recycling

... cont...

Constraints of these LPS system

- Proximity to humans increases the risk of zoonosis
- Environmental pollution by manure, feed leftovers
- Informal marketing channels have impact on hygienic standards of foods of animal origin
- Free roaming animals create traffic problems
- Noise and odor

5.4.1. Dairy cattle production system (DPS)

Outline Of the presentation

1. Constraints of DPS
2. Major diseases in dairy cattle production system
3. Management practices for the control and prevention of dairy cattle diseases

dairy production.....

- The greatest advances in dairy health in the last 25 year have been the shifts to disease *prevention*, rather than treatment, as well as from focus on individual animals to *groups* and herds.

dairy farming....

- Constraints (fFactors) determining the successful development of dairying are,
 - The pricing of input (breed, feed, vet. service) and output of the industry
 - The level of agricultural extension:
 - The availability of credit:
 - The availability and sustainable marketing infrastructure:
 - The execution of research and implementation of its recommendations
 - The level of intensification of dairying

Major health problems in dairy farming

- Mastitis
- Milk fever
- Brucellosis
- BTB
- Dystocia
- Lameness
- Death of calf due to:
 - ❖ Calf Diarrhea (calf scour)
 - ❖ Calf Pneumonia
 - ❖ Septicemia in calf

Good dairy farm health Management practices

What is dairy cattle?

It is a female animal intended for milk production for human consumption

Animals that produce milk need to be healthy and an effective health care program should be in place by

1. Establishing the with resistance to disease
2. Preventing the entry of disease into the dairy farm
3. Having an effective herd health management program in place
4. Using all chemicals & veterinary medicine as directed

Animals that produce milk need to be healthy and an effective health care program should be in

No	Good dairy farm mgt practice	Examples of suggested measures to achieve good dairy mgt practices	Objectives of measures
1	Establishing the with resistance to disease	<ul style="list-style-type: none"> • Choose good dairy breeds of animals well sited to the local environment & farming system • Determine the herd size stocking rates based on mgt skills, local conditions, availability of land, infrastructure, feed & other inputs • Vaccination of all animals 	Enhance herd disease resistance or Reduce stress
2	Preventing the entry of disease into the dairy farm	<ul style="list-style-type: none"> ✓ Only by animals from known source & control their introduction to the farm using quarantine ✓ Ensure animals transport on& off the farm ✓ Monitor risks from adjoining farm & limit access of people & wild animals ✓ Only use clean equipment from known source 	<ul style="list-style-type: none"> ▪ Maintain farm biosecurity ▪ Keep animals healthy ▪ Comply with international/national/regional animal movement & disease control

Cont...

No	Good dairy farm mgt practice	Examples of suggested measures to achieve good dairy mgt practices	Objectives of measures
3	Having an effective herd health management program in place	<ul style="list-style-type: none"> • Use identification system • Regularly check animals for sign of disease • Sick animals should be attended quickly • Keep written records • Manage animal disease that are zoonoses 	<ul style="list-style-type: none"> ➤ Detect animal disease early ➤ Prevent spread of disease ➤ Ensure food safety ➤ Ensure traceability
4	Using all chemicals & veterinary medicine as directed	<ul style="list-style-type: none"> ✓ Only use chemicals approved for supply & use under relevant legislation ✓ Use chemicals according to direction, calculate dosage, observe withdrawal period ✓ Only use vet. Medicines as prescribed by veterinarians ✓ Store chemicals & drugs and also dispose properly 	<ul style="list-style-type: none"> ▪ Prevent occurrence of chemical residues in milk

What are the objectives of animal tracing?

- The objectives of animal tracing is
- to address animal health and food safety problems and specifically
 - To control disease outbreaks
 - Effectively manage vaccination programs
 - Materialize zoning and compartmentalization
 - Control animal movement
 - enable early disease reporting
 - helps to introduce effective certification system

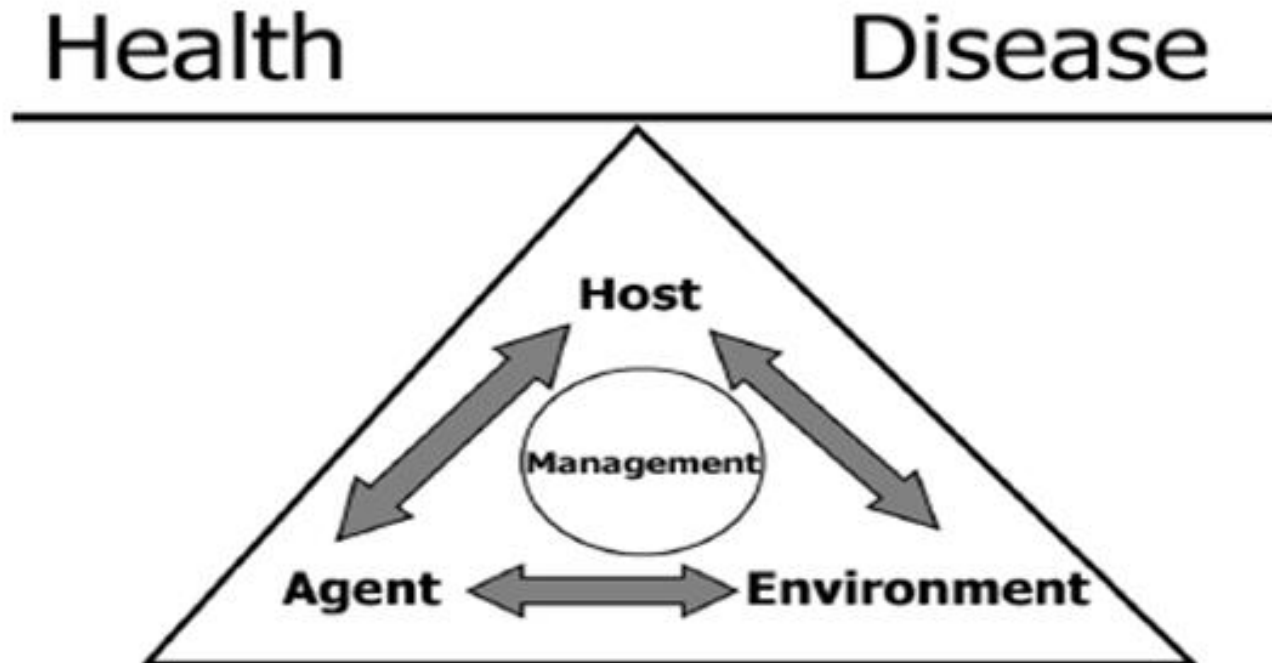
Animal tracing : defined

- It is the recording of animal movement from one premise to another using standard field data and data transfer techniques.
- .

National animal identification system

- National animal identification system consists of 3 components:
 - (a) premise registration
 - (b) Animal identification
 - © Animal tracing

The schematic representation of determinants (the balance of risk factors and protective factors)



Common health problems in dairy farm

1. Mastitis

- This is one of the biggest problems causing big economic loss in dairy farming.
- Mastitis as defined by the International Dairy Federation (IDF) is an inflammation of the mammary gland, with an infectious or non-infectious aetiology.
- Organisms as diverse as bacteria, mycoplasma, yeasts and algae have been implicated as causes of the disease.
- Although the majority of mastitis is of bacterial origin, mastitis is characterised by physical and chemical changes of the milk and pathophysiological changes of the mammary tissue with possible systemic symptoms.

Mastitis ...

- Classically, mastitis pathogens have been classified as either ‘contagious’ or “environmental”.
- Contagious pathogens can be considered as organisms adapted to survive within the host (i.e. the mammary gland).
- Major contagious pathogens are *S. aureus*, *Str. dysgalactiae* and *Str. agalactiae*, the major environmental pathogens comprise *Enterobacteriaceae* (*E. coli* and *Klebsiella*) and *Str. uberis*.

NB: Despite widespread implementation of mastitis control strategies mastitis remains a major challenge to the dairy industry.

Assessment and monitoring of mastitis

- The best milk quality indicator appears to be SCC, because it includes hygienic, compositional and technological aspects in addition to consumers' demands for healthy cows.
- A distinct change of major milk components can be determined as SCC exceeds 100,000 cells/ml. This suggests that the physiological threshold should be set and thrived at a level of 100,000 cells/ml (Hamann, 2001).
- For the field on herd level the following priorities can be given to the suitability of various diagnostic procedures:
 - 1) clinical assessment of the udder, teats and the cow; and
 - 2) individual SCC combined with the BTSCC and the composition of the milk.
- The individual cow SCC monitoring programme gives insight in the dynamics of the mammary gland. Cows that move from a low SCC to a high SCC are likely to have an intramammary infection and should be monitored very carefully.

Mastitis control

- **Mastitis control according to Hazard Analysis and Critical Control points (HACCP) principles:** New udder health control programmes approach; focusing on herd mastitis problem where the main areas of concern are
 - management factors,
 - cows and their environment and
 - udder health performance features

Dairy calves diseases and their health management practices

Outline Of the presentation

1. Introduction about risk factors that affect dairy calf diseases epidemiology
 - ✓ Exposure to infectious agents
 - ✓ Poor hygiene
 - ✓ Inadequate colostrum feeding
2. Major causes of morbidity and mortality in dairy calves
3. Principles and management practices for the control and prevention of dairy calf diseases

Con....

The following are risk factors that may dairy calf diseases epidemiology

- ✓ Exposure to infectious agents
- ✓ Poor hygiene
- ✓ Inadequate colostrum feeding

2. Major causes of morbidity and mortality in dairy calves

What is calf?

- It is a young bovine (male/female) upto one year of age

The three most important disease problems in young calf are

2.1. Diarrheal (Calf scour)

2.2. Pneumonia

2.3. Septicaemia

2. 1. Diarrhoea (Calf scour)

- Scouring is the most common disease in young calves and, as a result is the greatest single cause of death in calves, accounting for almost 50% of all calf deaths.
Scouring in calves is most critical during the first few weeks of life.
- One in seven dairy breed calves and one in thirteen beef breed calves are believed to die during the rearing
- The dung is liquid, of variable colour and smell and, in some cases, blood and mucus seen.
- The clinically affected calf can have a dull appearance with sunken eyes and is often reluctant to eat or drink.
- As a consequence, the calf suffers

dehydration, acidosis and the loss of salts and electrolytes from its body fluid with significant weight loss.



Calf scour ...

- Bacteria that may cause diarrhea in calf includes
 - ✓ Enterotoxigenic *E.coli* (ETEC)
 - ✓ *Clostridium perfringens*-c
 - ✓ *Campylobacter* species
 - ✓ *Salmonella dublin* species

Calf scour ...

- Viruses that may cause diarrhea in calf includes
 - ✓ Rota virus
 - ✓ Corona virus
 - ✓ Bovine Diarrhea virus (BVDV)

Protozoa that may cause diarrhea in calf includes

- Eimeria species (coccidiosis)
- Giardia species

The commonly involved agents in calf diarrhoea:

Calf diarrhea (Scours)

Agent	Age at onset	Signs
E coli (K99)	1-7 days	White-yellow
Rotavirus	1-7 days	Watery brown
Coronavirus	7-10 days	Watery, yellow
Salmonella	7-28 days	Yellow, bloods, cast, very sick
Cryptosporidia	7-21 days	Same as rotavirus
Clost. perfringes	7-28 days	Blood-tinged, death
Coccidia	> 21 days	Dark manure, blood

Calf scour ...

- In the case of the host defences this is best improved by:
 - Ensuring that calves receive plenty of good-quality colostrum within the first 6 hours after birth.
 - Supplying the correct nutrition to meet the calf's requirement at every stage.
 - Reducing stress to a minimum. Calves should be handled quietly, and exposed to a regular routine. Standard distressing procedures such as disbudding should only be carried out a way from critical periods, such as weaning.

Calf scour ...

- Controlling sub- clinical disease. Parasitic infestation and trace element deficiencies that are not severe enough to cause clinical signs may increase animals' susceptibility to other clinical disease.
- Managing the dam and selecting a suitable sire to ensure an easy calving process and to increase the quantity and quality of colostrum production.
- Ensuring the animals being reared are genetically suitable for the production system.

NB:

- Colostrum only contains antibodies against those diseases to which the dam has been exposed. The colostrum from heifers is likely to contain a smaller range of antibodies than that from mature cows as they have had less exposure to the diseases that exist on the farm.
- Good management of the dry cow is essential for calf survival and productivity
- Early intake of good quality colostrum is essential to aid the calf build natural immunity

2.2. Calf respiratory diseases (pneumonia)

Respiratory disease is the second leading cause of death losses (scours is the first) in un-weaned heifer calves. Respiratory problems have increased by 34 percent in the last 20 years, causing nearly 21 percent of all newborn calf losses.



Respiratory diseases

- Agents include these viruses:
 - IBR
 - BVD
 - BRSV
 - PI-3

Calf respiratory diseases ...

- Usually, bacteria's (pasteurella and haemophilus) and mycoplasmas are involved after secondary complication to viral infections.

To protect new-borns, dry cows should be vaccinated against:

- E. Coli
- Rota virus
- Corona virus
- Salmonellosis

2. 3. Septicemia

- ❖ When a calf has septicemia, it has disease-producing organism or their toxins in its blood.
- ❖ Septicemia in calves is usually the result of bacterial infection that occurs while the calf is in the uterus or during, at, or immediately after birth.
- ❖ The route of infection can be the blood of sick dam, infected placenta, inhalation or umbilical wound.
- ❖ Septicemia is the most severe medical problem
- ❖ The bacteria that cause septicemia in calves characterized by gram negative bacteria like E.coli and salmonella.

Septicemia....

- ❖ Clinically septicemia characterized by depression, reluctant to stand, suckle poorly within 5 days of birth, large and tender navel, may develop. Fever may not consistent finding in septicemic calves; many have normal or subnormal body temperature.
- ❖ Most septicemic calves have a history of inadequate colostrum intake.
- ❖ Treatment is difficult and expensive and survival rate is low

3. Principles for the control and prevention of diseases in dairy calf

Healthy calf rearing results from:

- 1. adequate colostrum intake**
- 2. provision of a clean, dry and comfortable environment**
- 3. meeting nutritional requirements**
- 4. minimizing pathogen exposure**
- 5. boosting specific immunity**

5 golden rules to colostrum feeding

What is colostrum?: it is the first milk produced by a cow following caving

1. Quick

The calf should get colostrum as quickly as possible after birth.

- The ability of the intestine to absorb antibodies from colostrum into the blood is most efficient during the first four to six hours of life.
- At about 12 hours after birth the absorption of immunoglobulins is reduced by 50% and after 24 hours the calf can hardly absorb any antibodies at all.
- Milk the cows as soon as possible after calving to assure adequate delivery of antibodies to the calf.
- If you wait to milk the cow for the first time, antibody content of colostrum will decrease by dilution.

5 golden rules to colostrum feeding

What is colostrum?: it is the first milk produced by a cow following caving

2 Quantity

- To provide the calf with enough energy, nutrients and antibodies, calves should get as much colostrum as possible as soon as possible.
- Protein, fat and sugars from colostrum help to increase the calf's metabolism and heat production.
- Moreover, colostrum intake facilitates the first stool (meconium).
- Ideally calves should receive 10% of their body weight, i.e. three to four litres of colostrum within one to two hours after birth and another two to three litres within six hours after birth, depending on weight.
- The antibodies absorbed in the first 12–16 hours will help to protect the calf against infection for three to four weeks.
- The calf's own production develops over the first four to six weeks.
- The amount of colostrum intake is, therefore, crucial.

Cont....

3 Quality

- ✓ Always test the antibody content and use or freeze the best quality. Colostrum should at least contain 50g/L of IgG. Colostrum with <50 g/L IgG will not provide an adequate amount of protection to the newborn calf, even if it is fed shortly after birth.
- ✓ Collect and feed colostrum in clean, disinfected buckets. Ideally, colostrum should be given to the calf directly after milking the cow for the first time.
- ✓ Fresh colostrum can be stored in the refrigerator for up to 24 hours and in the freezer for 1 year if refrigerated or frozen within 1 hour after collection.
- ✓ Frozen colostrum should be thawed slowly in a hot water bath at a temperature of 50° C

4. Frequency

- ✓ The calf should receive multiple colostrum feedings by bottle during the first day of life.
- ✓ Research has proven that calves that are stressed when receiving colostrum will not absorb the protective antibodies as efficiently as those that are calm.
- ✓ Thus a stressed calf would require more colostrum in order to achieve the same level of immunity as a calf that was not stressed.
- ✓ This is one of the reasons why routine use of an oesophageal tube is not recommended, except when, after several attempts, the calf refuses to drink from the bottle.

Cont....

5 Cleanliness

- ❑ Strict hygiene standards for cleaning and sanitation should be observed when milking a fresh cow.
- ❑ The udder as well as the recipient should be thoroughly cleaned.
- ❑ If this is not done the colostrum can expose the gut of the newborn calf to a high level of bacteria, thereby decreasing the absorption of immunoglobulins

How to measure colostrum quality?

- Because of the large variation in colostrum quality it is important to test it before feeding it to the calf.
- Colostrum containing 50 mg/ml of antibodies (IgG) or more is considered to be of high quality for newborn calves.

Refractometer

- The Brix refractometer optical or digital is a valuable tool that can easily be used on the farm to measure the immunoglobulin content of colostrum.
- The scale on these tools is designed to measure the amount of sucrose in a solution, but the Brix values can be related to the IgG content in colostrum.
- A Brix value of 22% corresponds to 50 mg/ml IgG; this percentage can be used as a cutoff point to decide whether colostrum quality is sufficient or not.
- The advantages of using a refractometer over a colostro-meter are that refractometers are less fragile than colostrometers and that refractometer readings are not temperature dependent.

Colostrometer

- Colostrometers or densitometers measure colostrum density, which indicates the concentration of antibodies in the colostrum.
- The colostrometer is placed in a cylinder containing colostrum and is allowed to float freely. Colostrum that tests green contains >50mg/ ml IgG and is safe to feed to newborn calves.
- Yellow or light green contains 20 to 50 mg/ml IgG.

Cont.....

- Producers are generally aware that calves are born without any immunity and therefore they can be infected within minutes of birth by virulent organisms before adequate protection from colostrum can be achieved.
- High management standards are therefore essential, be it in cattle housing or when calving in a field. Regardless of how much **colostrum is taken by the calf, poor hygiene** at calving will always have an adverse affect on calf health and performance.
- Young calves are exposed to both a wide range of infectious agents and rapid changes of feed/feeding system soon after birth.
- This makes the young calf particularly susceptible to digestive disorders arising from either infectious or digestive challenge.

5.4.2.Feedlot cattle production system

Outline Of the presentation

- Definition of feedlot & beef cattle
- Feedlot (Finishing): it is a confinement production operation in which beef cattle are being raised for beef products
- Risk factors that affect the epidemiology of feedlot cattle diseases
- Economic significant feedlot diseases
- Principle and management practices of feedlot

Risk factors that affect the epidemiology of feedlot cattle diseases

- ✓ Even if beef cattle have a **low incidence** of disease compared to other farm animals.
- ✓ Cattle in feedlots faces disease challenges similar to other diseases of livestock and production setting.
- ✓ The prevalence of disease in feedlots is influenced by many factors including immune status, level of stress, environment, nutritional management and husbandry practices
- ✓ Cattle in feedlots are primarily susceptible to infectious and non-infectious diseases but **less threatened by neoplastic** and **poisoning** due to their age and controlled environment, respectively.
- ✓ The **constant movement** of cattle in to and out of feedlots makes control of infectious diseases challenging, due to constant exposure to pathogens and stresses due to **transportation**

Economic significant feedlot diseases

- Bovine respiratory disease (BRD)
- Feedlot bloat
- Acidosis
- Urolithiasis
- Myocarditis due to blackleg
- Lameness due to foot rot
- Enterotoxaemia (Pulpy kidney)
- Infectious kerato-conjunctivitis (pink eye)
- Liver abscess

Bovine respiratory disease (BRD) (Shipping fever) or pneumonia

- ❖ It is common respiratory disease in feedlot cattle
- ❖ A number of factors contribute to an outbreak (like inadequate nutrition, stress, and viral and bacterial infections)
- ❖ Good management and vaccination is the best way to prevent outbreaks of respiratory disease.
- ❖ It is the most important cause of sickness (**morbidity**), death (**mortality**)
- ❖ This disease is caused by stress from yarding, transportation over long distance, dehydration, feed deprivation and mixing with different groups of cattle.
- ❖ Pathogenic organisms associated with shipping fever includes virus(IBR, PIV3, RSV, and BVDV) and bacteria(pasteurella, haemophilus somnus, mycoplasma & Arcanobacterium pyogenes).

Principle and major management practices of feedlot cattle diseases

- ✓ A plan of herd health program with veterinarians before purchasing any cattle or move them to a farm or ranch.
- ✓ This means the control and prevention of diseases in feedlot cattle depends on many factors

1. Construction of comfortable of feedlot facilities
2. Purchasing & introduction of healthy animal
3. Preimmunization and preconditioning
4. Apply processing procedures

- ❖ Identification,
- ❖ measuring body temperature,
- ❖ Vaccination
- ❖ Castration,
- ❖ Dehorning,
- ❖ Chemotherapy
- ❖ Growth promoting agents

1. Feedlot facilities

- ✓ One of the most important consideration in the construction of a feedlot is **good drainage**. Good drainage requires 6% slope
- ✓ The pens and alleyways should be **well drained** and **easily accessible for scrapping** the ground surface as necessary.
- ✓ To avoid **overcrowding** each animal should be provided with 18m² of space in well-drained land and 9m² in a paved lot
- ✓ **Trees should be planted to minimize wind**, rain, snow, excessive heat and sunshine. The shed should be opened to the south or southeast and the front should be high enough. The back of the shed should be >2.5m high.

2. Purchasing and introduction of healthy animal

- It very important phase of feedlot operation
- Purchase **healthy** animals
- Purchase a **uniform groups** of feeder yearling cattle that come from one source in which disease incidence is low
- Purchase **inexpensive** cattle that will perform the best and provide economic returns
- **Minimize stress during transportation** to the feedlot area.
- Cattle often **vaccinated**, dewormed, castrated, branded, implanted, injected with vitamins and antibiotics within few days after their arrival in the feedlot
- **Adopt the all-in-all out principle.**
- **Purchase preconditioned** cattle if possible and if economical

3. Preimmunization and preconditioning

- There are often large economical losses associated with the high morbidity and mortality due to acute respiratory disease in weaned beef calves.
- This means calves may be shipped to sales yards within a few days from ranch then to feedlot.
- The risk of these losses led to the development of the concept of preconditioning

3. Preimmunization and preconditioning

- Preconditioning is based on in part of immunological and nutritional principles.
- It is exposing of animals to a stressor in order to prepare it for a later encounter with a similar stressor.
- Preparation of 6 to 8 months old range-reared, recently weaned beef calves for entry in to a feedlot and an intensive fattening program.
- It includes castration, dehorning and branding 3 weeks before and all vaccinations 2 weeks before weaning, and weaning 3 to 4 weeks before sale or entry to the feedlot.
- During this post weaning period the calf should become accustomed to feedlot feeds and conditions

Preimmunization.....cont.....

- The spectrum of diseases that occur in back grounding operations during the first 45 days after arrival of yearlings/ beef cattle will depend on whether they were preimmunized, preconditioned or obtained from several sources with no preconditioning.
- ✓ Recently arrived cattle of **unknown background (market) should be vaccinated** and some need to be castrated, dehorned and treated for internal and external parasites
- ✓ None preconditioned, stressed cattle of unknown back ground should be watched closely for sign of BRD for ≥ 3 weeks after arrival.
- ✓ On their ration cattle are limited to feed good quality roughage along with a quantity of a highly palatable dense concentrated ration
- ✓ Cattle also should be weighed as groups soon after arrival

4. Applying processing procedures

Measuring normal vital signs

- Rectal body temperature = 101.5°F
 - Range is 100.4°F to 103.1°F
- Pulse rate = 40 to 70/minute for mature cattle, may be slightly higher for calves.
- Respiration rate = 10 to 30/minute.
- Alert behavior and normal feeding patterns.
 - Cattle are curious and will usually come up to feedbunk when fresh feed is presented.

Methods of treatment

- Intramuscular (IM)
- Intranasal
- Intravenous (IV)
- Oral
- Subcutaneous (Sub Q)

Types of vaccines

- Killed organism vaccines – Chemical antigen remains intact to stimulate the immune system.
- Inactivated bacterial toxins – Toxicity of pathogen is neutralized while antigen remains intact.
- Modified-live vaccines – Organisms grown to eliminate disease causing capability but retain antigenic structure

Injection management

- Always read and follow label directions.
- Administer all injections in front of the shoulder.
- IM injections should be given into neck muscle 2-3 inches below the top of the neck with a 1 in. to 1.5 in., 16 or 18 gauge needle
- SubQ injections use $\frac{3}{4}$ in. to 1 in., 16 or 18 gauge needle under the skin of the neck.

injection management...

- Avoid dull or dirty needles. Change frequently. Do not put a used needle into a multiple dose vial.
- Do not mix different vaccines in the same syringe.
- “Modified Live” vaccines are easily inactivated by heat, light, water, alcohol or other contaminants.

injection management....

- Reconstitute only the vaccine that will be used in a few hours and discard leftover vaccine.
- Store vaccines at refrigerator temperature and keep them in a cooler during processing.
- Do not use disinfectant on needles or syringes used to administer modified live vaccines.

Minimal health records

- Animal ID & Pen ID
- Date of occurrence.
- Reason animal was pulled.
- Therapy administered.
- Weight.
- Who pulled and who treated.
- Can be index cards, notebook or computer.