

COURSE CODE:	APH202
COURSE TITLE:	Introduction to Animal Agriculture
NUMBER OF UNITS:	3 Units
COURSE DURATION:	Three hours per week

COURSE DETAILS:

Course Coordinator:	Prof. A. B. J. Aina
Email:	ainabj@yahoo.com
Office Location:	COLANIM Building
Other Lecturers:	Prof. ‘Funmi Adebambo, Prof. A. M. Bamgbose, Prof. O. S. Onifade and Prof. O. A. Osinowo

COURSE CONTENT:

The role of livestock and poultry in the National Economy. Common animal husbandry terminologies.

Introduction to livestock and poultry products and by-products. Problems of livestock production in

Nigeria. Characteristics and food values of meat and milk. Introduction to animal health and diseases.

Livestock (Large and Small Farm animals) and poultry breeds and distribution in Nigeria.

Introduction to Animal Breeding and Genetics. Record keeping in livestock and poultry farms.

General importance of Record keeping. Common breeding problems in livestock and poultry

Industries. Typical mating systems. Typical trait values of animal breeds (Traits of economic importance). Livestock and poultry management systems including feeding, housing, rearing etc.

Routine and occasional management in poultry and livestock. Classification of poultry into productive functions e.g. eggs, table birds, breeder etc. Elements of climate and their effects on forage and animal production, including direct and indirect effects. Differences between browse and non-browse forages. Introduction to forage conversation – hay, silage, crop residues, pellets feeds etc.

COURSE REQUIREMENTS:

This is a University course that is compulsory for all 200 level students in all the Colleges of the University. Students are expected to participate in all the course activities and have minimum of 70% attendance to be able to write the semester examination.

LECTURE NOTES

INTRODUCTION

Animals and birds that are kept by man are called domestic animals and birds. There are many kinds of domestic birds which include Turkey, Duck, Goose, Guinea Fowl and Domestic fowl. However, when we speak of domestic fowl we mean ordinary cocks and hens. Farm animals can be divided into poultry and livestock, or small farm animals and large farm animals. The small farm animals comprise of poultry and rabbit. They have small body sizes compared with large farm animals like cattle, buffalo, camel etc. The two classes exhibit different production parameters.

The economic services rendered by poultry specie include the provision of poultry meat, egg, feathers. The meat and the egg are both of nutritional and economic importance. The poultry is used to know when the day is approaching by cock crowing. It is also used for entertainment as in cock fighting. The essential amino acids present in the egg of poultry and poultry products generally are rated highest in quality. The amino acid present in the egg is a reference standard for other proteins.

The role of farm animals in national economy

Animal production is a traditional activity in all parts of Nigeria. It forms a significant component of most farming systems in the country, whether pastoral, agro-pastoral or agricultural. According to FAO (1997), Nigeria has a population of 140 million sheep, 24.5 million goats, 7.6 million pigs, 19.61 million cattle, and 126.0 million chickens.

The contribution of animal production to the national economy is multi-faceted. The ruminant animals (cattle, buffalo, sheep, goats and camels) in addition, have a dual role of being important both for utilizing natural grazing lands and for combined crop/livestock farming, supplying

animal power in many countries and by-products of great value. The role of animal production can be grouped into 3 categories:

(a) Economic Roles

Farm animals supply man with meat, milk and eggs which are primary sources of much needed animal protein and are sold to obtain monetary benefits. Livestock husbandry in Nigeria is an employer of labour e.g. meat sellers, farm animal attendants in government and private establishments, veterinary doctors. It also supplies raw materials for industrial uses e.g. hides and skin in manufacturing leather materials, blood for blood meal and bone for bone meal in animal feeds, wool for clothing material, bristles of pigs for brushes, intestine for surgical use and casings for sausages, fat for cooking and manufacturing of candles, horns for musical instrument, feathers for pillow, hoofs can be turned into glue etc.

Livestock generates revenues for government and income for individuals. Considerable sub-regional trade in live sheep, goats, cattle, pig and poultry products exists between Nigeria and other neighbouring West African countries. Trade in animal skin is a source of foreign exchange earnings e.g. the “morocco leather” from Red Sokoto goat skins is very much in demand internationally. Large ruminant animals serve as power source e.g. cattle can be used to pull ploughs on the farm for tilling and cultivation of land (i.e. Animal traction) while camels and donkeys can carry farm products. Animal dungs can be used in the production of methane gas.

(b) Roles in farming systems

When livestock production is combined with crop production enterprise, the land becomes more effectively utilized. The animal dung when mixed with soil increases the soil nutrient status for improved and economic performance of crops. Livestock production enterprise facilitates the conversion through feeding to animal products of crop residue and by-products e.g. oil seed meals, wheat bran, etc. to produce foodstuffs for human consumption. Livestock enterprises also stabilize seasonal and yearly food production, improve net farm income, better distribution of labour and proven-requirements for production, thus supporting more profitable farming systems. Livestock enterprises in combined farming systems stabilize incomes and cash flow, improved control of plant pests, contribute to soil conservation and sustained land productivity by use of forages grown in relations to of control erosion, weeds and to improve soil fertility

with animal enterprises providing the income from consumption of these forages. Farm animals can be raised comfortably in land areas that are unsuitable for crop production.

(c) Socio-cultural roles

Livestock production enhances the social status of farmers. Livestock also play a socio-cultural role as they are of great use during cultural and religious festivals in the country. Animals like sheep, goat, poultry and rabbits serve as handy gifts to close relations and friends. They are used to pay bride price as well as sporting activities, thereby, enhancing unity and oneness.

PROBLEMS OF LIVESTOCK PRODUCTION IN NIGERIA

1. Feed Supply: Wide seasonal variations have an important influence on feed production. When there is high variation in feed supplies particularly, forages, marked fluctuations arise in the rate of weight gain of grazing animals causing low productivity and poor quality animal products.

The major part of the feed supplied thus goes just to satisfy maintenance requirements; can encourage adulteration of feeds by feed millers and make cost of feed to increase in case of grains for monogastric animals.

2. Low animal nutrition leads to high susceptibility to diseases and parasites. These cause exceedingly high losses in animal productivity.

3. Excess of animals to be supported by the environment. This is brought about largely because individual farmer and community or tribal groups do not relate their stock numbers according to available feed supplies. Overgrazing/underfeeding can lead to malnutrition

4. Much of the time the prevailing **temperature and humidity** impose stresses on animals. When this happens, the animals must expend extra energy if they are to maintain their thermal balance. This results in a low input-output efficiency of feed energy for productive processes.

5. The programmes for **genetic improvement are few** and this constitutes an important inhibitor to successful livestock enterprises.

6. Incentives to increase production are often low for the majority of the livestock owners because of **inadequate marketing organizations**, including processing and storage facilities for providing reliable supplies of products to consumers and feed to producers.

7. **Poor transportation** is a serious deterrent to producer incentive. For example, after cattle have been trailed a very long distance (400-600km), there may be little profit from their sales because of the weight shrinkage.
8. The system of **land tenure** can be a further inhibitor to potentially successful livestock enterprises since many of the owners will have to graze their animals in lands other than their own.
9. Other problems include those of **insufficient capital** for implementing innovations in husbandry e.g. improved variety of stock, feeding and milking devices, scarcity of appropriate technology, poor educational background of the intended users of the technology and inadequate means for informing farmers about worthwhile changes.
10. **Religious beliefs and social customs** are very difficult to alter and this limits the type and number of animals that can be reared or raised in some parts of the country.

SOME TERMINOLOGIES IN ANIMAL HUSBANDRY

Cattle: This refers to the entire Bovine species

Cow: Female cattle of mature age which have had one or more parturitions

Heifer: Female cattle of immature age which has not produced any offspring

Bull: A mature male cattle

Calf: Young cattle of either sex under one year old and usually not weaned

Calve: Act of giving birth (parturition) in cattle

Bull Calf: Young male cattle under two years of age

Steer: Male cattle which has been castrated at early age

Stag: Male cattle which was castrated after reaching sexual maturity

Free Martin: refers to female cattle born as a twin along with a male cattle which is usually sexually sterile

In-calf: Pregnant cow

Swine: refers to entire porcine species that has reached mature age

Sow: A mature female pig that has given birth at least once

Farrowing: The act of giving birth in swine

Gilt: Female swine/pig of immature age or which has not produced any offspring

Boar: A mature male swine

Piglet: Young pig of either sex

Litter: Entire offspring produced at a single birth

Barrow: Male swine that has been castrated at an early age

Hog: the entire swine species reaching mature age

In-sow: Pregnant sow

Sheep: refers to entire ovine species

Ewe: refers to female sheep after reaching sexual maturity and has produced one or more offspring

Ram: Mature male sheep

Lamb: refers to sexually immature sheep of either sex

Lambing: act of giving birth in sheep

Ram Lamb: sexually immature male sheep

Ewe lamb: Sexually immature female sheep

Wether: Male sheep castrated at an early age

Fleece: The wool of a single sheep

Goat: refers to the entire caprine specie

Buck or Billy: Mature male goat

Doe or Nanny: refers to female goat that has given birth once or twice

Kid: Young or sexually immature goat of either sex

Kidding: Act of giving birth in goat

In-Kid: Pregnant goat

Castrate: castrated male of any livestock at an early age

Poultry: refers to entire avian specie. These include domestic fowls, duck, goose, turkey, guinea fowl and pigeon.

Hen: Sexually mature female chicken

Cock: Sexually mature male chicken

Pullet: Sexually immature female chicken

Cockerel: Sexually immature male fowl

Capon: male chicken castrated at an early age

Chick: very young chicken of either sex

Chicken: domestic fowl of either sex and of any age

Fertility: the ability of an animal to reproduce. In the case of poultry it is the percent of eggs set which develops an embryo

Set: the acts of placing eggs under a hen or in an incubator

Hatch: the emergency of chick from the egg shell

Fowl: any vertebrate containing wings and feathers

Hatchability: the percent of eggs set which produce a living chick

Broiler: Poultry of either sex produced for meat purpose and slaughtered between the ages of 8-12 weeks.

Rabbit: refers to *Aryctolagus cuniculus* group of animals. They exist in the border line between the ruminant and the non-ruminant animals i.e. they are herbivores.

Rabbit buck: refers to mature male rabbit

Kindling: act of giving birth in rabbit

Rabbit Doe: refers to mature female rabbit

General:

Lactation: Act of milk production

Parturition: Act of giving birth to offspring

Weaning: removal of young one from milk feeding

Concentrate: Feed that is low in fibre but high in total digestible nutrients

Roughage: Feed that is high in fibre but low in total digestible nutrients

Udder: refers to the milk gland of an animal

Service: This is mating, coitus, breed, sexual intercourse or copulation between male and female domestic animals. The best results are usually achieved when the female is on heat. Service can be natural or artificial. Natural service is the direct mating of male and female animals.

Artificial Insemination: Is the artificial process of placing the spermatozoa in a position for contact with the female ovum or egg by an instrument other than penis.

Oestrus cycle: the interval from the beginning of one heat period to the start of the next

Heat or estrus: is a regular period in the female mammals when copulation is allowed or period of sexual desire in female animal.

Libido: period of sexual desire in male animals

Pregnancy: period from the time of conception to the time the animal gives birth to the offspring. It is described as the growth of foetus within the uterus of the female animal.

Still birth: when the foetus is born dead after a full time pregnancy. It could be as a result of prolonged labour in which case the foetus become tired and eventually died or infection in the uterus or accidental blow on the foetus, in the uterus.

Abortion: when the foetus is born before time. This could be as a result of disease such as those caused by *Brucella spp.* Mixing of animals of different sources can also cause abortion e.g. when the males are still struggling to mate the pregnant female.

Wean: to cease providing milk in the ration of the young animal

Ruminant herbivore: compartmented stomach animal e.g. cattle, sheep & goat

Non ruminant herbivore: simple stomach ruminant e.g. Horse

Non herbivore: Monogastrics

INTRODUCTION TO LIVESTOCK PRODUCTS AND BY-PRODUCTS

The primary livestock products include

Cattle	-	Milk, meat, hides
Sheep	-	Meat, wool, skin
Goat	-	Meat, milk
Swine	-	Meat
Poultry	-	Egg
Rabbit	-	Meat

Other by-products include: blood, bones, piths, horns, hooves, gall bladder liquid (bile), rumen digest, condemned carcasses, intestines, hair, tail hair, hides and skin, fat and feather.

Characteristics and Food Value of Meat

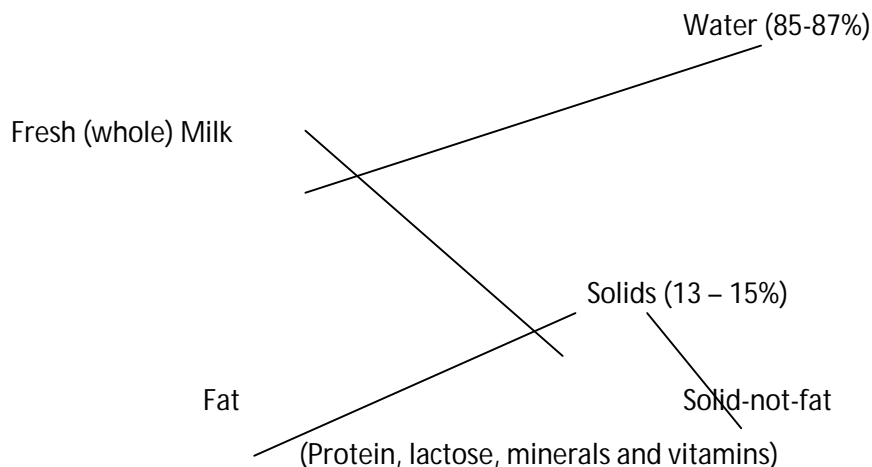
Meat is important in our diet because virtually **everybody finds it to be highly palatable** including babies and adults. The nutritive value of meat is excellent. Meat is high in good quality protein. The vitamin quality of meat is high. **Meat is rich in Fe, Cu** and other minerals. **The quality of meat is surpassed only by milk and egg.** Meat has an attractive appearance and desirable aroma. Meat has an important role in satisfaction of appetite and it is highly digestible.

The protein content of meat is 97% digestible. Fat is 95% digestible. Carbohydrate (in form of glycogen) is 98% digestible. Meat contain Protein (17%), Fat (20%), Water (62%) and Ash or Minerals (1%).

Food value of Milk

Milk is an important food for humans because of its high nutritive value. It is rich in proteins, minerals as well as vitamins. There is however a deficiency of Fe in milk. Living on milk alone may result in anaemia. But quite often the Fe supplied from other components of a diet would make up for the deficiency in milk. Milk is a rich source of Ca and P.

Most of the vitamins, except vitamin D, are present in adequate quantities. But in order to meet the minimum body requirements of these nutrients especially for infants, milk is usually fortified with synthetic forms of vitamins and minerals.



POULTRY MEAT

Poultry meat provides man with nutrients for growth, tissue replacement and **for weight control**. Its usefulness in this respect is due to its **lower fat content**. Poultry meat is about 20 to 35% protein, 1.3 – 33.8% fat. The protein in poultry meat corresponds with that of turkey, beef and pork in amino acids. It also contains all the essential amino acids required by man and is easily digested. Poultry meat contains more protein than other meats.

Unlike red meats, most fat in poultry meat is found under the skin and not distributed throughout the tissues i.e. there is no intramuscular fat. Poultry meat is a good source of riboflavin, thiamin

and ascorbic acid, and the liver is richer in these nutrients as well as vitamin A than other parts. Minerals present in poultry meat include Na, Fe, S, Ca, P and Cl.

Some uses of animal by-products

1. Hides and skins can be turned into glue and adhesives.
2. Blood meal is prepared from the by-product blood. The blood meal contains lysine, which is an essential amino acid in poultry feeds. Blood meal as a component of stock feed is used in calf-starter ration, swine feed mix and poultry feed mix. Dried blood is used as an organic fertilizer. It is a specially prepared organic nitrogen source in the cultivation of citrus fruits, tobacco, and flower growing.
3. Fats extracted from bones as tallow is suitable for cosmetics and soap manufacture.
4. Pure bones are also burnt and converted into lime (chalk) or animal feed (bone meal)
5. Horns and hooves, if heated they melt and are turned into gelatin, which is very good glue. Horns are locally used as musical instruments and ornaments.
6. The gall bladder liquid (Bile) if properly treated is an excellent detergent. The advantage is that there will be no need for synthetic detergent in the cleaning of slaughter house floor.
7. Intestine can be used for various surgical applications, sausage casings and as a cover on raw areas caused by the removal of skin for grafts.
8. Hair and tail are used in making brushes and local domestic cleaning appliances
9. Bone meal is a good source of phosphorus in that it contains 35% Ca and 17.9% P. Thus it can be used to replace the imported Dicalcium – phosphate (Ca_2PO_4) in preparation of poultry feeds.
10. Tanners (Leather workers) Convert hides and skins into leather for different domestic and industrial uses.
11. Farm yard manure (FYM) is a form of organic fertilizer which aids the growth of crops plantations and vegetables.

INTRODUCTION TO ANIMAL HEALTH AND DISEASES

Health is generally considered as the state of body and mind in which disease is/are absent in the animal i.e. freedom from signs and effects of disease. It refers to a situation when an animal is in

a state of maximum economic production. Physiologically it refers to a condition when the body functions properly. Health is also a matter of degree. Absolute health is virtually unknown both in man and animal. But when the body is functioning optimally and animals are growing at a rate optimum for the species and there is no sign of pain or deformity, we say that the animal is in good health.

Disease: is a departure from a state of good health by an alteration of the internal organs or external conditions of the body. It is a disruption of the normal function and performance. It is also the inability to perform physiological functions at normal levels provided nutrition and other environmental requirements are supplied at the adequate levels.

Signs of disease

- Loss of appetite and stoppage of rumination in ruminants
- Dull posture e.g. head downward, undue weariness
- Coarse and dry skin with unusual patches
- Variation from normal temperature e.g. normal body temperature of cattle is 38°C, Pig is 39.2°C - 40°C
- Variation in pulse rate. Normal pulse rate in cattle is 50-60 beats/minute
- Variation in rate and depth of breathing (e.g. 10-20/minute is normal for pig)
- Sunken eyes with starry look
- Watery dung with gas bubbles and blood spots
- Urine normally has straw colour but dark or bloody colour and abnormal odour indicate disease.
- Low yield and low quality production from animal e.g. blood and clot in milk indicate mastitis i.e. inflammation of the udder.

Causes of diseases

1. Infection agents or pathogens e.g. bacteria, virus
2. Parasites, external e.g. ticks, lice, flea, internal e.g. worms
3. Hereditary – caused by defective genes e.g. in humans, sickle cell anaemia

4. Congenital – defects caused by developmental accident during the embryonic stage or from toxic or infection agent during the prenatal development e.g. Pullorum disease in chicken, brucellosis in pigs, goat, sheep and cattle.
5. Nutritional deficiencies e.g. Vitamin B deficiency in chicks
6. Traumatism – disorders that are as a result of an injury e.g. wounds, burns
7. Environmental stress e.g. thermal stress, heat stroke, frost bite etc
8. Overcrowding – animals over-crowding, poor housing, ventilation and sanitation facilities.

Immunity

This is the degree of resistance to any specific disease organism. It can be complete immunity or partial immunity. It is also the power to resist infection or the action of certain poisons. This immunity is either

- (a) Inherited or natural
- (b) Acquired naturally
- (c) Acquired artificially

Inherited or natural immunity – is transferred from mother to offspring. This is done via the colostrum.

It is important that newly born animals receive colostrum as soon as possible after birth even if by hand

feeding. There are some species of animals that are not affected by diseases or poisons that are dangerous to others e.g. fowls are resistant to tetanus, the horse is not affected by foot – and – mouth

disease, rats are not attacked by tuberculosis.

Keratin – prevents the entry of disease organism into the skin when it is damaged i.e. when scratched, punctured, or wounded or bleached.

Skin Secretion – largely from sebaceous glands secrete certain fatty acid (oily) which have bacteriostatic effect i.e. prevent the bacteria from multiplying. The tear from the eyes has bacteriocidal effect because it contains lysozyme which is a bacteriolytic enzyme. In the mouth there is saliva which has a secretion that stops bacteria from growing i.e. bacteriostatic.

In the lining of blood vessels there are endolia cells, which are phagocytic. This is done by engulfing the bacterium that intends to attack the lining.

Acquired Immunity – results from an attack of some disease from which the animal has recovered. The recovery from a disease involves a process of natural immunization against that disease; the toxins or other antigens present in the body being destroyed by antibodies elaborated by the body tissues e.g. recovery from Newcastle disease confers immunity on the fowl.

Artificially Acquired Immunity - This is of two types:

- Active immunity may be artificially produced by inoculating an animal with a vaccine
- Passive immunity is that form of artificial immunity obtained by injecting into the body of one animal blood serum drawn from the body of another animal which has previously been rendered actively immuned by injecting particular antigen. The serum contains antibodies or “antitoxins” which enable an in-contact animal to resist an infection, or enable an already infected animal to overcome the infection, so that an attack of illness – if it occurs at all – is milder than it would otherwise have been. A young animal may acquire passive immunity through the colostrum of its dam, which had been immunized with this purpose in mind.

General control methods of Diseases

- Prevention of exposure to infection
- Vaccination programmes
- Immunization
- Separation of animals of different species and ages
- High level of hygiene
- Avoid stressful condition
- Avoid grazing animals in an infected environment
- Provide good ventilation
- Sufficient good feed/proper nourishment
-

INTRODUCTION TO ANIMAL BREEDING

Who Is A Geneticist?

- A scientist who studies genetics, the science of heredity and variation of organisms and employed as a researcher or lecturer.
- Some geneticists perform experiments and analyze data to interpret the inheritance of traits and can also be a Consultant or Medical Doctor who has been trained in genetics as specialization to evaluate, diagnose and manage patients with hereditary conditions or congenital malformations, genetic risk calculation, mutation analysis and referral to other medical specialties. Geneticists participate in courses from many areas, such as biology, chemistry, physics, microbiology, cell biology, English, and mathematics. They also participate in more specific genetics courses such as molecular genetics, transmission genetics, population genetics, quantitative genetics, ecological genetics, and genomics. Geneticists can work in many different fields, doing a variety of jobs such as in medicine, agriculture, wildlife, general sciences or many other fields. Others are:
 - Genetic counseling
 - Medical genetics
 - Gene therapy
 - Pharmacogenomics
 - Molecular ecology
 - Animal breeding
 - Genomics
 - Biotechnology
 - Proteomics
 - Microbial genetics
 - Teaching
 - Management of a Lab
 - Sales and Marketing of science products
 - Publishing of scientific material
 - Patenting procedures
 - Paternity testing

- Forensic DNA

A Day in the life of a Geneticist

- Geneticists are the leaders of the last frontier of biology.
- They are involved in unlocking the last few secrets of life.
- There they are expected to juggle a number of abstract problems as they put together the puzzles of DNA and heredity.
- Long hours are typical, They are closely tied to their work, and can spend years answering only one question about the genome. It is this dedication that classifies most people in the profession.
- Genetics has application in several fields and more can be expected as technology catches up with research.
- The major fields for geneticists are in medicine, agriculture and crime.
- Geneticists work at pharmaceutical companies to uncover the origins of disease, birth defects and the like, and then in turn develop ways to prevent or treat them.
- Geneticists that work in this field are involved in their work from beginning to end, although this could sometimes mean a lifetime of work literally. Since there are more mouths to feed in the world it is important that the supply meets the demand. Therefore, geneticists in agricultural research:
 - develop crops that can grow in atypical conditions, or to abnormal sizes.
 - understand the study of DNA, and with this they can apply their knowledge to solving crimes.
- Geneticists have the opportunity to be laboratory detectives and use DNA sampling to insure that the right person is convicted of the crime.
- With medicine, agriculture and crime the three biggest draws of the profession, most geneticists then find employment either in universities, the government or major pharmaceutical companies.
- There are two types of geneticists:
 - Laboratory Geneticist – This is the field that most geneticists choose to enter. Being a laboratory geneticist involves application of genetic technologies.

- Genetic Counselor – Being a genetic counselor means working in the role of a nurse or consultant. They work directly with parents that could be at risk for children with birth defects. It is also common for counselors to consult with insurance and health care companies about new medical technologies and conditions.

Associated Careers

Apart from spending everyday in a laboratory:

- Many geneticists with their M.D. often leave to practice medicine instead of developing genetics.
- There are also several positions within the government where a geneticist can work as a consultant, especially in agriculture and crime prevention.

Geneticist's work schedule

- Study the science of heredity and variation within organisms.
- Work as researchers or fill academic positions as professors and lecturers at a university.
- Work in the research field ranging from performing experiments and evaluating data as well as interpreting traits from inheritance.

Overall, the job boasts a higher than average salary but requires extensive education. Biological Scientist employment is expected to grow by nine percent between 2006 and 2016

LIVESTOCK BREEDS AND BREEDING

Livestock

- One or more domesticated animals raised in an agricultural setting to produce commodities such as food, fiber or labour.
- Usually the use of livestock does not include poultry or farmed fish, although these are now generally included among domesticated livestock.
- Animals generally reared for subsistence or for profit.

- They are important components of modern agriculture practiced in many cultures since the transition from hunter-gathering lifestyle to farming.
- The global livestock population is presently around 65billion.

History of Livestock Domestication

Animals are domesticated when their breeding and living conditions are controlled by humans. On a broader scale the term livestock refers to any breed or population of animal kept by humans for a useful purpose. This includes:

- domestic animals,
- semi-domestic, or
- captive wild

Table 1: Animal types and history of domestication

Animal/type	Status	Wild Ancestor	Time of first captivity	Area of Domestication	Current Commercial Use
Alpaca (mammal, herbivore)	Domestic	Vicuna	5000 - 4000 BC	Andes	Wool
Camel(mammal, herbivore)	Domestic	Wild Dromedary	4000-1400BC	Asia	Mount, Meat, Milk
Bison	Captive	N/A	Late 19 th Century	North America	Meat, Leather
Cattle	Domestic	Aurochs (extinct)	6000BC	WS Asia, India, North Africa	Meat, Beef, Veal, Blood, Milk, Leather
Dog	Domestic	Wolf	12,000BC		Herding, watching, meat, pack animal
Donkey	Domestic	African wild ass	4,000 BC	Egypt	Draught, meat, milk
Goat	Domestic	Bezoar goat	8,000BC	South West Asia	Meat, milk, wool, leather
Mule	Domestic	Sterile hybrid of Donkey and Horse			Mount, Pack animal, draught
Pig (omnivore)	Domestic	Wild Boar	7,000BC	Eastern	Pork, Bacon,

				Anatolia	leather, brushes
Rabbit (omnivore)	Domestic	Wild rabbit	400 – 900 AD	France	Meat, Fur
Sheep (Herbivore)	Domestic	Asiatic Mouflon sheep	9,000 – 11,000 BC	South West Asia	Meat, milk, wool, leather, mutton & lamb
Buffalo (herbivore)	Domestic	Wild Asian Buffalo (Arni)	4,000 BC	South Asia	Mount, meat, milk, draught
Yak (herbivore)	Domestic	Wild yak		Tibet, Nepal	Meat, milk, wool, mount, pack animal, draught.

Economic Value of livestock

Livestock are very important in the supply of the following commodities which are of very high economic value in the community.

- **Meat**
- **Milk (Dairy Products)**
- **Fiber**
- **Fertilizer**
- **Labour**

Nigeria's Animal Agriculture

- 13.8 million cattle, 97% of which are traditional Zebu breeds,
- 34.8 million goats,
- 22 million sheep,
- 72.4 million local chicken,
- 11.8 million ducks,
- 4.7m guinea fowls and
- 3.4 million pigs,
- The average Nigerian consumes less than 25% of the recommended 34 gm/head/day animal protein, i.e. less than 9 gm.
- 90% of the cattle are in the hand of Nomads, who move up and down the country in search of food and water, despite Nigeria's 923,738 sq. km. of land mass which are grossly underutilized with only 31% under cultivation.
- 100% of the sheep and goats are in small holder units
- 70% of the poultry breeds are in the backyard.

Table 2: Nigeria's livestock population

	Pastoral	Village	Urban	Total	% S.E.
--	----------	---------	-------	-------	--------

Cattle	11,478,145	2,358,078	49,590	13,885,813	1.6
Goats	1,142,154	32,287,589	1,023,981	34,453,724	2.9
Sheep	2,678,152	18,356,718	1,057,732	22,092,602	3.2
Pigs	-	3,352,560	53,821	3,406,381	6.0
Rabbits	-	1,475,437	244,409	1,719,846	8.3
Poultry	-	97,860,320	6,397,640	104,257,960	3.3

Source: FAO 2007.

NIGERIA'S LIVESTOCK DISTRIBUTION

CATTLE:

NW-----SOKOTO GUDALI; BUNAJI

NE-----ADAMAWA GUDALI; SHUWA; WADARA; KURI

SW----- MUTURU; KETEKU (a cross between Bunaji and Muturu)

SE-----MUTURU

N'DAMAS originated from D.R. of Congo and Senegal were imported into Nigeria.

GOATS:

NW-----MARADI; SOKOTO RED OR KANO RED

NE-----SAHEL; FULANI

SW-----WEST AFRICAN DWARF

SE-----WEST AFRICAN DWARF

SHEEP:

NW----- UDA

NE-----BORNO WHITE; BORORO; BALAMI

N CENTRAL-- YANKASSA

SW-----WEST AFRICAN DWARF

SE-----WEST AFRICAN DWARF

PIGS:

INDIGENOUS NATIVES;

EXOTICS---- DUROC; HAMPSHIRE; LARGE WHITE; LANDRACE.

POULTRY:

NORTH-----

- FULANI;
- GUINEA FOWLS;
- TURKEYS;
- DUCKS

SOUTH-----

- DWARF
- FRIZZLE FEATHERED;
- NAKED NECK;
- NORMAL FEATHERED

- TURKEYS AND
- DUCKS

PLATAEU---

- BIRHUM CHICKEN;
- DUCKS AND
- TURKEYS

EXAMPLES OF LIVESTOCK BREEDS

PIG BREEDS

Duroc

Red to Mahogany

Coloured pigs with droopy ears

American Landrace

BREED CHARACTERISTICS

The American Landrace is a white hog of long body length.

[American Landrace Breed Associations and Registries](#)

British Landrace

BREED CHARACTERISTICS

The British Landrace has the same high prolificacy and docility that is common among Landrace swine.

NIGERIA'S INDIGENOUS VARIETIES

NIGERIA'S INDIGENOUS PIG AND HER LITTER; *Source: Adebambo 1979*

Nigeria's indigenous pigs are multi-coloured, with colours ranging from black, brown, spotted white to spotted brown.

F₁ INDIGENOUS PIGLETS; *Source: Adebambo 1980*

INDIGENOUS LARGEWHITE X LOCAL F₁

LARGE WHITE X LOCAL F₁ COLOURED BOAR

F₂ INDIGENOUS PIGLETS FROM F₁ SOW; *Source: Adebambo 1981*

F₃ INDIGENOUS CROSSBRED BOAR; *Source: Adebambo 1985*

CATTLE BREEDS

Genus Bos: Cattle Breeds of the World, 1985, MSO-AGVET (Merck & Co., Inc.), Rahway, N.J.

Africander

Also Known As: *Afrikaner (Afrik.)*

Photographs:

The Afrikaner Cattle Breeders Society of South Africa, Bus/Box 979 Bloemfontein 9300, South Africa

Handbook of Australian Livestock, Australian Meat & Livestock Corporation, 1989, 3rd Edition

Bonsmara

. The Bonsmara has become so popular that it has grown to **with the better performing Hereford and Shorthorn cross-breeds. Ultimately three-quarter Afrikaners were mated to half-breeds to obtain progeny with 5/8 Afrikaner and 3/8 Hereford or Shorthorn blood.**

Photographs:

Select Genes Ltd., Irene 1975, Republic of South Africa.

INDIGENOUS CATTLE BREEDS OF NIGERIA

THE WHITE FULANI = BUNAJI *Source: Adebambo 1997*

BORORO/ RED FULANI *Source: Adebambo1997*

EXOTIC CATTLE BREEDS ON RANGE IN NIGERIA *Source: Adebambo1997*

SOKOTO GUDALI BULL; *Source: Adebambo 1997*

SOKOTO GUDALI AT BODIJA MARKET, IBADAN; Source: Adebambo 1997

SHORT HORN N'DAMA BREED; Source: Adebambo 1997

MUTURU CATTLE BREEDS (SW); Source: Adebambo 1997

NIGERIAN SHEEP BREEDS

West African Dwarf

Also Known as: Cameroons Dwarf, Djallonké, Forest-type, Fouta Djallon, Futa Jallon, Guinean, Kirdi, Kirdimi, Lakka, Nigerian Dwarf, Pagan, Savannah-type, Southern, West African Maned

Photographs:

Hair Sheep of Western Africa and the Americas: A Genetic Resource for the Tropics. (H.A. Fitzhugh and G.E. Bradford, eds.), A Winrock International Study, 1983.

Uda

Also Known As: *Oudah bicolore (French), Bali-Bali, Bororo, Fellata, Foulbe, Houda, Louda, North Nigerian Fulani, Ouda, Pied*

Photographs:

R. E. McDowell, Professor Emeritus of International Animal Science, Cornell University, and provided by Paul O. Brackelsberg, Professor of Animal Science, Iowa State University

BALAMI

BALAMI; Source: *Adebambo 1997*

Yankassa

Also Known as: *Hausa, White Fulani, Y'ankassa*

YANKASSA BREED; Source: *Adebambo 1997*

NIGERIA'S GOAT BREEDS

Nigerian Dwarf

Black and White dalmatian patterned doe

Gold and White doe

Black and White dalmatian patterned doe

Black and White doe

Chocolate and White doe

Black, White and Chocolate doe

WEST AFRICAN DWARF GOATS; Source: Adebambo1997

Sahelian

Also Known as: *Sahélienne, Cheèvre bariolée, Fulani, Sahel, West African Longlegged, Gorane, Niafouké, Nioro*

MARADI GOATS

NIGERIA'S RED SOKOTO GOATS = MARADI;

Source: Adebambo1997

MARADI GOATS ON RANGE; Source: Adebambo1997

INDIGENOUS POULTRY BREEDS OF NIGERIA

INDIGENOUS CHICKEN; Source: Adebambo 1994

COMPARISON OF EXOTIC AND INDIGENOUS CHICKEN

Source: Adebambo 2003

NAKED NECK INDIGENOUS CHICKEN

Source: Adeleke and Adebambo 2009

FRIZZLE FEATHERED INDIGENOUS CHICKEN

Source: Adeleke and Adebambo 2009

NORMAL FEATHERED INDIGENOUS CHICKEN

Source: Adebambo and Adeleke 2009

TAKING CHICKS WEIGHT

Source: Adenowo and Adebambo 2002

NAKED NECK INDIGENOUS COCK

Source: Adebambo and Adeleke 2009

YAFFA COCK

EXOTIC HENS—MARSHALL BREED

Source: Adebambo and Adeleke 2009

DIHYBRID FRIZZLE X MARSHALL COCK
Source: Adebambo and Adeleke 2009

DIHYBRID INDIGENOUS CROSSES (NoM) FEMALES

TRIHYBRID CROSSBREDS (AFzM)

TRIHYBRID AFzM FEMALES
Source: Adebambo and Adeleke 2009

SHADES OF HENS' EGGS DUE TO CROSSING
Source: Adebambo and Adeleke 2009

COCK SELECTION FOR SEMEN PRODUCTION
Source: Adeleke and Adebambo 2010

RHODE ISLAND COCK
Source: Adeleke 2009

GIRIRAJA COCK
Source: Adebambo and Adebambo 2001

INDIGENOUS DUCKS
Source: Adebambo 2007

INDIGENOUS MALE TURKEY (TOM)

Source: Peters et.al., 2010

CROSSBRED INDIGENOUS TURKEYS

Source: Peters et.al., 2010

THE DOMESTICATED TURKEY

The **domesticated turkey** is a large poultry bird. The modern domesticated turkey descends from the wild turkey (*Meleagris gallopavo*), one of the two species of turkey (genus *Meleagris*); in the past the ocellated turkey (*Meleagris ocellata*) was also domesticated.

The turkey is raised throughout temperate parts of the world and is a popular form of poultry, partially because industrialized farming has made it very cheap for the amount of meat it produces. The female domesticated turkey is referred to as a *hen* and the chick as a *poult*. In the United States, the male is referred to as a *tom*, while in Europe, the male is a *stag*. The average lifespan for a domesticated turkey is ten years.

The great majority of domesticated turkeys are bred to have white feathers because their pin feathers are less visible when the carcass is dressed, although brown or bronze-feathered varieties are also raised. The fleshy protuberance atop the beak is the snood and the one attached to the underside of the beak is known as a wattle.

Despite the name, turkeys have no direct relation to the country of Turkey and are native to North America

Easy to manage bird—THE GUINEA FOWL

Compared to chickens, guinea fowl are not difficult to raise, says an official in the livestock department, adding that these wildlife birds are resistant to common poultry diseases such as Gumboro, Newcastle and salmonella, and also require less labour and management. In Botswana the off-take rate and mortality for guinea fowl is only 3.4% and 2.2%, respectively, whereas chicken have scores of 10.6% and 6.8%. This gives guinea fowl, considering the local conditions, a better chance of becoming a favourite in future.

THE ANIMAL KINGDOM
KINGDOM -----ANIMALIA
PHYLUM -----CHORDATA
SUB-PHYLUM-----VERTEBRATA

GENERA	ORDER	FAMILY	GENUS	SPECIE	COMMON NAME
MAMMALIA	CARNIVORA	CANIDAE	CANIS	Canis familiaris	DOG
	PERISSODACTYLA	EQUIDAE	EQUUS	Equus asinus	Ass/donkey
	ARTIODACTYLA	CAMELIDAE	CAMELLUS	Camellus dromedarius	CAMEL
	« «	BOVIDAE	BOS	Bos indicus	Humped cattle
	" "	BOVIDAE	BOS	Bos taurus	Humpless cattle
	" "	CAPRINAE	OVIS	Ovis aries	Sheep
	" "	CAPRINAE	CAPRA	Capra hircus	Domestic goat
	" "	SUIDAE	SUS	Sus scrofa	Pigs
AVIS	ANSERIFORMIS	ANATIDAE	ANSER	Anser anser	Goose
	GALLIFORMIS	PHASIANIDAE	GALLUS	Gallus gallus	Chicken
	" "	" "	PAVO	Pavo cristanus	Pea fowl
	GALLIFORMIS	PHASIANIDAE	MELEAGRIS	Meliagris gallopavo	Turkey

duck " " " " CAIRINA Cairina moschata Muscovy

duck " " " " ANAS Anas platyrhycus Common

COLUMBIFORMIS COLUMBIDAE COLUMBIA Columbia livia Pigeon

" " NUMIDIDAE NUMIDA Numida numida Guinea fowl

TYPICAL TRAIT/GOALS FOR SELECTION

Major traits of economic importance radiate around:

- Growth
- Reproduction
- Feed efficiency and
- Colour identification for specifically selected breeds by breeders

Table 3: Traits of economic importance in different animal breeds

BREED	CATTLE	SHEEP	GOATS	PIGS	POULTRY	RABBITS	
No born/annum	1-2	2-6	2-10	6-33	60-205 220-320	8-30	
Prolificacy	1/birth	1-3/birth	1-5/birth	3- 16/birth	50-150	4-8/birth	
Gestation length--days	270-290	145-147	145-148	113-117	21-38days incubation	28-33	
Generation Interval--days	400-488	380-400	320-327	300-360	140-175	170-250	
Birth weight	12-17 kg	3-4kg	2-4 kg	0.8-3.0 kg	25-37g	0.2-0.6	
Daily gain							
Birth - weaning	0.2-0.6 kg	20-35g	18-30g	0.3-0.5kg	80-118g	30-120g	
Post weaning	0.3-1-0kg	20-90g	20-80g	0.4-0.9kg	80-270g	120-180g	
Live weight at slaughter	112- 450kg	20-65kg 20-45kg 15-35kg	20-63kg 19-37kg 18-25kg	45-90kg	1.2-2.5kg	1.5-4.5kg	
Back fat	-----	-----	-----	0.1- 3.0cm	-----	-----	
Edible meat %	45	48	45	60	58	50	

% Carcass yield	55	60	60	75	65	65	
Milk Production kg	490-5000 5000-10000	-----	25-288 38-288 75-300 150-250	-----	-----	-----	
Lactation Length days	260-305	-----	100-290 100-126 180-252	-----	-----	-----	
Daily yield kg	1.5-2.8	-----	0.2-1.6	-----	-----	-----	
Butter fat	200-350kg	-----	0.2-1.6	-----	-----	-----	
Milk Proteins	180-250kg	-----	0.5 -1.6	-----	-----	-----	
Egg Production	-----	-----	-----	-----	220-320 60-205	-----	
Clutch size (IND)					6-10/ann		
Pause Length					1-3 days		
Eggs/week					2-6		
Fertility					60-90%		
Hatchability					65-85%		

TYPICAL FARM RECORDS

- Date of animal purchase
- Age of animals purchased
- Possible weight of the animals prior to purchase and subsequently after
- Identification of parents
- Health records e.g. vaccination, deworming, disease to which the breed/ animal is susceptible, records of treatment etc.
- Financial records e.g. cost of purchase, feed cost, cost of veterinary services, sales and disposals
- Daily feed inventory

Table 4: Farm records in a ruminant farm

	DAIRY/ BEEF	SMALL RUMINANTS
Animal Number	Opening stock/week/month/ann	Opening Stock/week/month/ann
	Closing stock/week/month/ann	Closing Stock/week/month/ann

Weights	Birth	Birth
	Pre weaning	Pre weaning
	Weaning wt	Weaning wt
Post Weaning	Monthly	Monthly
Maturity	Age	Age
Parturition	Age at first calving	Age at lambing/kidding/kindling etc
	Generation Interval	Generation Interval
	Calving Interval	Lambing/Kidding/Kindling etc. Interval
Production	Morning Milk	
	Afternoon Milk	
	Total Milk /day	
	Fat %	
	Protein %	
	Lactose yield	
	Calving %	
	Weaning weight	
	Live weight gained	
	Lactation Length	
Efficiency of Milk Production	Zero grazing	
	Concentrate Feeding	
Feed Intake	Creep	Creep
	Starter	Weaners
		Growers
	Flushing	Ditto
	Lactation ration	Ditto
		Fattening
Carcass Quality	Live weight @ slaughter	Ditto
	Age at slaughter	Ditto
	Weight Gained	Ditto
	Carcass Weight	Ditto
	% carcass yield	Ditto
	% Rump	Ditto
	% Thigh	Ditto
	% Shoulder	Ditto
	% Lean	Ditto
	Not always	%Fat
	-----	Back fat Thickness (pigs)

	Meat Colour	Ditto
Products		
Meat	Cooking loss	
	Tensile strength	
Milk		
	Colour	
	Bacterial Count	
	% Lactose	
	% Fat	
	% Protein	

Table 5: Farm records in a poultry farm

	BREEDERS	LAYERS	BROILERS/DUCKS/TURKEYS	
Birds Number	Opening	Opening	Opening	
	Closing/week/mon/yr	Ditto	Ditto	
Weights	Day old	Ditto	Ditto	
	At first Egg	Ditto	Ditto	
	Wt of 1 st Egg	Ditto	Ditto	
	Average pause length	Ditto	Ditto	
	Hen Day Production	Ditto	-----	
	Hen Housed Production	Ditto	-----	
	Average egg weight	Ditto	-----	
	Average Weekly Production	Ditto	-----	
	Mating Ratio	-----	-----	
	% Fertility	-----	-----	
	% Hatchability	-----	-----	
	Chick Viability	-----	-----	
Feed	Chicks	Ditto	Starter	
	Growers	Ditto	Finisher	
	Layer	Ditto	-----	
	Cock	-----	-----	
Feeding	Feed /doz eggs	Ditto	Ditto	
	Feed / Kg eggs	Ditto	Ditto	

	Feed / chicks hatched	-----	-----	
	Feed Conversion Efficiency	Ditto	Ditto	
Carcass Quality	-----	-----	Live weight at slaughter	
	-----	-----	Weight Gained	
	-----	-----	Feed Intake	
	-----	-----	Feed Conversion Ratio	
	-----	-----	Carcass yield	
	-----	-----	% Breast	
	-----	-----	% Shank	
	-----	-----	% Leg	
	-----	-----	%Thigh	
	-----	-----	Gizzard weight	
			% Boneless meat	
Egg Quality	Sampled Egg weight	Ditto	-----	
	% Albumin	Ditto	-----	
	% Yolk	Ditto	-----	
	Shell strength	Ditto	-----	
	Yolk Colour	Ditto	-----	
	Albumin Height	Ditto	-----	
	Yolk Height	Ditto	-----	
	Haugh Unit	Ditto	-----	

- Quarantine new and sick animals,
- Separate sick from the healthy ones.
- Keep all records of morbidity and mortality, drugs used, dosage, duration of treatment, and period of withdrawal.

PROBLEMS OF LIVESTOCK BREEDING IN NIGERIA

The greatest and major problem of livestock breeding and breeds development in Nigeria emanates from:

- lack of breeding policy
- lack of literate livestock keepers
- Non descript Animal breeds
- Lack of professionally trained breeders
- Inadequate training in the art.

Parental: SSbb X ssBB
Short/White hair X long/Black hair
Genes: Sb : Sb X sB : sB



F1 Progenies: SsbB: SsbB: SsbB: SsbB
All Black/ short hair

F1 Interse Mating: SsbB X SsbB
Genes: Sb: SB: sb: sB X Sb: SB: sb: sB (different from the Parentals)

F2 Progenies: SbSb:SbSB:Sbsb:SbsB
SBSb:SBSB:SBsb:SBsB
sbSb:sbSB:sbsb:sbsB
sBSb:sBSB:sBsb:sBsB
SbSB:SbsB:SBSb:SBSB:SBsb:SBsB:sbSB:sBSb:sBSB = 9 Short Black
SbSb: Sbsb:sbSb = 3 Short and white hair
sbsB:sBsb: sBSB = 3 Long and Black hair
sbsb = 1 Long and white hair

Results : 9x short black hair, 3x long black hair, 3x short white hair,
1x long white hair.

Two traits (black/white and short/long hair, with black and short dominant) show a 9:3:3:1 ratio in the F₂ generation. (S=short, s=long, B=black, b=white hair)

(1) Parental generation. (2) F₁ generation. (3) F₂ generation.

Results : 9x short black hair, 3x long black hair, 3x short white hair, 1x long white hair.

SPECIFIC SELECTION REQUIREMENTS

There are Specific Selection requirements on:

- Male lines-----Growth and Feed efficiency, semen quality
- Female lines-----reproductive abilities; mothering ability except in poultry, milk production, ease of calving, kidding, lambing, farrowing, high fertility and hatchability

TYPICAL TRAIT VALUES OF ANIMAL BREEDS

TARGETTED TRAITS FOR ECONOMIC IMPROVEMENT

Major traits of economic importance radiate around:

- Growth
- Reproduction
- Feed efficiency and
- Colour identification for specifically selected breeds by breeders

COMMON TERMINOLOGIES IN ANIMAL BREEDING

- BREED
- STRAIN
- LINE
- SPECIE
- PUREBREEDING
- PUREBRED
- CROSSBREEDING
- CROSSBRED
- INBREEDING
- INBRED
- RANDOM MATING
- OUT CROSSING
- TOP CROSSING
- TOP-IN-CROSS
- INCROSSBRED
- TOP-IN-CROSSBRED
- OUTCROSSBRED
- HETEROSIS/ Hybrid vigour
- HYBRID
- DI HYBRID
- TEST CROSS
- DOMINANT
- RECESSIVE
- HAPLOID (n)
- DIPLOID (2n)
- GAMETE
- ZYGOTE
- HOMOZYGOTE

- HETEROZYGOTE
- GENE POOL
- SEX CELL
- SOMATIC CELL
- SEX CHROMOSOME
- SEX-LINKED GENE
- AUTOSOMELOCUS
- PHENOTYPE
- EPISTASIS
- TELOMERE
- CENTROMERE

MAJOR CLIMATIC ZONES

Equatorial

- constant heat, rainfall and relative humidity (RH)
- mean annual temp. = 27°C
- total annual rainfall. =2000 to 3000mm
- bimodal rainfall , 2 peaks
- lies between 5 and 7° latitudes north and south
- vegetation=tropical rain forest
- climatic stress, considerable

Humid

- high temp, relative humidity and rainfall
- temp between 15 and 30° C
- 3 seasons-cool/dry,hot/dry,hot/wet
- rain forest, plants less vigorous
- radiation less 120kcal/cm²/yr
- adjacent to equatorial zone

Sub humid

- rainy season is short , dry season longer
- wider temp range;10 to 32°C
- savanna/ open grassland
- nomadic livestock husbandry, common
- less climatic stress
- f0rage prod seasonal, nutritional ,yes
- epizootic diseases, common
- parasites, easier to control

Semi arid

- low rain, very long dry season
- daily and seasonal temp ,varied widely

- high solar radiation, dry atmosphere, clear sky
- 250 to 500mm/yr. livestock production only
- lack of feed, water, nutritional and climatic stress affect productivity
- parasites easy to control
- not suitable for cattle

Arid

- desert common in sub tropics
- temp. 0 to 52°C
- rainfall insignificant
- support limited no of livestock
- total radiation, = 140kcal/cm²/yr

Montane

- altitudes 300 to 1500m above sea level
- mean annual temp decreases by 5.6°C for every 1000m ascent
- the higher the altitude, lower ambient temp
- the higher the altitude, lower atmospheric pressure
- pressure decreases by half at 5,500m above sea level
- potential for dairy not exploited

DIRECT AND INDIRECT EFFECTS OF CLIMATE ON LIVESTOCK

Direct Effect

1. heat balance: homeotherms?
mammals, 37 -39 °c. birds, 40 – 44°c
- a thermal balance must be preserved by livestock in order to maintain temp.
 - balance between heat production and / or gain from the environment and heat lost to the environment.
 - $m = e \pm f \pm cd \pm cv \pm r$ or
 - $m - e \pm f \pm cd \pm cv \pm r = 0$

m =metabolic heat production

e = heat lost from skin and respiratory passage by evaporation,

f = heat lost or gain in bringing food and water to body temperature,

cd = heat ± by direct contact between body and surrounding surfaces

cv = heat ± by convection

r = heat ± by radiation

- m is affected by basal, digestive and muscular heat production and increased metabolism due to growth, milk production & reproduction.
- out of these avenues only basal hp cannot be reduced else no maintenance of body temperature.

Heat lost in domestic animals

- e, most important & includes losses from skin thro sweating and respiration (panting).
- non evaporative heat losses : r, cd and cv.
- heat lost thro respiration depends on ambient air temp, difference in water vapour pressure between inhaled air and area of soft mucosa.
- cv and e heat losses are increased when cool breeze blows on the animals.
- maximum air movement to be consider in housing of animals.
- at high temp wind & water sprays prevented significant reduction in milk yield.
- solar radiation increases the heat load on the animal.
- pigmented skin of tropical breeds helps them to adapt better than temperate ones in the tropics.
- white surface may absorb 20 % while black surface may absorb 100 % of the visible radiation.
- the length, density & condition of hair affect the influence of solar radiation on the heat load of the animal.
- standing animals receives less solar radiation /unit body area than lying down,
- daylight length affects metabolic rhythms reproduction & hair growth.

Grazing behaviour

- Grazing time of cattle during the day is affected by; degree of climatic stress, breed & type of cattle and quantity & quality of pasture available.
- *bos taurus* (exotic type of cattle) and their crossbreeds seek shade in the hot afternoon thus confining their grazing to early morning and late afternoon.
- *bos indicus* (indigenous cattle)only confined at night ; protect from predators during the dry season in semi arid tropics cattle under nomadic and semi nomadic systems experience inadequate feed and water. Distance covered in search of water and feed + stress of ambient temp have significantly reduced livestock productivity in the semi arid tropics.

Intake and utilization of feed and water

- feed intake: depressed by high ambient temp
- feed intake in *B. taurus* is depressed at lower temp than of *B. indicus*
- at temp above 40°C, feed intake and rumination ceases in *B. taurus*
- feed intake is depressed with increase relative humidity at temp >23.9°C
- increased radiation depress feed intake in *B. taurus*
- water is a nutrient, assist in heat loss – cd
- in *B taurus* milking cows, water intake increased with temp up to 29.4°C, before declining
- increasing radiation intensity leads to increased water intake in cattle

Growth

- birth weight are low, growth rate, slow in *B indicus*
- piglets require temp >32°C in first two days so they do not get chilled
- chick s more tolerant of high temp than adult birds
- above 35°C, chicks may die in boxes on transit from hatcheries

Milk production

- milk, butter fat and solid non fat (SNF) are depressed by high ambient temp
- milk production in *B. taurus* is optimal at 10°C
- production declines at 21 to 27°C in jersey *B. taurus* but > than 32°C in *B. indicus* (critical temp)

Reproduction

- temp, RH and length of daylight affect reproduction in domestic livestock
- female cattle: climate affect age at puberty, oestrus duration, incidence of ova abnormality and embryonic death, foetal death, gestation length and foetal size
- bulls: age at puberty, sexual libido & spermatogenesis/semen characteristics

Indirect effects:

1. feed and water supply:

Temp, effective rainfall photoperiod and intensity of radiation limits plant growth and quantity available. Feed quality depends more on effective rainfall & intensity of solar radiation

a. equatorial/ humid tropics

-forage has low DM (%), graze from mid morning. more nutritious in wet than in dry season

- positive correlation between rainfall and crude protein, nitrogen free extract, silica free ash
- inverse relationship between rainfall and crude fibre

b. semi arid/ arid tropics

DM contents are high most part of year. Cattle require regular and frequent access to water. *B. taurus* require more water than *B. indicus*

- water demand of small ruminants and camel not as high as for cattle
- restrict feed intake when water is deprived,
- cattle exist on low quality feed
- crude fibre of standing hay is high & onset of lignification is earlier than in the humid zones

2. parasites and diseases

3. storage of products

FORAGES

***Panicum maximum* (Guinea grass)**

- A perennial, bunch tall grass, spreading by short rhizomes or rootstocks from which tillers emerge freely. The grass is suitable for silage, green silage, hay and pasture.
- Guinea grass is one of the most productive forage grasses in tropical countries. It grows up to 3.5m tall. The plants seed readily but the heads ripen very unevenly and shatter readily.

***Pennisetum purpureum* (Elephant grass)**

- A robust stoloniferous grass with a vigorous root system. Though native to subtropical Africa (Zimbabwe), it is common in most tropical and subtropical countries. It occurs either as green or purple variety but the green predominates.
- Elephant grass spreads slowly but the growth is very rigorous. The forage is grazed or made into silage or used in a cut and carry system. Elephant grass could be grazed and cut at heights of 90 and 50cm, respectively.

***Stylosanthes guianensis* cv. Verano**

- An annual/short term perennial legume suitable for the Guinea and Sudan Savanna zones of Nigeria. *Verano stylo* is adapted to various soil types and areas with annual rainfall from 700-1700mm. It is the most common stylo species found all over the country. *It* is preferred by ruminant from the late growing season into the dry season. Suppression of *stylo* by the associated grass species can be prevented through early grazing of the pasture.

INTRODUCTION TO ANIMAL PHYSIOLOGY

The most important livestock products originate from physiological processes. These include meat, milk and eggs. For an animal to be productive, it must first be alive and healthy. The various physiological systems ensuring normal functioning of an animal include the Respiratory, Circulatory, Nervous, Endocrine, Reproductive, Digestive and Excretory Systems.

Animal physiology and meat production

- Growth
- Muscle development
- Fat deposition

Connective tissue development is influenced by factors such as:

- Species
- Sex
- Nutrition
- Age

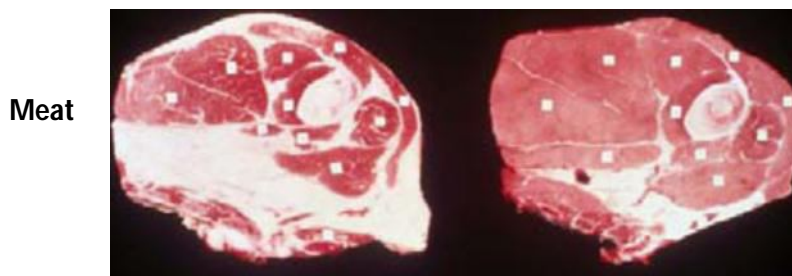
Growth is a characteristic of living things and can be defined as an increase in body size or mass of part or all of the body over a specific period of time. Growth results from any or all of the following processes:

- Increase in body weight till mature size is reached
- Increase in cell number and size accompanied by protein deposition
- Increase in structural tissues and organs. Structural tissues include Bone, Muscle and other connective tissues such as fat, tendons, etc.

Development often accompanies growth as cells and tissues become differentiated, increasing in complexity. Development involves the directive coordination of all diverse processes until maturity is reached. It involves:

- Growth
- Cellular differentiation
- Changes in body shape and form

Meat is derived principally from muscle, fat and connective tissue. The major component of muscle is protein, formed in the cells of the body in processes involving formation of messenger-RNA in the nucleus (Transcription) and protein synthesis in the cytoplasm (Translation).



Animal physiology and milk production

Mammary gland development and growth

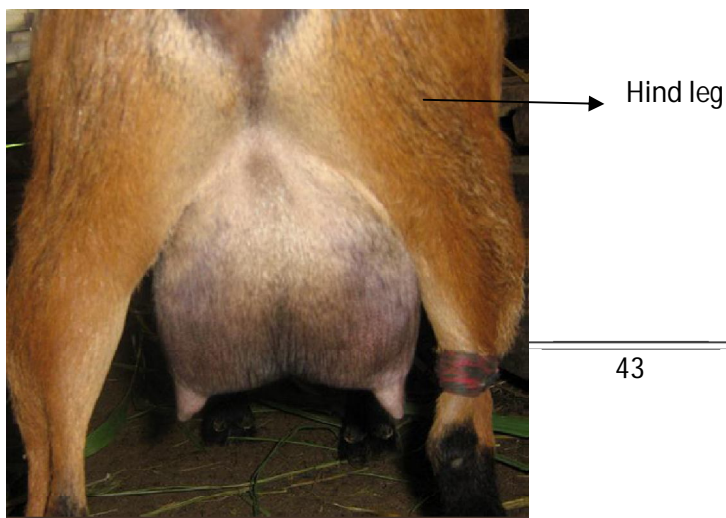
Udder size and milk production

Influencing factors

- Stage of lactation
- Parity
- Feeding frequency
- Milking frequency

Female mammals produce milk after parturition for nurture of their young. Milk is produced in the mammary gland known as the **udder** in Cattle, Sheep and Goats.

Mammary gland (Udder) of a Goat

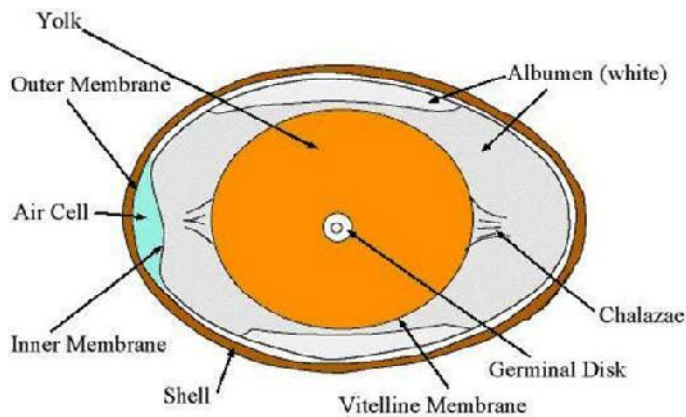


→ Udder

→ Teat

Animal physiology and egg production

The chicken egg is one of the most complete foods available to man. It is well packaged (in a shell) and contains protein, fat, minerals and other nutrients in proportions needed. A good understanding of the physiology of chicken egg production helps the farmer to maximise profit.



Structure of chicken egg

Animal physiology and artificial insemination

Definition and utility

Artificial insemination, or AI for short, is the introduction of spermatozoa into the female reproductive tract around the time of oestrus for the purpose of achieving conception. AI is one of the most powerful tools developed in the twentieth century for the genetic improvement of livestock. It enables the application of high selection pressure on the male side thereby substantially increasing the rate of genetic progress per year.

Artificial insemination involves the following processes:



Semen preservation and storage

- Fresh, diluted semen
- Ambient storage, 25-30oC
- Chilled storage, 5oC
- Deep-frozen storage, -196oC



Artificial vagina for bull semen collection

Animal physiology and embryo transfer

Definition and utility

Embryo transfer (ET) is an applied reproductive physiology procedure for obtaining several offspring from a highly valued dam using other females as surrogate dams. It is a technique that enables high selection pressure to be applied on the female side.

The processes involved in ET are:



- Super-ovulation, mating or AI
- Embryo recovery, embryo transfer

Animal physiology and controlled breeding

Definition and utility

Controlled breeding is the manipulation of the female reproductive cycle to suit Management objectives. It involves the following processes:

- Separation of sexes, oestrus detection, oestrus synchronization, AI, ET, Pregnancy diagnosis

Animal physiology and artificial insemination

Definition and utility

Artificial insemination, or AI for short, is the introduction of spermatozoa into the female reproductive tract around the time of oestrus for the purpose of achieving conception. AI is one of the most powerful

tools developed in the twentieth century for the genetic improvement of livestock. It enables the application of high selection pressure on the male side thereby substantially increasing the rate of genetic progress per year.

Insemination involves the following processes:



- Semen preservation and storage
 - Fresh, diluted semen
 - Ambient storage, 25-30oC
 - Chilled storage, 5oC
 - Deep-frozen storage, -196oC

Equipment used for Artificial insemination



Cattle artificial vagina (AV)



Rubber liner for cattle AV



Cone for cattle AV



Ram/Buck AV

MARKING HARNESSSES

Introduction

Oestrus or "heat" is a period during the reproductive cycle when female animals become sexually receptive, signalling they are ready for mating. In most cases, this can also be referred to as "standing heat" because the female will stand to be mated by the male. Oestrus is caused by oestrogen being produced within developing follicles in the ovary, and ovulation usually occurs after the initial signs of oestrus are detected.

Duration of oestrus and the time of ovulation in relationship to the onset of oestrus vary with the species. If behavioural or physical signs are not obvious, oestrus may even pass unnoticed. Successful recognition of the signs of oestrus for mating, just prior to the time of ovulation, can result in increased conception rates for the herd or flock.

Detection Aids

Apart from personal observations and sound record keeping, there are various methods used to detect oestrus in the herd. Marker animals can be used for oestrus detection and there are different marking devices that can also be used. Marker animals are usually males that have been altered in some way, so they cannot mate, but they still have the desire to mate, resulting in a visual mark from the marking device left on the female in oestrus.

Teaser animals are another detection aid, involving surgical alteration of the male, causing them to be sterile. The most common surgical method is a vasectomy, involving the removal of a section of the vas deferens thereby preventing sperm passage. Others include: pressure-sensitive heat-mount detectors such as KaMar® heat detectors and Chin-ball marking harness in bulls. In sheep, a marking harness can be fitted on the vasectomized or aproned ram. The harness is similar to the chin-ball marker used for cattle. It has a coloured crayon that is situated over the sternum of the ram so that it will mark the ewes' rump as it attempts to breed.