

COURSE CODE:	APH509
COURSE TITLE:	Beef Animal Production
NUMBER OF UNITS:	2 Units
COURSE DURATION:	Two hours per week

COURSE DETAILS:

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COURSE CONTENT:

Prospects and problems of beef industry in Nigeria. Sources of beef animals. Brief review of beef production systems. Factors to consider in establishing beef herd/ industry. Grazing methods, uses and problems. Factors affecting beef quality. Mating methods in beef herd. Cost of beef production. Health problems in beef production.

COURSE REQUIREMENTS:

This is a compulsory course for all 500 level students in the Department of Animal Production and Health. Students in final year from other Departments in College of Animal Science and Livestock Production could choose the course as an elective. 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

ANIMAL DISTRIBUTION

No animal species occurs uniformly over the whole world, but each is restricted to a definite RANGE or AREA OF DISTRIBUTION. The entire land or water over which a species may occur is termed its GEOGRAPHICAL RANGE and the kind of environment in which it lives is its ECOLOGICAL RANGE. All the animal livings in a particular area, large or small are collectively termed the FAUNA (the equivalent term for plant is Flora). The plants and animals together are the BIOTA.

FACTORS REGULATING DISTRIBUTION

Since every species produces offspring in excess of the numbers that can survive within its normal range, there is a population pressure by which individual tend to expand the boundaries of their range. Factors which acts to reduce population distribution are competition, enemies, disease, shortage of food, adverse seasonal weather conditions and decrease in available shelter. The distribution of all animals, from protozoa to mankind is consequently dynamic rather than static and always subject to changes. This is equally true of plants on which so many animals depend. Most plants, being rooted to the ground, cannot extend their range as individuals but only by dispersal of seeds.

The external factors that limit distribution are termed barriers. These include

- a. Physical barriers- such as land for aquatic species and water for most terrestrial forms;
- b. Climatic barriers- such as temperature (average, seasonal or extreme), moisture (as rain, snow, air humidity or soil moisture), amount of sunlight etc.
- c. Biological barriers- such as absence of appropriate food or presence of effective competitors, enemies or disease. Many kinds of animals and insects are limited to particular species of plants for their food, shelter or breeding places, so that their distribution is controlled by factors that regulate these plants.
- d. Every species of animal and plant has a limit of tolerance- maximum or minimum-to each factor in its environment. Changes in a factor beyond the tolerance units in migration or death, or survival of only those individuals better (more tolerant) to the altered conditions.

BEEF CATTLE POPULATION AND DISTRIBUTION

There are over 1.1 billion cattle in the world, many of which are used for work or milk production with beef production only a side issue of their major intended usefulness.

All dairy cattle are beef cattle but not all beef cattle are dairy cattle. Most of the cattle produced strictly for beef are found in North and South America, Australia and New Zealand. The distribution of the World cattle population is such that the leading beef producing countries are not necessarily the highest beef consumers per capital. In fact, the World cattle population is accounted for by only 20 countries. Cattle population, however, appears to be increasing more rapidly in the tropics than elsewhere. The reasons for the tremendous population variation include:

1. Religious and other customary beliefs which prevent the eating of the flesh of cattle e.g. India produces 2 times as any other country. It is however, illegal to eat any of the cattle and the slaughter of buffalo is restricted. In most parts of Africa, cattle are slaughtered for ceremonial reasons
2. Some countries have a large geographical area with little ratio of number of population with number of cattle e.g. China. In this situation, the per capita beef consumption is low and limited;
3. Some countries have a small geographical area with a high ratio of number of people e.g. Finland. There they export some of the animal.
4. Some countries import considerable amount of beef they eat e.g. Switzerland.
5. Apart from geographical and religious factors, climate is an important factor in the distribution and production of cattle as it has direct and indirect effects on the animal. The direct effects are manifested on the animals themselves while the indirect effects are accounted for by climatic effects on their environment.
 - a. Super humid climatic areas are characterized by dense rain forest with tall trees with dense crowns and interlocking branches. Such areas have high humidity and excessive rainfall and climatic stress on livestock is considerable. Such areas are found in Indonesia, Philippines, Burma an S.E. Asia country, the West Coast India, part of West Africa, the East Coast of Central America, parts of South America. Forage is available all year round but it is usually low in protein, minerals and high in fibre content.
 - b. Humid areas are also forested but have moderately high temperature and lower humidity. Climatic stress is thus not as severe as in the super humid areas. Such areas have more potential for the development of animal husbandry.
 - c. Sub-humid areas are characterized by high grassland that may be interspersed with trees when it is known as Savanna. Rainfall is usually seasonal. Large areas of Savanna are found North and South of the Equator in Africa particularly in the East. Such areas also occur in India, S.E. Asia and North Australia, while smaller areas are found in Central and South America and in many of the Tropical highlands. Such areas are the most suitable for animal production and a large proportion of the tropical domesticated cattle are found there. In these areas the climatic stress on domestic livestock are more easily controlled. Even endemic diseases may be easier to control than in forest areas. In the absence of the major disease problems, nutrition, however, still constitutes a major problem of the animal industries since forage production is very seasonal.
 - d. The semi arid areas are characterized by short grasses, low humidity, high temperatures and low rainfall. In these areas nutritional stress and lack of water are greater limiting factors in animal husbandry than the climatic stress. It can however support livestock.
 - e. Disease also supports some livestock. Nomadic tribes follow the rains across deserts and feed flock on plants that spring up soon after rain. Irrigation helps to support high stocking rates or densities.

Direct Effects of Climate

- i. Effect of High Temperature- Exposure of beef cattle to temperature above 80°F (27°C) results in activation of the thermoregulatory mechanisms of the body, resulting in increased respiration and vaporization rates. At temperature above 95°F (35°C), there is failure of heat regulatory mechanism with consequent rise in rectal temperature, increase in water intake, reduced appetite, reduced growth and milk production and possible losses in body weight.
- ii. Effect of High Temperature on Grazing Habits: High temperature reduces the length of day time grazing of cattle.
- iii. Effect of High Temperature on Growth: This is due to effect on grazing time and feed intake
- iv. Effects of High Temperature on Milk Production. It depresses milk production and affects milk composition
- v. Effects of High Temperature on Reproduction: High testicular temperatures adversely affect spermatogenesis and hence, the fertility of the bull. There may be seminal degradation.
- vi. Effects of High Humidity. Humidity is the amount of vapour in the atmosphere:
 - a. High humidity add to the heat load of the animal by reducing evaporative heat loss
 - b. High humidity also depress the amount of daylight grazing
 - c. High humidity have some effect on feed intake (reduce it) and hence reduce productivity
 - d. High humidity lower the dry matter content of forages i.e., there would be high moisture content and low dry matter content

Indirect effects of climate

1. Effect on Feed supply: Climate affects the quantity and quality of feed available to the animal. This is because plant growth is dependent on temperature, precipitation and the length and intensity of day light while the quality of the feed is affected by precipitation and humidity.
2. Tropical forage matures quickly so that at the same age as the temperate type, it has higher crude fibre content and lower digestible nutrients but quicker maturity. Thus, tropical stocks have to digest more fibrous feed with resulting increase in heat load. In areas with high humidity, there is rapid deterioration in quality of mature forage. This is however less intense in drier area.
3. In humid and super-humid zones, forage contains such high water content and become bulky that the animal is unable to ingest a sufficient quantity containing enough dry matter to satisfy nutrient requirement.

Effects on parasites and diseases

High humidity and temperature zones favour the multiplication of endo- and ecto-parasites. This is because of the effect of vegetation on the incidence of insect vectors of disease. One of such dreaded vectors of disease is the tsetse fly which is a great threat to animal production. Various direct and indirect effects of climate on the animal have great significance in the determination of geographical distribution of world cattle population. The variations in climatic conditions also call for various physiological adaptations in the animal and the need to adjust to environmental pressure and behavioral patterns of the animal.

MATING IN BEEF HERD

Mating: It is the physical meeting of the male and female animal for the purpose of parturition or giving birth. Before mating can occur, the female animal must be on heat. She must be willing for the male animal to mount her. Mating is the precursor to sexual reproduction in farm animals.

There are two major types of mating

1. Natural
2. Artificial

Natural mating: This is the process of allowing male to mount or climb on female animal on heat without any assistance e.g. hand and pasture mating.

Artificial mating: This does not require the physical mating of the male and female animal e.g. artificial insemination. It is the method of introducing sperm into the vagina of the female animal by artificial means.

METHOD OF MATING

There are three methods of mating in cattle

1. Hand-mating:

It involves secluding the bull from the female and allowing him to serve the animal only at owner's discretion. When a cow is found to be on heat she is brought to the bull and service. This method is practiced by pure bred breeders who want to be sure of calf parentage of each calf. It also ensures that heifers are not mated prematurely and that cows may be held back if required for one or more heat after calving.

Advantages

It uses a bull on more female.

It also helps in keeping accurate record.

Disadvantage

It is labour intensive and expensive.

2. Pasture mating:

It is a traditional method that is common throughout the world. The bulls are allowed to run with female to be mated. The numbers of cows a bull can service depend greatly on the types of pasture. Bulls can serve 10-25 cows under range condition whereas a bull can serve 40 cows on improved pasture where there are no physical obstruction like mountains and trees. And where forage extremely sparse forage, a bull can serve 15 cows. The bull must be above 3 years.

Advantage

There is reduction in required labour and the cost of keeping a male is low.

Disadvantage

It leads to transfer of infectious disease and heifer may be mated immaturely. Also, a female may be mated by more than one male, hence paternity becomes difficult to determine.

3. Artificial insemination

This is the method of introducing sperms into the vagina of the female animal by artificial means. It means that female has no contact with the male. It is rather less efficient with heifers than with cows because heifers rarely show estrous so clearly.

Advantages

It gives operator or the breeder access to bulls of genetic worth that he could never afford to purchase.

It facilitates crossbreeding program.

It eliminates disease spread by venereal contact.

Many offspring can be produced by a particular male in a given period.

Disadvantage

It requires more labour and experienced personnel and management.

CATTLE NUTRITION

Cattle are natural grazers. They possess remarkable ability to digest plant carbohydrates that are generally indigestible to most other mammals. It is natural then to assume that grazing is the best way to supply a nutrient-dense diet to growing cattle. Cattle would consume crop residues and forages and contribute manure to the soil. The widespread use of synthetic, soluble fertilizers and other agro-chemicals emerged in the 20th century. These materials, coupled with plant breeding technology and larger machinery for more efficient tillage and harvesting, led to high corn yields and cheap corn prices. Crop residues became part of main feedstuffs for grazing animals

Pasture and Appropriate Animals for Sustained Cattle Production

Matching the right animal or plant with the appropriate environment is a wise management decisions that leads to healthy animals and a productive and successful farming system. Maternal traits, milking ability with early maturity and tenderness are three important traits because a cow must calve on pasture and raise a thrifty cow that lays down fat quickly. Qualities to be selected for in animals including herd bulls are:

1. Dual purpose breed types (for beef)
2. medium frame
3. End weight 408-499kg
4. Age at slaughter 16 to 24 months (for beef)
5. Early maturing
6. Low maintenance requirements
7. High milk protein and butterfat (for dairy)

Cattle require consistent source of protein, energy, minerals, vitamins and water to maintain productivity and health. Producer can determine an overall picture of the nutritional status of the herd by:

- Using body condition scores
- Assessing pasture condition
- Soil and plant tissue testing to determine mineral and nutrient content (with subsequent appropriate supplementation)

NUTRIENTS IMPORTANT IN CATTLE PRODUCTION

Energy

Feed intake is regulated by an animal's energy needs. Therefore, energy should be considered first when attempting to balance animal diets. Adequate energy concentration in the diet allows cattle to utilize other nutrients such as protein, vitamins and minerals. Major determinants of animal's energy requirements are:

1. Weight
2. Body condition score
3. Milk production
4. Rate of growth
5. Level of activity
6. Impacts of climate (heat, cold, humidity etc)

Fresh grass, with high quality grass-legume can meet energy requirement of growing or lactating cattle in the wet season. Energy supplementation on pasture helps in maintaining high grains and milk production. Dry cows can subsist on lower quality feed stuffs and maintain an acceptable body condition score in order to be successfully bred and deliver a healthy calf. Energy supplement such as grain can result in better protein digestion and therefore higher milk production and greater weight gains.

Forages have the ability to supply all the energy needed to maintain highly-productive cattle throughout the growing season, but only managed intensively. Legume-grass pasture will easily have protein content greater than 18% during the vegetative stage. As plants mature, the nutrient values lowers. Consider getting your forage analyzed to determine nutrient content and concentration.

Protein

Cows generally require crude protein in the range of 7-14% of daily dry matter intake. Requirement is less for dry cows, pregnant and lactating cows especially dairy cattle require more. Growing cattle e.g. replacement heifers and steers require from 10.5-14% of their dry matter intake to be protein

Minerals and Vitamins

Principal mineral requirements are calcium and magnesium. Others are to consider are salt, phosphorus, potassium and sulfur. They are needed for cellular respiration, nervous system development, protein

synthesis and metabolism, reproduction. Vitamins are important for formation of catalysts and enzymes that support growth and body maintenance in animals. Vitamin A supplementation should be included in the mineral mix at about 1,200 to 1,700 IU's (International units) per pound of dry matter of feed intake per day. Green forage, high quality hay and cereal grains are typically high in Vitamin E.

Water

Cattle require 3-30 gallons of water per day. One gallon of water per 45kg body weight is required during the wet season. Two gallons of water is needed during hot weather. Double estimates for lactating cattle. Water should be clean and fresh. Dirty water decreases water intake. Decreased water decrease nutrient metabolism. Factors that affect water intake include, age, physiological status, temperature and body size.

Sources of Feeds

There are three sources of feeds for cattle and these are roughages, concentrates and succulents.

Roughages

Roughages possess great bulk, low nutrients and high fibre, digestibility is low, provide tactile stimulation, satisfy appetite and prevent digestive disturbances. This needs to be supplemented with other feeds high in nutrient concentration. Quality of roughage depends on the stage of maturity when cut, pliability of the stem, proportion of leaves, roughage include various classes of straw, low grade dried grass and hay.

Concentrate

These are feeds with low fibre and high nutrient concentration. Energy and digestibility values are high. Large variation in protein content such that concentrates are classified on this basis into low, medium and high quality. Cereal grains constitute the low quality protein group. Cereal grains are combined with feeds that are high in protein to make up for the deficit. Peas, beans and their residues are in the medium quality group (12-25% digestible protein). Meat, blood, liver meals, fish meals and dried separated milk (i.e dried skim milk where butter content has been removed). Their use is limited in beef production partly for economic reasons. Also, ruminants are capable of utilizing a low quality protein concentrate efficiently. Have great use in the production of monogastric animals.

Succulents

These include green feeds such as young cereals but mainly root crops like yam, cassava, sweet potato and banana. They are characterized by high moisture and fairly low dry matter contents. Roots have high percentage of easily digestible and metabolisable sugar. Protein content is very low and fibre is negligible. They are fed with fibrous feed for normal functioning of the digestive system. Green feeds are suitable only when young as fibre contents increase with advancing age with a corresponding decrease in digestible protein

Feed Additives

Fats

Accumulated fat in processed carcass are suitable for livestock feed. But must be stabilized with suitable anti-oxidants, otherwise, they will become rancid and unpalatable. Example of anti-oxidants is Butylated Hydroxyly Anisol (BHA). Serves as sources of energy and reduce dustiness in ground dry ration. High levels of fat depress digestibility of other nutrients

Non-Protein Nitrogen (NPN)

Examples include urea, biuret, creatinine, ammonium salts. These are synthetic compounds with high protein equivalence. Urea contains 46.7% nitrogen (27.3% crude protein). However, urea is not protein. In rumen, protein is synthesized by bacterial degradation of urea to NH_3 which combine with carbohydrate fragments to form protein in bacterial cells. When urea is used, carbohydrate should be present to promote rapid growth in the rumen bacteria. Synthetic NPN could be toxic in concentrate form and thus be used with care. If used, a period of adjustment (2-6 weeks) has to be given so that the rumen micro-flora can effectively degrade them for subsequent protein synthesis. Microbial protein becomes available when the bacterial cells are digested

Molasses

Low quality roughages, farm by-products and urea are not palatable. Molasses addition will

1. Increases the palatability of the ration.
2. Supply part of the energy needed for rapid growth of the rumen micro-organisms.
3. Enhances effective microbial breakdown of the ligno-cellulose fractions of the roughage portion of the diet.
4. When dried ground feeds are used molasses reduces dustiness.

Antibiotics

These are medicine, drug or health insurance agents. The effect is to control the growth of harmful organisms. It makes the animal grow faster and convert feed into meat more efficiently. Examples are aureomycin, penicillin and terramycin. Ideal antibiotics for use as a feed additive must be

1. Active against a wide range of detrimental organisms
2. Save at high dosage levels
3. Palatable at necessary concentration
4. Readily absorbed and distributed throughout the animals system
5. Retained in the tissues long enough to be effective i.e. not easily excreted
6. Stable both in feed and tissue i.e. not easily decomposed
7. Should not cause the microorganisms to become resistant
8. Cheap enough to guarantee economic returns
9. Easy and practical to feed

High levels of inclusion however, cause a depression in appetite, apparently due to partial destruction of beneficial micro-organisms in the rumen. Before including antibiotics in ration, the beef producer should study the costs, type of ration and health of the animal. Expert advice is usually necessary.

Hormones

Several synthetic estrogen substances are now used in beef cattle industry. They include diethyl stibetrol, hexestrol and dienestrol, diethylstibestrol generally referred to as the most extensively investigated of these estrogenic substances. The physiological properties of the female sex hormone and its action in animal body are similar to that of the natural sex hormone in both male and female. Several synthetic estrogen substances are now used in beef cattle industry. They include diethyl stibestrol, hexestrol and dienestrol, diethylstibestrol generally referred to as the most extensively investigated of these estrogenic substances. The physiological properties of the female sex hormone and its action in animal body are similar to that of the natural sex hormone in both male and female. Summarized results of various tests indicate an average increase of 16% in weight gains and reduction in feed requirement by 12%

CONSERVATION OF GRASS FODDER

The need to maintain the nutritional status of animals at a satisfactory level throughout the year necessitates the provision of adequate feed during the unfavourable period e.g. dry season. Seasonality of forage production necessitates conservation of grass during the rainy season for dry season feeding. The most common methods of grass conservation are silage and hay making.

Silage

Silage making is the process of controlled fermentation of succulent crops such that the growth of lactic acid producing organisms is favoured and that of other bacteria is suppressed. The quality of resulting silage depends on the period of fermentation. Ensilage is done by chopping the crop during harvesting by rapid filling of the silo by adequate consolidation and sealing. Grasses, legumes, whole cereals and fruit residues are used. Grass for silage making must have the following properties:

- a. Must neither be high in moisture content nor too dry. Moisture content of up to 70% is still considered suitable.
- b. Sufficiently mature to contain above 28-30% dry matter, dry matter increased with maturity
- c. Grass must be rich in soluble carbohydrate e.g. sugar to provide energy for the anaerobic bacteria fermentation which results in the production of lactic and acetic acid.

In practical feedings, silage replaces the roughage fraction of the ration and lessens grain consumption because

1. Well preserved silage is more palatable than most dry roughage
2. The concentrate present in the silage naturally tends to replace part of that in the grain ration

Hay Making

This is the cutting and drying of forages with a view to reducing the moisture content to levels conducive to storage. Drying should be accomplished rapidly to reduce dry matter losses through plant respiration. Handling should be carefully done so that the leaves which constitute the most nutritious part of the plant do not fall off. It can be done by field drying or barn drying. Barn drying is easier to handle but

much more expensive. Hay cut when plants are high in protein and low in fiber is much better from nutritional stand point than mature hay. Method and length of drying and storage affect quality

Pelleted Feeds

The pelleting of feeds is becoming popular as a means of ensuring uniform intake. This could take the form of all-pelleted ration or pelleted forages. The forage must be coarse enough to allow for optimum cellulose digestion in the rumen, and prevent the incidence of digestive disturbances. Qualities of all pelleted rations are

1. Prevents selective eating
2. It reduces weight of feed
3. Reduces dustiness
4. Reduces labour and equipment
5. Lessens storage space

Advantages of pelleted forage

1. Reduction in transportation cost
2. Reduces dustiness
3. Reduces labour
4. Reduces nutrient losses
5. Makes automatic feeding feasible
6. Effective utilization of low quality forage is ensured since preparation ensures complete consumption of the roughage

Pelleted Feeds

Grasses

Panicum maximum, Pennisetum purpureum, Andropogon gayanus, Cynodon dactylon.

Tree Legumes

Leucaena spp, Acacia spp, Sesbania spp, Ficus spp, Gliricidia spp, Gmelina spp,

Forage Legumes

Centrosema pubescens, Stylosanthes, Desmodium, Lablab, Alfafa, Trifolium, Tephrosia

Concentrates

Cottonseed cake, Wheat bran, Copra cake, Maize offal and bran, Groundnut cake, Rice bran, Soybean cake, Palm kernel cake

Agro-industrial by-products

Cassava peels, Yam peels, Cocoyam peels, Cocoa pod husk, Coffee pulp, Brewers spent grain (Dry brewers grain), Pito mash

GRAZING METHODS, USES AND PROBLEMS

Set Stocking:

This is the least complicated and least productive system of grazing control. The cows are given access to a given area of pasture at predetermined stocking rate. No part of the grazing area is reserved for conservation but the pasture may be topped (a device for stimulating regeneration) with a moving machine during the grazing season. Its greatest disadvantage is a tremendous waste of forage involved as a result of trampling and soiling. There is consequently no provision for dry season feeding

Strip Grazing:

This is a method involving a short term grazing of pasture followed by long period of rest of varying duration. A limited grazing area is allowed each day behind an electric fence. By this type of restriction of the grazing area, conservation of part of the pasture or hay or silage is possible. The stocking rate depends on the estimated daily dry matter requirement of the animals. This system ensures efficient pasture utilization with little selection and wastage.

Rotational Grazing:

The controls of worms and ticks are also greatly facilitated. In most cases, however, efficient operation of the system involves a carefully worked out plan of fertilization with nitrogen to ensure a quick recovery of the pasture after the cattle would have been removed. The choice between strip and rotational grazing is largely a matter of convenience. The greater flexibility of the former appeals to the stockman with grassland/pastureland that is permanent. What is vital is to appreciate that both systems require a high stocking rate to achieve increased milk output.

Rational Grazing:

This system is an elaboration of Rotational Grazing advocated by the French man Andre Voisin. The system attempts to vary the rest period between grazing according to the season of the year. During the season of maximum pasture growth a smaller number of total available paddocks are rotationally grazed at frequent intervals and the rest is used for hay and silage making. The number of paddocks available for grazing is increased as the pasture growth diminishes. For instance, using 40 cows on 40 acres, there may be eight 5-acre paddocks only 4 of which will be grazed in rotation initially, then 6 and finally 8. The extra paddocks, in the meantime, have been cut for silage and hay. Rotational Grazing is thus illustrated;

Grazing	PADDOCKS							
Grazing Period	1	2	3	4	5	6	7	8
1 st -20 th April	<.....Grazed.....>							
Rainy season starts about	5 days on each paddock							
March								
21 st April - 11 th May	<.....Grazed.....><cut for silage..>							
	5 days on each paddock							

12 th May – 5 th June	<.....Grazed 4 days on each paddock..><...cut for hay...>
6 th June – 30 th June	<....., " " " " ...>
1 st July – 1 st August	<.....Grazed 4 days on each paddock.....>
By this time (August) the pasture growth is already decreasing	
2 nd August - 3 rd September	<.....Grazed 4 days on each paddock.....>
4 th September 13 th October	<.....Grazed 5 days on each paddock.....>

Such a system [Rotational Grazing] allows a "rest" period inversely proportional to the rate of grass recovery. Note: The above is for Tropical condition.

Split-herd and Creep Grazing:

This is based on the concept that the physiological needs of different groups within a herd demand different grazing management to meet nutritional requirement since a herd usually consists of cows in early, -mid-, and late lactation, heifers being grazed with adult cows and so on.

[A] The method ensures that the high yielding cows are fed first by allowing rotational grazing at low intensity. They are known as "top grazers" and graze the better parts of the herbage. They are then followed by the low yielders or "bottom grazers" with less nutrient requirement. The sequence of the groups thus takes into consideration both the requirements of the animals and their account to which they turn the herbage i.e. the purpose to which they utilize the herbage.

The sequence may be as follows:

1. Dairy cows
2. Fattening cattle
3. Young rearing stock(intermediate between calves and adult)

OR

1. High quality cows
2. Ordinary Dairy Cattle (1-2 years old heifer)
3. Dry cows and heifers more than 2 years old, horses, sheep etc

[B]The system is also adopted in the creep grazing of calves and young lambs as a means of satisfying their nutritional needs and to control worm infestation. The younger animals graze ahead of their dam at low intensity while the dams are following at higher intensity.

[C.] The system is also used in the beef industry for fattening steers by allowing them to graze at intensity ahead of replacement heifers.

Zero Grazing (Soilage):

This is a long established system of grazing control. The practice is becoming increasingly popular as a result of intensification of grassland management and the improvement of machinery for harvesting fresh herbage.

The system is believed to achieve a reduction in herbage wastage caused by selective grazing and by trampling and fouling. The system involves yarding (confining) the herds all year round and cutting the

grass during the growing season for direct feeding of the animals. It is expensive in equipment but saves fencing and laying of water pipes to fields while enabling fields too distant or inaccessible for grazing to be utilized.

Production per acre is claimed to be 7-10% higher by better utilization of the grass. It is however difficult to make conclusive statement about zero grazing since results of study varies from place to place.

Zero grazing does not always result in an increase in milk production and may in fact, result in slight reduction in yield.

Results indicate that the extent of reduction in herbage wastage and extent of such increase in production/acre that may result is greatest when tall crops, such as elephant grass and Giant star grass are compared to shorter forage Spp. Any advantages from zero grazing would also depend on the intensity of the FREE GRAZING (The animals are left to harvest the herbage on their own) system with which it is composed. Some results have indicated that:

1. Yields/acre of energy in terms of TDN or milk production/acre has been reduced by zero grazing (grass cut and of energy in terms of TDN or the milk production/acre has reduced by zero grazing (grass cut and brought to the animals) can graze closer to the ground than is possible with machine harvesting.
2. On the other hand, it is difficult to strictly compare free grazed animals since differences in the quality of consumed herbage may result from the ability of the grazing animals to select their diet.
3. Animal's requirement for energy is also smaller under zero grazing while differences in the quality of herbage eaten are also bound to exist. Reduction in energy requirement is that due to movement in search of and harvesting of the feed.
4. It has also been indicated that the digestibility of free grazed herbage is 2 units higher than that of zero grazing, principally due to the selective effect of the grazing animal.
5. There is also experimental evidence to suggest that rumen activity is less and digested nutrients are efficiently metabolized under zero grazing when compared to free grazing. Considerable energy is however expended in grazing and the extent of such energy expenditure is dependent on the quality of the herbage.

Good quality herbage is grazed relatively faster and cost less in terms of energy expenditure than low quality herbage. In the final analysis, it appears that the efficiency of energy utilization is less in FAVOUR of grazing animals than those zero grazed.

Uses of Zero Grazing

1. It may be adopted if land is not abundant and stocking rate is higher (1/2 acre or less per cow).
2. To minimize wastage of herbage due to refusal of grass by cattle as a result of fouling with dung or urine.
3. Where fencing or water supply is poor.
4. Where most of the utilizable pasture is either inaccessible or too far from the dairy building and where expansion of adjacent pasture is limited by available space.

5. To effectively ration available grass to different groups of animals where there is shortage of grass.
6. It may be used where environmental conditions are unsuitable for grazing at certain times of the year e.g. when the grass is wet or the soil is muddy so as to avoid increased incidence of foot rot.

Problems of Zero Grazing

1. Efficient machine harvesting requires that grass be reasonably mature by which time a decrease would have occurred in the nutritive value of the grass. This thus, prevents the maximum utilization of pasture at optimum stage of growth and nutritive value.
2. Lack of storage facilities or inability to keep harvest in pace with needs sometimes results in staleness. Piling up of harvested grass also results in heating and spoilage. It is therefore desirable but difficult to ensure that only daily requirement should be harvested and this should be fed in as many installments as possible to increase or maximize intake.

ADVANTAGES OF ZERO GRAZING

- (a) It offers control over quantity and quality of grass fed
- (b) More farm space can be utilized for feeding
- (c) Allowance can be made for the requirement of different classes of animals.
- (d) It reduces fencing and water piping requirement for paddock
- (e) It saves time and labour required to graze animal to and from pasture especially where farm is very large

Disadvantages of Zero Grazing

1. There is need for increased machinery and labour for harvesting the grass
2. No flexibility with respect to public holiday's labour allocation
3. Increased labour is required to clear the yard and thus intensive handling of manure
4. Increased requirement for bedding materials since animals stay indoor all the time
5. Palatability of grass reduces rapidly after cutting and this may cause refusal and subsequent wastage

Zero grazing is becoming popular in Nigeria for the reasons that it serves:

- (a) A way out of the dangers of exposing imported cattle to solar radiation
- (b) A means of reducing the risk of diseases e.g. ticks, tsetse fly etc.

There, however, had been some problems in its efficient utilization. These include lack of machinery, and human and administrative problem e.g. overtime, public holidays etc

It is desirable especially for the exotic breeds of cattle in the afternoons. The economic aspects of its adoption have not been given serious investigation but it may be costly to operate on small and private farms. Generally speaking, rotation, strip and zero grazing are more practical and profitable on rotation

and supplemental pastures than on permanent pastures, more productive with high producing dairy cows and more beneficial where parasite infestations are heavy.

FACTORS AFFECTING BEEF QUALITY

Management

Animals kept under an intensive management system perform better than those left to roam about in beef quality as the energy used in roaming about to feed is conserved in the intensive system.

Age

Physiological age of the animal has a large impact on the meat quality of cow. Meat from younger animals is more tender than the meat from older animals. Meat from immature animals holds water between the muscles hence beef obtained from fully matured cattle is of higher quality compared to those slaughtered earlier than its maturity age. Bone and cartilage characteristics are used to determine the maturity of a carcass. Cartilage of young animal is much more than older animals which are converted to bone as the animal ages. The texture of meat from more mature cows is much coarser than the texture of meat from younger cows. However, increased darkening of meat is caused by ageing due to increased level of myoglobin.

Slaughtering Methods/Techniques

The slaughtering method practiced in tropical countries causes an incomplete bleeding and makes the remaining blood to splash on the meat. When blood is found on the meat, this shows that the meat is not a quality one as meat is predisposed to microbial contamination. This method also affects hide and skin of the animal.

Finishing

This refers to the amount, character and distribution of external, internal and intramuscular fat. For example, small amount of fat beneath the skin during dry cooking prevents beef from drying out. Therefore, too much fat on a carcass decreases the retail cut yield

Nutrition

If cow are not fed with quality feed, this affect their beef quality. Feeds are converted into meat. The quality and quantity of feed affect beef quality. High variability in feed supplies affects the weight gain of grazing animals causing poor quality meat. Lack of improvements in crop yields and the competition between human and animals as well as brewing industries for the available grains makes nutritional requirement at reasonable cost more difficult to achieve since a viable livestock industry is interdependent on agricultural products.

Disease factor

The beef industry is faced with insidious economic diseases such as mastitis, trypanosomiasis causing anaemia, emaciation, intermittent fever and poor condition, streptothricosis, endo- and ectoparasites

and some reproductive diseases leading to breeding inefficiency and infertility. A light helminth infection deprives calves of their vigour while a heavy burden results in marked reduction of weight gain, decreased feed efficiency and consequently poor condition or even death

Marketing

The marketing system in this part of the world is no organized. There is no market information to show trend of supply, demand, current prices and even customer's suggestion or complaints in beef bought. Nigerian consumers have not been known to request for a particular type of meat to change the given marketable products. There is also no standard for weighing or organized auction of live cattle or weighing of meat.

Firmness

This refers to firmness of the flank area or lean cut surface. Carcass with more fat is firmer than that of muscle. A small amount of fat is desirable for optimum meat quality. A small amount of fat beneath the skin during dry cooking prevents the meat from drying out. Although, firmness make no contribution to meat palatability, firm retail cut are more attractive because they hold their shape better. Firmness is also an important quality in cuts which will undergo extensive processing.

Sex

Small differences in palatability have been observed between the sexes such that beef from bulls can be more variable and this is often associated with the higher variability in ultimate pH. Quality can also be due to heifers/cows having lower eating quality than bulls.

Transportation

It is during transit that most death and tissue bruising occurs, muscle tissue shrinkage also occurs which causes reduction of weight and this affects meat quality.

Heredity

Tenderness in beef may be up to 60% heritable. Livestock producer can make improvement to quality by careful selection of breed and strain.

COST OF BEEF PRODUCTION

Profits in the beef cattle industry are determined by the total production and the prevailing market prices as well as the cost of production. Even when prices are favourable and production is high, attempts must be made of minimizing the cost factors or operational costs which are variable from place to place and also depend on managerial ability of the operator. Large amounts of capital are usually involved in the provision of land, buildings facilities, machinery and animals.

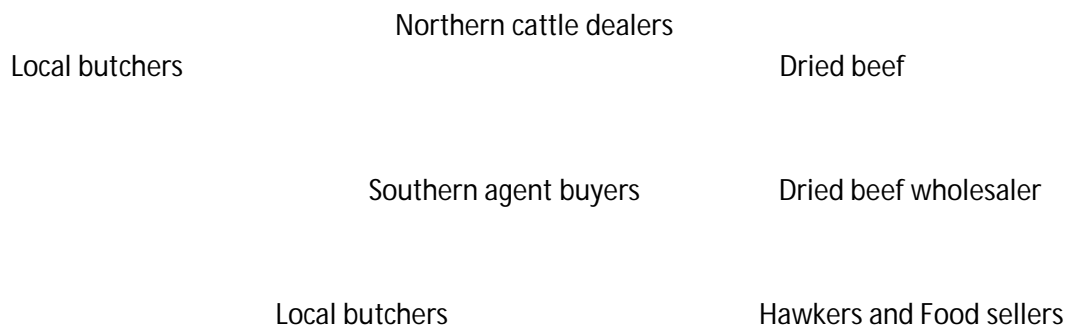
MARKETING AND CONSUMPTION OF BEEF

Even though the animal protein needs of the population could be supplied by poultry, swine, etc., almost half of Nigerian's meat supply is beef. Beef supply amounts to about 3.62kg /head/annum, compared with 1.78kg/head/annum of goat meat, 0.93kg of pork, 0.98kg of poultry and 0.78kg of mutton. It is estimated that approximately 10% of the Nigerian cattle population is slaughtered annually. The major cattle producing areas of West Africa stretch from Senegal to Chad, covering the boundaries between the coastal and the Northern States of Nigeria are part of the supply for the coastal areas.

The bulk of the beef consumed in the South comes from the North because of the limiting effect of trypanosomiasis on cattle production in the South, and for the fact that most of the cattle kept in the South are rarely used as a regular source of meat.

Fulani and Shuwa Herdsmen

Itinerant cattle buyers.....>Intermediate cattle buyers



CONSUMER

The diagram shows the scheme of the current marketing system from the producer to consumer. The actual ownership of trade change 6-8 times before final sales

The large and small towns and villages along or near cattle trade routes are well supplied with beef, as cattle unable to withstand the strain of a long trek are sold en route to avoid death losses. In places far from the trek routes slaughtering are at intervals depending on the purchasing power of the villagers. In large cities like Ibadan, Hausa cattle dealers buy through their agents in Northern Nigeria and arrange transport to the South. The cattle are sold to wholesale butchers who slaughter and sell to retail butchers and contractors supplying institutions. The retail butchers then sell in the local markets. Since refrigeration facilities are in most cases lacking, slaughtering must be adjusted to meet daily demands. Available slaughter facilities lack proper drainage and the standard of hygiene is generally low. The animals are slaughtered without proper rating and carcass transport media are inadequate.

With the help of USAID, the modern central Abattoir at Ibadan was opened in 1972. Similar facilities are planned for other big centres of population throughout the country.

In most places, beef is not sold by weight and prices paid for similar or same joints depend on the bargaining power of the consumer. An assessment shows a range of N700-N800 per kg for the best cuts. The offal usually command higher prices as most people value these parts.

SOCIAL AND ECOLOGICAL CONCERNS FOR BEEF PRODUCTION

Production of beef is worldwide in activity and in scope. The methods of production are as varied as the producers and their environments. World population of cattle is 1358 million (FAO,2004) while 76% of this population is from developing countries, Nigeria boasts of about 20million , this figure might not reveal the total production level since slaughtering activities and beef marketed through formal outlets are documented. The availability of beef tends to increase with the standard of living. In Africa, the wealthiest consume like others in developed countries while the poor deepen in their consumption. In Nigeria, beef production contributes substantially to the national economy. The industry offers employment to Nigerians; it is second only to arable farming in Nigerian agriculture as an income earner. Nigeria has high prospects of increasing her cattle population because there is a ready market for beef and she has not yet attained the FAO recommended requirement for animal protein consumption of 35g per day. Breeds adapted to the environment are trypanotolerant, also vast grassland is available, and moreover, there are no tribal, religious or social taboos to beef consumption or leather goods. However despite all these prospects, the industry is beset with myriads of problems and challenges that can be broadly classified into three: 1) Controllable. 2) Uncontrollable. and 3) Genetic.

SYSTEMS OF PRODUCTION

Extensive System

This is the easiest and most unspecialized system of cattle production and can also be termed as the traditional system of production. Cattle production is therefore based purely on this system especially in the tropics. The animals are produced solely on ranges, the young calves are left with their dams to suckle, and they are thereafter maintained on pasture. The seasonality of rainfall and forage production invariably results in considerable nutritional stress of the animals. This restricted period of forage production occasioned by abundance of forage during the rainy season and followed by period of relatively rapid deterioration and long period of stagnation. In some areas, the climate is so unfavourable that the land is infertile, therefore the animal will starve. In both cases, the period of plenty is too short to allow young stocks to complete sufficient growth to carry them to the condition where they may be profitably sold for meat.

During the unfavourable period, the animal subsist on diets that are barely sufficient for the maintenance of essential metabolic processes and have to draw on their body reserves for much needed energy. This not only results in an appreciable loss in body weight. The weight gained during the rainy season is lost during the dry season, this vicious cycle makes it difficult for the animal to reach market weight until they are 4-6 years of age.

Advantage of Extensive System

It is the cheapest form of livestock husbandry and does not involve investments like buildings, feeds and other sophisticated management practices

Disadvantages

It is considered wasteful in terms of land and can only be successful and economical where land is not use for crop production. Also, the seasonality of forage and water supply results in such fluctuations and irregularity in the growth pattern such that the genetic potential of the animal is not fully expressed. Slow growth rate therefore prolongs the period from birth to slaughter.

Semi Intensive System

This system consists essentially of partial rearing of animals on pasture and supplemental feed. The management practices adopted largely depends on the time of the year in which the calves are born. In Nigeria, the semi intensive system is used on the government and corporations owned estates and ranches. The animals are either produced or reared from birth or bought as store cattle and then fattened to slaughter.

Intensive System

This system involves confinement of animal .Feed and water is provided adequate nutrients are provided to satisfy requirement for efficient feed conversion and growth. Intensive beef production can be broadly classified into:

Veal production: This is from calf fed from birth to slaughter weight on high quality milk /feed while the
Baby beef production: This is based on pure beef breeds. In the case of using pure beef breed, the calf after weaning, is intensively fed with the aim of attaining slaughter weight faster. It also involves the fattening or finishing up of other animals which might have been earlier reared extensively on pastures. Such operation vary all the way from small mostly hand labour, barn yard enterprises, utilizing home grown feeds and obtaining manure to large and highly mechanized year round business, that grow little or more of the feed that is utilized. The intensive system is generally common in areas of close proximity to grain production.

Advantages of Intensive System

1. Mechanization of farm operations is possible.
2. Growth is controlled and uniform, maturity is rapid.
3. Proper records can be kept and economic evaluation of the enterprise is possible.

Disadvantages

1. It is capital intensive
2. The chances of disease spread is high

MEAT HANDLING

Pre-Slaughter Handling and Stunning of Cattle

There is an increasing demand for animals to be reared, handled, transported and slaughtered using humane practices all over the world. In the developed countries, animal handlers practice good husbandry, having a caring attitude towards the animals and their welfare. In Nigeria, the contrary obtains.

Getting animals from farm to abattoir forms the first link in the chain of meat production and one which is both important and to some degree contentious. It is important because it can influence carcass and lean meat quality and contentious because the process of handling and transportation provide many opportunities for the animal welfare to be compromised.

Appropriate handling of cattle can result in improved productivity of live animal, in higher quality of slaughter livestock, carcasses and cuts and in greater profitability in the production. Stress in its many forms e.g. deprivation of water or food, rough handling, exhaustion due to transporting over long distances, mixing of animals reared separately resulting in fighting is unacceptable and should be avoided because of its deleterious effects on meat quality. However in Nigeria, animals trek over long distances without food and water and when transported in trailers, they are overcrowded. The most serious consequences of stress is death which is usually due to poorly ventilated overcrowded trucks.

Animals should be transported early in the morning or late at night during hot weather. From the loading on the farm, to the stunning pen, animals must be treated kindly and the Lorries, lairages and equipment for livestock handling must be designed to facilitate humane treatment. Stress immediately prior to slaughter (fighting or rough handling in the lairage) causes stored glycogen (sugar) to be released into the blood stream. After slaughter this is broken down in the muscles producing lactic acid. This high level of acidity causes a partial breakdown of the muscle structure causing meat to be pale. Long term stress before slaughter such as a prolonged period of fighting during transport and or lairage leads to exhaustion. The sugars are used up so that less is available to be broken down and less lactic acid is produced. The reduced acidity leads to an abnormal muscle condition known as dark cutting in beef. Such meat has a high pH and spoils quickly.

During transport and lairage, an electric goad should be used to encourage movement rather than a stick or tail twisting, not only to avoid stress but also to prevent carcass bruising. To avoid fighting animals not reared together must not be mixed during transport and lairage. Load and unload using shallow stepped ramps to avoid stumbles. Trucks should neither be over nor under loaded. Overloading causes stress and bruising due to crushing. Under loading results in animals being thrown around and falling more than necessary. Drivers should not approach corners at excessive speed. Plenty of water should be available.

Fasting before slaughter reduces the volume of gut content and hence bacteria and therefore reduces the risk of contamination of carcass during dressing. It is usually sufficient for animals to receive their last feed on the day before slaughter.

Steps Involved in beef slaughtering in Nigeria

Lairage= resting of animals before slaughtering

Ante- mortem inspection= inspecting the animals for any disease

Reject diseased animal for destruction

Stunning

Hoisting= holding the animal upside down for easy drain of blood

Sticking= killing the animal by cutting the jugular vein

Bleeding= Allowing the blood to drain and collection of blood

Flaying= Removal of skin

Opening= Partial skinning of the abdomen

Evisceration= Removal of all the thoracic and abdominal visceral organ

Splitting= Cutting the animal into two longitudinally

Post mortem inspection

Washing

Chilling

HEALTH AND DISEASE MANAGEMENT

Health Problems Associated with Pasture and Range Feeding

A disease is any process which disrupts an animal's normal function. There are different types of diseases and there are different routes to which these diseases are transmitted. Some are transmitted through

- 1) Ingestion
- 2) Inhalation
- 3) The skin
- 4) Infection from fomites (fomites are objects which can convey infectious organisms e.g. beddings, vehicles, harnesses etc).

Some important diseases of animals arise as a consequence of their environment or the way they are managed by their owners. These include infectious diseases, metabolic disturbances, nutritional deficiencies and imbalances poisons and others.

Poisons

Diseases caused by poison are amongst the most troublesome to diagnose because of the difficulty to detect and identify the poison. Poisoning can be divided into two biological toxins and non- biological toxins.

Plant poison: There are numerous plants in pastures that are poisonous to livestock. The poison of these plants are mostly secondary compounds not involved in plants basic metabolism and they often have a

bitter taste e.g. alkaloids and cardiac glycosides which makes them unpalatable. Grazing animals usually ignore poisonous plants but may be forced to overcome their aversion to eat them under certain circumstances such as:

1. Drought
2. Overstocking
3. Prolonged dry season
4. Range fires
5. Unfamiliar grazing
6. Condition of the livestock

Diarrhoea

Diarrhoea occurs in many diseases and is not itself a specific disease. Diarrhoea is often a major problem and is usually caused by a few specific micro-organisms, either singly or in combination. Neonatal diarrhoea (diarrhoea in young domestic animals) for example can be caused by bacteria, viruses and protozoa. It can also be caused due to gastro-enteritis. Helminths of the stomach and intestines can cause varying degrees of inflammation to the lining of the stomach and intestine resulting in diarrhoea leading to an additional loss of nutrients which pass too quickly to be digested. Roundworms are particularly important in this respect.

As a result of excessive fluid retained in the intestine, this fluid is passed out in the faeces which are watery and passed frequently as a result ie diarrhoea. If the organisms cause haemorrhage in the intestines, then the diarrhoea may be stained with blood i.e. dysentery. In diarrhoeic animals, if fluid lost into the intestines exceeds fluids taken in by drinking, the kidneys attempt to compensate by concentrating the urine which is reduced in output. If this fails, dehydration (which is the reduction in the body tissue fluid and the blood thickening) occurs. It is generally accompanied by weakness, loss of appetite and low body temperature.

Diarrhoeic animals should be isolated from others. Electrolyte solution should be administered as a drench to replace lost fluid. Pens, yards, stalls should be cleaned out to prevent faecal contamination of beddings etc. Overcrowding should be avoided.

Bloat

Bloat is the distension of the rumen with gas. The left side of the abdomen behind the ribs becomes swollen. In some cases, Animals are distressed and have difficulty in breathing and may die if untreated.

There are two types of bloats

Frothy bloat and Gassy Bloat

Other aspects to be discussed are a) Helminths b) Snake bite