Raising Healthy Cattle Under Primitive Conditions

By: James Carlson, D.V.M.

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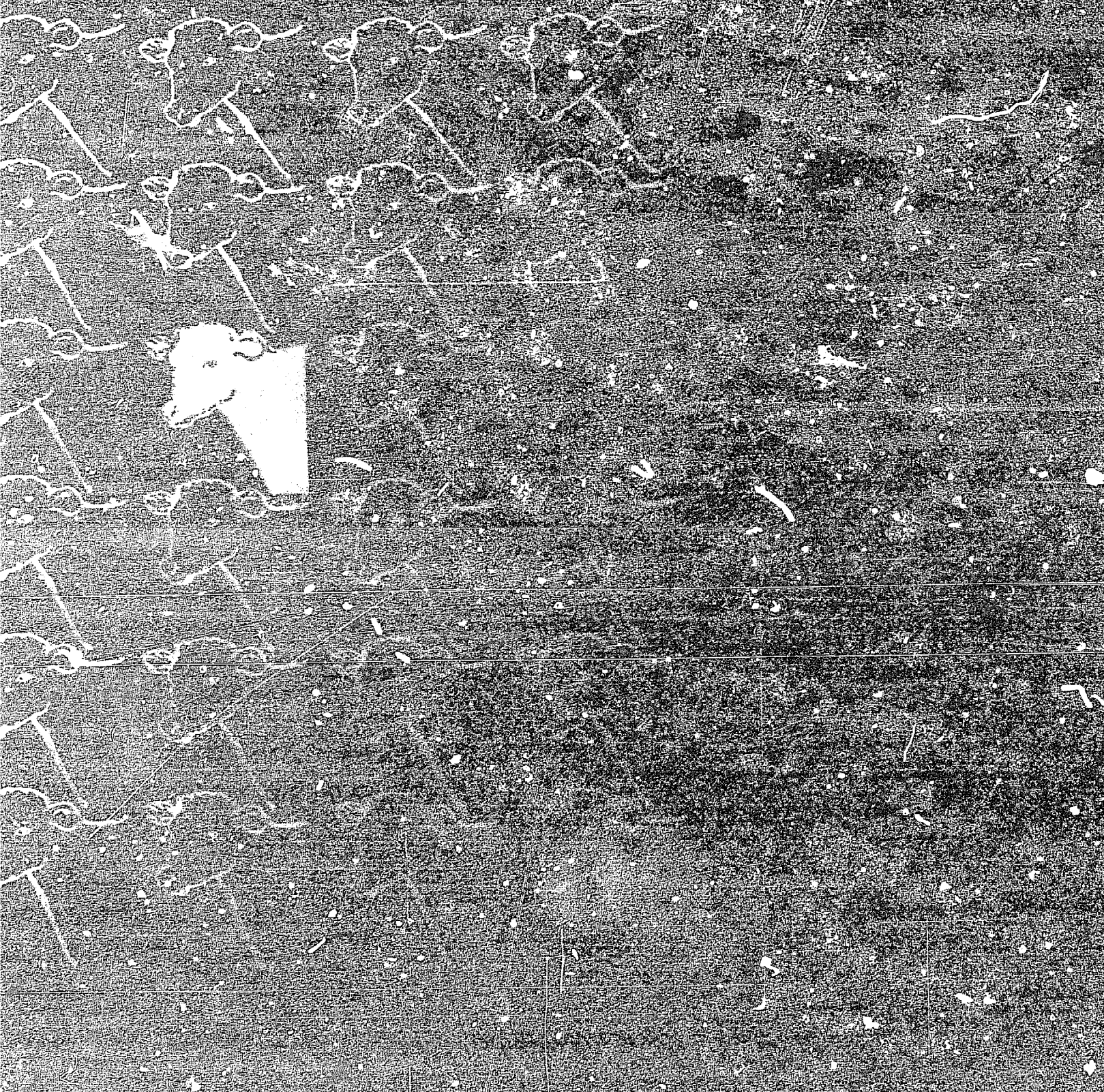

Raising Healthy Cattle Under Primitive Conditions

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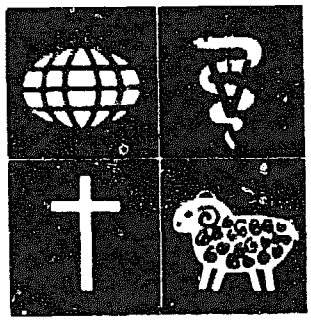
JAMES CARLSON, D.V.M.



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CHRISTIAN VETERINARY MISSIONS

Christian Veterinary Missions, publisher of this book, is an international organization of Christian Veterinarians with headquarters in the USA. It is affiliated with World Concern. Its members are dedicated to helping their fellowman by sharing of themselves and their experience and expertise with others.

THIS IS AN EXPERIMENTAL FIRST EDITION

It can be improved with your help. If you are a veterinarian, veterinary technician, animal husbandry worker, missionary, development worker or anyone with ideas or suggestions for ways this booklet could be changed to better meet the needs of your people, please write to the authors at Christian Veterinary Mission., 19303 FreMont Ave. N., Seattle, WA 98133

Thank you for your help.

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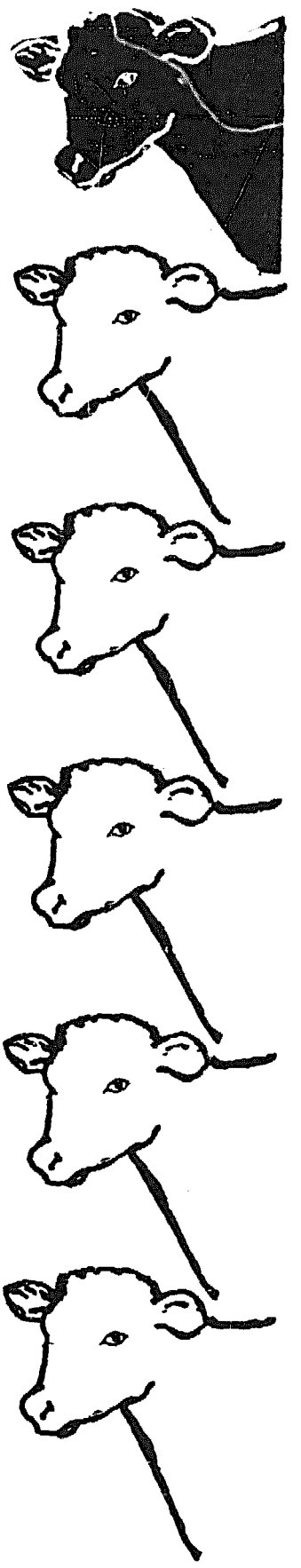
Introduction



BACKGROUND

This booklet was provided by Christian Veterinary Missions to provide basic information concerning beef cattle for missionaries, small farmers, and agricultural workers. Topics discussed are Facilities and Handling, Nutrition, Management, Diseases and Poisonings. There also is a section in the back which gives instructions on consulting by mail where more information is needed or a specific problem exists.

The author has practiced Veterinary Medicine in a rural community for fifteen years. In addition, he has done veterinary and nutritional consultation work. Currently he is involved in a livestock and farming enterprise with his family. He has made several short-term missionary tours to Haiti.

Because this is an experimental first edition, it can be improved with your help: **Any suggestions concerning changes or improvements for future editions are welcome and appreciated.** Please send your comments to Christian Veterinary Missions.

INTRODUCTION

Beef cattle play an important role in the life of small farmers in developing countries. They are an important source of nutrition providing useable protein and also in combating problems such as iron deficiency anemia. Because of the unique ruminant digestive system, beef cattle can utilize forage and marginal grazing systems to provide useable protein, carbohydrates, minerals and vitamins for man. These feedstuffs would not otherwise be used. They also provide farm power for traction and transportation. In addition to numerous by-products such as leather, the manure is an excellent source of fertilizer and fuel for cooking.

In many countries beef cattle serve as a savings account for schooling, marriages, religious activities, etc. The loss of one cow could equal the loss of an entire families' income for one year. Therefore, proper management and disease prevention and control are directly linked to the farmer's livelihood and well-being.

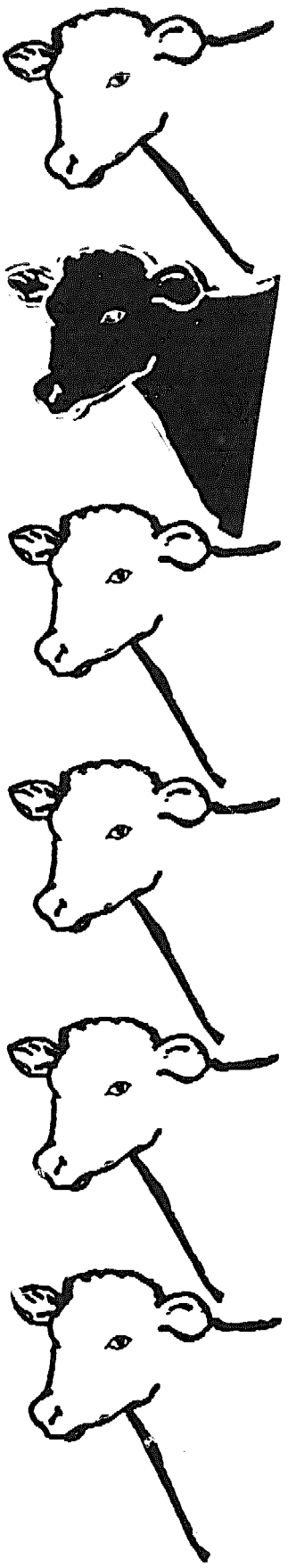
Projections indicate that by the year 2000 the world will need 80 percent more beef than in 1970.

Developing countries are expected to increase their numbers of cattle by 41 percent and their output of meat by 90 percent to keep up with population demands. These increases will require a substantial improvement in the management of their beef herds.

This book is intended to assist in an understandable manner the small farmer, missionary, or agricultural worker who applies proper management and disease control techniques for beef cattle. It is not intended to replace the services of a veterinarian if available.

Section 2

FACILITIES AND HANDLING

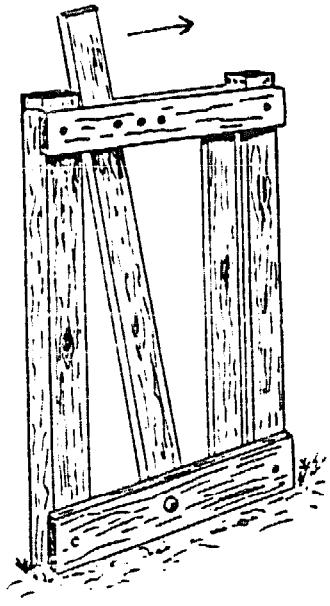


Restraint

In the handling of beef cattle it is important to keep in mind the large size of these animals and the potential for human injury. Cows and bulls can pose special problems in this area. Always remember cattle can kick to the side as well as behind their body.

There is also the risk of injuring the animal with improper restraint measures. Some reasons for restraint involve the following: dehorning, castration, branding, treatment of wounds, treatment for infection, treatment of foot problems, calving difficulties, blood sampling, etc.

Whenever cattle are to be handled while standing, the easiest and best solution is to have a crush or chute. The width of the crush should be 70 cm with height of 150 cm.

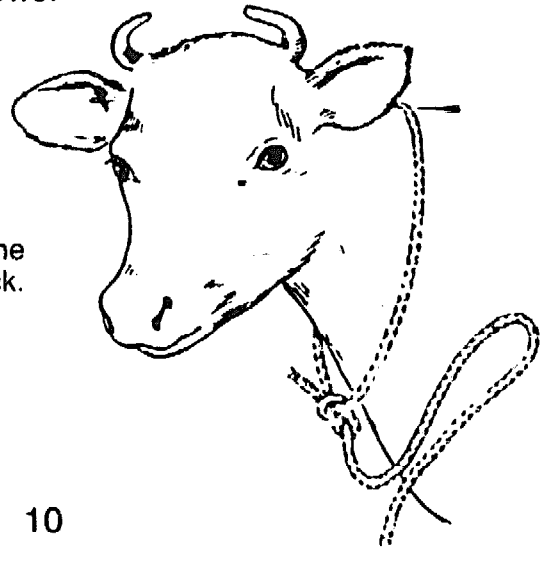


Close-up of simple Head catch. The middle board is pulled closed and a pin inserted into the hole.

One important thing to bear in mind with a crush or chute is: If there is any obstruction beneath the animal's neck (and if it would lie down) this will cause the air supply to be shut off and the animals will suffocate in a matter of seconds. Thus if the animal should lie down in the headgate, the head catch should be released immediately and the animal removed from the chute.

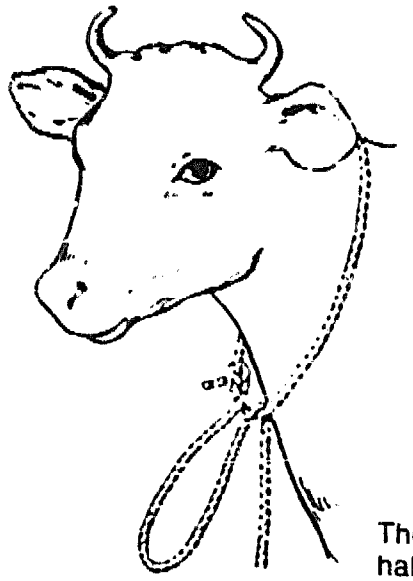
If a crush or chute is not available, the animal will have to be restrained with a rope tied to an immovable object such as a tree or post. A halter can be made from a rope as follows:

Cow

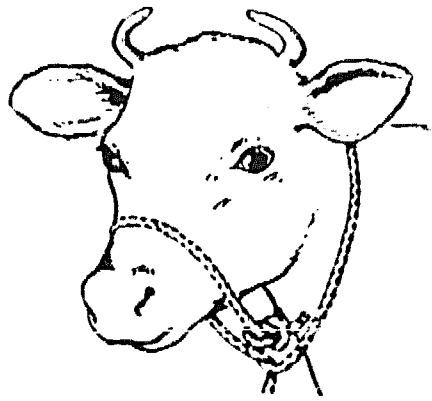


TEMPORARY ROPE HALTER

A rope loop fastened with a bowline knot is placed around the cow's neck.



A bight in the standing part passed through the loop and over the nose.



The nose piece should be pulled tight when the halter is in use.

Fig. # 2 (FAO Manual—1983)

One should never place a rope around the neck and tighten it up tight as the animal will suffocate from lack of oxygen. The rope could also be placed around the horns of the animal. A nose lead as illustrated below is also a very efficient means of restraint.

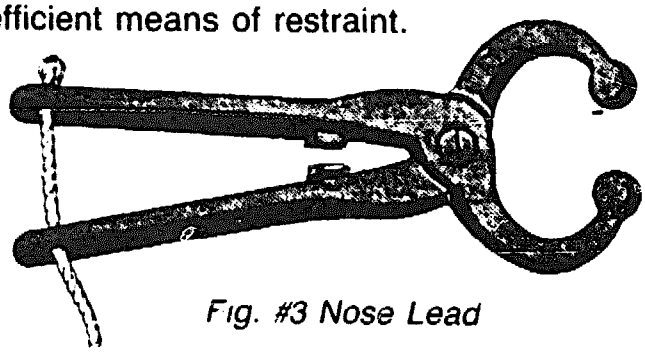


Fig. #3 Nose Lead

If a nose lead is not available, one may grasp firmly the bridge of the nose with the thumb and forefinger.

A tail restraint is also a very effective method to direct the animal's attention away from another part of its body i.e. castrating, treating udder, etc. One should stand to the side of the cow to avoid being kicked.

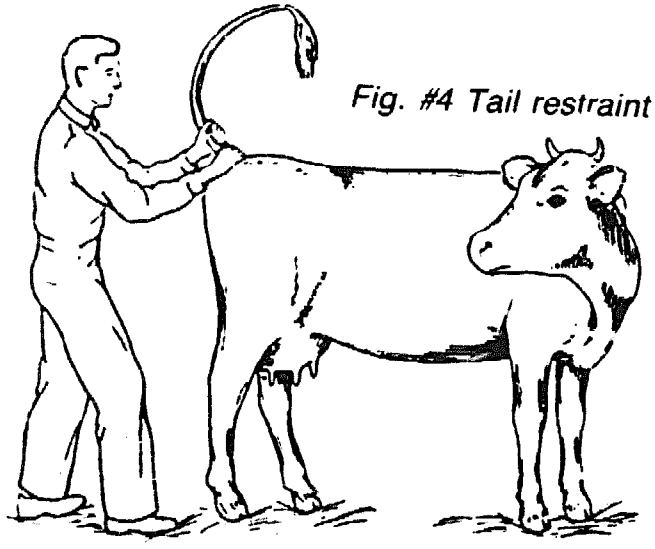
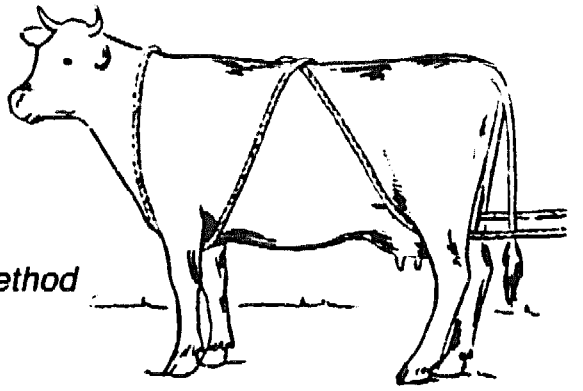


Fig. #4 Tail restraint

Casting—This involves laying the cow down and securing with ropes. Reasons for casting a cow or bull might be for surgery, examination and treatment of the feet and legs, wound treatment, etc. There are two methods that can be employed:

Casting—Burley Method-Find a soft area or bedding to lay the animal down. Secure the cow with a good halter and position a 40-foot piece of rope as shown in the diagram with the center over the top of the shoulders.



Casting

Fig. #5 Cow with Burley Method

When the ends of the rope are pulled, the cow will lie down. Flex the back legs and make a half hitch around the fetlock and several figure 8's between fetlock and hock. The front legs can be secured with another rope.

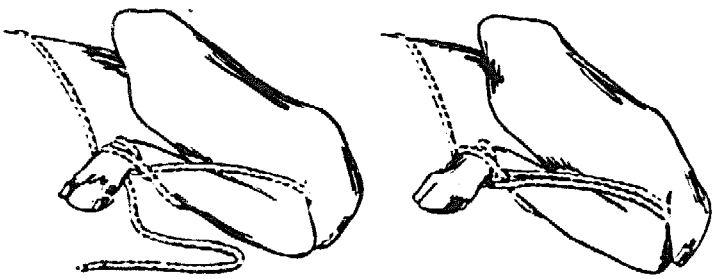


Fig. #6 Securing the legs

Casting—Rope Squeeze Method

Secure the cow with a good halter and make a loop around the cow's neck or horn using a bowline knot which will not slip. Continue placing the rope around the animal as shown in the picture.

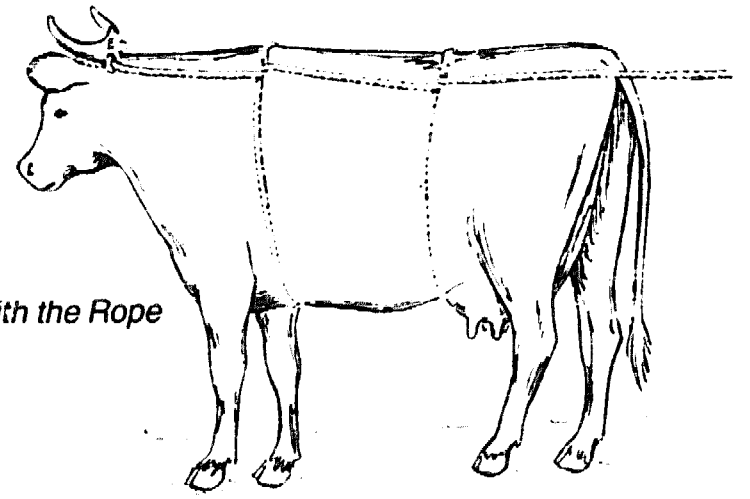


Fig. #7 Casting cow with the Rope Squeeze Method.

Pulling the rope will force the cow to lie down. Then the legs can be tied to each other with ropes or stretched outward to immovable objects. Care should be taken if the rope is placed around the animal's neck so it is not too tight for proper breathing.

Local anesthetics such as lidocaine can also be used for surgical procedures and relief of pain. General anesthetics and tranquilizers can be used in the place of or in combination with ropes for casting.

Feeding Equipment

Other equipment needed for handling beef cattle would be a feeder for hay and a feeder for grain and mineral. If hay or grain is to be fed, it should be in a feeder. This eliminates waste of feed and also helps so internal parasites are not spread as readily.

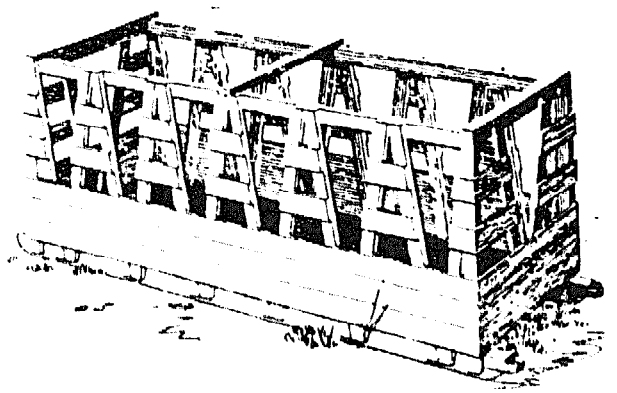


Fig. #8 Hay Feeder (Colo. State University Bulletin #469)

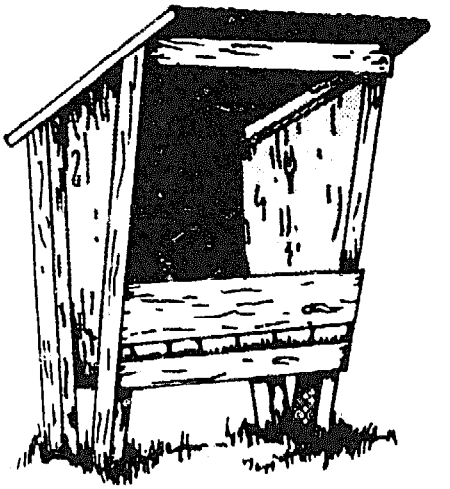


Fig. #9 Mineral feeder (Colo. State Univ. Bulletin #469)

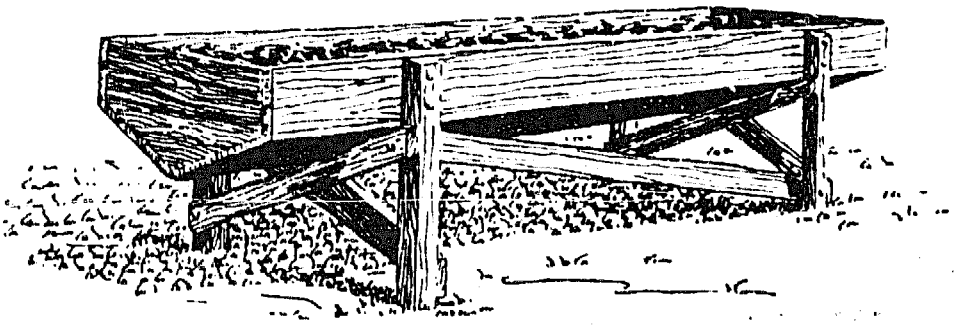


Fig. #10 Feed Bunk (Colo. State Univ. Bulletin #469)

Section 3

Digestion and Nutrition

What Makes Animals Function

Animals eat, move about, reproduce, and gain weight because of the various organ systems in the body. Organs are well defined parts of the body which perform particular functions. These organs may be divided into Skeletal, Muscular, Digestive, Respiratory, Circulatory, Lymphatic, and Urogenital systems.

Skeletal System

This system contains bones and supporting structures for the body.

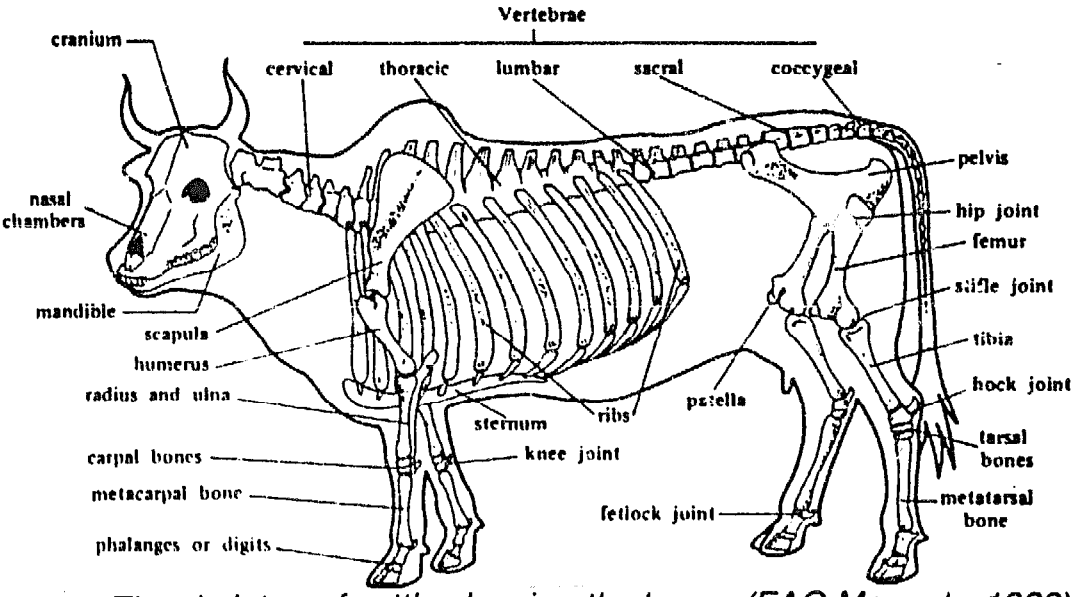


Fig. #11 The skeleton of cattle showing the bones (FAO Manual—1983)

Muscular System

This system contains all of the separate muscles which cause movement. These muscles cover the skeleton and are of great economic importance in meat-producing animals.

Digestive System

This system runs from the mouth to the rectum and includes the liver and pancreas. It converts the food into a useable form and excretes the unuseable remains. This system will be studied more closely in the next section.

THE INTERNAL ORGANS OF THE COW (Right side)

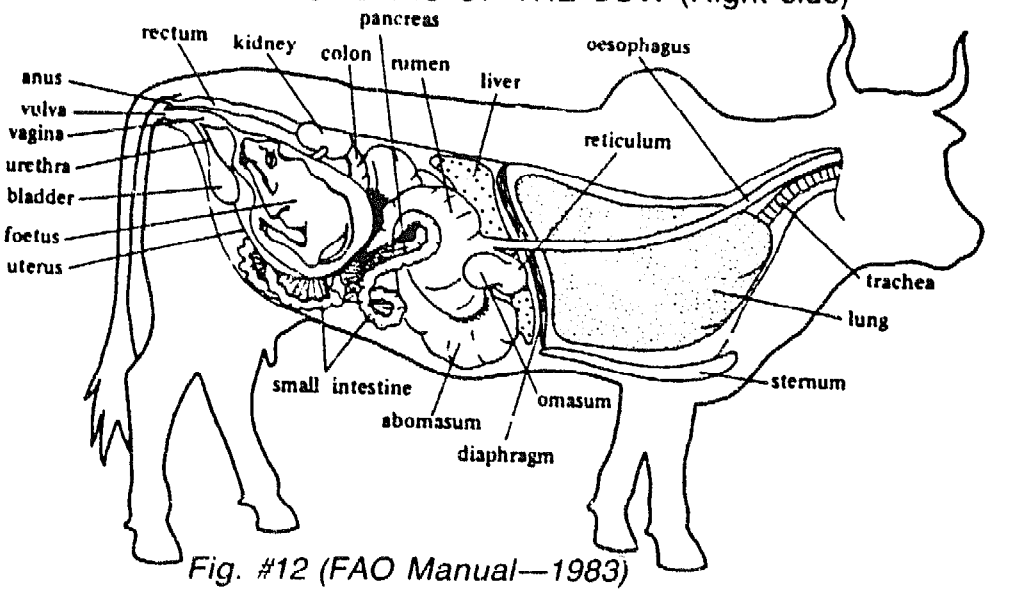


Fig. #12 (FAO Manual—1983)

THE INTERNAL ORGANS OF THE COW (Left side)

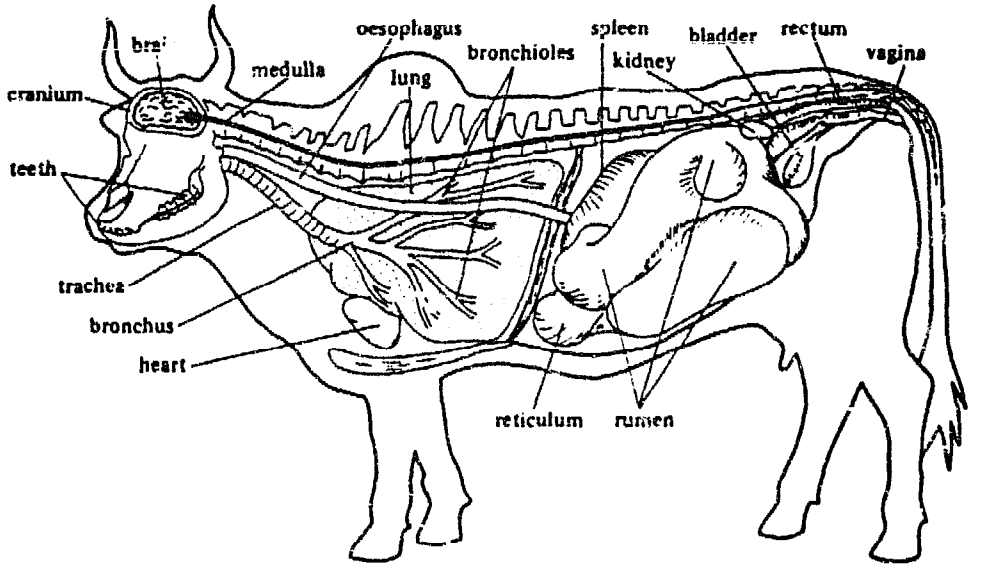


Fig. #13 (FAO Manual—1983)

Respiratory System:

This system consists of the nasal passages, trachea, and the lungs. The nasal passages and trachea take in the air and oxygen needed for the body functions. The oxygen is absorbed into the blood in the lungs and the carbon dioxide is exhaled.

Circulatory System

This organ system is made up of the heart, arteries, and veins. The heart pumps blood to all parts of the body. Arteries carry blood from the heart, and veins bring the blood back to the heart.

CIRCULATION AND BLOOD VESSELS

Arteries carry blood FROM the heart. Veins carry blood TO the heart.

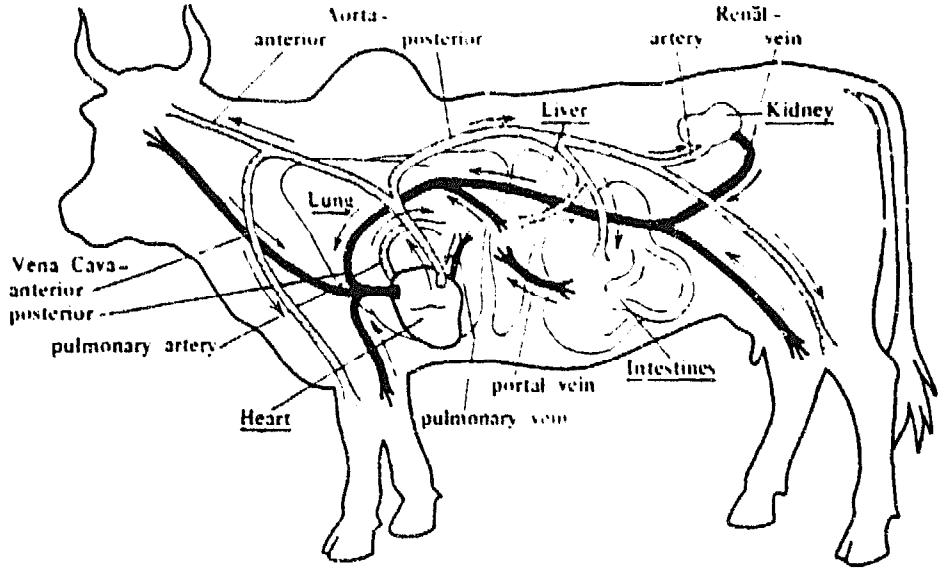


Fig. #14 (FAO Manual—1983)

The blood in its passage around the body picks up oxygen from the air in the lungs and nutrients from food in the intestines. The blood then transports nutrients and oxygen to the cells throughout the body. It brings back to the lungs carbon dioxide formed in the tissues. Waste materials formed during body processes or metabolism are carried to the liver for processing and to the kidneys for filtration and excretion in the urine.

The blood is made up of red blood cells, white blood cells and plasma. The red blood cells contain hemoglobin and carry oxygen throughout the body. They are formed in the bone marrow. The white blood cells help protect the body against disease by engulfing and ingesting micro-organisms. These cells are mainly formed in the lymph nodes. The plasma contains the other cells in the blood and contains over one half of the volume. Other functions which the blood provides is the regulation of body temperature and transportation of hormones from the glands to various organs.

Lymphatic System

This system is actually part of the circulatory system and acts as the middleman between the blood and tissues in feeding the body. The vessels of this system collect the lymph (colorless fluid from plasma) through the vessel walls and pass it back to the veins through the lymph nodes which filter bacteria.

The Nervous System

The nervous system is responsible for coordination and control of all the activities of the body. This system is made up of the brain, spinal cord, and nerves which are distributed throughout the body.

Urogenital System

The urinary system consists of the kidneys, bladder, urethra (urinary tube). The kidneys filter the blood separating out wastes and concentrating the urine. The male and female genital organs are discussed in a later section.

Ruminant Digestion

Ruminants are defined as cloven-footed, cud-chewing mammals with multi-compartment stomachs. Ruminants such as cattle are unique since they have a special digestive system for tearing down the complex carbohydrates and proteins in plant materials. They convert low quality, high fiber feedstuffs to meat and milk, rich in proteins, minerals and vitamins. The primary part of this digestive system is the large fermentation vat called the rumen. This is what makes ruminant digestion different from other animals.

The first problem in digesting feedstuffs is to reduce the particle size. This is accomplished initially by the cow chewing her feed enough to swallow it. Once in the rumen, the feed is thoroughly saturated with rumen fluids which soften the plant materials and start to break them down. The more resistant plant materials are sent back to the mouth to be rechewed during the cud-chewing or ruminating process. This is a longer and more thorough chewing than the initial one during the eating stage.

The next phase is the process of fermentation and the rumen provides the ideal conditions for this process. The rumen is maintained at

a desirable temperature, flooded with water and saliva, populated by millions of bacteria and protozoa, and constantly mixed by contractions of the rumen muscles. The micro-organisms attack the small particles of feed and use them for their own growth or convert them into soluble forms which can be absorbed through the rumen wall into the blood stream. The semi-solid food continues through the reticulum, omasum, abomasum (true stomach), and the small intestine where micro-organisms and glandular secretions breakdown proteins, carbohydrates, and fats into simpler substances which can be absorbed through the stomach and intestinal walls. Digestion continues in the small intestine and the first part of the large intestine. What is left of the food then passes through the cecum, colon, and rectum where it is excreted.

STOMACH OF THE RUMINANT (from right side) SHOWING DIRECTION OF FLOW OF FOOD.

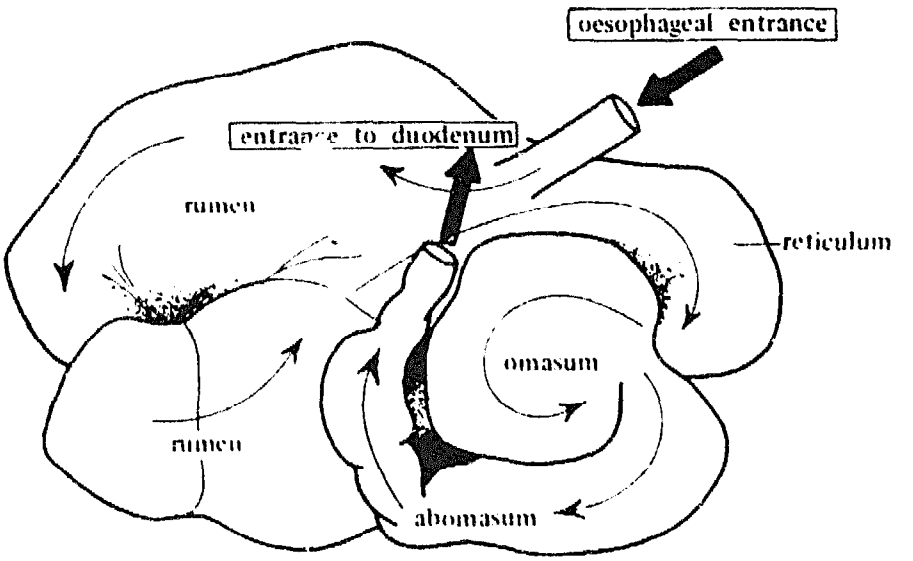


Fig. #15 (FAO Manual—1983)

Because ruminants can subsist on roughage (grass, bowse, legumes, hay, and straw) they do not normally compete with people for food.

Feed Nutrients

Nutrients are substances needed in the feed of animals. The elements of nutrition are:

1) water
2) energy (carbohydrates and fats)
3) protein
4) minerals
5) vitamins

ENERGY

The fuel that keeps the body functioning, warm, and able to move about.

PROTEIN

The building materials used by the body.

MINERALS

CALCIUM PHOSPHORUS

Make up large part of teeth and bones and a small but important part of the body tissue. Help in regulating body functions.

WATER

Over half of the body composition. Aids in carrying out and regulating body processes.

Fig. #16

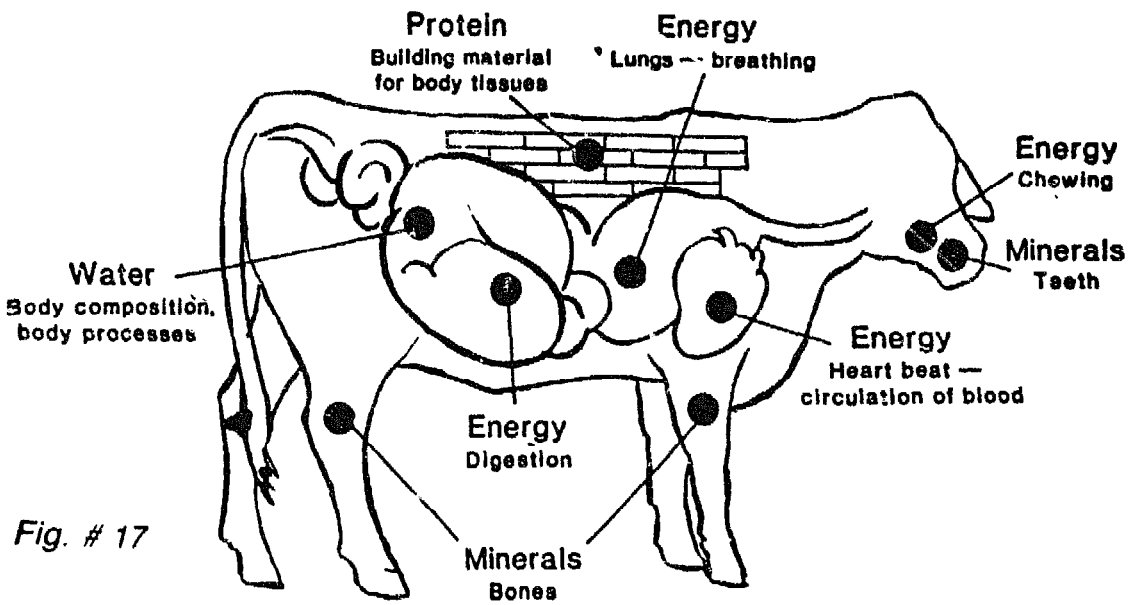


Fig. # 17

Water

This essential nutrient makes up over one half of the body composition. Water is essential for carrying out and regulating body processes. Feed intake of cattle is related to water intake. In other words, if the intake of water is hindered, the feed intake will also decrease. Under average conditions animals should consume:

1-1.5 gal. water/100 lb. body weight/day

or

4-6 liters water/50 kg. body weight/day

Water consumption depends on air temperature, humidity, feed source, body size, activity of animal, and quality of water. Sources of water

are the water consumed and also from the water in feeds. Young plants may contain up to 90% water and mature plants may contain 10% water. Animals which are not supplied with enough water eat less feed, their blood thickens, their performance and productivity suffer, and they gradually die from dehydration. Zebu cattle require less water than European cattle. Cattle should be allowed to drink at least two times per day.

Estimated Daily Water Needs of Cattle

Species	Weight (kg)	Condition	Approximate daily water needs (liters)
Cattle	50	Growing	5 to 6
	100	Growing	8 to 9
	150	Growing	12 to 14
	200	Growing	17 to 19
	300	Growing	23 to 25
	450	Fattening	30 to 34
	450	Pregnant	30 to 38
	550	Lactating	38 to 50
	500	Grazing	20 to 30

Energy

Energy gives the body power, similar to fuel in an engine. This power may be used to move the animal, to keep it warm, and to aid in the processes of growth, reproduction, and breathing. Cattle get their energy from the feed they consume—milk, grass, hay, grains, etc. Energy is divided into classes—carbohydrate and fat.

Carbohydrates consist of fiber, starches, or sugars. These substances provide heat and energy for the bodily functions. When excess carbohydrate is taken in, it is stored as fat by the animal.

Fats can be in the form of plant fats such as soybean oil or peanut oil and animal fats such as talow. Fats provide more energy than carbohydrates. Fat occurring within the animal provide insulation and a protective covering of the internal organs.

Protein

Protein is used by the body to make muscles (meat), to make milk, and to make repairs of worn-out or damaged tissues. Thus, a growing calf needs a lot of protein because it is building new muscles. A mother cow must get enough protein so she can produce milk for her calf. The protein is provided by the feed sources—grazing and hay. If the sources do not provide enough protein, a supplement will have to be added. Small calves get most of their protein from milk. If excess protein is fed, it will be used for energy.

Crude Protein is a measurement of protein content of feeds and is derived by multiplying the per cent nitrogen times 6.25.

Crude Protein = % N x 6.25

Because of the rumen fermentation, cattle can take lower quality protein such as that found in roughage and convert it into higher quality useable protein. They can also use non-protein nitrogen such as urea. This product, however, requires energy such as that found in grains for it to be utilitzed. Urea should never be used without a high energy source such as grains, or it can be toxic.

Minerals

Minerals are used to make bones, teeth, muscles and blood. They are necessary in some chemical reactions that take place in the body. Most of the mineral source comes from plant materials. However, often a deficiency will exist of one or more minerals and a mineral supplement will have to be fed. Calcium and phosphorus are necessary for bone formation and should be given in a ration of 1-2 parts calcium to 1 part phosphorous. Bone meal and dicalcium phosphate are excellent sources of calcium and phosphorous. Limestone provides calcium but not phosphorous. These sources are often mixed with salt 50 - 50. Trace minerals of zinc, copper, molybdenum, potassium, selenium, etc. are deficient in certain areas and may need to be supplemented. (See mineral supplement page 31.)

Vitamins

Vitamins have many different functions includiing being necessary to allow cattle to make proper use of other feeds they eat. Baby calves get vitamins from their mother's milk. As cattle grow older their stomachs develop and many of the vitamins are produced right in the stomach. Green forages provide vitamin A and vitamin E; whereas, sunlight provides a form of vitamin D. If these and other vitamin requirements are not adequate, then they must be supplemented in the feed or by injection.

For best results in beef cattle production, it is helpful to add supplemental protein, energy, and minerals to the animals' diet. However, if it is not feasible economically to add protein or energy, one should still add supplemental minerals.

Formulating Diets

Feeding livestock to achieve maximum production at minimal cost is the goal of all beef cattle producers. Properly fed animals are also much healthier and able to resist disease. These production levels are achieved when an appropriate amount and balance of calories, protein, minerals, and vitamins are fed. The amount and quality of the feedstuffs consumed affects animal performance.

Nutritional factors that are major concerns in cattle rations are water, dry matter (D.M.), energy (T.D.N. or N.E.), protein (C.P.), calcium (Ca), phosphorous (P), and vitamin A. These nutrients are most likely to be critical under most conditions.

The term **dry matter** (D.M.) describes the amount of feed an animal eats in one day with all water removed. A certain amount of D.M. is essen-

tial to satisfy an animal's appetite and promote rumen functioning. A cow will need to consume more of a very succulent or wet feed as compared to a dried one in order to take in the same amount of dry matter.

Energy in a ration is the most important factor limiting production. All feeding standards and ration formulations are based on some measure of energy. It accounts for the highest proportion of expense compared to other nutrients because of the quantities needed. Energy is expressed in calories, kilocalories (Kcal), or megacalories (Mcal). Energy value of feeds, Metabolizable Energy (M.E.) may be described as Net Energy (N.E.) or Total Digestible Nutrients (T.D.N.). N.E. is the most precise and reliable measure of energy that is converted to animal tissue. T.D.N. is an older method of calculating energy and is not quiet as accurate as N.E.

Feed Intake

In order to properly formulate rations one must be able to estimate what the feed intake should be. One factor which affects feed intake is the body weight of the animals. Most animals **will consume between 2 and 3 % of the body weight in dry feed per day.** Younger animals usually consume more feed per pound of body weight than older animals. Cattle in the later stages or pregnancy or after calving need considerably more feed to maintain their body condition. Livestock consuming feeds high in water will have to consume more total weight of feed to meet their dry matter requirements. Cattle consuming feeds which are high in energy (grains) will consume less volume of feed because of the high calorie content of the feed. Other factors which increase consumption are cold temperatures and hard work (draft animals). Some conditions that decrease consumption are high external temperatures, high humidity, crowding, excessive handling, and sickness. Nurtient requirement tables will have expected dry matter intakes.

Before one begins to formulate a balanced diet, we need to establish 2 things:

1) nutrient requirements of the animals
2) nutrient content of the locally available feedstuffs

Nutrient requirements may vary according to size, age, sex, growth rate, reproductive status, and work expected. Usually animals will first use nutrients to maintain basic body functions; then they will use additional nutrients for growth, milk production, pregnancy, etc. These nutrient requirements will depend upon production goals. There are a number of tables available which list nutrient requirements of cattle. Among these are the tables of the National Research Council of the U.S. National Academy of Sciences.

Nutrient Requirements for Growing-Finishing Steer Calves And Yearlings (Nutrient Concentration In Diet Matter)

Weight[b] (kg)	(lb)	Daily gain[c] (kg)	(lb)	Minimum Dry Matter Consumption (kg)	(lb)	Roughage (%)	Total Protein (%)	Digestible Protein (%)	NE_m[1] (Mcal/kg)	(Mcal/lb)	NE_g[1] (Mcal/kg)	(Mcal/lb)	ME[1] (Mcal/kg)	(Mcal/lb)	TDN[d,f] (%)	Ca (%)	P (%)
100	220	0	0	2.1	4.6	100	8.7	5.0	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.5	1.1	2.9	6.4	70-80	12.4	8.3	1.35	0.60	0.75	0.23	2.2	1.00	62	0.48	0.38
		0.7	1.5	2.7	6.0	50-60	14.8	10.7	1.60	0.71	1.00	0.43	2.5	1.13	70	0.70	0.48
		0.9	2.0	2.8	6.2	25-30	16.4	11.8	1.81	0.82	1.18	0.54	2.8	1.27	77	0.86	0.57
		1.1	2.4	2.7	6.0	-15	18.2	13.3	2.07	0.94	1.37	0.62	3.1	1.41	86	1.04	0.70
150	331	0	0	2.8	6.2	100	8.7	5.0	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.5	1.1	4.0	8.8	70-80	11.0	7.0	1.35	0.60	0.75	0.23	2.2	1.00	62	0.35	0.32
		0.7	1.5	3.9	8.6	50-60	12.6	8.5	1.60	0.71	1.00	0.43	2.5	1.13	70	0.46	0.36
		0.9	2.0	3.8	8.4	25-30	14.1	9.7	1.81	0.82	1.18	0.54	2.8	1.27	77	0.61	0.45
		1.1	2.4	3.7	8.2	-15	15.6	11.1	2.07	0.94	1.37	0.62	3.1	1.41	86	0.76	0.54
200	441	0	0	3.5	7.7	100	8.5	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.5	1.1	5.8	12.8	80-90	9.9	6.0	1.25	0.56	0.60	0.27	2.1	0.95	58	0.24	0.22
		0.7	1.5	5.7	12.6	70-80	10.8	6.8	1.40	0.64	0.78	0.35	2.3	1.04	64	0.32	0.28
		0.9	2.0	4.9	10.8	35-45	12.3	8.2	1.70	0.78	1.10	0.50	2.7	1.22	75	0.47	0.37
		1.1	2.4	4.6	10.1	—15	13.6	9.3	2.07	0.94	1.37	0.62	3.1	1.41	86	0.59	0.43
250	551	0	0	4.1	9.7	100	8.5	4.8.	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.7	1.5	5.8	12.8	55-65	10.7	6.7	1.56	0.71	0.95	0.43	2.5	1.13	70	0.31	0.28
		0.9	2.0	6.2	13.7	45-50	11.1	7.1	1.64	0.74	1.02	0.46	2.6	1.18	72	0.35	0.31
		1.1	2.4	6.0	13.2	20-25	12.1	8.0	1.81	0.82	1.18	0.54	2.8	1.27	77	0.43	0.35
		1.3	2.9	6.0	13.2	—15	12.7	8.5	2.07	0.94	1.37	0.62	3.1	1.41	86	0.50	0.38
300	661	0	0	4.7	10.4	100	8.6	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.9	2.0	8.1	17.9	55-65	10.0	6.2	1.56	0.71	0.95	0.43	2.5	1.18	70	0.27	0.23
		1.1	2.4	7.6	16.8	20-25	10.8	6.8	1.81	0.82	1.18	0.54	2.8	1.27	77	0.33	0.29
		1.3	2.9	7.1	15.6	—15	11.7	7.6	1.98	0.90	1.31	0.59	3.0	1.36	83	0.41	0.32
		1.4a	3.1	7.3	16.1	—15	11.9	7.8	2.07	0.94	1.37	0.62	3.1	1.41	86	0.42	0.34
350	772	0	0	5.3	11.7	100	8.5	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.9	2.0	8.0	17.6	45-55	10.0	6.1	1.64	0.74	1.02	0.46	2.6	1.18	72	0.25	0.22
		1.1	2.4	8.0	17.6	20-25	10.4	6.5	1.81	0.82	1.18	0.54	2.8	1.27	80	0.29	0.25
		1.3	2.9	8.0	17.6	—15	10.8	6.9	1.98	0.90	1.31	0.59	3.0	1.36	83	0.32	0.28
		1.4a	3.1	8.2	18.1	—15	10.9	7.0	2.07	0.98	1.37	0.62	3.1	1.41	86	0.34	0.29
400	882	0	0	5.9	13.0	100	8.5	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		1.0	2.2	9.4	20.7	45-55	9.4	5.7	1.64	0.74	1.02	0.46	2.6	1.18	72	0.22	0.21
		1.2	2.6	8.5	18.7	20-25	10.2	6.3	1.81	0.82	1.18	0.54	2.8	1.27	80	0.27	0.25
		1.3	2.9	8.6	19.0	—15	10.4	6.5	2.07	0.98	1.37	0.62	3.1	1.41	86	0.29	0.26
		1.4a	3.1	9.0	19.8	—15	10.5	6.6	2.07	0.98	1.37	0.62	3.1	1.41	86	0.29	0.26
450	992	0	0	6.4	14.1	100	8.5	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		1.0	2.2	10.3	22.7	45-55	9.3	5.5	1.64	0.74	1.02	0.46	2.6	1.18	72	0.19	0.19
		1.2	2.6	10.2	22.5	20-25	9.5	5.7	1.81	0.82	1.18	0.54	2.8	1.27	80	0.23	0.22
		1.3	2.9	9.3	20.5	—15	10.4	6.3	2.07	0.98	1.31	0.62	3.1	1.41	86	0.26	0.25
		1.4d	3.1	9.8	21.6	—15	10.0	6.1	2.07	0.98	1.37	0.62	3.1	1.41	86	0.26	0.23
500	1102	0	0	7.0	15.4	100	8.5	4.8	1.17	0.53	—	—	2.0	0.91	55	0.18	0.18
		0.9	2.0	10.5	23.1	45-55	9.1	5.3	1.64	0.74	1.02	0.46	2.6	1.18	72	0.18	0.18
		1.1	2.4	10.4	22.9	20-25	9.2	5.5	1.81	0.82	1.18	0.54	2.8	1.27	80	0.19	0.19
		1.2	2.6	9.6	21.2	—15	10.0	6.0	2.07	0.98	1.31	0.62	3.1	1.41	86	0.22	0.22
		1.3d	2.9	10.0	22.0	—15	9.7	6.0	2.07	0.98	1.37	0.62	3.1	1.41	86	0.22	0.22

[a]The concentration of vitamin A in all diets for finishing steers is 2,200 iu/kg of dry diet.

[b]Average weight for a feeding period.

[c] Dry matter consumption, ME and TDN allowances are based on NE requirements and the general types of diet indicated in the roughage column. Most roughages will contain 1.9-2.2 Mcal of ME/kg dry matter and 90-100 percent concentrate diets are expected to contain 3.1-3.3 Mcal of ME/kg.

[d]TDN was calculated by assuming 3.6155 Mcal of ME per kg of TDN.

[e]Most steers of the weight indicated, and not exhibiting compensatory growth, will fail to sustain an energy intake necessary to maintain this rate of gain for an extended period.

[f]Due to conversion and rounding variation, the figures in these columns may not be in exact agreement with a similar energy concentration figure calculated from the data of Table 1.

(Adopted from National Academy of Sciences—1976)

Nutrient Requirements for Beef Cattle Breeding Herd (Nutrient Concentration in Diet Dry Matter)

Weight[b] (kg)	Weight[b] (lb)	Daily gain[c] (kg)	Daily gain[c] (lb)	Minimum Dry Matter Consumption (kg)	Minimum Dry Matter Consumption (lb)	Roughage (%)	Total Protein (%)	Digestible Protein (%)	NE_m[f] (Mcal/kg)	NE_m[f] (Mcal/lb)	NE_g[f] (Mcal/kg)	NE_g[f] (Mcal/lb)	ME[f] (Mcal/kg)	ME[f] (Mcal/lb)	TDN[d,f] (%)	Ca (%)	P (%)
Pregnant Yearling Heifer – Last Third of Pregnancy																	
325	716	0.4d	0.9	6.6	14.5	100c	8.8	5.1	1.09	0.49	0.38	0.17	1.9	0.86	52	0.23	0.23
		0.6	1.3	8.5	18.7	100	8.8	5.1	1.09	0.49	0.38	0.17	1.9	0.86	52	0.21	0.21
		0.8	18	9.4	20.7	85-100	9.0	5.3	1.24	0.56	0.60	0.27	2.1	0.95	58	0.23	0.21
350	772	0.4d	0.9	6.9	15.2	100	8.8	5.1	1.09	0.49	0.38	0.17	1.9	0.86	52	0.22	0.22
		0.6	1.3	8.9	19.6	100	8.8	5.1	1.09	0.49	0.38	0.17	1.9	0.86	52	0.21	0.21
		0.8	1.8	9.4	20.7	85-100	8.8	5.1	1.24	0.56	0.60	0.27	2.1	0.95	58	0.22	0.21
375	827	0.4e	0.9	7.2	15.9	100	8.7	5.0	1.09	0.49	0.38	0.17	1.9	0.86	52	0.21	0.21
		0.6	1.3	9.3	20.5	100	8.7	5.0	1.09	0.49	0.38	0.17	1.9	0.86	52	0.20	0.20
		0.8	1.8	11.6	25.6	85-100	8.7	5.0	1.17	0.53	0.50	0.23	2.0	0.91	55	0.20	0.20
400	882	0.4d	0.9	7.2	15.9	100	8.7	5.0	1.09	0.49	0.38	0.17	1.9	0.86	52	0.21	0.21
		0.6	1.3	9.7	21.4	100	8.7	5.0	1.09	0.49	0.38	0.17	1.9	0.86	52	0.20	0.20
		0.8	1.8	11.6	25.6	85-100	8.7	5.0	1.17	0.53	0.50	0.23	2.0	0.91	55	0.19	0.19
425	937	0.4d	0.9	7.8	17.2	100	8.8	5.1	1.09	0.49	0.38	0.17	1.9	0.86	52	0.20	0.21
		0.6	1.3	10.1	22.3	100	8.7	5.0	1.09	0.49	0.38	0.17	1.9	0.86	52	0.20	0.20
		0.8	1.8	12.1	26.7	85-100	8.7	5.0	1.17	0.53	0.50	0.23	2.0	0.91	55	0.18	0.18
Dry pregnant mature cows—Middle third of pregnancy																	
350	772	–	–	5.5	12.2	100e	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
400	882	–	–	6.1	13.4	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
450	992	–	–	6.7	14.8	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
500	1102	–	–	7.2	15.9	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
560	1213	–	–	7.7	17.0	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
600	1323	–	–	8.3	18.3	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
650	1433	–	–	8.8	19.4	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
Dry Pregnant mature cows—Last third of pregnancy																	
350	772	0.4d	0.9	6.9	13.9	100e	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
400	882	0.4	0.9	7.5	15.4	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
450	992	0.4	0.9	8.1	16.5	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
500	1102	0.4	0.9	8.6	17.9	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
550	1213	0.4	0.9	9.1	19.0	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
600	1323	0.4	0.9	9.7	20.3	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
650	1433	0.4	0.9	10.2	22.4	100	5.9	2.8	1.09	0.49	–	–	1.9	0.86	52	0.18	0.18
Cows nursing calves—Average Milking ability—First 3-4 months postpartum																	
350	772	–	–	8.2	18.1	100b	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.29	0.29
400	882	–	–	8.4	19.4	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.28	0.28
450	992	–	–	9.3	20.5	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.28	0.28
500	1102	–	–	9.8	21.6	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.28	0.28
550	1213	–	–	10.5	23.1	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.27	0.27
600	1323	–	–	11.0	24.2	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.25	0.25
650	1433	–	–	11.4	25.1	100	9.2	5.4	1.09	0.49	–	–	1.9	0.86	52	0.25	0.25
Cows Nursing calves—Superior Milking Ability—First 3-4 months postpartum																	
350	772	–	–	10.2	22.4	100b	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.42	0.39
400	882	–	–	10.8	23.8	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.42	0.38
450	992	–	–	11.3	24.9	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.40	0.37
500	1102	–	–	11.8	26.0	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.39	0.36
550	1213	–	–	12.4	27.3	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.37	0.35
600	1323	–	–	12.9	28.4	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.36	0.34
650	1433	–	–	13.4	29.5	100	10.9	6.4	1.17	0.53	–	–	2.0	0.91	55	0.35	0.35
Bulls, growth and maintenance (moderate activity																	
300	661	1.00	2.2	8.8	19.4	70-75	10.2	6.3	1.40	0.64	0.78	0.35	2.3	1.04	64	0.31	0.26
400	882	0.90	2.0	11.0	24.2	70-75	9.4	5.6	1.40	0.64	0.78	0.35	2.3	1.04	64	0.21	0.21
500	1102	0.70	1.5	12.2	26.9	80-85	8.8	5.1	1.32	0.60	0.70	0.32	2.2	1.00	61	0.18	0.18
600	1323	0.50	1.1	12.0	26.4	80-85	8.8	5.1	1.32	0.60	0.70	0.32	2.2	1.00	61	0.18	0.18
700	1543	0.30	0.7	12.9	28.4	90-100h	8.5	4.8	1.17	0.53	0.50	0.17	2.0	0.91	55	0.18	0.18
800	1764	0.00	0.0	10.5	23.1	100h	8.5	4.8	1.17	0.53	–	–	2.0	0.91	55	0.18	0.18
900	1964	0.00	0.0	11.4	25.1	100h	8.5	4.8	1.17	0.53	–	–	2.0	0.91	55	0.18	0.18
1000	2205	0.00	0.0	12.4	27.3	100h	8.5	4.8	1.17	0.53	–	–	2.0	0.91	55	0.18	0.18

(a) The concentration of vitamin A in all diets for pregnant heifers and cows is 2,800 u/kg dry diet; for lactating cows and breeding bulls, 3,900 u/kg.
(b) Average weight for a feeding period.
(c) Dry matter consumption, ME and TDN requirements are based on the general type of diet indicated in the roughage column.
(d) Approximately 0.4=0.1 kg. of weight gain/day over the last third of pregnancy is accounted for by the products of conception.
(e) Average quality roughage containing about 1.0-2.0 Mcal ME/kg dry matter.
(f) 5.0=0.5 kg of milk/day.
(g) 10=1 kg. of milk/day.
(h) Good quality roughage containing 2.0 Mcal ME/kg dry matter.

(From National Academy of Sciences—1976)

The next step involves selecting available feeds and their **nutrient content**. The nutrient content of available feedstuffs is evaluated by laboratory analysis. If a laboratory is unavailable or impractical to use, one can use various feed-composition tables to determine the nutritive value of feeds. These feed values vary according to maturity at harvest, moisture, soil, climate, and storage conditions.

TABLE 4

Composition of Common Feeds (Dry Matter Basis)

Feedstuff	Dry Matter	Total Protein	ME Mcal/Kg	TDN	Calcium	Phosphorus
Dry Roughages[b]	%	%	%	%	%	
Alfalfa hay	89	18.5	2.06	60.0	1.16	0.20
Babiagrass hay	90	8.7	1.75	51.0	0.48	0.18
Bermudagrass hays						
Ahera	87	9.7	-	54.0	0.39	0.21
Coastal	90	10.5	1.77	56.0	0.41	0.20
Common	89	9.0	1.73	51.2	0.40	0.18
Midland	90	10.7	52.0	0.34	0.30	
Tift 44	87	11.7	58.0	0.42	0.22	
Corncobs	90	2.7	1.70	46.6	0.12	0.04
Cornstover	87	5.9	2.13	58.6	0.49	0.09
Cottonseed hulls	90	4.3	1.48	41.1	0.16	0.10
Fescue hay	89	9.5	1.95	52.5	0.43	0.31
Grass-clover hay (65-35%)	90	11.8	2.17	55.6	0.87	0.30
Lespedeza hay	91	13.8	2.10	54.0	1.15	0.25
Oat hay	89	9.0	2.21	60.8	0.25	0.23
Orchardgrass hay	89	10.6	2.06	57.8	0.38	0.33
Peanut hay	91	11.3	2.20	61.9	1.31	0.28
Peanut hulls	91	7.4	.71	20.7	0.27	0.07
Sorghum (grain) hay	89	13.2	2.13	58.3	0.56	0.31
Soybean hay	91	15.1	1.88	52.0	1.25	0.30
Wheat straw	90	3.6	1.74	47.7	0.17	0.08
Silages[b]						
Alfalfa silage	38	17.2	1.95	56.6	1.04	0.26
Corn silage	35	8.0	2.53	65.5	0.30	0.22
Grass-legume silage	37	13.8	2.02	55.0	1.13	0.25
Sorghum (grain) silage	30	8.2	2.13	56.5	0.26	0.15
Small grain silage	26	10.1	2.13	58.0	0.36	0.25
Concentrates						
Barley	89	13.0	3.00	81.0	0.09	0.47
Cane molasses	75	4.3	2.75	91.0	1.19	0.11
Corn	89	8.5	3.29	91.0	0.02	0.35
Cottonseed meal	91	41.4	2.68	75.8	0.18	1.32
Cottonseed (whole)	92	24.9	3.29	91.0	0.15	0.73
Milo	89	10.9	3.00	81.2	0.04	0.33
Oats	89	12.7	2.75	76.4	0.11	0.39
Poultry litter	89	24.5	3.29	56.0	2.23	1.78
Soybean meal (44%)	89	45.8	3.07	84.0	0.34	0.70
Soybean meal (49%)	90	49.9	2.93	87.0	0.29	0.70
Soybean hulls	91	12.1	1.88	75.0	0.49	0.21

Composition of Common Feeds (Dry Matter Basis)

Feedstuff	Dry Matter	Total Protein	ME Mcal/Kg	TDN	Calcium	Phosphorus
Dry Roughages[b]	%	%	%	%	%	
Soybeans (whole)	92	41.7	3.4	91.0	0.27	0.65
Urea	100	279.6	—	—	—	—
Wheat	89	13.4	3.18	91.0	0.06	0.39
Mineral Sources						
Dicalcium phosphate	96	—	—	—	23.1	18.6
Defluorinated rock phosphate	100	—	—	—	33.0	18.0
Ground limestone	100	—	—	—	38.0	0.02
Sodium tripolyphosphate	96	—	—	—	—	25.9
Steamed bone meal	95	12.7	—	15.8	30.5	14.3

a Values can be converted to as-fed basis by multiplying by the dry matter percent.

b Nutrient content of harvested roughages can vary greatly. Forage analysis should always be obtained.

Table #4 (Georgia Extension Service - Bulletin #715)

TABLE 5

Composition and feeding values of selected cereal grains, their milling by-products, tubers, and molasses, dry-matter basis.

Feed	CP (%)	NE_m NFE (%)	NE_g (Mcal/kg)	ME (Mcal/kg)	Ca (%)	P (%)
Maize *(Zea mays)*						
White dent	10.0	80.8	1.90	1.26	.02	.30
Bran	11.3	71.9	1.92	1.28	.06	.73
Sorghum *(Sorghum bicolor)*						
Grain	11.2	80.5	1.88	1.25	.03	.34
Rice *(Oryza sativa)*						
Rough, with hulls	9.7	70.8	1.30	.64	.07	.030
Bran, 6-12% fiber	13.8	48.7	1.92	1.28	.12	1.51
Polishings	14.0	58.6	2.03	1.37	.05	1.48
Wheat *(Triticum aestivum)*						
Grain	13.6	77.7	1.84	1.22	.08	.45
Bran	15.0	60.4	1.69	1.13	.13	1.38
Middlings	1.87	65.2	2.06	1.40	.10	.91
Sweet potato *(Ipomoea batatas)*						
Tubers, mixed	4.1	87.6	1.60	.99	.15	.15
Cassava *(Manihot* spp.)						
Whole	4.6	83.4	1.54	.92	.10	.15
Sugarcane *(Saccharum officinarum)*						
Molasses	5.4	74.0	1.15	.41	1.09	.12

Table #5 (Winrock International — 1985)

TABLE 6

Composition of selected protein feeds, dry matter basis.

Feed	CP (%)	NE_m (Mcal kg)	NE_g (Mcal/ kg)	Ca (%)	P (%)
Coconut *(Cocos nucifera)*					
Meal, solvent extracted	24.4	1.46	.84	.19	.66
Cottonseed *(Gossypium* spp.)					
Meal, solvent extracted	44.2	1.48	.86	.35	1.09
Soybean *(Glycine max)*					
Meal, solvent extracted	51.9	2.01	1.35	.34	.70
Sunflower *(Helianthus* spp.)					
Meal, solvent extracted	37.9	1.08	.28	.47	.83
Leucaena *(Leucaena leucocephala)*					
Browse, dough stage	23.4	1.77	1.15	1.40	.22
Shad *(Gliricidia sepium)*					
Browse, midbloom	19.9	1.44	.82	.67	.19
Wisteria *(Sesbania grandiflora)*					
Browse, 43-56 days	27.5	1.80	1.17	1.60	.53
Urea[a]	281.0				

[a] Urea contains 45% N that, when multiplied by 6.25, yields 281% crude protein equlivalent, not protein.

(Table #6 Winrock International - 1985)

Tropical forages mature more rapidly than forages in temperate zones. They have lower levels of protein, minerals, energy, and higher levels of crude fiber. Forages high in crude fiber are digested slower and this causes the animal to eat less feed. Another problem with forages grown in the tropics is the high water content which reduces the energy intake. To reduce the forage's water content, thereby increasing the dry matter content, one can:

—cut grasses for green chop in the mornings
—allow the grass to wilt in the sunshine
—feed the dried grass in the evening or the next day

As you can see, raising beef cattle in the tropics presents special management problems.

Diet Formulation Example

The following diet formulation is taken from *Winrock International Technotes #22:*

The mathematics of balancing a diet are simple. Let's go through an example of how to do this for a 400-kg penned cow that it not lactating but is in the middle trimester (third) of pregnancy.

Step 1: Determine which feeds are available and record their composition. The cow owner has a small plot of molassesgrass from which

he cuts fresh forage by hand daily after about 50 days of growth. The farmer also has a limited supply of sugarcane molasses. The nutrient composition of these two feeds is as follows:

	% DM	Mcal/ % TDN	kg ME	% CP	% Ca	% P
Molassesgrass 50 days' growth, fresh	22	53	1.9	9.0	.63	.54
sugarcane molasses	77	53	1.92	5.4	1.09	.12

The dry matter (DM) content will influence how much of the feed the animal will voluntarily eat each day. Cattle generally eat 2% to 3% of their weight in dry matter each day if they are performing a major function such as producing milk or growing rapidly. This cow will need to consume more of a very succulent feed as compared to a drier one in order to take in the same amount of dry matter. Both total digestible nutrients (TDN) and metabolizable energy (ME) are measures of energy content on a dry matter basis. The crude protein (CP), calcium (Ca) and phosphorous (P) levels are also listed (because these are essential nutrients).

Step two: Record the animal's requirements. The information listed here is from the tables mentioned previously and has been obtained from many scientific feeding studies. It may not be exactly right for this cow, but it will be close.

Animal class	kg DM	kg TDN	Mcal ME	g CP	g Ca	g P
Cow, 400 kg, middle one-third pregnancy	7.5	3.6	13.1	525	13	13

Step three: Begin to formulate the diet with the information from the previous steps. In order to keep costs down, let's attempt to balance the feed nutrient content with the animal's needs using only the forage, molassesgrass. The cow will eat at least the equivalent of 7.5 kg/day dry matter of this succulent forage. By multiplying the values from step one by 7.5 kg/day, we see that if the cow eats only fresh-cut molasses-grass, her nurtient intake will be:

	kg DM	kg TDN	Mcal ME	g CP	g Ca	g P
Molassesgrass provides	7.5	3.975	14.25	675	47.25	40.5

Step four: Evaluate the diet. This diet contains more than enough of each nutrient for the cow. Obviously, then the farmer will not need to purchase or use any molasses. Because the diet has an oversupply of most nutrients, the farmer can somewhat reduce the amount of feed he gives the cow and still meet her needs. The farmer should also supply salt and, if available, a trace mineral mixture for free-choice consumption.

Step five: Convert the diet from a dry matter to an as-fed basis,

especially in the case of fresh forages. The molassesgrass is 22% dry matter. So, for this cow to consume 7.5 kg. of dry matter, she must eat 34.9 kg/day (7.5 kg ÷22%) of molassesgrass as it is cut from the plot. In some cases, where animal nutrient requirements are high and the available forage is low in dry matter, it is not physically possible for the animal to consume the amount of fresh food necessary. In such cases, it would be wise to wilt the forage, or to add a drier and higher energy feedstuff.

To summarize then, the tools you need to formulate livestock diets include 1) some idea of the nutritional requirements of the animals you are feeding; 2) a list of some of the feedstuffs you have available, and 3) a knowledge of the feedstuff composition. Formulate the diet on a dry matter basis, evaluate the diet by comparing the animal dietary requirement with the composition of the formulated diet, and make adjustments as needed. Finally, convert the diet to an as-fed basis as it will be based on forage plus perhaps some supplemental (calories or protein) concentrates.

Economic Comparisons of Feed

In addition to examining the nutrient content of feeds, we need to consider the price of feeds also. Costs per unit of dry matter, per unit of crude protein, or per unit of energy are most useful for comparing the true costs of feeds.

If one could get a dry feed for the same price per kg as you could get it fresh, which would be the best buy? Obviously, the dry feed would be the best buy because you would not have to pay for the weight of the water.

Because feeds differ in weights per pound, bushel, or kg and in nutrient concentration, they should not be purchased solely on the basis of price per weight measure (pound, bushel, kg). The following formula compares feeds on a cost per weight of nutrient basis using pounds as the weight measure: (bushels or kilograms could be substituted for pounds by using the appropriate conversion tables).

$$\text{Cost (\$/lb. of nutrient)} = \frac{\text{Cost per 100 lb. feedstuff}}{\text{\% nutrient in feed stuff}}$$

Example: A farmer needs to purchase a protein supplement of either soybean meal (45.8% protein) at $220/ton (2000 lb.) or cottonseed meal (41.4% protein) at $180/ton. Which supplement would be the best buy?

Soybean meal would convert to $11/100 lb. and cottonseed meal would convert to $9/100 lb.

Soybean meal cost/lb. protein = $11/45.8 =$.24/unit of protein

Cottonseed meal cost/lb. protein = $9/41.4 = $.22/unit of protein

Thus the cottonseed meal should be the best buy based on cost per unit of protein.

Mineral and Vitamin Supplements

Salt or sodium chloride is necessary for body cells to function, for saliva production, and it stimulates the appetite. Either loose salt or block **salt should be available to cattle at all times.** The average requirements

for a mature cow are 40-50 gm/per day.

Minerals are nutrients needed in small amounts for the proper functions of the body. A lack of required minerals results in decreased growth and production. Minerals are found in plants that the animal consumes, but these plants may not contain enough of all the minerals needed. Plants grown in areas of high rainfall i.e. tropics, have lower levels of minerals. Mineral deficiency signs include loss of condition and/or hair, abortion, diarrhea, anemia, loss of appetite, and a craving for dirt, wood, or bones.

The kind and amount of minerals supplemented will vary from region to region based upon soil conditions. **Calcium and phosphorus are the minerals most often deficient and usually need to be supplemented.** Then, based upon the region, the other minerals may need to be provided.

TABLE 7

Suggested mineral requirements (dry basis).

	Beef cattle	Lactating dairy cows
Macroelements		
calcium (%)	.28	.52
phosphorus (%)	.25	.36
magnesium (%)	.1	.2
potassium (%)	.65	.8
sodium (%)	.08	.18
sulfur (%)	.1	.2
Microelements		
cobait (ppm)	.1	.1
copper (ppm)	8.0	10.0
iodine (ppm)	.5	.5
iron (ppm)	50.0	50.0
manganese (ppm)	40.0	40.0
molybdenum (ppm)	--	--
selenium (ppm)	.2	.1
zinc (ppm)	30.0	40.0

Adapted from McDowell (1985). Note: The true requirements will range higher and lower because of various dietary and animal factors.

Most minerals are mixed with salt to provide for a better consumption. To calculate the amount of mineral supplied daily from a mineral mixture, multiply the percentage of mineral element in the mixture times the intake of the mixture and divide by the total dry matter intake of the animal. Mineral mixtures should be placed in areas where cattle congregate or at watering supplies.

Vitamins, like minerals, are supplied by the plant; but in some instances, need to be supplemented. They are required for growth, transportation of energy in the body, and other body functions. Whether to supplement these vitamins depends upon regional conditions as well as production expectations. Vitamin A is the one that is more often supplemented either in the feed or water or by injection. Vitamin A re-

quirements for beef cattle are 3000 I.U./100 lb. (6600 I.U./100Kg) body weight. If the cattle are not eating green feed or a legume, vitamin A should be supplemented. The other vitamins—D, E, K, B, C—may need to be supplemented in lesser amounts.

Feeding the Cow After Calving

One of the most important goals for the beef cattle producer is to have a calf per cow per year. With a gestation period of 285 days, the cow has 80 days to recover from the calving cycle and rebreed. First-calf and second-calf heifers are especially difficult to rebreed in this time period. The reason is that the younger animal is still growing herself, nursing a calf, and getting ready to breed all at the same time. The time period between calving and the first heat cycle (conception time) is directly related to the "nutritional status" of the animal. Thus proper nutrition is most important at this time.

After calving dry matter requirements increase by 49%, energy requirements increase by 45%, and protein needs increase by 140%. Therefore, it is important that cows which have calved be separated and fed appropriately, increasing the energy and protein levels. In some instances and especially with younger animals, addition of a grain concentrate and/or protein supplement is necessary at this post-calving period. Phophorous levels are also very critical. Other suggestions for feeding cows after calving include using young, tender grasses to replace mature forages. Also, adding legumes either by interceding in grass pasture, as green chop, hay, or silage can be very beneficial. In order for cows to breed after calving, they need to be gaining weight.

Pasturing Forage

In order to plan ahead, a farmer will need to know how many livestock his pasture will carry. This would depend upon a number of factors including size and age of animals to be pastured, rainfall, amount of forage produced, and type of pasture.

In the humid tropics approximately .5 hectacres are needed to support one cow per year. In drier areas approximately 10 hectacres will be needed per year. Cattle which are approximately one year old will need one half as much pasture as mature cows.

The amount of forage available during the year varies according to the season. Thus, one might not have enough cattle grazing pasture during the rainy season, but will hopefully have enough forage to sustain the animals through a dry season. It's desirable to have some extra hay or forage on hand to be prepared for drought conditions which occur periodically.

Because pastures are usually the cheapest feed source available, any efforts made to upgrade and improve pastures are beneficial. The first step in deciding what improvements should be made is to take a soil test. This will help one determine what plant nutrients must be added to improve productivity of the pasture. Sometimes lime will need to be applied which adds valuable nutrients such as calcium, magnesium, and phosphorous. According to the soil tests, nitrogen, phophorous, sulphur, and other types of fertilizers may be used to provide needed nutrients.

Another method of upgrading pastures is to clear all brush and tree growth. Then one can plant various grains and/or legumes. The choice of grasses will depend on the climate and the expectations of the pasture. It is also important to control weeds growing in the pastures. Cattle will usually eat grasses and weeds will go unchecked using up valuable nutrients and moisture. Weeds can be controlled by clipping (mowing) and the use of herbicides (weed killers.)

Prevention of overgrazing also helps in the control of weeds as well as having a good stand of grass to compete with the weeds. **Cross-fencing** pastures allows grazing one part of the pasture down, and then moving the cattle to another part, allowing the first part to make a second growth for later grazing.

When pasturing cattle, make sure there is a good water source available as well as salt and mineral.

Hay Production

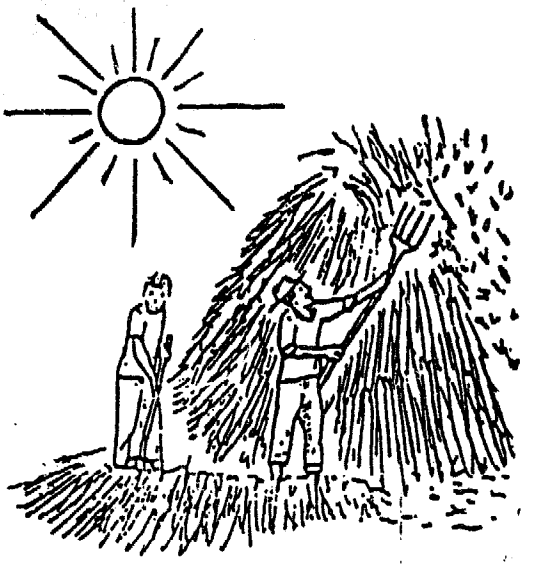
To provide extra feed needed during dry seasons, one can use surplus grass or legumes to produce hay. This provides a more constant supply of nutrients so animals can be carried through seasons of low forage production. Hay production involves cutting these grasses and legumes during the wet season and storing them for later feeding.

It is usually best to cut the forage before the plant flowers. By doing the harvesting at this stage, one can get the maximum yield and still have high quality hay. If the hay gets too mature, the quality of the hay decreases and also the livestock will not eat it as well.

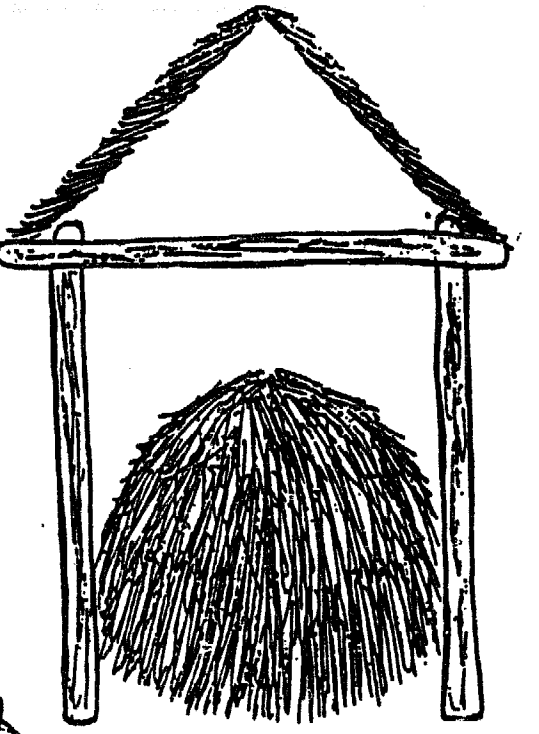
The sickle, knife, and scythe are the and tools used for cutting forage for hay. A scythe is usually the fastest. Cut the growing plants after all dew has evaporated from the leaves, usually by mid-morning. Leave the forage on the ground to dry for about one day. (This time may lengthen if the forage is extremely wet or is rained on.) Do not let the forage get too dry or risk getting rained on. After the forage has properly dried, it should be gathered into piles with a hay rake or a 3-4 tine fork. As soon as possible it should be moved to a storage area close to where it will be fed. Animals may be used to pull carts to transport the hay from the field to the feeding area.

The hay should be handled carefully to avoid losing the leaves. The hay stacks should be located in a well-drained area and fenced to keep stray animals out. The stacks should have a peak in the center so the rain will run off and can be up to 10 m. tall. It is even better if there could be some sort of cover over the top of the stack.

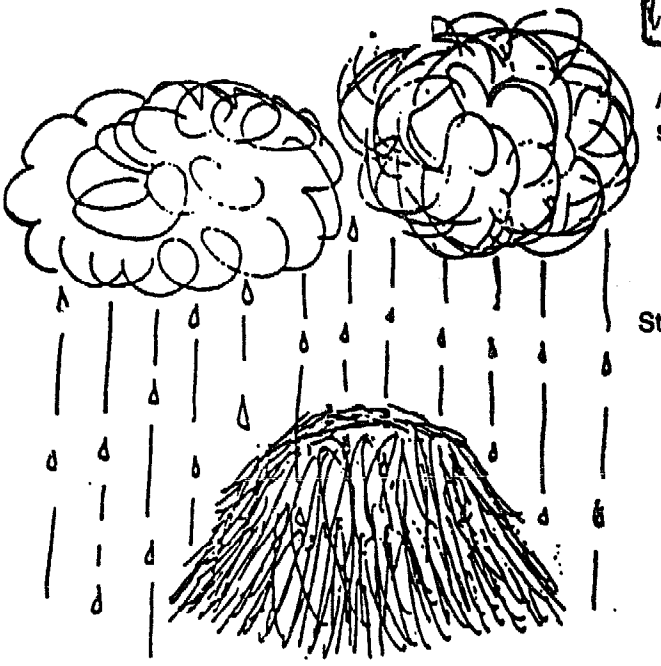
Whenever possible, try to schedule hay cutting between rains. Hay that is rained on before it is stored loses many of its nutrients.



If possible stack the hay close to the feeding area.



A cover over the hay will prevent spoilage.



Stack the hay so it will shed water.

Drawings donated by Maureen Birmingham, D.V.M.

Section 4

Management

MANAGEMENT OF BEEF CATTLE

This section will concentrate on management practices to successfully raise beef cattle. If one wants to keep one or more cows, he must consider the following:

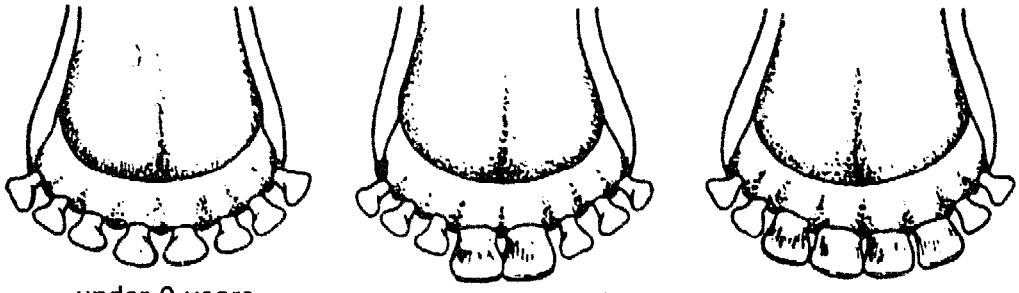
1. Do I have enough forage and water for the animals?
2. Do I have facilities to keep the animals?
3. Is there someone in the family to tend to the animals? (feed and water)
4. Do I have access to a bull for breeding?
5. Can I provide minerals and additional feed if needed?
6. How will I market the beef?

Aging Beef Cattle

The age of cattle is estimated by the front teeth. The eruption of the front teeth occurs as follows:

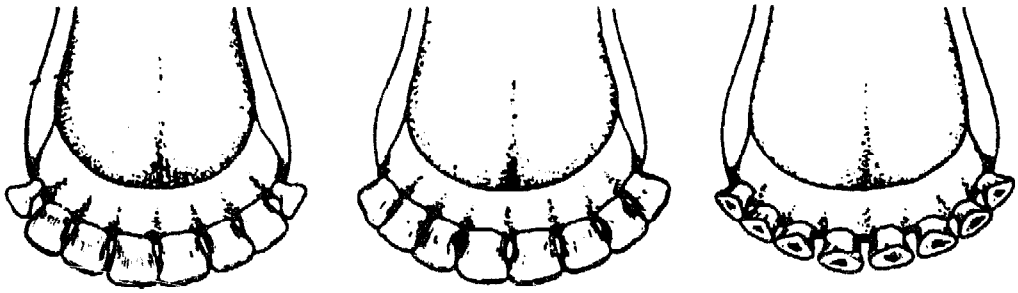
1. First pair - 1.5-2 years
2. Second pair - 2-2.5 years
3. Third pair - 3-3.5 years
4. Fourth pair - about four years

THE ERUPTION OF TEETH IN ZEBU CATTLE



under 2 years | 2 years 3 months | 3 years

The small teeth are the temporary or milk teeth which fall out. The large teeth are the permanent incissors.



3 years 6 months | about 4 years old (4 pairs of permanent incissors | old animal. 4 pairs of permanent incissors in wear.

The teeth of exotic and improved breeds erupt slightly earlier but considerable variation occurs between all breeds and types of cattle of the same ages.

Fig. #18 (FAO Manual—1983)

Estimating the Weight of An Animal

Most producers will not have a scale available, so determination of approximate weight is necessary. Weight estimation is needed for determination of drug dosages, check on feeding practices, and the determination of market times.

The only equipment needed for this procedure is a metric tape measure. The formula for making this calculation is:

heartgirth (cm) x heartgirth (cm) x body length (cm)
divided by 10,840

By using this formula, you will get the approximate body weight. The following steps will help you with the procedure:

Step 1: **Measure heartgirth.** This is the distance around the chest at a point just behind the shoulder blade, down over the ribs, and under the body behind the elbow. Place the measuring tape completely around the animal, tighten snugly and record the number.

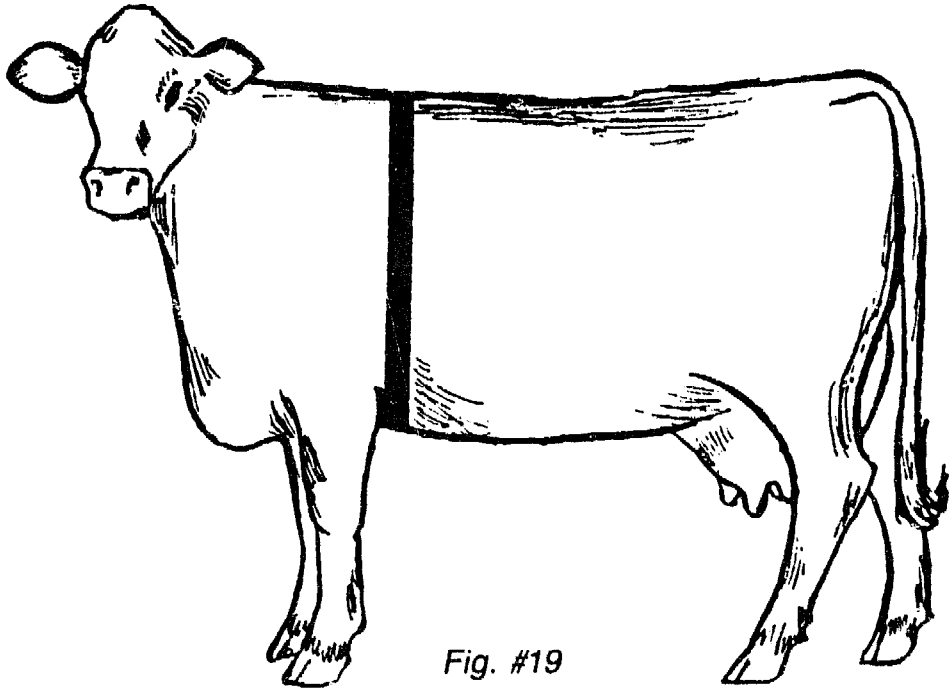


Fig. #19

Step 2. **Measure body length.** This is the distance from the point of the shoulder (the most forward part of the shoulder) to the pinbone (the rear most part of the rump.) Pull the tape snugly and record the number.

Step. 3 **Apply the formula.** Assume an animal has a heartgirth of 170 cm and a body length of 144 cm.

170 x 170 x 140 divided by 10,840.
170 x 170 equals 28,900
28,900 x 140 equals 4,046,000
4,046,000 divided by 10,840 equals 373 kg. or the approximate weight.

Another method to estimate weight is to measure the heartgirth and use the table below for determining weight in kg.

Table 1. Estimated Live Weights of Dairy Cows from Heart Girths

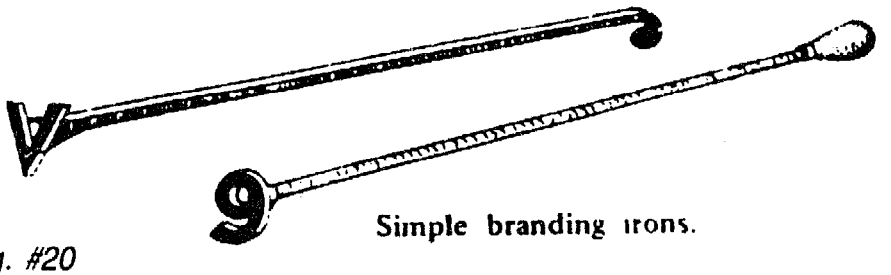
Heart girth cm	Weight kg	Heart girth cm	Weight kg	Heart girth cm	Weight kg	Heart girth cm	Weight kg
140	255	160	328	180	409		
142	264	162	338	183	420		
145	273	165	348	185	431		
147	282	168	358	188	442		
150	291	170	368	190	453		
152	300	173	378	193	464		
155	309	175	388				
157	319	178	399				

(Winrock International 1985)

Identifying Animals

Reasons for marking of individual animals include: proof of ownership, keeping track of an animal for production history, as a marking for quarantine, or as a record of immunization. Cattle can be identified by a number of different methods.

1. **Branding** can be done by the use of a hot iron. The animal should be restrained in a chute or tied with ropes. The iron is heated red hot and applied to the hide for approximately 3 seconds. The animal should be dry before being branded. If the iron is left on the hide too long, it will burn through and could result in screwworm infestation. This can be prevented with an insecticide repellant.



Simple branding irons.

Fig. #20

2. **Ear Clipping** is accomplished by trimming a notch out of the ear.
3. **Tatooing** of the ears is done by a special instrument that places letters or numbers in the skin of the inside ear. These numbers are dyed with ink.
4. **Ear Tagging** involves placing metal or plastic tags in the ear. These tags can have numbers or letters on them.

Selection of A Bull

Selection of sires is the most important way to upgrade one's herd. The bull contributes 50 percent of the genetic potential to the offspring and his daughters go on to become replacement females. It is projected that the bull can contribute up to 80 percent of the genetic material in a herd over a period of time. Traits commonly selected for include birth weight, weaning weight, yearling weight, milking ability of offspring, carcass traits, etc.

Table 9 Chart Heritability Traits

Sire Selection
Heritability Estimates of Some Economically Important Traits*

Trait	Heritability (%)
Calving Interval (Fertility)	10
Birth Weight	40
Weaning Weight	30
Cow Maternal Ability	40
Feedlot Gain	45
Pasture Gain	30
Efficiency of Gain	40
Final Feedlot Weight	60
Conformation Score:	
Weaning	25
Slaughter	40
Carcass Traits:	
Carcass Grade	40
Ribeye Area	70
Tenderness	60
Fat Thickness	45
Cancer Eye Susceptibility	30

From Gregory, 1969. Beef cattle breeding. USDA Ag. Inf. Bull. No. 286 (Revised)

Quite often in attempts to upgrade a cow herd, bulls are brought in from other areas to be used in crossbreeding. This is when the parents of different breeds are mated together, i.e., Brahma and Charlois. This results in an increase in gain, fertility, and thriftiness. However, when animals from temperate climates are brought into tropical regions, this sometimes results in disappointment. The problem is that the newly arrived animal cannot adapt to the climate change. These animals also do not have resistance to ticks, tsetse fly, etc. An animal brought into a tropical region for breeding purposes should be heat tolerant, capable of resisting local diseases, and tolerant of varying planes of nutrition.

Inbreeding is the mating of related animals. For example, a bull is mated with one of his daughters. This is generally **not recommended** because the undesirable traits of these individuals are increased in their offspring. These characteristics might include death, dwarfism (miniature calves), hydrocephalus (water on the brain), spastic, or lacing coordination, deformed joints, and double muscling. They may also have cleft palate (imperfectly closed top of mouth), curved spine, and either bent or extended legs, as a result of inbreeding. These calves either die immediately after birth or develop abnormally. Thus, livestock producers need to avoid breeding animals which are closely related to each other.

In selecting a bull, one should examine the overall confirmation and appearance of the bull. Pay close attention to the feet and legs for soundness. The testicles should be of the same size with a firm consistency. The larger the testicles, the better fertility the bull will have. The distance around the testicles should be over 30 cm. for yearling bulls. Mature bulls

should measure 36-40 cm. Note the reproductive organs in the diagram below.

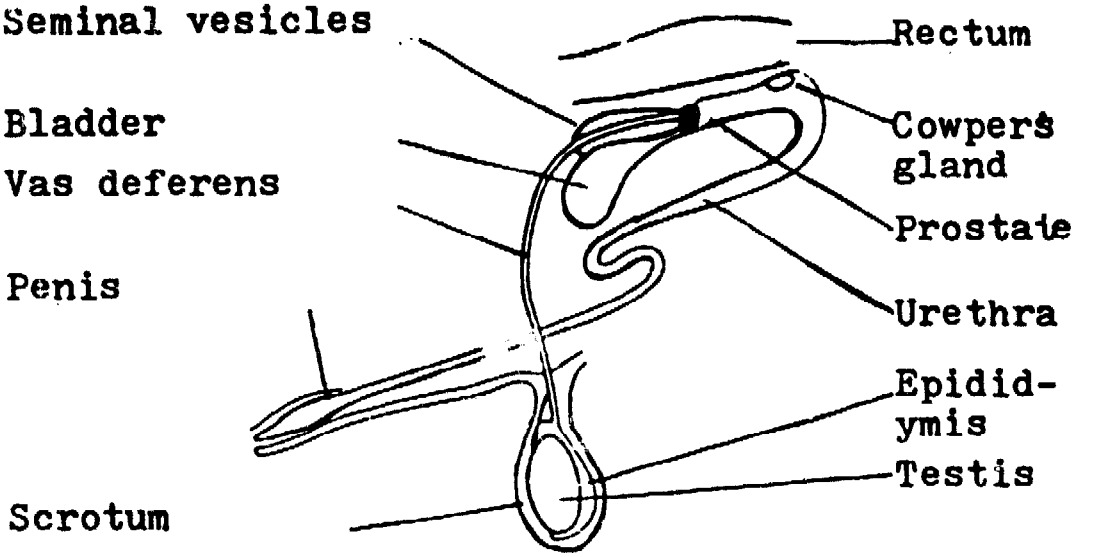


Fig. #21 Male reproductive organs

The sperm is produced in the testis and stored in the seminal vesicles until ejaculation. Outside temperature (excess heat or cold) can influence the quantity and quality of the sperm. Also, presence of fever or infection can reduce the number of sperm.

A one to two-year old bull, **given the proper nutrition,** should be able to breed 10-15 cows in a 60-day season. A mature bull should be able to breed 15-20 cows in a 60-day season. If a bull is fed well and does not have to roam a pasture to breed cows, he can breed even more cows than mentioned above. The best way to analyze a bull's reproductive ability is the collection of semen and evaluation by trained person.

Artificial insemination is the process of collecting semen from superior bulls, diluting, and freezing it in liquid nitrogen and then transporting it. This semen is then used to breed cows instead of natural breeding with a bull. The advantages are the use of genetically superior bulls at a nominal cost, elimination of spread of veneral disease, and elimination of cost and maintenance of a bull. The disadvantages are the cost of the semen and the time and management involved in heat checking and breeding. This procedure can be carried out by trained personnel. It should be attempted only where excellent management and nutrition is practiced.

Selection of a Female

Selection of females is also very important and there are many traits to consider in this process. The first might be the fertility or reproducing ability of the animal. This is determined by its parents as well as enviromental factors—namely, nutrition. Different breeds are known for their reproductive abilities. One also needs to consider the size of the animal. We don't want a heifer or cow so small that she will have trouble delivering the calf; but, on the other hand, a very large cow will require too much feed to maintain her production. Other characteristics to consider would be structurally correct feet and legs and a sound udder.

Reproduction

The cow will only accept the bull when she is in "heat" or estrus. With proper nutrition and health, the estrus cycle occurs every 21 days and lasts approximately 18 hours. Ovulation, or the release of the egg from the ovary, occurs approximately 11 hours after the end of the estrus or heat period. Thus, it is best for a cow to be exposed to the bull at the end of the heat period rather than the at beginning. The level of nutrition has a very large effect upon the frequency of heat cycles. In order for a cow to cycle following calving, she needs to be gaining weight.

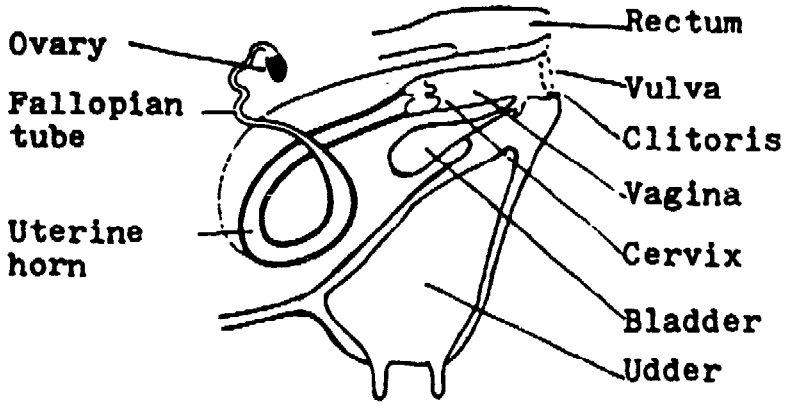


Fig. #22 Female reproductive organs

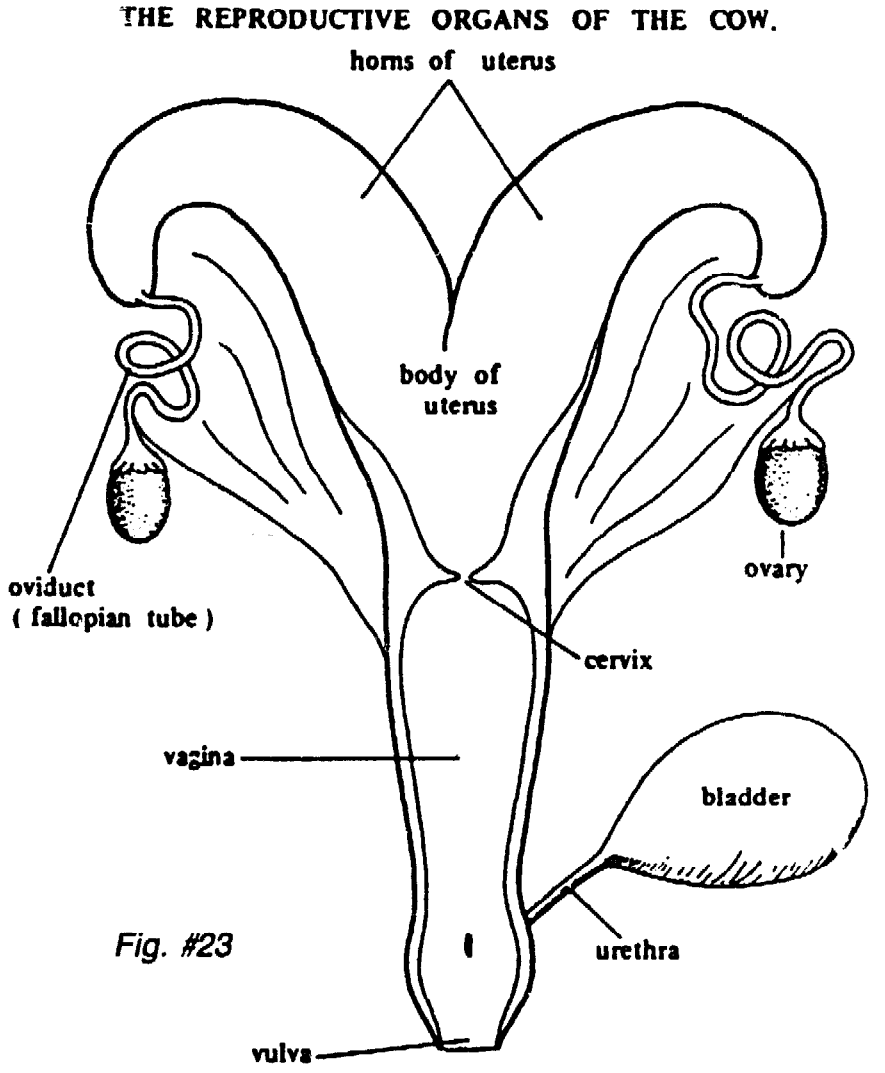


Fig. #23

The signs of heat in a cow are: bellowing, restlessness, the cow mounting or being mounted by another, and a slight discharge of mucus from the vagina. The cow will often seek out the bull.

PUBERTY	LENGTH OF ESTRUS CYCLE	LENGTH OF HEAT PERIOD
6-24 mo.	18-24 days (avg. 21)	4-24 hr. (avg. 18)

When the male mates with the female, he deposits his ejaculate in the vagina. There are thousands of sperm cells present in the ejaculate. Some of the sperm cells pass through the cervix and into the uterus. Fertilization takes place in the fallopian tube and the egg is fertilized by only one sperm. The fertilized egg then moves into the uterus and becomes attached to one of the horns of the uterus. The fetus becomes enclosed in a sack called the placenta. It receives its nutrition through the umbilical cord and transfer of nutrients from the mother's blood.

Care of the Cow Before Breeding

The first heat cycle for a heifer will occur at six months up to 2-3 years depending on nutrition and breed. Heifers should not be bred before 1 year of age for proper structural development. If a cow does not receive the proper feed after calving, it will take considerable time for her to come into heat for re-breeding. A cow may lose weight for 3-6 weeks following calving and thus it is important to feed a cow well during this period. The preferred length of time between calving and re-breeding is 1-3 months. However, with poor nutrition, this time may be lengthened to 1-2 years. The most difficult time for a cow to settle is after her first calf as she is still growing, milking, and trying to re-breed.

Before breeding is also the best time to give any vaccinations. Recommendations for vaccination will be given in a later section.

Pregnancy Diagnosis

Where possible, determination of pregnancy is most valuable and beneficial. This could be done by a veterinarian or trained technician by manual examination of the uterus through the rectal wall. Also, if the animals can be observed closely, the absence of estrus within 24 days after exposure to a bull would indicate likely pregnancy.

Because feeding cows which aren't pregnant is expensive, pregnancy diagnosis is important.

Caring for The Cow at Calving Time

The gestation period (length of pregnancy) for the cow averages 285 days or about 9½ months. As birth of the calf approaches, the udder becomes enlarged with milk and there is a marked loosening of the region of the tail head, and pin bones. The vulva also swells and enlarges. When these signs occur, the cow needs to be observed three or four times per day in the event assistance is needed for delivery of the calf. Just before the cow delivers, she will produce a water sack 15-25 cm. in diameter. This sack will break and usually within two hours the cow will deliver by herself. If the cow is in **severe labor for more than two hours** , it should be examined by a veterinarian or experienced personnel. Before examin-

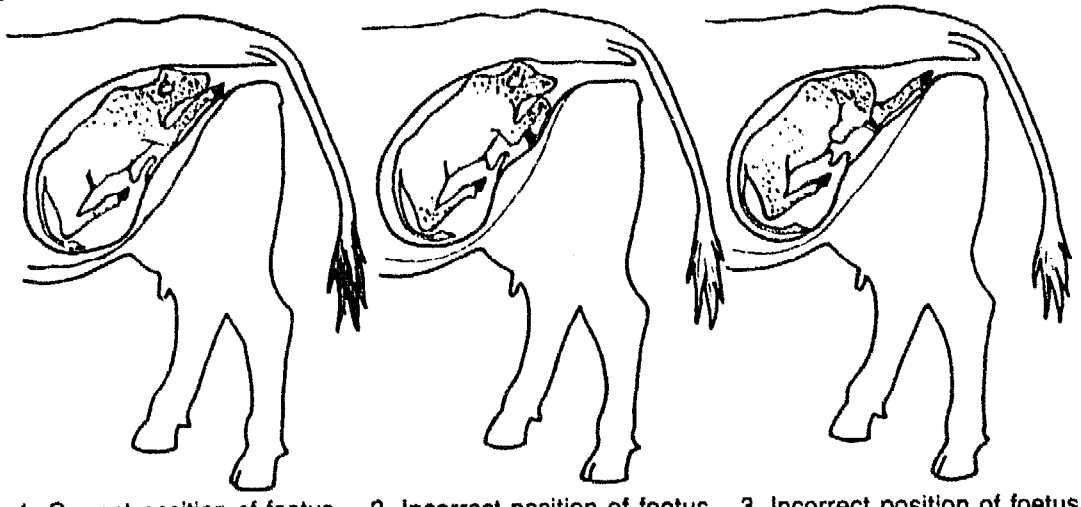
ing the cow, clean off the vaginal area with water. Also, be sure to use ample lubrication of soapy water on the hands and arms. Use of an O. B. glove or sleeve is recommended before examination of a cow.

Conditions Requiring Assistance at Birth

1. **Large Calf-Normal Position**
   Normally, the front feet and the head will come out of the vulva first. If the cow cannot deliver the calf by herself, assistance will be needed. Ropes should be attached to both legs, and be sure to attach the rope above the fetlock or joint as you may dislocate the joint or break a leg. You should have one or two strong men to pull the calf. If it is an especially difficult pull, a rope can be attached around the back of the ears and through the mouth to provide another point of traction. **Do not pull straight out on the calf,** but rather pull at an angle downward toward the back legs of the cow. If one pulls straight back on the legs, the calf could be caught by the hips in the pelvic canal of the cow and would be very difficult to deliver.

Fig. #24—Correct presentation of calf—note location of ropes above the Fetlock and also the direction of pull (downward).

Fig. #25—THE POSITION OF THE FETAL CALF IN LATE GESTATION



1. Correct position of foetus, (forelegs and muzzle correctly placed.)
2. Incorrect position of foetus, (showing forelegs bent back)
3. Incorrect position of foetus, (showing head twisted back)

2. **Backwards Calf**

If the legs are turned with the dewclaws facing upward the calf is probably backwards. About 5% - 10% of calves will come backwards and usually will require assistance. Attach the ropes to the hind legs and pull as described previously. In this position, the umbilical cord will break before the calf can breathe; so once the pulling is started, it is very important to get the calf out quickly. Often the calf will have fluid in the lungs. To help in this situation, the calf should be raised up by the hind legs and swung back and forth upside down to drain the fluid out of the lungs. Sometimes it helps to hang the calf upside down for 2 or 3 minutes to drain the fluid and stimulate breathing.

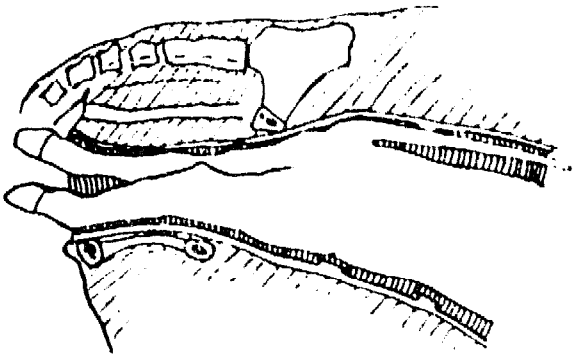
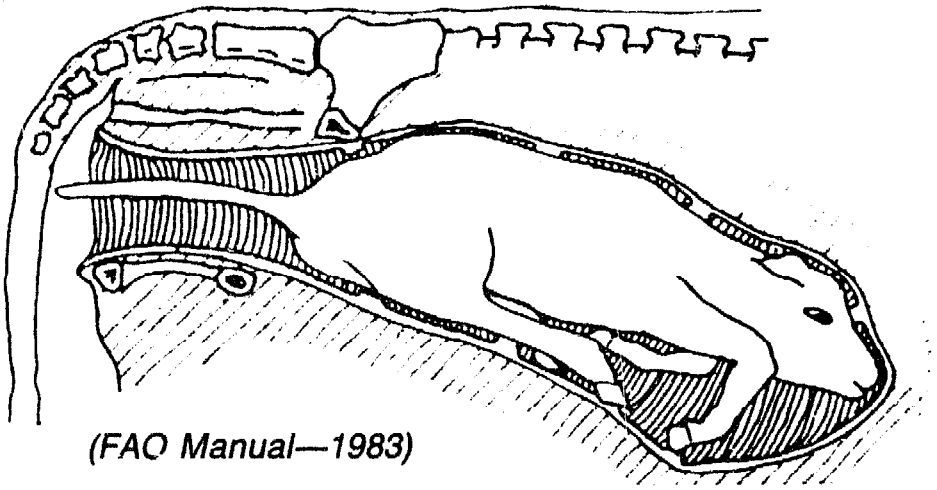


*Fig. #26—**Backwards presentation:** always check that the tail is not being forced into the roof of the vagina as it is in this diagram. It should be lying between the hind legs during the birth.*

(FAO Manual—1983)

3. **Breech Calf**

A small percentage of calves will be positioned in a **tail-first** position which is impossible for the cow to deliver by herself. In this position, a local anesthetic block in the spinal cord is most helpful to keep the cow from straining while manipulations are performed. Very carefully, the calf needs to be pushed forward so that the backlegs can be located and pulled out into the birth canal. Then the calf can be pulled as a normal backwards calf. The danger in this procedure is in tearing a hole in the uterus with one of the back legs while bringing it into position.



(FAO Manual—1983)

*Fig. #27—**Breech presentation:** the calf is coming backwards but with both legs forward so that only the tail is felt in the vagina. Because there is nothing dilating the vagina the cow often does not strain, and consequently many breech births may go unnoticed for several hours and produce a dead calf.*

4. **Headback Position**
   In this position the legs are preceding into the birth canal normally but the head is bent to one side or the other. Carefully push the calf back into the uterus and grasp the head with a rope snare or by the nose and pull it up into the canal. It may be helpful to put one leg back into the uterus to allow more room to work. (See figure 25.)

5. **Legback Position**
   In this position one leg fails to come into the birth canal. As before, push the calf back while at the same time pulling the leg into the canal. (See figure 25.)

   If the above procedures do not result in a successful delivery, the only alternative is a **Caesarean Section** which must be done by a qualified person.

As the calf reaches the ground, clear any placenta or mucus from the nose and mouth. Breathing can be stimulated by throwing cold water on the head or by tickling the end of the nostril with a piece of hay or straw. Slapping the side of the chest with the flat of the hand will also stimulate breathing.

Care of A Calf Immediately Following Birth

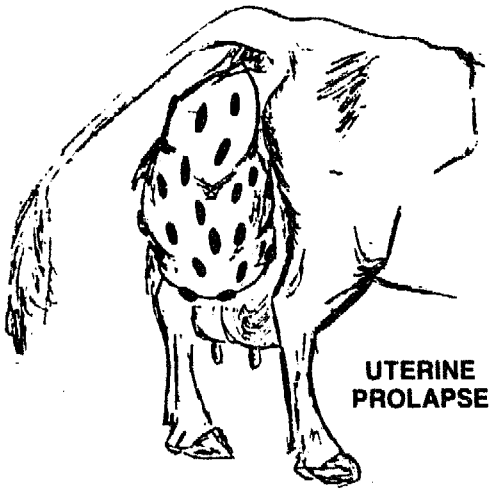
After the calf is breathing normally, apply iodine to the naval cord to prevent naval infection. The cow should be allowed to lick the calf as soon as possible as this stimulates breathing and helps dry off the calf. **If the calf does not nurse within six hours after birth, the cow will have to be milked and the colostrum (first milk) fed to the calf.** The colostrum is highly nutritious and also contains antibodies. The antibodies are the only source the newborn calf has to fight off infection. Calves that do not receive adequate colostrum will have a much higher death rate, more scours, and more pneumonia. The newborn calf's stomach can only absorb the antibodies during the first hours of life and thus, the importance of receiving the colostrum within the first hours of life and thus, the importance of receiving the colostrum within the first six hours.

Special Problems Following Birth

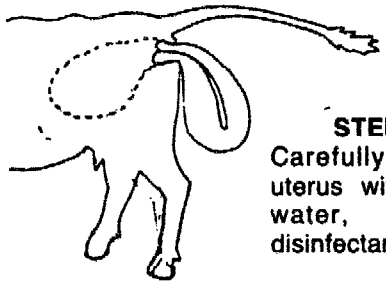
Uterine Prolapse: Occasionally, immediately following birth, a cow will continue straining and the entire uterus will be pushed out. This occurs usually after a difficult and prolonged labor. This is an emergency because the cow can go into shock and die quickly. The major problem in treating this condition is to keep the cow from straining while the uterus is replaced. The injection of a spinal block of local anesthetic will relax the cow. In addition, a rope tied tightly around a cow's abdomen just ahead of the udder helps to stop the straining. Also, with the cow lying down, one can tie a rope to the hind legs and secure the rope to a stationary object overhead such as a tree limb. With steady pressure the hind quarters should be elevated by 1-3 feet. This procedure gets the uterus off the ground so that cleaning is easier, makes it easier to replace the uterus into the cow, and keeps the cow from straining.

The uterus should be washed off with clean water and soap. Slowly and carefully the uterus should be replaced into the cow. Once the uterus

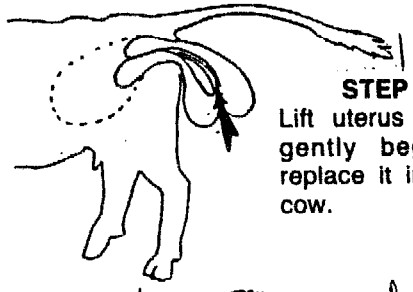
is inside the cow, it must be turned inside out by pushing gently with a closed fist into each uterine horn. At this time an antibiotic should be administered into the uterus. The vulva should then be sutured to prevent another prolapse. Also an antibiotic should be given to the cow for 4 or 5 days. Treatment of this condition requires trained personnel.



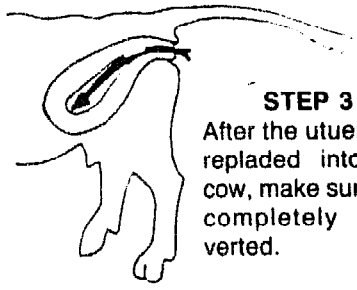
UTERINE PROLAPSE



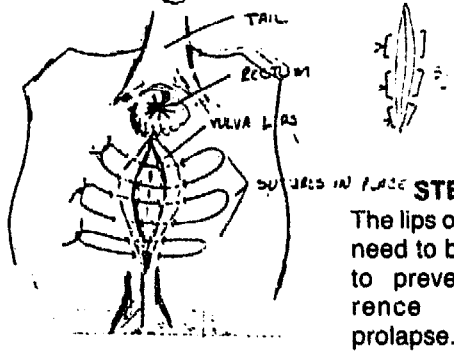
STEP 1
Carefully wash uterus with soap, water, and disinfectant.



STEP 2
Lift uterus up an gently begin to replace it into the cow.



STEP 3
After the utuerus is repladed into the cow, make sure it is completely inverted.



STEP 4
The lips of the vulva need to be sutured to prevent recurrence of the prolapse.

Retained Placenta

Sometimes the placenta will remain attached to the uterus longer than 24 hours. If this occurs, the cow should be watched closely for signs of infection. These signs include listlessness and loss of appetite. If the cow doesn't show signs of infection, it is best to leave the cow alone and let it fall off on its own. If the placenta has not been shed after 3 days, it is best to give the cow some antibiotics daily. If it is deemed that removal is necessary, a gloved hand should be lubricated and inserted into the uterus. With careful manipulation the placenta is removed. Following removal of the placenta, antibiotics should be administered into the uterus.

Nerve Paralysis

Sometimes following a difficult delivery of a large calf, the cow cannot get up. This usually results from damage to nerves in the pelvic canal. The cow may attempt to stand, but one or both legs slide outwards. The treatment for this condition is to tie the legs together with a rope above the hocks. Also, the cow should be rolled into a different position every 12 hours. If the cow cannot stand within 2 weeks, the chances of recovery are slim.

Managing Nursing Calves

In certain cases where the mother cow may die or be used for milk production, a baby calf may be raised without the mother's milk. In these cases, it is still very important that the calf receive colostrum within 6 hours of birth. While whole milk is the best choice of milk, other substitutes might be goat's milk or milk replacers. Milk replacers should contain 22% protein and 10% fat. It is best to feed the calf with a nipple bottle 1-2 liters 2-3 times per day. Do not overfeed the calf as this causes scours and intestinal upset. Keep the calf hungry. Provide water and a small amount of concentrate or grain free-choice. After 6-8 weeks on the bottle, the calf can be gradually switched to hay and grain.

A few management procedures should be performed after birth and before weaning:

1. **Castration**

   If the male calf is not to be kept as a bull it is best to castrate it early. There is practically no stress or bleeding when done at this time and the calves are easier to handle. Before castration or dehorning it is best to vaccinate the animals for blackleg and malignant edema.

   The best method of castration, on young animals up to six months, is with a clean sharp knife. Secure the animal with ropes or a crush. First, use a mild disinfectant and water to clean off the scrotal area. Then grasp the end of the scrotum, pull it tight, and cut off the lower ⅓ of the scrotum. After exposure of the testicle, a steady pull on it will break the spermatic cord inside the body cavity and very little bleeding occurs. If there is any fatty tissue hanging out of the scrotum, it needs to be trimmed away with a knife or scissors. **The use of a screwworm fly repellant is recommended every 2-3 days following the castration until the wound heals.** Exercise of the calf is recommended for 1-2 weeks following castration to help prevent infection.

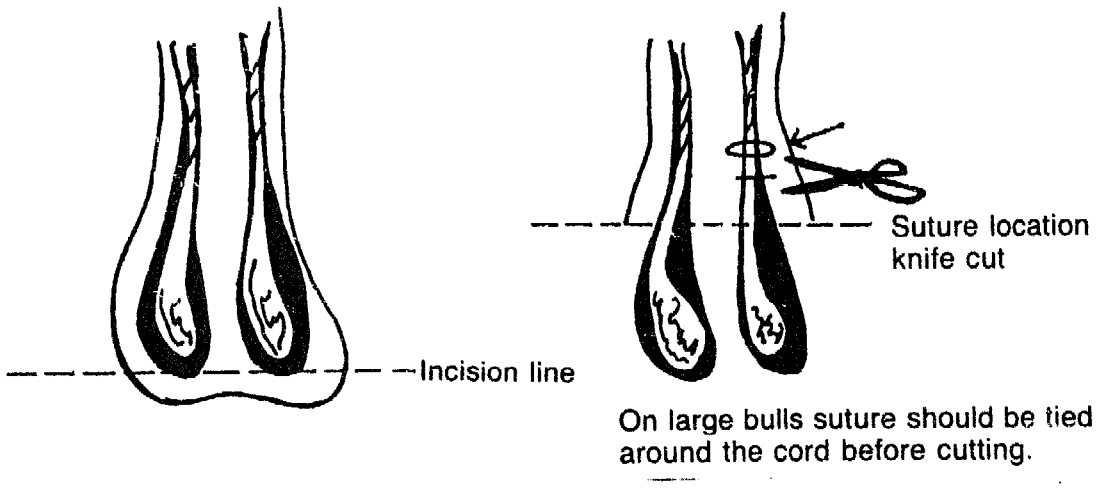


Fig. #29 Castration technique. View from rear of scrotum.

Another method involves the use of a **Burdizzo** which crushes the spermatic cord without cutting or wounding the scrotal skin. (See figure 30.) The advantage of this method is that there is no bleeding or chance of infection or screwworm infestation. The crushing of the cord stops the blood flow to the testicles and they wither away. Careful attention should be taken in making sure the cord does not slip sideways from the jaws of the burdizzo when crushing. Each cord should be crushed separately.

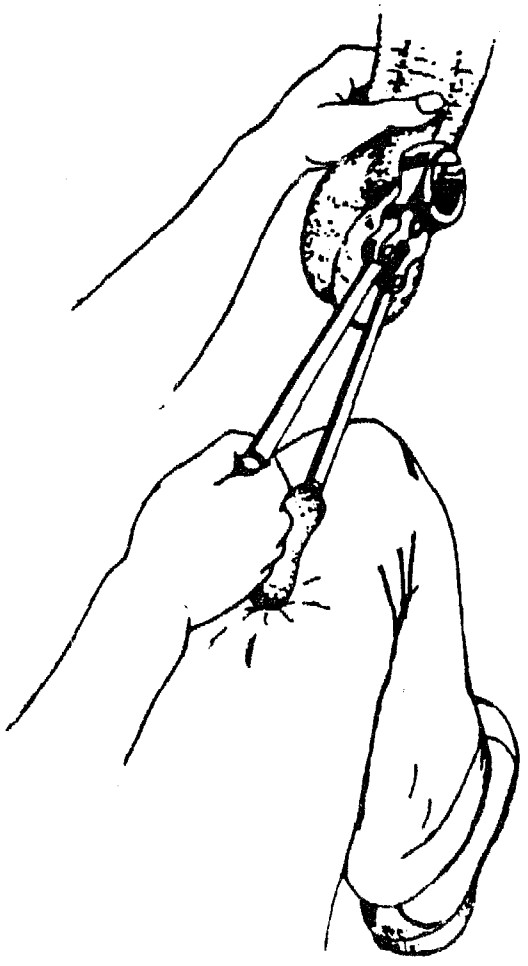


Fig. #30
Proper use of a Burdizzo

An **emasculator** can be used on older animals instead of cutting the cord with a knife. This decreases blood loss. If this instrument is unavailable, tie a piece of suture (catgut) around the cord tightly and cut the cord 1-2 cm. below the suture. (See figure 29.)

If there is considerable bleeding 15-25 minutes after the castration, the bleeding will have to be controlled. This can be done by application of cotton into the scrotum and/or suturing the wound closed. The cotton and/or sutures should be removed in 24 hours and the wound treated with antibiotics, fly repellant and penicillin injections for infection. If there is considerable swelling 1-2 days afterwards, penicillin should be administered again.

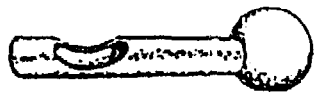
2. **Dehorning**

   The reason for dehorning is to keep cattle from injuring humans and one another with their horns. If dehorning is desired, it should be done at an early age. Several methods are available which include a hot iron, paste of caustic soda, mechanical dehorners, or

a saw. The method of choice for baby calves in a warm climate is a hot iron. As soon as the horn button appears, the red hot iron is applied to the horn. The end of the iron should be hollowed out so that its sides go down around the button. It should be held on the horn for a few seconds to kill all the horn cells. The advantage of this method is there is not bleeding. However, it cannot be used on animals over four months of age. Caustic paste can be applied to a calf's horn that is 1-10 days old. One disadvantage of this method is that, in rainy weather the paste gets into the calf's eyes. Also, oftentimes the cow will lick the paste off diminishing its effectiveness. Mechanical methods of dehorning are used primarily on older animals. It is necessary to control the bleeding following these procedures. A small amount of bleeding can be controlled by applying cotton directly into the recess where the horn used to be. To control heavier bleeding, the vein can be pulled with a forceps or a hot iron can be used to cauterize the bleeding vessel. As with castrating, it is most important to use a fly repellant for screwworms and maggots.

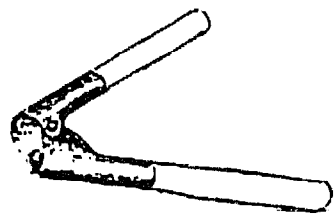
DEHORNING CATTLE

Dehorning instruments:

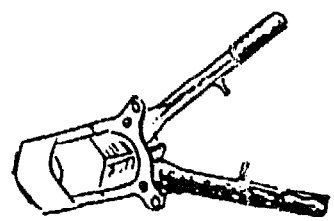


Tube dehorner for calves up ing calves to 1-year old.

Hot iron dehorner for calves up to 4-5 months old.

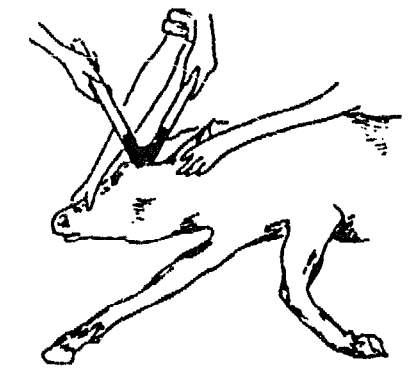


Barnes dehorner for older cattle



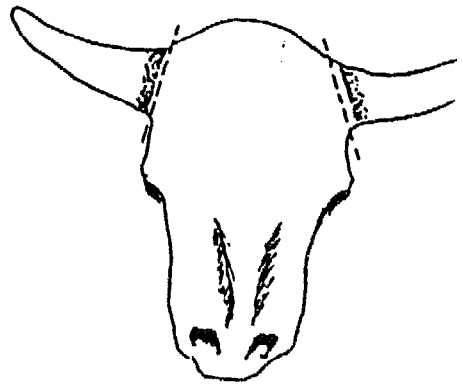
Keystone dehorner for older cattle

Dehorning saw (used only for dehorning)



Using a Barnes dehorner on a calf

Dotted lines indicate ¼-inch of skin to be removed along with the horn butt to prevent regrowth. This is true for both calves and older cattle.



3. **Implants**
   The use of hormonal implants increases weight gain by 10%. These are implanted into the ear of the animal according to individual implant instructions. These can be given as early as 1-2 months of age but should not be given within 100 days of slaughter. The implants will last for 100-200 days depending on the type of implant. These should not be used on breeding animals:

Medical Kit

Specific equipment is needed for proper examination and treatment of animals and should include the following:

1) strong rope and/or halter
2) nose tongs—handy if available-not necessary
3) rectal thermometer
4) soap and disinfectant for cleaning and treating wounds
5) container for water and disinfectant
6) cotton, sponges, or clean rags for cleaning wounds
7) bandage material of some sort
8) surgical instruments—knife, forceps, tweezers, surgical needles, and suture of some sort
9) syringe and needles
10) wound dressing of some kind
11) tick and screwworm medication
12) antibiotics—such as penicillin
13) dewormer
14) medication for allergic reactions

Using Drugs Properly

Drugs as chemical substances work in the treatment of disease. They generally have strong actions and can have serious side effects. Precautions need to be followed when using drugs and these include:

1) Be sure to select the proper drug to treat the problem at hand. A drug which is effective for one disease may be totally worthless in the treatment of another disease.
2) Read label warnings and follow directions, observing expiration dates of medicine.
3) Be sure to give the correct dosage. If too low or too high a dose is given, the drug could cause a serious reaction (possible death) in the animal.
4) Use cleanliness and sterility in administering the medication. Boiling the syringes and needles in water for 15 minutes is best. Chemical disinfection is also used.
5) Store medications properly, usually refrigerated and out of the sunlight.

Drugs can be administered in a number of ways depending on directions given on the label. These include:

1) orally as bolus- administered with a pill or balling gun
2) orally as a paste- administered with a syringe or caulking gun

3) orally as a drench- administered with a dose syringe, bottle or tube
4) intramuscular injection- given by needle in large muscle areas or hind legs or shoulder
5) subcutaneous injection- given under the skin, usually in the neck region. Use a shorter needle ½-1" long and direct needle at an angle. Certain drugs such as pencillin should never be given into a blood vessel; so always pull back on the plunger of the syringe just before injecting a drug to be sure you're not in a vein. When giving I.M. or S.Q. injections and the needle is in a vein, blood will show in the syringe and a different injection site needs to be found.

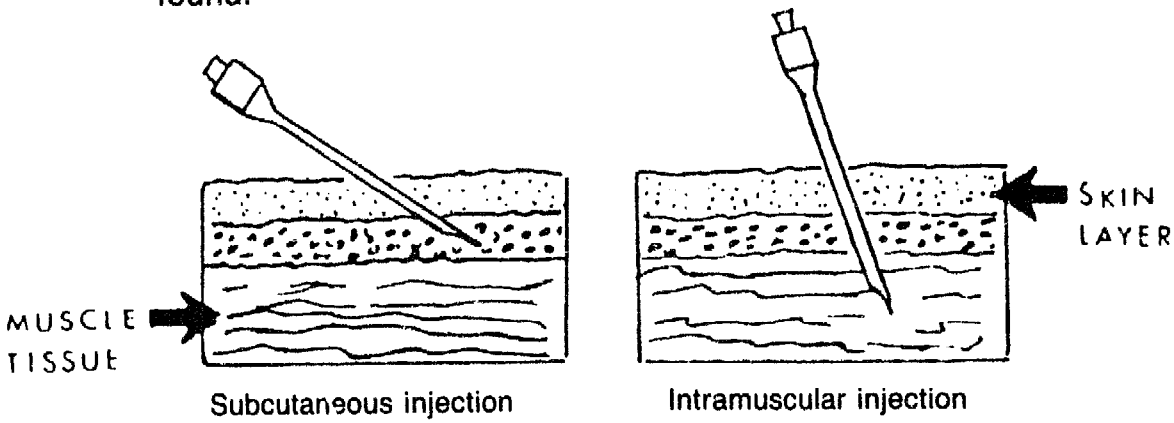


Fig. #32

6) intravenous injection- given directly into the vein; either jugular or tail vein
7) intra-peritoneal injection- given by administering the drug directly into the abdominal cavity
8) administered in the feed or water

Be very careful not to inject oneself with a needle. Also, never give any medication by any route other than what is recommended by the manufacturer.

Figuring Drug Dosages

The effectiveness of most drugs is dependent to a large degree on proper dosage given periodically so as to maintain a proper concentration in the blood. The dose varies depending on the concentration of the drug and the weight of the animal. Units of measure include:

International Unit (I.U.)- arbitrary measure of drug activity against micro-organisms in the laboratory; used for older antibiotics such as penicillin .

Milligram (mg)- 1/1000th gram- metric measure of weight

Milliliter (ml)- 1/1000th liter- volume measure

Cubic Centimeter (cc)- volume measure; 1 cc is equal to 1 ml

Kilogram (kg)- weight measure; equals 2.2 pounds.

To determine the proper amount of injectable drug given an animal, one has to convert the dose in units or mg per lb. or kg of body weight into volume (ml) to give. We need to know three things:

1) Weight of animal: This can be estimated with the help of a heart-girth measurement and expressed in lb. or kg. Remember

there are 2.2 lb. in each kg.

2) Concentration of the drug: This information is found in the package label and is expressed as units/ml or mg/ml.
3) Dosage per lb. body weight of per kg body weight: This information is found on the package label or insert and is expressed in mg/lb or mg/kg.

Example: a farmer has a 700 lb. (318 kg) cow and needs to give a dose of tetracycline. The dose level is 5 mg/lb and the concentration of the drug is 100 mg/ml. How many ml or cc should he give?

1) write down pertinent figures:
   weight of cow- 318 kg (700lb)
   dose level- 11mg/kg (5mg/lb)
2) figure total dose in mg for weight of cows:
   weight multiplied by dose equals total mg.
   312 kg x 11 mg/kg equals 3500 mg
   (700 lb x 5 mg/lb equals 3500 mg)
3) figure out how many ml it takes for total mg needed:
   because there are 100 mg in each ml you will divide total mg by the concentration:
   3500÷100=35ml (cc)
   100 mg/ml

This is the amount you would give to the cow.

Proper Use of Antibiotics

Antibiotics are substances that are used to inhibit or kill microorganisms (germs). They are the most commonly used drugs to treat disease and are also the most misused drugs. They are very effective when used properly. Some points to consider are:

1) An antibiotic is a substance which can be harmful to life. Misuse can harm the animal being treated.
2) The choice of an antibiotic depends on accurate diagnosis of the disease problem.
3) Antibotics are effective against bacterial infections. They are **not** effective against viral and protozoan infections.
4) Antibiotics can be used alone or in combination with other antibiotics. However, certain combinations of antibiotics tend to work against each other and should be used only under the recommendation of a veterinarian.
5) Effectiveness of antibiotics depends on giving the proper dose, repeated at the proper time (ex. 12-24 hr.), and given for a recommended time (ex. 3-5 day). If the proper concentration of the drug is not maintained in the blood then, the antibiotics usefulness is diminished considerably. Usually one has to give more than one dose of the antibiotic. If antibiotics are given for too long of a period they may kill the normal bacteria in the rumen causing digestive upsets. Always read and follow the label and dosage instructions carefully.
6) Some bacteria can become resistant to antibiotics. This is likely to occur when antibiotics are used over a long period of time

or when they are used in too low of a dosage level.

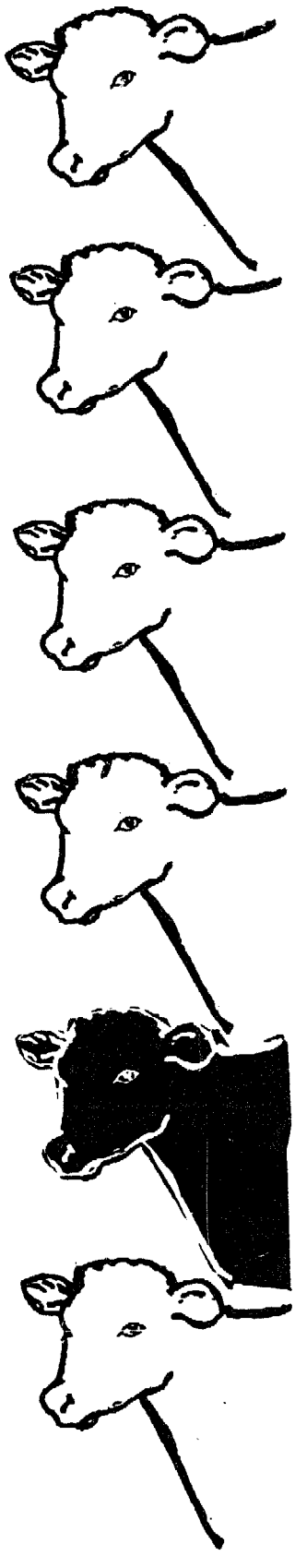
7) Antibiotics are most effective against acute (sudden) infections where bacteria are growing rapidly.
8) Withdrawal periods are listed on product labels. These are the number of days that the antibiotic exists in the meat or milk after the last injection. Their guidelines must be strictly observed.
9) Antibiotics can be added to feed or water for treating or preventing disease.
10) A good guideline for telling if the antibiotic is effective in treating a disease is to observe the rectal temperature. It will usually be elevated in the disease condition and should fall back to the normal range (38-39.5 C) after antibiotic treatment. Continue treating the animal at least 48 hours after the temperature has dropped. If the temperature does not drop after 24 hours, then another antibiotic should be tried or the diagnosis re-elevated.

The following section on antibiotics contains excerpts from the Stockman's Veterinary Guide, Lee Newman D.V.M.

Sometimes animals are allergic to certain medications or vaccines. This is called **anaphylactic shock** and usually occurs almost immediately following injection of the drug. The symptoms observed are nervousness followed by severe depression, glassy or puffy eyes, increased slobbering, and grinding of the teeth. Rapid shallow breathing, muscle tremors, sweating, and staggering can also be observed. Convulsions and death can occur very quickly without treatment. Treatment consists of injections of epinephrine, corticosteroids (azuim, or dexamethazone) and antihistimines. These drugs should be available and need to be administered as soon as allergic symptoms are observed.

Section 5

Diseases



Diseases

Disease may be defined as any change from the normal function of the body. The causes of disease are bacteria, viruses, protozoa, parasites, fungi, poisons, trauma and nutritional deficiencies.

Bacteria, viruses, and parasites are living organisms which live inside or outside of the affected animal. There are numerous infectious agents that can be spread from animal to animal. They are spread by (1) biting insects, (2) direct contact between well animals and sick animals, and (3) indirect contact through blood, secretions, and excretions of diseased animals. Non-infectious diseases would include trauma, deficiencies and poisons which do not not spread from animal to animal.

Bacteria

Bacteria are single-celled organisms which are individual discrete forms of life. Given ideal conditions of warmth, nutrients, and mositure, most of them can also multiply outside of the animals' body. Under adverse conditions some bacteria can turn themselves into a very resistant spore which can survive for many years. The classic example is anthrax whose spores exist in the soil for up to 40 years. Other examples of bacterial infections include mastitis, blackleg, tetanus, navel ill and calf diptheria.

Viruses

Viruses are smaller than bacteria and can be seen only with special microscopes. Unlike bacteria, they cannot multiply outside of the animal's living cells. Once inside the animal, viruses penetrate the animal's cells and use these metabolic processes for their own purposes. Viruses are usually quite selective in the sites they choose to infect. Examples of disease viruses cause are rinderpest, African swine fever, and foot and mouth disease.

Protozoa

Protozoa belong to the animal kingdom and are larger than bacteria. One difference between protozoa and bacteria is that in some diseases the protozoan organisms undergo part of their reproductive cycle in an intermediate host such as a tick or fly. Examples of protozoan disease caused in this way are East Coast Fever and Redwater Tick Fever. Examples of protozoan diseases with no intermediate host are cocciciosis and trypanosomiasis.

Rickettsia

Rickettsia are bacteria that multiply only in living cells. Examples of these are anaplamosis and heartwater which are transmitted by ticks.

Parasites

Parasites are organisms that live on or in a host animal but contribute nothing in return and derive nutrients from the animal. Ectoparasites, living on the outside of animals, include ticks, mites, fleas, and lice. Endoparasites, living inside the animal, are flukes, flatworms, and roundworms.

Fungi

Fungi are members of the vegetable kingdom. Ringworm is an example of a disease caused by a fungus.

Bacteria and viruses invade the body in various ways, mainly through digestive, respiratory, genitourinary tracts, and skin. The ability of the infective agent to cause disease depends upon the virulence of the host.

Factors Affecting Whether An Animal Becomes Ill

Not all animals that are exposed to a disease agent will become ill. Many factors are involved in the disease process including:

a) **pathogenicity of infectious agent-** this refers to the ability of the organism to invade the host's body. Some agents are highly infectious; whereas others need special conditions to cause illness.

b) **age of the animal-** very young and very old animals are more susceptible to disease.

c) **nutritional status-** animals which are in poor physical condition due to inadequate nutrition are much more likely to get sick. Also, some nutritional deficiencies are directly responsible for disease.

d) **parasites-** animals heavily infected with internal or external parasites are much more susceptible to infection.

e) **weather conditions-** extreme weather conditions have considerable influence over disease processes.

f) **stress-** conditions such as shipping fatigue, excessive labor, etc. can predispose animals to disease.

g) **immune status-** whether an animal has been previously exposed to an illness or has been vaccinated or received immunity from its mother affects the susceptibility to an illness.

h)**other factors-** sex, breed, sanitation, and management.

Diagnosis of Disease

Certain thoughts should be kept in mind in determining first if an animal is sick and then the reason for the sickness. First, it is important to get a history of the illness and the animals involved from the owner. Some questions that need to be asked are: the number of animals involved, contacts with adjacent animals, addition of new animals to a herd, changes in weather conditions, treatment methods applied, etc. Usually the more questions asked, the easier it is to arrive at a diagnosis. The second thing is the surroundings in which the affected animals live. For example, lice and flukes favor marshy areas; leptospires flourish in damp soil; and dirty surroundings favor disease-carrying insects and parasites. Often the cause of various poisonings or nutritional diseases can be detected by examination of the surrounding area.

The final determination of a disease is done by inspection of the sick animal. First, look at the animal from a distance noting the posture, alertness, and the general attitude of the animal. An animal standing with its legs tucked underneath, with its head down, and ears drooping, is obviously depressed. If the animal is laying down, this may indicate a more serious illness. In observing from a distance one should note whether the breathing is labored, presence of a cough, if there is any lameness, or signs of diarrhea or straining, and if the animal is gaunt or full. An animal

not eating or drinking normally is usually sick.

Upon closer examination of the animal, the rectal temperature should be checked. This is accomplished by gently inserting a thermometer into the rectum and holding it there for two minutes. Be sure to shake the thermometer down to 94 °F before using. **The normal temperature of cattle or buffalo varies from 101 °F to 102.5 °F or 38 °C to 39.5 °C.** This may increase by up to 1 °F for younger animals, or those animals under stress from excessive heat. An increase in body temperature usually indicates an inflammatory process is taking place and antibiotics are indicated. **The normal respiration rate (breathes per minute) for adult cattle is 15-20 respirations per minute.** The pulse can be checked with a stethoscope or under the jaw on the facial artery and should be 40-60 beats per minute for adults. Pulse and respiratory rates increase with exercise, excitement, hot weather, and illness. Younger animals will normally have increased respirations and pulse compared to older animals. The haircoat should be examined as well as checking for nasal and eye discharge, the presence of ticks, and/or lice, and also the condition of the teeth and gums. The gums can give an idea of the blood circulation in the animal. Normally, they should be bright pink:, whereas, paleness would indicate poor circulation, shock, or heavy parasite infection. One should also check for any swellings around the eyes, naval, neck, etc. By thrusting a closed fist into the left upper flank region, you can count the number of times that the rumen contracts. This should be 2-3 times per minute in a healthy cow. Rumen movement less than 2-3 minutes suggests a more serious illness. Also, the muzzle or nose should be clean and wet as opposed to a dirty nose with discharge.

After examination of the animal one needs to make a diagnosis based upon the history and the signs of the illness. Specific diseases will be covered later in the section with treatment suggestions. If possible, it is sometimes helpful to submit samples to a laboratory for analysis. Blood samples, tissue samples, and feed samples can be collected by a qualified personnel. It is also worthy to remember that certain diseases such as rabies or anthrax can be transmitted to man. Thus, until a definite diagnosis is made precautions should be taken to protect one's safety.

Prevention of Diseases

When an infectious disease invades an animal's body, the animal will be susceptible to it and the disease process occurs or the animals will be able to reject the disease. As we have mentioned previously, the animal's ability to resist disease is dependent on a number of factors. One of the most important of these factors is within the animal itself—the immune system. This complex system allows the animal to fight off certain infections before they can be harmful.

The immune system is made up of antibodies which circulate throughout the body via the bloodstream. These antibodies seek out and destroy invading organisms. They are produced as a result of previous exposure to the disease or by a vaccine. Vaccines contain disease organisms which have been modified so they give only a mild attack of the disease which makes the animal resistant to the disease.

Vaccination is the processs of introducing an infection in animal

by using an altered form of a disease agent. Types of vaccines include:

toxoids—prepared from toxins (poisonous substances secreted by bacteria)

bacterins—bacteria that have been inactivated but will usually give disease protection for up to twelve months. (An example is blackleg bacterin.)

live bacterial suspensions- produce a longer lasting immunity than bacterins but are also more dangerous to use. (An example is brucellosis strain 19.)

modified live virus- vaccines are live virus that have been modified to not cause disease in the host animal. These vaccines produce an effective and longer lasting protection.

antiserum- agents which contain ready-made antibodies. These are used sometimes in the treatment of certain viral and bacterial diseases. The duration of protection is quite short.

Vaccines are not available for all diseases. Where they are available for diseases specific to certain areas, they afford a very economical protection. It is considerably more effective and less expensive to **prevent** a disease rather than treat it. Vaccines should always be **refrigerated** and **protected from the light.** Specific vaccinations will depend on diseases in your area.

Other management factors important in the prevention of disease include cleanliness of the environment the animal lives in and the nutritional state of the animal. **A healthy well fed animal can resist diseases much better than one that is weak, due to improper nutrition.** Also, **the presence of parasites makes the animal much more susceptible to disease or infection.**

Diseases

The following section contains a brief summary of various diseases that can affect cattle. It is not possible in a manual such as this to describe in detail every illness that affects cattle. This section is divided into viral diseases, bacterial diseases, protozoal and rickettsial diseases, tick-borne diseases, parasitic diseases, and miscellaneous diseases.

Diagnosis and treatment should be carried out by trained personnel when available. Post-mortem exam (examination of dead animal to determine the cause of death) and collection of laboratory samples would be best done by qualified people. Some definitions of common terms are:

acute—having a sudden onset

chronic—having a long duration

incubation period—refers to length of time from exposure to a disease until the signs of the disease become apparent.

Viral Diseases

Foot and Mouth Disease—

(Afta Epizootica, Afthosa Fievre', Aphteuse)

Nature and Occurrence

Foot and mouth disease (F.M.D.) is a highly contagious disease of predominantly cattle and other cloven-footed animals. It can affect cat-

tle, buffalo, pigs, sheep, goats, and many wild species. Cape buffalo have been shown to act as carrier animals. This disease occurs in almost all of the tropics and especially in South America, Africa, and Asia. It is not present in North America, Australia, or New Zealand.

Although F.M.D. does not cause a high death loss, the reduced production of affected animals and also rapid spread of the infection make it a very serious disease.

The disease is spread chiefly by the contents of the blisters (on the nose, tongue, mouth, udder, and feet) bursting. It is also spread by the milk, urine and nasal discharge, conveying the infection directly from a sick animal to those that are healthy. The infection can also be spread by birds and meat products. It is more prevalent in cooler seasons of the year.

Symptoms

The incubation period (time from exposure to observation of sickness) is usually 3-8 days. The symptoms in older animals and in lean animals are not as severe as in younger animals or better conditioned animals. Also, the symptoms are not as severe in African or Creole cattle as in temperate-zone breeds. Symptoms include: high temperature, loss of appetite, formation of vesicles (small blister-like swellings) on the tongue, dental pad between the claws and around the hooves. The vesicles soon rupture, becoming ulcers in the mouth, resulting in drooling and difficulty in chewing. The animals will become lame and the hooves will fall off sometimes. Vesicles will also form in the udder and teats and milk production will diminish. In younger animals the heart muscle cells are destroyed and take on a yellowish look (tiger heart). These animals either die or are poor doers. Most animals recover spontaneously in 7-14 days.

Diagnosis, Treatment and Control

Rapid accurate diagnosis of F.M.D. is essential. Vesicular Stomatites resembles F.M.D. and requires laboratory analysis to differentiate the two. If F.M.D. symptoms occur the proper governmental authorities should be contacted immediately.

Treatment with disinfectants and protective dressings will sometimes shorten the life of the disease.

Control is by slaughter or mass vaccination depending on governmental policy. If vaccination is attempted, the vaccine should be prepared from the same sub-type of virus that is causing the outbreak. Vaccination is usually repeated every six months.

Vesicular Stomatitis

(Sore Mouth, Stomatite Vesiculeuse Contagiuse)

Nature and Occurrence

Vesicular Stomatitis (V.S.) affects horses, cattle, and pigs. The symptoms and lesions are the same as F.M.D. It affects far fewer numbers of animals and there is virtually no death loss as compared to F.M.D. It is present in virtually all countries.

Symptoms

The incubation period is generally three days followed by fever and vesicle formation in the inner cheeks and tongue. Foot and teat lesions

are rare and recovery takes place in 3-4 days.

Diagnosis, Treatment and Control

As mentioned previously, it is impossible to tell V.S. from F.M.D. and thus, governmental authorities should be notified if suspicious symptoms occur. Treatment is not usually attempted as recovery is rapid and complete. Standard hygience procedures are recommended as well as isolation of sick animals for control. A vaccine is available but not extensively used.

Malignant Catarrhal Fever

(Malignant Head Catarrh, Snotsiekte)

Malignant Catarrhal Fever (M.C.F.) is a fatal infection of buffalo, cattle, and deer. Sheep, goats, and wild ruminants like the wild beasts do not show symptoms but are thought to spread the disease particularly at the time of parturition (birth). The disease is cause by a herpes virus and occurs sporadically world-wide. Its prevalence is particulaly high in East, Central, and South Africa.

Symptoms

The incubation period ranges from 1-4 months. Symptoms can vary but many include discharge from the nose and eyes, inflammation of the mouth, high temperatures, loss of condition, emaciation, difficulty in breathing, opacity, (cloudiness of the eyes) sometimes with blindness, and peeling and thickening of the skin. Depression is severe, and the lymph nodes on the outside of the body are clearly swollen. Diarrhea may occur. Nervous signs, particularly lack of coordination, may be severe. Most affected animals will die 4-12 days after the onset of the disease.

Diagnosis, Treatment and Control

Diagnosis is based on symptoms and post-mortem lesions which include inflammation and ulceration of the esophagus and stomach and swelling of the kidney, liver, and lymph nodes. There is no treatment and control measures include keeping cattle and buffalo separate from wild game, sheep, and goats. Acutely ill cattle do not spread the disease to healthy animals.

Rinderpest (Cattle Plague, Peste Bovina)

Nature and Occurrence

Rinderpest (R.P.) is a highly infectious and usually fatal disease of ruminants and pigs. In the past, this disease has been the world's most destructive disease of cattle. R. P. is presently confined to East and West Africa, the near East, and Asia. The virus is transmitted in oral and nasal secretions, feces, and expired air.

Symptoms

The incubation period is 3-15 days and the characteristic signs occur in the mucous membranes. First there is a high fever followed by depression and the animal going off feed. The membranes of the mouth and eyes are intensely inflammed. Hemorrhagic patches and ulcers are seen on the mucous membrances with the presence of ropy, foul-smelling salvia. There is a purulent discharge from the nostrils with coughing and rapid breathing. Diarrhea begins 1-2 days after the appearance of mucous lesions. The death loss approaches 100%.

Diagnosis, Treatment, and Control

R.P. may be confused with M.C.F. however, M.C.F. does not usually display the intestinal lesions and diarrhea. B.V.D. can also be confused with R.P. Laboratory diagnosis of lymph tissue may be used for confirmation.

Treatment is ineffective. For control there is a vaccine available which gives life-long immunity. In areas where R.P. is a problem, all susceptible animals should be vaccinated upon reaching 6 months of age. In areas where wild game are present, it is difficult to eliminate the disease.

Bovine Virus Diarrhea (Mucosal Disease)

Nature and Occurrence

Bovine Virus Diarrhea (B.V.D.) is a disease of domestic and wild ruminants. The occurrence is world-wide with younger animals affected more than older animals. The infection rate can be very high, but the death rate is low.

Symptoms

The symptoms of B.V.D. resemble very closely that of R.P., F.M.D., and M.C.F. There is a high body temperature very early which decreases to normal or subnormal later in the disease process.

The incubation period lasts 1-3 weeks with fever ulcers of the mouth, and diarrhea. Pregnant animals abort 3-6 months after infection, or they can give birth to calves which exhibit neurologic abnormalities.

Diagnosis, Treatment, and Control

Laboratory diagnosis may be needed to distinguish B.V.D. from the other viral mucosal diseases. There are erosions and ulcers along the entire digestive tract.

Treatment is usually unsuccessful.

Control can be achieved by vaccination and keeping a closed herd.

Cow Pox (Variola)

Nature and Occurrence

Cow Pox is a mild viral disease affecting cattle which can be transmitted to man. This virus attacks the cells of the skin and is usually spread during milking of dairy cattle.

Signs

Cow Pox affects hairless areas of the body usually the teats and the sides of the udder. Infection begins as a blister with yellowish fluid which breaks and fill with pus. Scabs eventually will form leaving a characteristic "pock" mark. The lesions in the teats prevent calves from nursing, and milking is difficult. The incubation period is 3-5 days with the lesions disappering after about two weeks.

Diagnosis, Treatment and Prevention

Characteristic signs in hairless areas are helpful in diagnosis. It should be remembered that this disease can be transmitted to humans.

Treatment involves keeping the lesion clean while applying a sulphonamide or antibiotic ointment.

There is a vaccination available but is seldom used due to the mild nature of the disease. Disinfection of equipment and hands during milking is the best method of control.

Warts (Papillomaas or Fibromas)

Warts appear as fleshy lumps and are caused by viruses. They appear more predominantly in 6 month to 2-year-old cattle. Most cases will recover spontaneously without treatment. In certain wart locations (ex. teat or penis) the warts can be removed surgically. There are vaccines available to prevent and treat warts or an autogenous vaccine can be prepared. An autogenous vaccine is made by preparing a vaccine from the acutal warts removed from the animal and injecting this solution. If these warts are quite numerous or large, they may develop a bacterial infection.

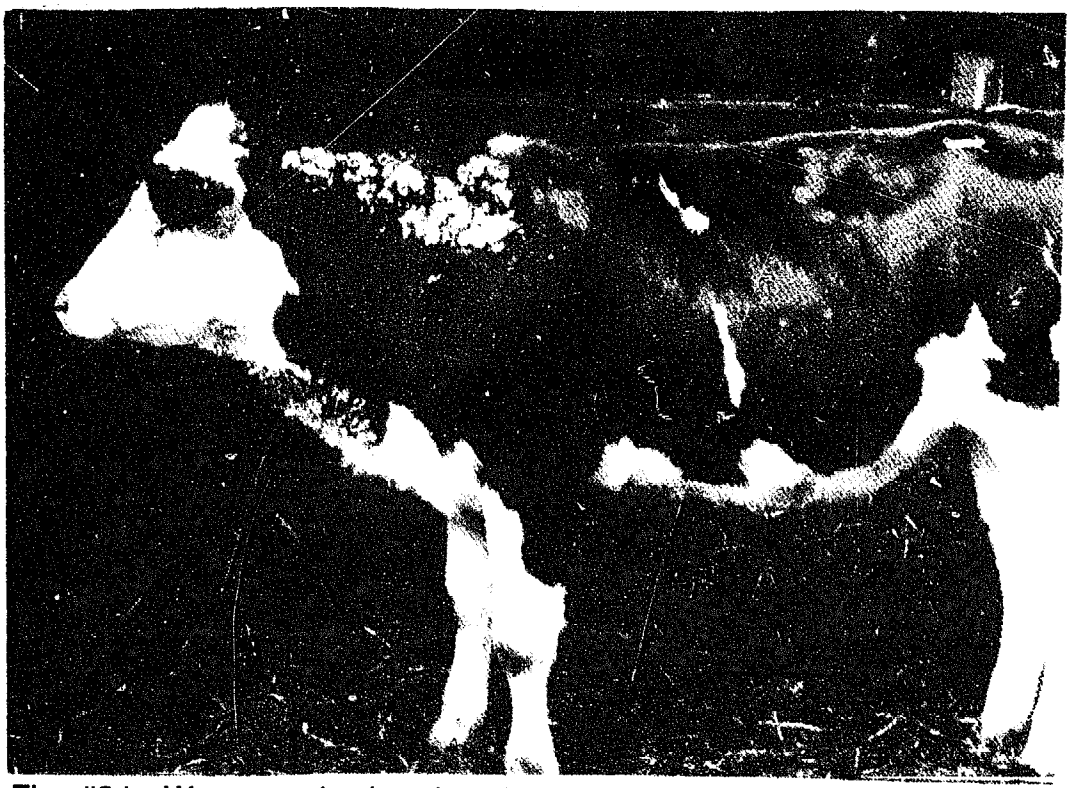


Fig. #34—Warts on the head and neck. These normally disappear spontaneously, but vaccines can be used. (Veterinary Book for Farmers—R. W. Blowey 1985)

IBR Syndrome (Infectious Bovine Rhinotracheitis—I.B.R.)

(Infectious Pustular Vulvovaginitis— I.P.V.)

Nature and Occurrence

I.B.R. and I.P.V. show different clinical signs of the same infection in ruminants. The cause is a herpes virus and the occurrence is worldwide. The IBR syndrome is characterized by fever and inflammation of the nasal passages and trachea. The IPV syndrome is characterized by fever and vulvovaginitis. Recovered animals from both syndromes often remain carriers. IBR spreads by close contact with sick animals via airborne transmissions. IPV spreads venereally.

Signs

The incubation period of IBR is usually less than one week. The clinical signs are a sudden high fever, loss of appetitie, runny eyes, and nasal discharge. Abortion is very common among pregnant animals. Unless there is a secondary bacterial infection, most animals recover com-

pletely within two weeks.

The IPV syndrome is manifested by low grade fever, congestion of the lining of the urogenital tract, swelling and discharge from the vulva, and the formulation of pustules in the vagina. The vaginal irritation is intense. As with IBR, complete remission of signs occurs within two weeks. Bulls can develop an infection of the outer lining of the penis.

Diagnosis, Treatment and Prevention

Diagnosis is based upon clinical signs, large nuumber of animals affected, and recovery from infection. Diseases which might be mistaken for IBR are FMD, RinderPest, MD and MCF.

A live virus vaccine is available and effective for prevention of the disease. **It should not, however, be given to pregnant animals.** It will cause the cow to abort. Treatment is used for prevention of secondary infection.

Rabies (Hydrophobia, Lyssa, Rage)

Nature and Occurrence

Rabies is a fatal disease which affects the nervous system of all animals and man. It is transmitted by infected saliva of affected carnivores (dogs, cats, rats, skunks, foxes, hyenas, mongoose, bats, etc.) Cattle are commonly infected and the distribution is world-wide except for the British Isles, Australia, and New Zealand. Rabies is most common in Third World Countries. According to the U. S. Communicable Disease Center, in 1983 there were more cases of rabies reported in cattle than dogs and cats.

Signs

The incubation period is from 3-8 weeks up to 6 months. In dogs and hyenas the first symptoms are marked changes in behavior. The animal may become nervous and aggressive and saliva drools from the mouth. The mode of transmission is usually a bite from an infected animal or contact with the saliva of such an animal.

Cattle will become restless and excited, their voice will change, and there may be considerable bellowing. Later there is a grinding of the teeth and drooling of saliva. Finally there is a weakness in the hindquarters and paralysis.

Diagnosis, Treatment, and Prevention

Diagnosis is very important due to possibility of infection in man. If rabies is suspected in an animal the proper health authorities should be notified for a definitive diagnosis. There is no treatment for rabies once the symptoms have begun and it is close to 100% fatal. There are adequate vaccines for all animals and man. In cattle vaccines are usually used only in the face of outbreak.

BACTERIAL DISEASES

Anthrax (Fievre Charbonneuse, Carbunco Bacteridiano)

Nature and Occurrence

Anthrax is an acute infectious disease of all warm-blooded animals and man. Its occurrence is world-wide and seems more predominant in tropical countries. Cases are seen more commonly during moist rather than dry periods of the year.

The infection is caused by a large bacillus which is transmitted by eating contaminated animal products or drinking of contaminated water. The organism can also enter the body through inhalation or through a wound. Anthrax forms highly resistant spores which are believed to remain infective for 10-20 years in the soil. These spores are also highly resistant to standard disinfectants.

Symptoms

After an incubation period of 1-10 days, most animals are usually found dead without any signs of previous illness. Death occurs very rapidly after the first symptoms occur. These are high fever, muscle tremors, labored breathing, staggering, and convulsions. Frequently, there are bloody discharges from the nose and anus.

Diagnosis, Treatment and Prevention

If an animal dies suddenly with no previous symptoms of illness, anthrax should be suspected and no post-mortem examination should be attempted. For diagnosis, a blood smear should be obtained from the ear or tail. (See figure #35) A vaccine is available for use in endemic area. Only high quality vaccines should be used as inferior vaccines can actually cause the disease. Extreme caution should be taken to not eat meat from suspected anthrax animals as this can result in human deaths. This should be strained with Giemsa-Wright, or Leishman stains and examined in a laboratory for large encapsulated bacteria or spores.

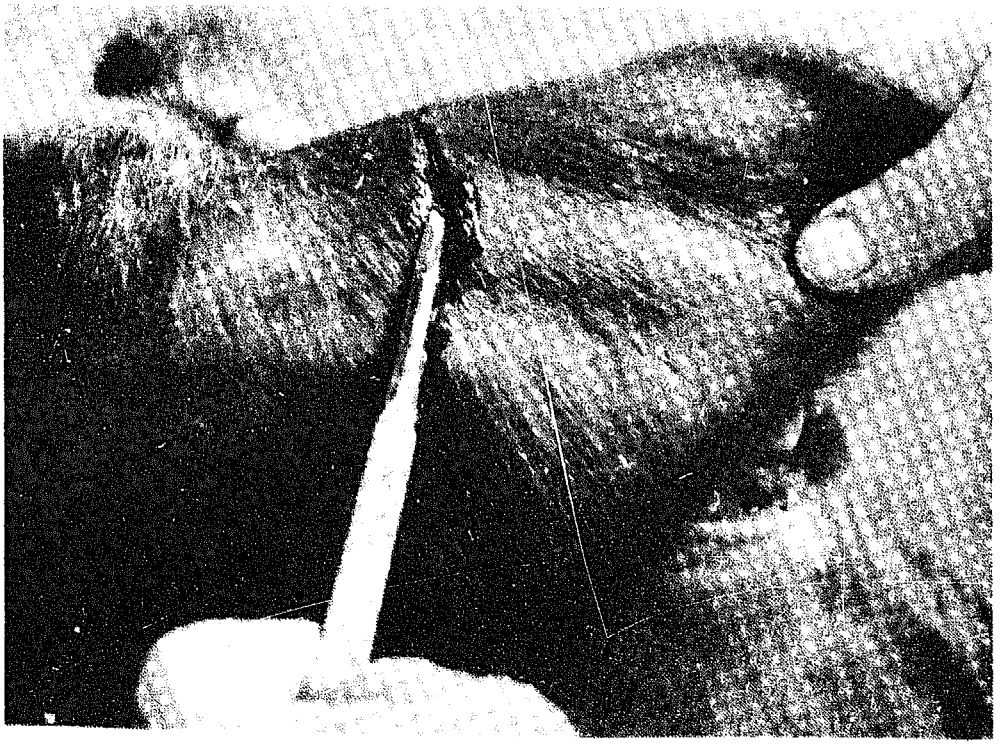


Fig. #35 Collection of a blood smear from a dead animal. (Veterinary Book for Farmers—Blowey, 1985).

Post-Mortem

Bloating and decomposition occur rapidly. Should the carcass be opened by mistake, the spleen would be enlarged and filled with tarry pulp. The blood would be dark and unclotted. Often snake bite, lightning

strike, or bloat are confused with anthrax.

Treatment of exposed animals is sometimes attempted using penicillin. Carcasses should be either burned or buried and the exposed area treated with quick lime. Anything coming in contact with the dead animal should be burned. The premises should be fenced off and all animals and man kept out.

Clostridial Diseases

Nature and Occurrence

Clostridial diseases are caused by a group of organisms called **Clostridium.** These organisms produce very potent poisons (exotoxins) which are damaging to cattle. Most clostidial species form **spores** which during unfavorable environments can survive in the soil for long periods of time.

It appears that clostridial organisms are present in about every region of the world. Usually clostridial infections are very severe and occur suddenly resulting in rapid death. Treatment is usually unsuccessful, but good vaccines are available for prevention of the disease.

Blackleg (Black Quarter, Quarter Ill, Charbon Symptomatique, Felon, Carbunco Symtomatico)

Cause: Clostridium Chauvoeli

Blackleg is most common in younger animals 6 months to 2 years old. It probably invades the body through a break in the skin or mucous membrane. It is characterized by a severe inflammation and death of muscle tissue in the heavily muscled parts of the body as a result of toxin formation.

Many times animals are just found dead with no signs of sickness. If symptoms are observed they include lameness, swelling on the upper leg which crackles on touch due to gas under the skin, severe depression, high temperature, and death. There may also be bloody discharges from the nose and anus before and after death.

Treatment is usually unsuccessful; however, large doses of penicillin may be helpful in early cases. Because this disease closely resembles anthrax, a post-mortem should not be attempted, but qualified personnel contacted for diagnosis. A blood smear from the affected muscle tissue will tell this disease from anthrax.

Prevention should be the main objective in outbreaks of the disease. A very effective vaccine is available and can be given as early as 2 weeks of age with annual booster injections.

Malignant Edema (Gangrenous Septicemia)

Cause: Clostridium Septicum

Malignant edema is closely related to blackleg but usually occurs following a wound. There is swelling around the wound, high fever and depression, followed by death. There is a jelly-like hemorrhagic fluid in the swellings.

Diagnosis and treatment are the same as in blackleg. Vaccination is the best method of prevention as well as proper treatment of wounds.

Cleanliness and disinfection during castration and obstetrical procedures is also beneficial for prevention of the disease.

Acute Cervical Hemorrhagic Edema
Cause: Clostridium Sordelli

This condition is similar to malignant edema except it is not associated with a wound infection. The animals show an elevated temperature, depression, incoordination, and death with 6-24 hours. Post-mortem lesions involve swelling and dark hemorrhage in the neck region. Treatment is usually unsuccessful with penicillin, the drug of choice. A vaccine is available for prevention.

Tetanus (Lockjaw, Tetanos)
Cause: Clostridium Tetani

Tetanus is a fatal toxicosis of all domestic animals and man. The organisms frequently enter the body through wounds, such as castration infections and deep puncture wounds. The course of the disease is usually 3-10 days.

The first signs of the disease are muscular stiffness and spasms. The tail and ear muscles are erect while the muscles of the jaw hold it tightly closed (lockjaw).

Consequently, the animal cannot eat or drink. These animals are very sensitive to sound, light and movement. They may assume a saw-horse stance.

If started early, treatment is sometimes successful. This includes injection of tetanus antitoxin (if available), thorough cleaning and disinfection of the wound, and large doses of antibiotics (penicillin). Prevention involves cleanliness when doing any surgical procedures such as castration and proper care of wounds. There is also an effective vaccine available. Any person working with animals should also have a current tetanus vaccination.

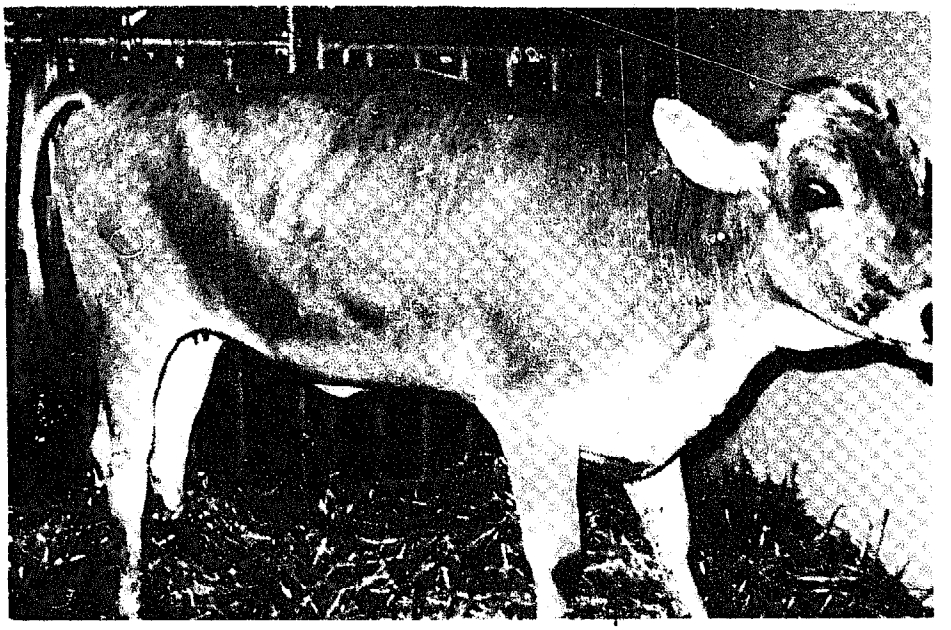


Fig. #36 Cow with tetanus. Animal exhibits "pump handle" tail and straight-legged posture. (Veterinary Book for Farmers—Blowey, 1985).

Botulism (Lamziekte Disease)
Cause: Clostridium Botulinum

Botulism is a fatal paralytic disease caused by eating contaminated feed or water containing the organism. This organism proliferates in decaying animal and vegetable material. Where animals are mineral deficient and are apt to chew bones with decaying flesh on them, the disease is common.

Signs of the disease are staggery gait, difficult swallowing, drooling of the mouth, eyes that stare, paralysis of the tongue, lips, throat, and legs, and general weakness. The animal goes down with labored respiration and dies in 1-4 days.

Treatment is ineffective and prevention consists of proper disposal of all carcasses, provisions of fresh water, and correcting any mineral deficiency. Vacicnation is available for problem areas.

Enterotoxemia (Overeating Disease)
Cause: Clostridium Perfrigens Type D

This disease often takes on two forms:

1) affecting nursing calves
2) affecting cattle on full feed or concentrate

In nursing calves the symptoms include bloating, severe abdominal pain, diarrhea, depression, fever, and death within a few hours. Often the calves are found dead with bloat. This disease usually occurs after a storm where calves can't nurse for some time and then take on a large amount of milk.

Treatment involves Cl. Perfrigens antiserum, antistamine, and antibiotics. A vaccine is available.

Signs for cattle on a high concentrated ration are sudden death within 1-2 hours following consumption of a large volume of feed. Prevention involves vaccination, lowering the concentrate level of the feed, regular feeding times, and feeding low-level antibiotics.

Black Disease (Infectious Necrotic Hepatitis)
Cause: Clostridium Novyi Type B

Black disease has a high death rate and causes a severe liver infection. Signs include high fever, depression and death within a short amount of time. Post-mortem inspection reveals large amounts of parasitic fluke infections.

Treatment is usually unsuccessful, but antibiotics can be used in high doses and a vaccine in available.

Bacillary Hemoglobinuria
Cause: Clostridium Hemolyticum

Bacillary hemoglobinuria has a high death rate and similar signs as Black disease. Other symptoms involved would be reddish urine (red water) and jaundice (yellowing of the mucous membranes). Treatment and control are the same as Black disease.

Hemorrhagic Septicemia

(Pasteurellosis, Shipping-Fever, Cattle Fever)

Hemorrhagic Septicemia (H.S.) is caused by a Pasteurella species

which is present in the nasal passages of healthy animals. Oftentimes, the presence of stress (weather change, parasites, nutritional and mineral deficiency, dust transportation, etc.) along with a virus (IBR and/or Pi3) weaken this animal and it is susceptible to Pasteurella infection.

The disease is of world-wide distribution occurring sporadically in some countries. It affects cattle, buffalo, sheep, goats, reindeer, and wild ruminants. Buffalo appear highly susceptible to the disease. In tropical regions it is seen frequently during the rainy season. Younger animals are more susceptible than older animals.

Symptoms

In some cases no symptoms are seen but the animal dies suddenly. Symptoms most often observed would include depression, high fever, off feed, diarrhea (sometimes bloody), and swelling of the throat, head, brisket, legs, or tailhead. There is labored respiration with runny eyes, nose, and persistent cough. The course of the disease can be acute or chronic.

Diagnosis, Treatment and Prevention

Post-mortem lesions would include a severe broncho-pneumonia, hemorrhages under the skin, on the intestines, and in the heart. There is often a sticky yellow fluid in the body cavities and the swollen tissues. Diseases which may be confused with pasturellosis include contagious bovine pleuro-pneumonia, MCF, and IBR.

If caught in the early stages, treatment is often effective. Antibiotics recommended would include a combination of tetracyclines and sulphonamides. If an animal is suspected of coming down with the disease its temperature should be checked for diagnosis. Early recognition and treatment of the infection is most important.

Vaccination is available for prevention as well as elimination of conditions which cause stress on the animal such as excessive work, overcrowding and poor environmental and feeding conditions.

Contagious Bovine Pleuropneumonia (Peri-Pneumonia)

Nature and Occurrence

Contagious Bovine Pleuropneumonia (CBPP) is caused by a small bacterial Mycoplasma Mycoides. It is highly infectious and causes a severe infection of the lungs.

This disease is widespread in certain tropical regions of Africa, Australia, Asia, and Latin America. CBPP affects cattle and buffalo. It is spread by material coughed up by an infected animal. Recovered animals remain chronic shedders of the infection. The incubation period is 1-4 weeks.

Symptoms

Symptoms characteristic of CBPP are characteristic of pneumonia and pleurisy. These include fever, coughing (dry and painful), and labored breathing. There is depression, loss of appetite, and swelling in the throat region. As the disease progresses, the haircoat becomes dull, constipation alternates with diarrhea, and finally the animal goes down. The affected animal appears to be in considerable pain and they stand with their elbows out. The course of the disease may be from 1-7 weeks.

Post-mortem lesions include a marbled appearance of the lungs possibly affecting only one side. There is also an inflammation of the membrane covering the lungs and thoracic cavity.

Diagnosis, Treatment and Prevention

Diagnosis is accomplished by typical signs, port-mortem lesions, and laboratory analysis of lung tissue or serum.

The drug of choice for treatment is tylosin (tylan), but treatment should not be initiated without governmental supervision.

Control is based upon four methods: slaughter, blood testing, quarantine, and vaccination.

A veterinarian should be informed if CBPP is suspected.

Diphtheria (Bacillary Necrosis)

Nature and Occurrence

Diphtheria is an acute (fast-acting) high infectious disease which primarily affects young calves. It is caused by the bacteria. Fusiformis Necrophorus. The disease can spread rapidly especially in housed animals. The disease occurs world-wide and can affect calves as early as three days old.

Symptoms

The calf will refuse and there is coughing, salivation, high temperature, and the development of rough, greenish-yellowish deposits on the mucous membranes of gums, cheeks, palate, and tongue. These deposits are firmly attached to the underlying tissue and have a foul-smelling odor. There is a swelling of the face with affected calves drooling and frothing at the mouth. When examined, these calves may have a mass of partially chewed feed at the front of the tongue with an ulcer underneath.

The calves will often **breathe extemely noisily** with a snoring sound but they are not particularly depressed. If left untreated the disease can progress into pneumonia.

Diagnosis, Treatment and Prevention

The classical symptoms along with examination of the mouth should lead to an accurate diagnosis. Pnuemonia is most often confused with diphtheria. In pneumonia the calf will be very sick with rapid but quiet respiration.

Treatment with antibiotics in combination with sulphonamides is usually quite effective if treatment is started early. Coarse feed or feed with thorns should be avoided. A preventative vaccine is not available.

Fig. #37 Calf with diphtheria—note the swelling of the cheeks on the left. (Veterinary Book for Farmers—Blowey 1985)

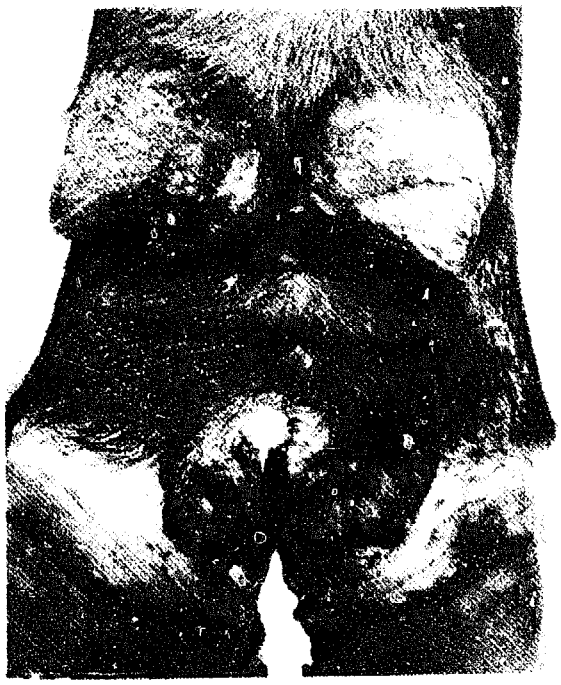


Fig. #38 Foot rot—the most common form of lameness in cattle. (C.S.U. Extension Bulletin—536)

Footrot(Foul in the Foot, Panartium, Pietin)

Nature and Occurrence

Footrot is an infection of the feet caused by a number of organisms but chiefly **Fusiformis Necrophorus.** This organism lives in the soil and gains entrance to the foot upon injury or wet conditions.

Symptoms

Affected animals will be lame on usually just one foot. The area just above the hoof becomes inflamed and swells. Swelling can also develop in the interdigital spaces (between claws). As the disease progresses, abscesses will break out just at the hoof line and drain. In later stages the tendons and joints can become infected at which point treatment is usually unsuccessful. The animals will tend to lay down and there is a rapid loss of condition.

Diagnosis, Treatment and Prevention

Diseases often confused with footrot would be sole abscesses, infections and inflammation of the upper joints of the leg, and foot and mouth disease. The characteristic swelling above and between the hooves should distinguish most other lameness. If started early, treatment is fairly successful with best results obtained by using a combination of tetracyclines (terramycin) and sulfonmides. In animals where there is a lot of diseased tissue, this should be trimmed away surgically and treated with an antibiotic ointment or copper sulfate and wrapped with a bandage. Animals may also be walked through a 2-5% solution of copper sulfate, 4% formaldehyde solution, or a mixture of powdered copper sulfate and slaked lime. Movement of animals to dry ground may sometimes help in the control of the disease.

Calf Diarrhea (An Overview)

Calf diarrhea is the number one cause of death losses in newborn calves. The specific causes of calf scours are **E. Coli, Salmonella Species, Corona, and Roto Viruses, B.V.D. Virus, cocidiosis,** and nutritional causes. Usually a stress such as adverse weather conditions, transportation, change in the feeding schedule, etc. will precipitate an outbreak of scours.

Thus a combination of stress and the presence of a virus or bacteria or both, cause the animal to have diarrhea. More fluid is lost in the feces than is replaced by the mouth and the animal becomes dehydrated. The blood becomes thicker and more difficult for the heart to pump and poor circulation develops. The extremities (tips of ears, feet, mouth, and nose) become cold and the body temperature drops. At this point the calf goes into shock and usually dies.

When diarrhea is first observed, treatment should be the first priori-

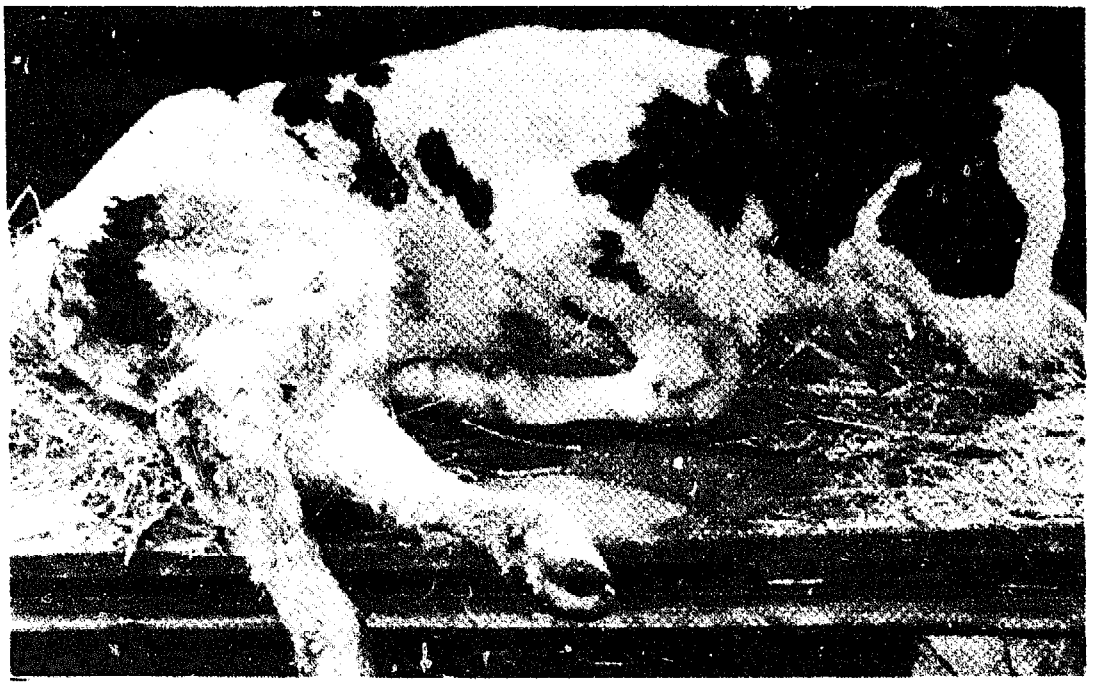


Fig. #39 Depression and weakness in a calf with severe diarrhea. (Cornell University)

priority followed by diagnosis of actual cause of the diarrhea and then prevention.

Treatment consists of four steps:

1. provide fluids (This is to counteract the massive loss of fluids in the feces.)
2. replenish salts and nutrients (Excessive water in the feces carries with salts and other nutrients that normally would be absorbed in the small intestine.
3. administer antibiotics
4. withholding milk (The intestine can no longer absorb milk.)

Several commercial preparations are available to be mixed with water and administered orally for fluid and nutrient dehydratio. If these products

are not available, one can mix up his own oral supplement as follows:

1¾ oz fruit pectin (sugar, honey, or corn syrup can be substituted if fruit pectin is unavailable)

1 tsp. salt

2 tsp. baking soda

1 can beef consomme (meat broth soup) add warm water to make 2 quarts

Two quarts should be fed orally 2-3 times daily. Provide fresh water at all times and continue with supplement for 24 hours after diarrhea ceases. If the calf is too weak to nurse the supplement from a bottle, it can be administered with a stomach tube or fluid feeder.

If the calf is in shock or unable to move, subcutaneous (under the skin) or intravenous fluid therapy with sterile solutions may be required.

In deciding on the choice of antibiotics to use, a culture and sensitivity to the fecal material or tissues is helpful, if lab facilities are available. If lab facilities are unavailable, the response to treatment is the next best alternative. Tetracyclines, sulfonamide, neomycin, and nitrofuozones are commonly used antibiotics for the treatment of scours.

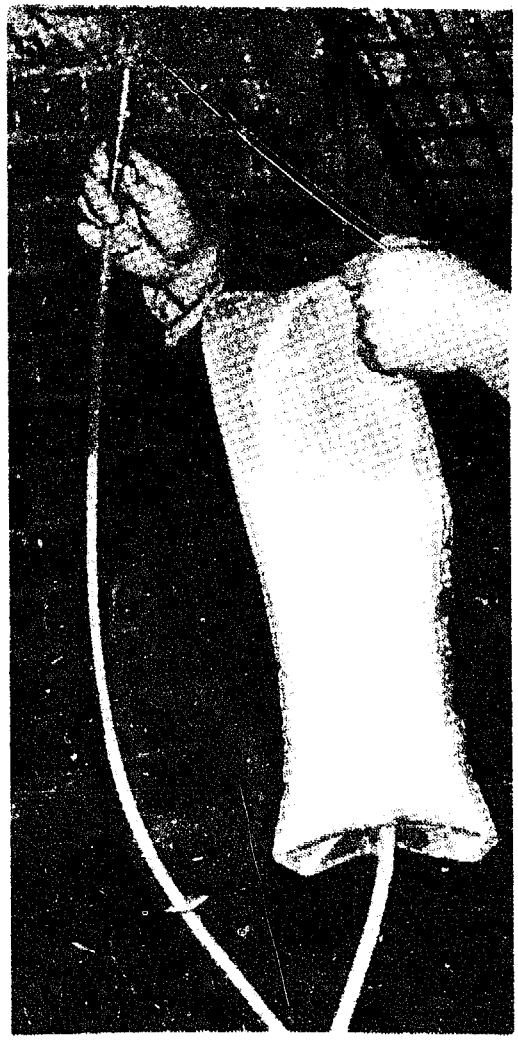


Fig. #40 Dispensing bag filled with colostrum. The stomach tube part is held in the operator's right hand.

Prevention of calf scours involves a number of procedure including:

1) Make sure the newborn calf receives colostrum within six hours after birth so it can have antibodies to fight infection.
2) Separate calves with diarrhea from other calves to minimize the spreading of infection.
3) Pay strict attention to cleanliness of the environment the calf lives in.
4) try to keep the calf dry and warm with clean bedding.
5) Vaccines are available to prevent scours in some cases such as viral scours and E. Coli.
6) Maintain the proper nutrition level with regular feeding schedules.

The specific causes of scours will be covered in the next section.

Colibacillosis (Infectious Dysentery, White Scours)

Nature and Occurrence

Colibacillosis is an infectious disease of calves caused primarily **by E. Coli.** It enters the calf via the mouth or the navel cord. It usually occurs within the first week of life. Lack of colostrum and feeding milk in excessive quantities predisposes calves to colibacillosis.

Symptoms

The feces are very watery and white or yellow in color with a foul odor. The animal is depressed and rapidly becomes weak because of the diarrhea.

Diagnosis, Treatment and Prevention

If the disease is recognized early, the infection can be treated. If, however, dehydration and depression are severe treatment is unsuccessful. For treatment follow the 4-point plan outlined in the calf diarrhea section. Vaccination for prevention may be helpful given to the calf at birth or the mother before giving birth.

Calf Paratyphoid (Salmonellosis)

This infection of calves is caused by Salmonella bacteria. It usually affects calves between 5 and 12 weeks of age. This disease occurs world-wide.

Symptoms

Symptoms include yellowish, watery diarrhea along with depression. This is preceded by a fever of 103-106°F. Fresh blood may be present in the feces. Usually a large number of calves are affected and the mortality (death rate) is high.

Diagnosis, Treatment and Prevention

Diagnosis can be confirmed by culture of the liver and lymph nodes. The liver, on post-mortem exams, will be swollen and the kidneys will have a mottled appearance.

Treatment involves fluid therapy and antibiotics as outlined in the general section on scours. Chloramphenicol gives good results for treatment. Also, there is a vaccine available for prevention.

Salmonella bacteria can cause diarrhea in man and even death in young children. Careful attention should be made to washing hands and clothes after handling calves with diarrhea.

Roto and Corona Virus Infection

These viruses cause diarrhea in calves less than 2-3 weeks old. Often times **E. Coli.** is also involved and severe dehydration and death losses are involved. Diagnosis involves viral cultures of the feces. If viral infections are diagnosed, there is a modified live virus vaccine available for prevention.

White Diarrhea in Buffalo Calves

This disease is seen in young buffalo calves and cause a high death loss. It does not respond to antibiotic therapy. The cause of this disease is **Ascaris Vitulorum.** Piperazine is used for treatment and prevention given at 30 days of age with a follow-up treatment at 60 days of age.

Brucellosis (Contagious Abortion, Bang's Disease, Undulant Fever, Epizootic Abortion)

Nature and Occurrence

Brucellosis is an infection of cattle and buffaloes affecting the reproductive organs. The causal organism is **Brucella Abortus** which is shed in the placenta and can remain infective for up to 2 years. The organs affected are the uterus, fetus, fetal membranes, udder, and testicle.

The disease occurs world-wide and is spread by contamination from the afterbirth, fetal fluid, aborted fetuses, vaginal discharges, and milk.

Practically all animals including man are susceptible and the incubation period ranges from 14 days to 2 months. In man the disease is called Undulant Fever. Man is usually infected by drinking milk from affected animals or by handling infected afterbirth or discharges. The symptoms are acute fever, followed by relapses of fever, sweating, weakness, etc.

Some suggestions for prevention are:

1) Have all cows blood tested before mixing into a new herd.
2) All membranes and fetal material should be burned and clothes disinfected.
3) Milk should be boiled before drinking, and great care should be made to keep from contaminating small cuts on the hands and arms.
4) Use of plastic gloves when doing obstetrical procedures

If brucellosis is suspected, governmentql authorities should be notified for diagnois and prevention.

Vibriosis (Bovine Genital Campylabacteriosis)

Nature and Occurrence

Vibriosis is a general disease of cattle caused by Campylobacteria. It is a venereal disease in that it is spread at mating or by artifical insemination with contaminated semen. The disease occurs world-wide and is characterized by abortions and low fertility in the cows.

Symptoms

The main signs are reduced fertility and low calving rates. The abortion rate is generally low. The fetus generally dies early with cows coming into heat at 6-12 weeks after mating. The early fetus is usually either reabsorbed by the cow or aborted unnoticed. The disease may clear up in infected females but will affect younger animals not previously exposed. The infected bull will spread the disease but shows no symptoms.

Diagnosis, Treatment and Prevention

Vibriosis can be suspected based upon history but can only be confirmed by laboratory tests. These tests are sometimes difficult under field conditions and also inconclusive. Differential diagnosis includes brucellosis, trichomoniasis, and leptospirosis.

Treatment of cows is not advised, but bulls can be treated with antibiotic sheath washings. Vaccination is available for prevention, and also artificial insemination with uninfected bulls can be used to prevent the disease from spreading.

Advice from local health authorities is best for prevention and control.

Leptospirosis

Nature and Occurrence

Leptospirosis affects almost all domestic animals as well as man. It is caused by various **Leptospira** species. This disease occurs world-wide and is spread by contact with infected urine. Rats act as important carriers.

Symptoms

The signs of disease vary greatly but may include high fever, abortions, reduced milk production, blood in the milk and urine, and also jaundice or yellow-color in mucous membranes. Post-mortem signs include enlarged yellowish liver and kidneys.

Diagnosis

Diagnosis involves laboratory analysis of blood and urine samples. Antibiotic treatment with tetracyclines and/or penicillin is effective if started early. Recovered animals may continue to be carriers of the disease for sometime.

Where leptospirosis is a major problem, vaccination is available. Elimination of rats and rodents is beneficial in controlling the spread of the disease.

Tuberculosis (Pearl's Disease, Phthisis, Consumption)

Nature and Occurrence

All mammals (warm-blooded animals), including man are susceptible to this disease. It occurs world-wide and is of great economic importance in some regions of the tropics.

In cattle, tuberculosis is widespread in Angola, Zaire, Argentina, Chile, Dominican Republic, Honduras and Mexico.

Zebu cattle appear to be more resistant to tuberculosis than European breeds.

The method of transmission is either by inhalation (breathing) or infected droplets from coughing of an affected animal or orally (by mouth) through infected discharges. The course of the disease is usually chronic (long term) and the incubation period is quiet long.

Symptoms

The symptoms vary according to the site of the infection. Whenever there is an unexplainable loss of condition accompanied with a swelling of the lymph nodes, T.B. should be suspected. The milk yield will be reduced and hard nodules can be felt in the udder.

If the intestines are involved, there will be diarrhea. If the animal is infected by inhalation, the lungs will be involved and it will develop a progressive chronic cough.

The infection is characterized by the formation of tubercles which vary from a few millimeters to 10cm in diameter. They are filled with pus or calcified deposits.

Affected animals gradually become thinner and often die. Other times, the disease is diagnosed only at slaughter.

Diagnosis, Treatment and Prevention

Diagnosis in the live animal is by a **tuberculin test** involving injection of tuberculin into the skin of the suspect animal. In the infected animal

there is a reaction to the tuberculin and a resultant swelling. In the dead animal the presence of tubercles in the lungs, liver, intestine, or udder are evidence of the disease. Laboratory examination of the infected lymph nodes is also used for diagnosis.

Treatment should not be attempted and infected animals should be destroyed. Testing and disposal of reactors is the only method of control. There is no effective vaccine available.

Because man is susceptible to this disease, great care should be taken to avoid contact with infected meat, milk, or tissues.

Lumpy Jaw and Wooden Tongue
(Actnomycosis, Actinobacillosis)

Nature and Occurrence

These diseases are caused by **Actinomyces Bovis**—lumpy jaw, and **Actinobacillus Lignieresi**—wooden tongue in combination with other pus-producing bacteria. These organisms live normally in the mouth and skin of animals and gain entry to the body through wounds.

Lumpy jaw usually affects the bony tissues of the head (upper and lower jaws). Whereas, the organism causing wooden tongue affects the soft tissues of the head and tongue. These diseases occur world-wide and can also affect man. The incidence of disease is quite low.

Symptoms

There is usually a swelling on the upper or lower jaw, or the tongue will enlarge. This swelling will increase in size over weeks and months. Eventually there will be an eruption at the skin surface where pus oozes out. These eruptions often heal over and break out elsewhere on the lesions. The animal will experience difficulty in eating and chewing. In wooden tongue, the tongue will protrude from the mouth making eating and drinking virtually impossible. Due to the interference with eating, the animal will lose condition.

Diagnosis, Treatment and Prevention

The diagnosis is quite easy due to the evident clinical signs. It is important, however, to distinguish whether the bony tissues are involved. If the upper or lower jaw bones are infected then treatment is very difficult and in many cases impossible. If the soft tissues or tongue are infected, then treatment is highly successful. If the swelling is localized then it should be disinfected and drained surgically, flushing the wound daily with a dilute iodine solution. If the wound is not localized or if the tongue is affected, antibiotics such as streptomycin and/or sulofonamides along with sodium iodine I.V. should be given.

Fig. #41 Lumpy Jaw affecting a calf. (Stock Diseases—Bayer)

If the lesion is draining, then appropriate fly control methods should be administered.

Control methods involve keeping sharp awns or grass beards out of the feed source.

Steptothricosis (Dermatophilosis, Cutaneous Actinomycosis, Senkobo Disease)

Nature and Occurrence

This disease causes a chronic dermatitis (skin infection) and scab formation in cattle damaging the hide and causing a loss of condition in affected animals. It affects cattle in many tropical countries particularly West Africa, the Far East, and the Latin American countries.

The cause of the disease is **Dermatophilus Congolensis.** It spreads from one animal to another through injuries to the skin and bites of ticks and flies. It occurs more commonly during the rainy season.

Symptoms

Skin lesions occur primarily on the back, sides, belly, inside of legs, face, and ears. They appear first as papulles (small skin enlargements) which ooze serum. These form scabs which can extend over a large area of the body.

Animals seriously affected lose condition, become weak, and can actually die from starvation.

Diagnosis, Treatment and Prevention

Diagnosis is based upon clinical signs and the seasonal incidence of the disease. Laboratory examination of affected skin and scabs can confirm the diagnosis.

Treatment with aureomycin injections along with bactericidal washes of the lesions helps in some cases.

Control involves keeping affected animals separate from other animals. Also, frequent dipping to protect from ticks and flies helps. Removal of thorn bushes from grazing areas is also beneficial.

Pinkeye (Infectious Bovine Keratoconjunctivitis, Infectious Ophthalmia)

Nature and Occurrence

This disease causes an inflammation of the outer layer of one or both eyes. It is caused by **Moraxella Bovis**. The occurrence is world-wide. Animals recently introduced into an area are more susceptible.

The disease is spread by either direct contact or insects.

Symptoms

Initially there is increased watery discharge from the eyes followed by cloudiness of the eyes and swelling of the eyelids. The animal becomes oversensitive to light and the discharge becomes thicker. The outer covering of the eye may ulcerate and even rupture. Untreated cases can result in blindness.

Diagnosis, Treatment and Control

This disease affects only the eyes which distinguishes it from other viral diseases such as IBR, BVD, and MCF which affect other parts of the animal as well as the eyes.

Treatment should be started early and involves direct application of

antibiotics to the eye. Affected animals should be kept in a dark place away from sunlight and flies.

Control of flies and ticks can help in the spread of the disease. There is a preventive vaccine available for severe outbreaks.

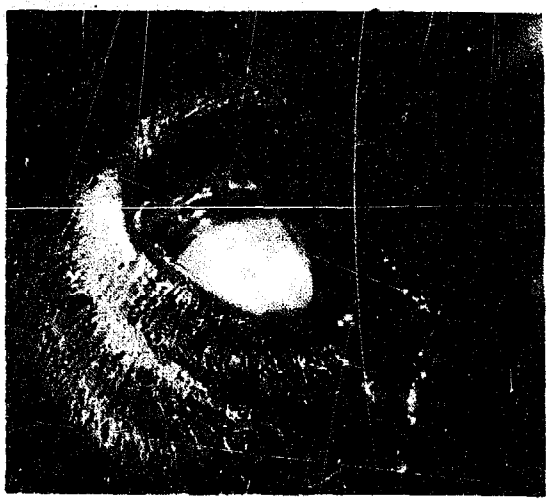


Fig. #42 A case of pinkeye. (Stock Diseases—Bayer)

Diseases Caused by Protozoa and Rickettsia

Tick-Borne Diseases

In many developing countries tick-borne diseases represent the greatest threat to development of the livestock industry.

Ticks are a group of parasites which cause major losses of productions through their blood-consuming ability and transmission of other diseases. These disease are transmitted by the tick's habit of moving from one host to another between blood meals carrying the disease with them. The second method of transmission is for the disease itself to pass through one of the stages of the tick. Examples of diseases transmitted by ticks include East Coast Fever, Heartwater, Babesiosis, Anaplasmosis, etc. Other losses attributable to ticks include skin and hide damage. Skin damage caused by ticks permits entry of other parasites like screwworms. Tick paralysis can also be caused by certain ticks.

Ticks are distributed world-wide, but occur principally in tropical and sub-tropical countries. Before feeding on the blood of their hosts, they are usually flat but when enlarged with blood they are spherical. Ticks are capable of taking in many times their own weight in blood. Each tick may suck out .3ml of the animal's blood.

The tick family is divided into two groups: soft ticks, which infest birds, and **hard ticks**, which infest animals and man. The hard ticks (Ixodid) have a hard shell covering the whole upper surface of the male and a small area of the female. From the color and other characteristics of this shield, ticks can be identified. All ticks have four pairs of legs and a round body.

During development the tick passes through the stages of egg, larval, and nymph before it becomes an adult. The eggs are laid on the ground. The larval (small tick with 3 pair of legs) then emerge from the eggs and climb up on grasses and shrubs attaching themselves to passing animals. According to their method of further development they are divided into one, two, or three host ticks. A one-host tick goes through all stages of development on one animal. For two-host ticks, the larval develop into nymphs on the first host, then drop off, molt into adults, and become attached to a second host. Three-host ticks attach themselves to a different animal at each stage of development, dropping off and molting into the next stage on the ground.

When the female tick has mated and engorged itself with blood it drops to the ground where it lays 2,000 to 20,000 eggs and then dies. This entire life cycle may take from a few months to several years. It is important to know in controlling ticks whether the tick is a one-, two-, or three-host tick.

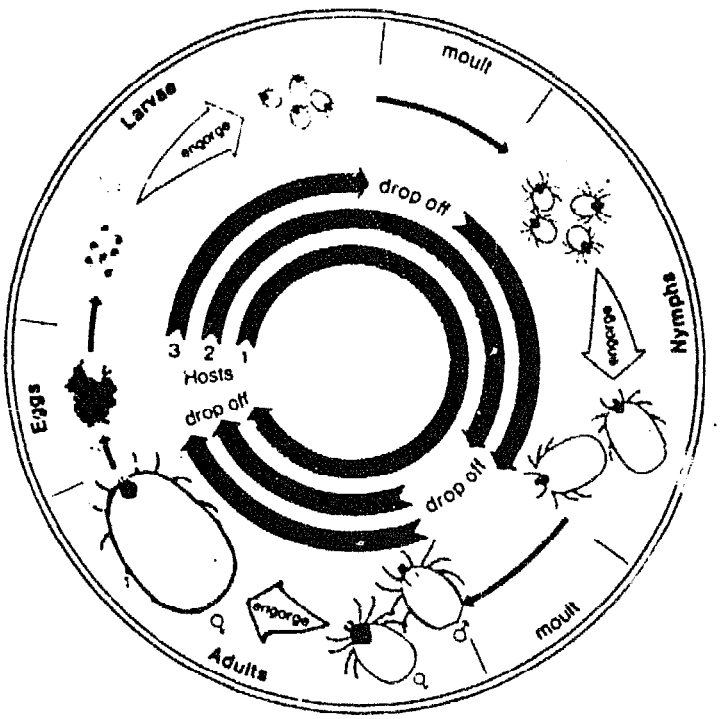


Fig. #43 Cycle of development of one or more host ticks. (Stock Diseases —Bayer)

Ticks are generally controlled by the immersion of animals in an application of a chemical (acaracide) capable of killing the ticks. A one-host tick stays on the animal longer than the two- and three-host ticks and consequently, the dipping interval can be longer for one-host ticks than for two- and three-host ticks. The strength of the dips can also be varied.

Common One-Host Ticks:

Boophilus Decoratus (Blue Tick)
found in South, East and Central Africa, and Central and South America
transmits Babesiosis and Anaplasmosis

Boophilus Annulatus (North American Cattle Tick)
found in Egypt, Western Asia, Central America,
transmits Babesiosis

Boophilus Microplus (Blue Cattle Tick)
found in Australia, Asia (S.E.), Central and South America, and South Africa—transmits Babesiois, Anaplasmosis and Theileriosis

Common Two-Host Ticks

Rhipicephalus Evertsi (Red-Legged Tick)
found in Central and Southern Africa
transmits East Coast Fever and Babesiosis

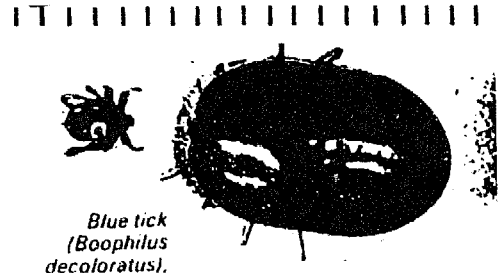
Rhipicephalus Bursa
found in Africa and Southeast Asia
transmits Babesiosis, Anaplasmosis and Theileriosis

Hyaloam Truncatum (African Bont-legged Tick)
found in Africa
transmits sweating sickness in calves

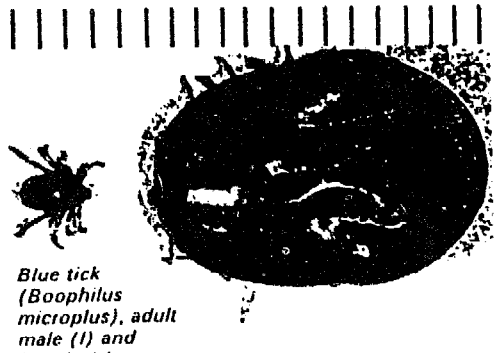
Common Three-Host Ticks

Rhipicephalus Appendiculatus (Brown Ear Tick)
found in Central, East and South Africa
transmits East Coast Fever, Corridor Disease, and Babesiosis

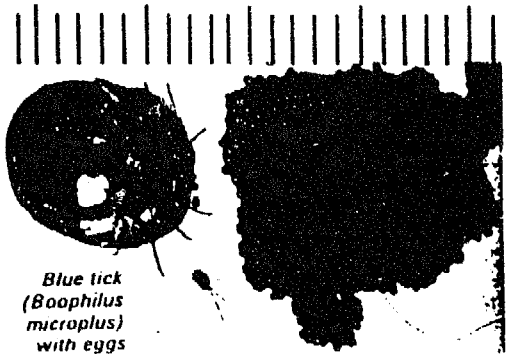
Amblyomma Hebracum (Bont or Heartwater Tick)
found in tropical regions
transmits Heartwater



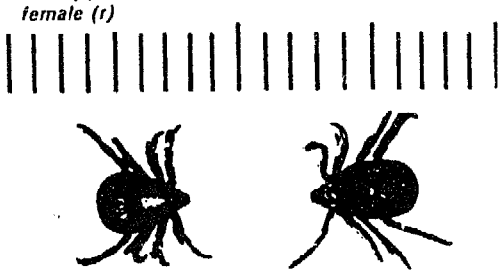
Blue tick (Boophilus decoloratus), adult male (l) and female (r)



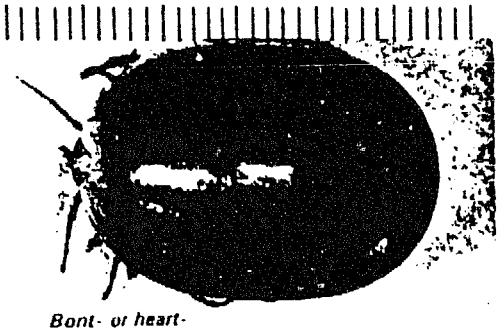
Blue tick (Boophilus microplus), adult male (l) and female (r)



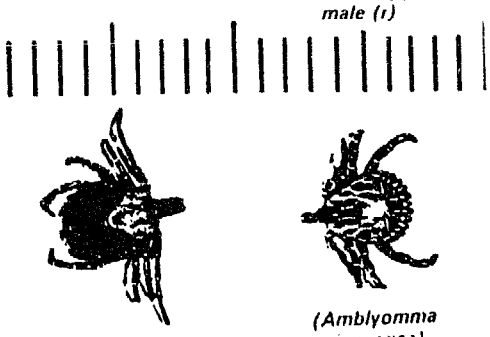
Blue tick (Boophilus microplus) with eggs



Red legged tick (Rhipicephalus evertsi), adult female (l) and male (r)



Bont- or heart-water tick (Amblyomma hebraeum), engorged female



(Amblyomma cajennense), adult female (l) and male (r)

Fig. #44 (Stock Diseases—Bayer)

Tick Control

Tick-borne diseases differ from many other diseases in that young animals are more tolerant than older animals to these diseases. Thus, when animals are exposed to a sufficient number of infected ticks early in life they suffer a mild infection, recover, and develop a resistance to further infection. They remain, however, carriers of the disease. If com-

plete tick control cannot be achieved in an area, calves need to be exposed to moderate numbers of infected ticks so they can build up resistance. In areas where tick control is good or certain ticks are not present, calves will grow up susceptible to tick-borne diseases. If these animals are moved to an infected area or control breaks down there is the potential for severe losses in adult animals.

Boophilus microplus— artificial infestation

The only effective way of controlling ticks and the diseases they transmit is by dipping or spraying them in an acaracidal solution (chemical which kills ticks). In many countries the government supervises tick control measures.

Excellent recommendations for treatment and control have been developed by the Food and Agriculture Organization. These recommendations include dipping, operation of dipping tank, measuring tank capacity, maintaining dip fluid strength, spraying, hand spraying, hand dressing, frequency of treatments, and acacridides. These can be obtained by writing to Director, Publications Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Carocalla, 00100 Rome, Italy.

Protozoan and Rickettsial Dieseases Transmitted by Ticks

Anaplasmosis (Gall-Sickness)

Nature and Occurrence

Anaplasmosis is caused by rickettsia which live in red blood cells. It is widely distributed throughout the tropical, sub-tropical, and temperate areas. Anaplasmosis is transmitted primarily by ticks and biting flies. It can also be spread by non-sterilized instruments and needles during dehorning, tatooing, and vaccination. The incubation period is 30-40 days.

after the animal is bitten by an infected tick. The animals at greatest risk are those newly introduced into an area or foreign breeds.

Symptoms

The disease is more prevalent in summer and early fall. Initially there is an increase in the body temperature. The animal is depressed, off feed, mucous membranes are pale to yellow, and the lymph nodes are enlarged. The urine is dark yellow and constipation may be present. There is a high death rate especially in older animals. If death results it is usually 3-4 days following the onset of sickness.

Post-mortem lesions include a general yellow color to the internal organs. The spleen, liver, kidneys, and gall bladder are enlarged. Hemorrhages occur on the heart and intestines.

Diagnosis, Treatment and Control

Diagnosis is based upon clinical signs, post-mortem lesions, and laboratory analysis. Blood smears can reveal the anaplasma parasite in the red blood cells. Babesiosis can often be confused with Anaplasmosis.

Treatment can be successful if started early using tetracyclines (terramycin) or imidicarb.

Control involves treatment of ticks and vaccination. Also, because this disease can be transmitted by needles and surgical equipment great care should be taken when treating and vaccinating animals. A fresh needle should be used for each injection in areas where the disease exists.

Babesiosis (Redwater, Piroplasmosis, Tick Fever)

Nature and Occurrence

Babesiosis is caused by a protozoan parasite that is spread by carrier ticks. It causes extensive breakdown of the red blood cells resulting in anemia and jaundice (yellowing of skin). The distribution of the disease is world-wide wherever ticks are located. Ticks from the **Boophilus** species and most commonly incriminated. Other **Babesia** species affect horses, dogs, pigs, and sheep.

The disease commonly occurs in animals 6-12 months old which have not had previous exposure. Cattle living in an affected area are protected by antibodies developed at a young age. The protozoan parasite passes from one generation of ticks to another by transovarian transmission. They are then passed on to susceptible animals through the blood-sucking habits of carrier ticks. Carrier cattle also provide a source of infection for ticks. As in Anaplasmosis imported cattle are especially susceptible to the disease.

Symptoms

Symptoms include a sudden high fever of 106°F (41°C) or higher approximately 10-12 days after the bite of a tick. The animal is depressed, off feed, with anemic mucuous membranes, and later yellow mucous membrances. Due to the anemia, breathing is rapid and the heartbeat is strong and fast. The animal becomes weak and may develop nervous symptoms. The breakdown of the red blood cells produces hemoglobin which often stains the urine red. The untreated animal will die in 2-3 days as the disease may become chronic.

Post-mortem lesions include a very large spleen. The organs are

either very pale colored or yellowish. The urine is pink or red. The presence of a fever associated with red urine, anemia, and jaundice are highly suggestive for babesiosis.

Diagnosis, Treatment and Control

Diagnosis is best accomplished by examination of a blood smear which demonstrates the Babesia organisms. Diseases which are often confused with babesiosis include rabies due to the nervous symptoms and Anaplamosis.

Drug therapy, if given early in the course of the disease, can produce dramatic results. Drugs commonly used are Pirevan, Phenamidine, Isothionate, Amicarbolide (Diampron) or Diminazene acoturate (Berenil). Because there is a small margin of safety between a therapeutic dose and a toxic dose, careful consideration should be given to the dosage label recommendations. Animals with advanced cases of the disease should be given a blood transfusion along with drug therapy. One problem with therapy is that the drug totally eliminates the parasites from the blood. Thus no immunity can develop and the animal is once again susceptible to the disease.

Control of the diseases involves three factors: elimination of the tick carrier, elimination of the protozoan parasite, and control by premunition. Elimination of the ticks and thus, the Babesia is discussed under tick control. Premunition involves vaccination of susceptible cattle with blood from donor animals which are carrying the disease.

Products Used to Successfully Treat Babesiosis

Compound or Compound Group	Proprietary Name	Chemical Description*
Acridine derivatives		
Acriflavine hydrochloride (Euflavine, Trypaflavine)	Gonacrine[a]	A mixture of 3.6-diamino-10-methylacridinium chloride and 3.6-diamino acridine hydrochloride
Azo-Naphthalene dyes		
Trypan Blue	Congo Blue Niagara Blue	3.3¹-[(3.3¹-dimethyl[1.1¹-biphenyl]-4.4¹-diyl)bis(azo)]bis [5-amino-4-hydroxy-2.7-naphthalene disulfonic acid] tetrasodium salt
Diamidine derivatives		
Aromatic		
Diminazene diaceturate	Berenil[b] Ganaseg[c]	4.4¹-diamidinodiazoaminobenzene diaceturate
Pentamidine diisethionate	Lomidine[a]	4.4¹-diamidinodiphenoxypentane di(beta-hydroxyethane sulfonate)
Phenamidine diiisethionate	Lomadine[a]	4.4¹-diamidinodiphenylether di(beta-hydroxyethane sulfonate)
Cardanilide:		
Amicarbalide diisethionate	Diampron[a]	3.3¹-diamidinocarbinilide diisethionate
Imidocarb dipropionate	Imizol[d]	3.3¹-bis(2-imidazolin-2yl) cardanilide dipropionate
Quinoline derivatives		
Quinuronium sulfate	Acaprin[e] Akiron Pirevan Piroplasmin	6.6;-ureylenebis(1-methylquinolinium)bis(Methosulfate)
	Babesan[f]	N.N¹-di-6-quinolinylurea

FOOTNOTES:

[a] May & Baker Ltd., Dagenham, England.
[b] Farbwerke-Hoechst AG, Frankfurst, West Germany.
[c] Squibb Mathieson, E.R. Squibb & Sons de Mexico, Mexico City, Mexico.
[d] Burroughs Wellcome & Co. Ltd., London, England.
[e] Ludabel Farbenfabriken, Baver, Leverkusen, West Germany.
[f] Imperial Chemical Industries Ltd., Macclesfield, Cheshire, England
* Obtained when available from the Merck Index, Ninth Edition, 1976.

Relative Efficacy of the More Commonly Used Babesiacidal Compounds

	Diminazene	Imidocarb	Amicarbalide	Phenamidine	Quinuronium	Trypan blue	Pentamidine
Cattle:							
Babesia bigemina	++++	++++	++++	++	+++	++	++
B bovis	+++	+++	++	++	++	—	
B divergens	++	+++	++		+	—	
Horses:							
B. caballi	+++	++++	+++	+++	++	++	
B. equi	++	+++	+	++	—	—	
Sheep:							
B. motasi	+++		+++		+	+	
B. ovis	+	++			+	—	
Swine:							
B. trautmanni				++	++	++	
B. perroncitoi	+++				++	—	

Table #9 (Diseases and parasites in the tropics - HTB Hall)

Tick Paralysis

Nature and Occurrence

Tick paralysis is caused by the absorption of toxins (poison) from the salvia of feeding ticks. It causes a paralysis of man and domestic animals. This disease can occur anywhere that ticks are located but is a serious problem in North America, Australia, Africa, and India. It predominantly affects cattle under one year of age.

Symptoms

The first signs are barely noticed but include a worried look and slight staggered movements. As the disease progresses, there is an ascending paralysis. The animal first drags its hind legs, then cannot get up, and finally dies from paralysis of the breathing muscles.

Diagnosis, Treatment and Control

Diagnosis includes a paralysis with the presence of ticks and recovery of the animal, if the ticks are removed. Prompt removal of ticks by hand, followed by treatment of an acaracide, is recommended. Recovery may be complete in a matter of hours after removal of ticks or it may take a few days. Prevention and control involve tick control using acaracides and also avoidance of known tick-infested areas.

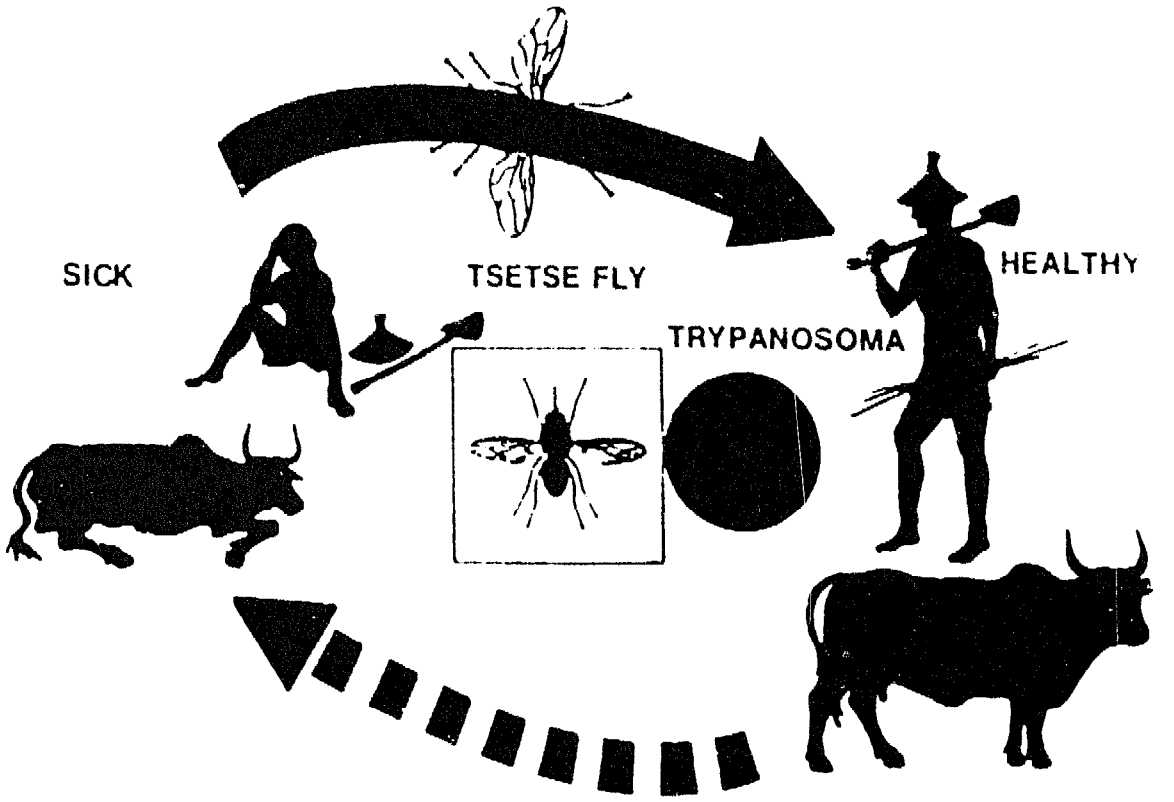
Protozoan Diseases Transmitted By Flies

Trypanosomiasis (Nagana, Sannare, Sleeping Sickness, Chagas Disease)

Nature and Occurrence

This disease is caused by a protozoan organism called a trypanosoma (T. Congolense, T. Vivax) and is spread by blood-sucking flies (Tsetse fly). These trypanosomes undergo part of their reproductive cycle in an intermediate host-tsetse fly. When the fly bites an infected animal the trypanosomes in the blood of the animal enter the salivary gland of the fly and multiply. Before the fly can breed, it must have a feed of blood and thus, spreads the disease to another animal. When it feeds on the blood of a susceptible animal it infects this animal with trypanosomes via the salvia. The tsetse fly is about the same size as an ordinary house fly. It often picks up the trypanosomes from wild game such as the warthog and giraffe. These animals are immune to the disease but transmit it to humans (sleeping sickness) and animals (nagana). All species of domestic animals are susceptible to the infection.

African tryanosomiasis is caused by a blood parasite transmitted through the bite of the TSETSE FLY when it feeds.



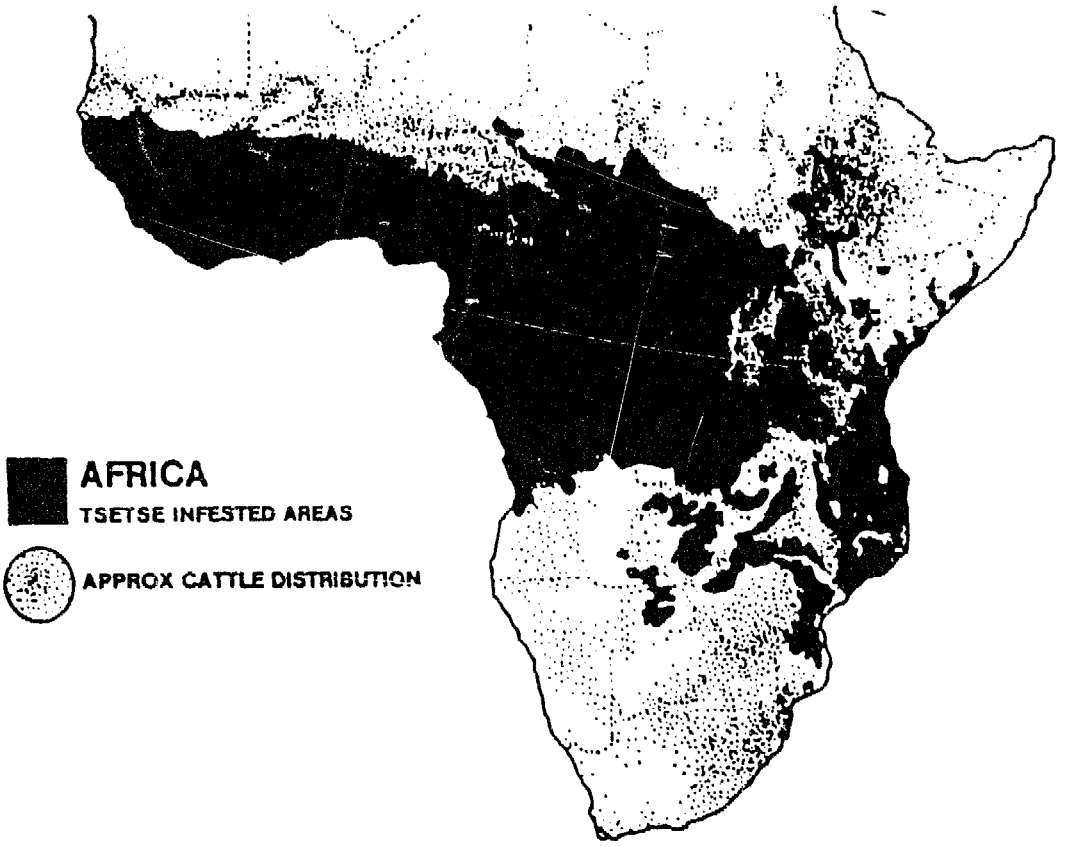
As well as man and cattle, the disease also affects camels, horses, sheep, goats, pigs, and dogs.

Table #10-A

(FAO Program for control of African Animal Tryspanosomiasis.)

The area most affected by trypanosomiasis is central Africa. It also occurs in Central and South America. Legions of tsetse flies control over 4.5 million square miles of some of Africa's choicest land (an area larger that the continental U.S.A.). Thirty-five million Africans and many millions of cattle live under threat of the disease. If tsetse infected areas could be reclaimed for cattle production, Africa's annual meat production could be doubled. Needless to say, trypansosmiasis is one of the most awesome problems affecting Africa today.

This disease which occurs in almost 9 million km² of the savannah and forest areas of the African continent . . .



. . . is spread by the TSETSE FLY and limits the production of livestock and agriculture in most of these areas.

Table #10-B

(FAO Program for control of African Animal Trypanosomiasis.)

Symptoms

The time period between the bite of an infected tsete fly and infection generally takes 5-7 days. Symptoms then develop gradually over several weeks. The animals are dull and depressed and their appetite is greatly diminished. Body weight and condition deteriorate as well as milk production. There may be a slight discharge from the eyes which have sunken appearance. There is a fever and enlargement of the lymph glands. One sign is anemia and a paleness of the mucous membrances of the mouth and conjunctiva. Many animals die within a few weeks; whereas, other animals will recover spontaneously or many linger for years. Abortions and still-births occur frequently.

Fig. #46 The effect of trypanosomiasis on a naturally-infected N'Dama yearling. The animal is stunted and has a characteristic nagana pose. (Veterinary Book for Farmers, Blowey—1985)

Post-mortem examinations reveal a carcass that is in very poor condition with paleness to the organs due to the anemia. The spleen and lymp nodes will be enlarged.

Diagnosis, Treatment and Control

Diagnosis involves symptoms, history of the herd and location, and blood smears. Either a stained smear of examination of a fresh smear of blood will demonstrate the parasite. Positive diagnosis can be made only by a smear examination.

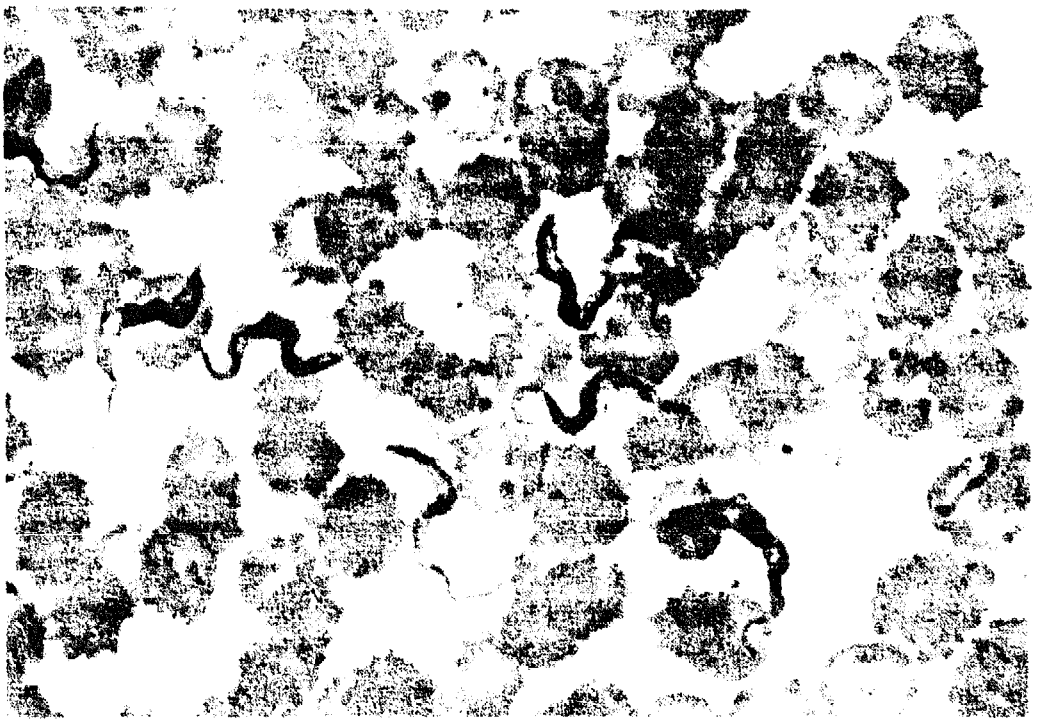


Fig. #47 A microscopic view of trypanosomes in the blood of an infested animal. (FAO)

Treatment involves proper rest and nutrition to minimize loss from the disease. Drugs recommended for treatment include:

Diminazeve Aceturate (Berenil)
Homidium Chloride (Novidium)
Isometamidium Chloride (Somorin)
Quinapyramine Sulphate (Antrycide)

It is best to follow a veterinarian's instruction as to the use and dosage of the drugs. Insufficient dosage may lead to resistance of the Trypanosome to the drug.

Control measures involve:

(1) **treatment** of animals with drugs to control the prarasite
(2) **vector control** by reducing or eliminating the tsetse fly
(3) **trypanotolerant livestock** resistant to the disease

Tsetse control involves insecticide spraying and biological control. The insecticide spraying is done by ground crews, helicopter and airplanes. This can be a very effective method of control if a large area is covered and multiple sprayings are accomplished. Biological control involves the release of sterile laboratory-reared males. Because the tsetse female mates only once in her life, this process is effective if a large number of sterile male flies are released. The second method of biological control involves the release of specific pests or diseases of the tsetse fly. The third method of biological control is by setting up traps which contain an attractant which attracts the flies and traps them at the same time. Another method of over-all control is the increased use of trypanotolerant cattle. These cattle, by natural selection, have developed a natural resistance to trypanosomiosis. These breeds include the **humpless** West African breeds of N'Dama from Zaire, Baoule' from Ivory Coast, and Race Locale from Togo. European and Zebu cattle are more endangered by this disease. No one method of control will eliminate this disease, but a **combination** of the above methods will greatly reduce the effects of the trypanosomiosis.

Protozoan Diseases Spread Without An Intermediate Host

Coccidiosis

Coccidiosis is caused by a protozoa which lives inside the cells of an infected animal's intestinal tract. It occurs world-wide but is more important where animals are confined in small areas. Younger animals which have recently been stressed are most susceptible. The death rate is usually low; however, outbreaks can occur with many animals affected. The source of infection is the manure from affected or carrier animals. Infections occurs when cattle, eat or drink manure contaminated feed or water.

Symptoms

The most characteristic sign is foul-smelling, dark, watery manure. Severely affected animals develop watery diarrhea with clots of blood and shreds of mucous lining from the intestinal tract. These animals will lose their appetites, become depressed and dehydrated, lose weight, and go off feed. Straining is quite common.

Untreated animals may die in the acute phase or later from secondary infection. If the animal survives the severe phase, it may recover

but with significant weight loss. Cattle can also suffer central nervous system disorders from coccidiosis. These animals show muscular tremors, convulsions, and bending of the neck and head. These animals usually die withing 24 hours after symptoms first appear. Post-mortem signs show hemorrhages of the intestinal tract.

Diagnosis, Treatment and Control

Diagnosis is made by symptoms and microscopic examination of manure for coccidial oocysts. Treatment involves the isolation of sick animals. Drug therapy involves gut sulfas like sulfaguanadine, ionphores and Amprolium. Control involves the used of Deccox and Amprolium to prevent the disease. Sanitation measures of not feeding cattle on the ground and maintaining clean water supplies are also important. Pasture rotation and avoidance of overcrowding are helpful.

PARASITES

Ectoparasites

As stated earlier, ectoparasites live outside of the host animal. Ectoparasites commonly involving cattle include ticks, mites, flies and lice. Since ticks were covered in an earlier section, we will deal primarily with mites, flies and lice.

Mites

Mites have four pairs of legs like ticks but are much smaller. They are important because they cause various types of mange in cattle. Mange causes an inflammation of the skin as the mites burrow into the skin. These mites occur widely throughout the world. Their entire life cycle is usually spent on one animal.

Demodectic Mange is caused by **Demodex Falliculorum.** It affects most domestic animals and man. The parasite lives deep in the hair follicles and sebaceous glands of the skin. The infection is very slow in developing and the initial signs are thickening of the skin and the loss of hair. Itching may develop into abscesses. These mites can be demonstrated by skin scraping and examination under a microscope. Treatment is very difficult. Rotenone preparations of 2% in oil may be beneficial. Ivermectin injections can also be helpful. Antibiotics are helpful in the event of abscess formation.

Sarcoptic Mange is caused by **Sarcoptes Scabei** and is spread by direct contact with infected animals. This mite burrows deeply into the skin causing itching, scratching and skin infection with the formation of fluid leaking from the sores.

Treatment involves cleansing the lesions with soap and water and dipping the animals in gammexane (lindane), limesulphur (2% calcium, polysulphide), coumaphos (Co-Ral), and 5% solution toxaphene. Dipping at weekly intervals is suggested until the signs disappear. Ivermectin (Ivomec) injections are also very effective.

Flies

Flies are characterized by only one pair of wings. Their economic importance results from their attacking a group of animals and irritating them by biting. The animals will not eat or drink because they are distracted by the flies and subsequently lose condition. Flies can also

transmit disease, i.e. tsetse fly. Other flies of economic importance include the warble fly and screwworm fly.

The **warble fly** or heel fly lays its eggs on the lower part of the back legs of cattle. The eggs hatch into a larva which penetrates the skin and migrates throughout the muscle tissue of the animals body. The larva locates underneath the skin on the back of the animal and forms a maggot or grub. This maggot then penetrates through the skin damaging the hide and completing the life cycle. Warble flies most generally occur in colder climates and can be prevented with organophosphate insecticides (Co-Ral, Warbex, or Neguvon) as a dip or pour-on.

Screwworm flies occur commonly in Central and Latin America. These female flies deposit their eggs on the edges of wounds. The eggs hatch into maggots which burrow into the flesh causing abscesses and eventual death to the animal if not treated. The process can occur in a matter of days. Control involves treating all wounds and surgical procedures (castration and dehorning) with cleanliness using disinfectants and insecticide fly repellants or screwworm pastes. Elimination and control of flies is also helpful using sterile male flies and insecticide preparations.

Lice occur in colder climates and are more common on poorly fed cattle. They are more frequently located around the ears, neck and base of the tail. Because they suck blood, untreated animals become anemic and lose weight. Treatment involves insecticides and tick-control medications.

Internal Parasites

Internal parasites are referred to as helminths and are divided into two groups, the flatworm and the roundworm. The flatworms are further divided into flukes and tapeworms. Internal parasites have varying effects on animals; they parasitize ranging from no effect at all to loss of condition and eventual death. They live inside the animal as opposed to external parasites which live on the skin.

Roundworms

Nature and Occurrence

Roundworms or nematodes cause damage to cattle in two ways: blood-sucking and causing inflammation and damage to the gut lining. The large stomach worm (Haemonchus) and brown stomach worm (Ostertagia) bury themselves in the stomach wall and feed upon blood. The worms suck a few drops of blood and then move to another location. The tiny cuts continue to bleed after the worm moves on and also serve as routes of bacterial infection. In addition, the brown stomach worm causes disruption of digestion by reducing stomach acidity and causing a severe diarrhea. Among the parasites which cause damage to the surface of the gut, the small stomach worm (Trichostrongylus) and the cooperids (Cooperia) are most common. The worms disturb digestion in the stomach and disrupt absorption of vital nutrients in the intestine. Lowered feed efficiency and poor weight gains are frequent results. Diarrhea is another common effect. The mature female worms living in the gut of the animal produce large numbers of eggs which pass out of the animals with the manure. The warmth and moisture of the manure cause the eggs

to hatch and develop into larvae. These larvae migrate into the grass. If the cow or calf graze contaminated grass of forage, the parasites are ingested and the animals are infected with roundworms.

Symptoms

The destructive effects of these parasites are more severe in younger animals. Usual signs include loss of appetite, loss of weight and condition, dull haircoat, constipation or diarrhea. The resulting anemia is characterized by pale mucous membrances, depression and possible "bottle jaw" (accummulation of fluids under the skin of the lower jaw). The animal may also have a potbellied appearance.

Diagnosis, Treatment and Control

Diagnosis involves examination of the animals, history, and fecal examination. Because the parasites are quite small, a microscopic examination of the feces is best. A common method involves the floatation method whereby a small amount of feces is mixed with a sugar or salt solution. Because most parasite eggs will float to the top and fecal debris settles out, this method is highly reliable. The top layer of solution is examined microscopically and the parasite eggs identified. Most animals living in temperate or tropical climates are infected with roundworms and should be routinely treated.

In choosing products to treat nematodes, one must keep in mind the following: availability, effectiveness of the product, types of worms controlled by the product, ease of administration, safety, and length of residues for slaughter animals. Products available to treat nematodes include:

Ivermectins (Ivomec-Merck) an injectable given subcutaneously 1 ml/50 kg body weight

Benzimidazoles (Thibenzole-Merck) (Fenbendezole-Safe-Guard-Hoechst Agri Vet) these are available as feed pre-mixes, oral suspensions, pastes, boluses, and crumbles

Imidazathiazoles (Levasale-Pitman Moore) (Tramisol-American Cyanamid) these are available as boluses, drench, gel, in feed, or as an injection

Organophosphates (Baymix-Haver-Lockhart) (Halox, Loxan, Wellcome, JenSal) these are available as a feed pre-mix, boluses, or drench

Phenothiazine (Tefenco-West-Argo) this drug is available to be mixed with the feed (Febantel-Bayer)

Morantel Tartorate (Rumatel, Nemater-Pfizer) this drug is available as a pre-mix or a bolus.

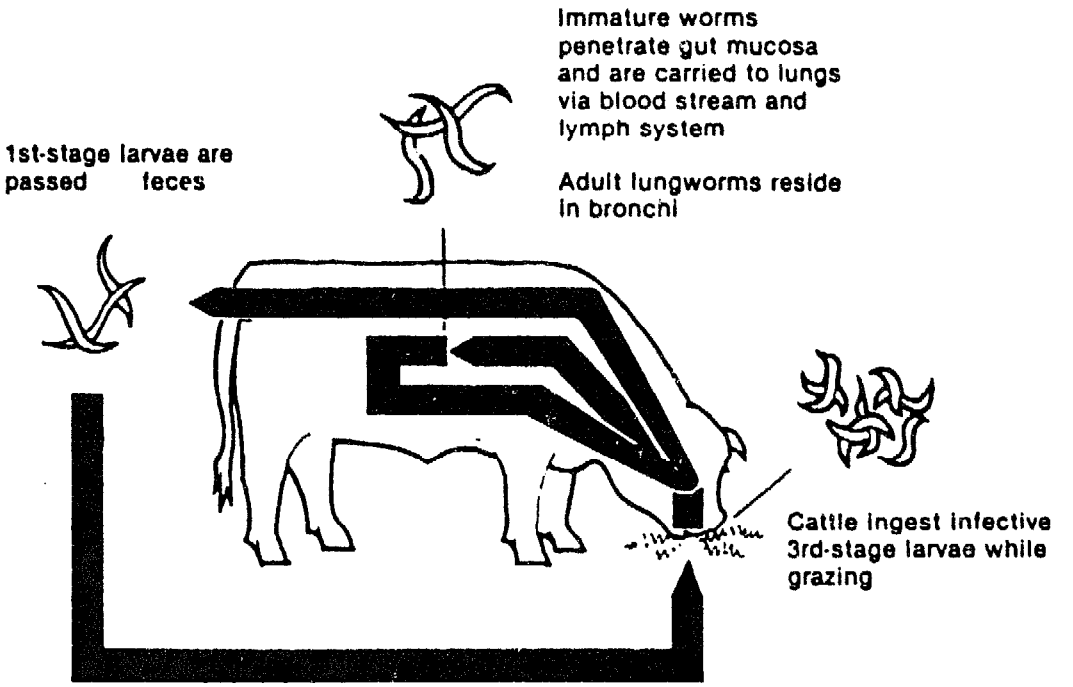
Strict following of manufacturer's recommendations as far as dosage and time before slaughter is recommended. **Guidelines as to types of treatment and frequency of treatment will vary from region to region, but one guideline might be the following: deworm cows every 6 months and deworm calves every 3 months. The changing of the type of wormer from year to year is suggested to keep the worms from building up a resistance to one type.**

Overstocking of pastures contributes greatly to internal parasitism because it enhances the movement of parasites from animal to animal.

Adult cattle are the source of worm eggs which develop into larvae and infect young animals. Therefore, separation of cattle by age group as much as possible is helpful in controlling parasitism. Larvae require moisture for their development and migration; therefore, properly drained pastures encourage parasitism. Rotation of pastures so they are free of cattle 4-6 months can help greatly in controlling parasites in young cattle. For cattle in a dry lot, frequent removal of manure and care that it does not contaminate feed and water will also contribute to the control of parasites.

Lungworms

The lungworm parasite lives in the air passages of the lung causing irritation, mucous production, and secondary bacterial infection. The disease occurs most frequently in younger calves. Common clinical signs include rapid and shallow breathing. Infected animals may have a loose cough which is made more severe by excercise. Animals with heavy infections tend to lose condition and may stand with their head extended and mouth open with saliva drooling from the mouth.



The life cycle of *Dictyocaulus viviparus*, the lungworm of cattle.

Fig. #48 (Stock Diseases—Bayer)

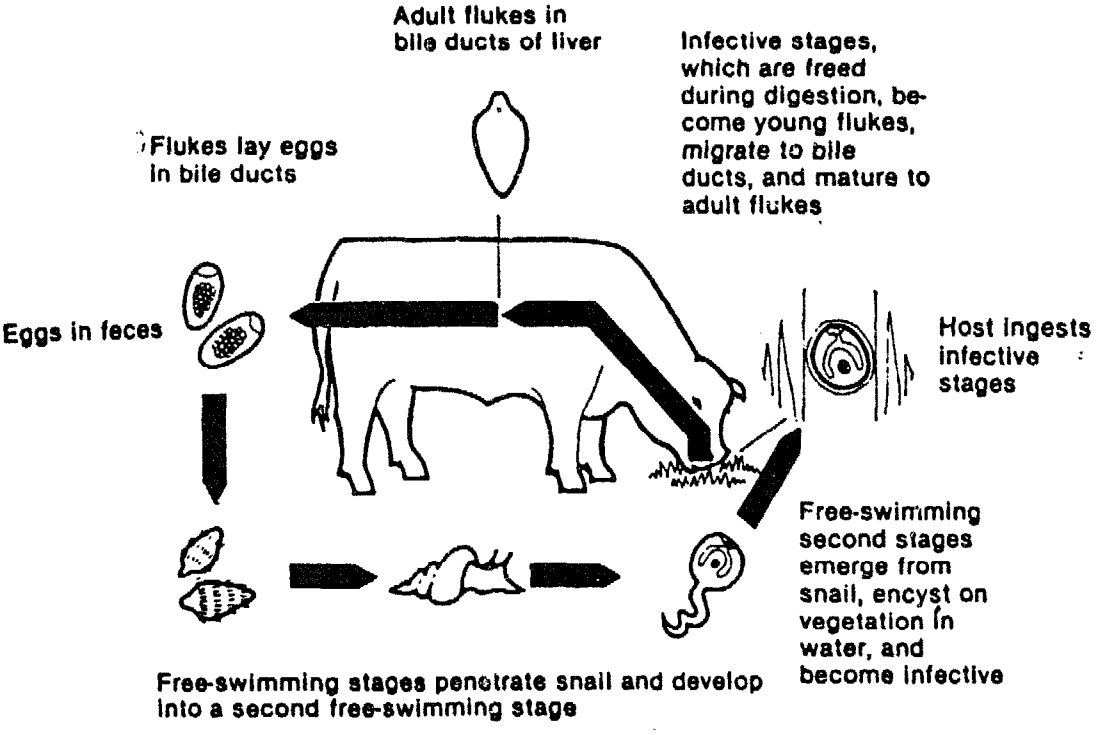
Diagnosis is based upon clinical signs, post-mortem diagnosis, and demonstration of larvae by the Baermann technique. The most acceptable treatment is levamisole (Ripercal, Tramisol, Levasole) given orally or subcutaneously. Since this parasite does not persist on the leaves of grass or soil for long periods of time, a two-month interruption of grazing is enough to free a field of the parasite. Treatment of infected cattle before going to a clean pasture reduces the number of larvae shed and aids

in keeping calves free of the infection. Separation of calves from older animals aids in protecting them from heavy exposures.

Liver Flukes

Nature and Occurrence

Liver flukes (Fasciola Hepatica and Fasciola Gigantica) occur in many tropical countries. The disease they cause is rarely fatal but causes serious losses due to damage to the liver and bile duct. The flukes are flat, unsegmented, leaf-shape parasites 20-50 mm long and 12 mm wide. They are greyish-brown in color. Fluke eggs pass out of the cow with the feces. In moist areas these eggs hatch into an intermediate stage which requires snails for further development. After 1-2 months in the snail, the fluke lives on water vegetation. After being eaten with the vegetation, the young flukes penetrate the gut wall, migrating in the gut cavity, and finally penetrate the liver. In the liver the fluke causes serious tissue damage and reaches maturity in the bile duct where it releases eggs which pass out of the cow's body with feces to start the cycle again. Infection takes place in damp, marshy, or swampy areas where snails are found.



Life cycle of *Fasciola hepatica*, the common liver fluke of cattle.

Fig. #49 (Stock Diseases—Bayer)

Symptoms

The liver fluke affects cattle by the damage which it does to the liver. This organ has large reserves of tissue and tolerates large numbers of flukes without obvious clinical signs. Signs commonly seen are anemia, unthriftiness, bottle jaw, and reduced milk flow. Post-mortem signs indicate severe damage to bile ducts and liver.

Diagnosis, Treatment and Control

Diagnosis is based upon a history of fluke disease in a herd pastured in moist areas with heavy snail populations and showing clinical signs.

To confirm the diagnosis, a fecal examination needs to be done. Because the eggs are heavy a fecal sedimentation test needs to be done rather than a fecal floatation test. Also, egg production does not take place until severe liver damage has already occurred.

Treatment is often difficult because drugs strong enough to treat the parasite are also toxic to the animal. Drugs which have been used are carbon tetrachloride and hexachlorethlene. A newer drug Clarsulon (Curatrem-Merck) is also available now as a treatment.

Since the disease requires the snail as an intermediate host, it can best be prevented by elimination of exposure of cattle to the snail. This can be done by drainage to remove water necessary for the snail's environment and fencing cattle away from areas where the snail lives.

Tapeworms

Tapeworms (Cestodes) are long, segmented, flat, white worms. These worms may be several meters in length and each segment has a number of eggs. Tapeworms occur in most animals and man and are usually located in the small intestine. They require an intermediate host to complete their life-cycle. Cattle act as intermediate hosts for human tapeworms **(Taenia Saginata and Taenia Solium)**. Tapeworms which affect cattle are **Moniezia Expansa** and **Thysanosoma Spp.** Their effects are minimal compared to the other worms, but they do utilize nutrients from their hosts resulting in possible weight loss and malnutrition. Treatment of these parasites is rarely justified.

Non-Infectious Diseases

Lameness

The symptoms of lameness are obvious with a limp or carrying of one or more legs. Footrot was discussed earlier and other lameness conditions will be discussed here: **Sole Abscess** is hard to differentiate from footrot. There is usually less swelling above the hoof area and usually no drainage of the hoof area. It is caused by an abscess within the hoof wall which is often hard to distinguish. Treatment involves casting the animal and probing the hoof area to locate the abscess. Once it is located, the hoof area needs to be cleaned and pared with a knife, the abscess drained and treated with antibiotics, and wrapped with a bandage.

Another common cause of lameness is **arthritis** or inflammation of joint tissue. This condition can affect one or more joints and is either infectious or non-infectious. The signs are a swelling of the joint accompanied by possible heat and a pronounced lameness. If the cause is infectious or bacterial, antibiotics are recommended as well as rest. Infectious arthritis is seen more often in younger animals and may be accompanied by a rise in body temperature. Non-infectious arthritis is usually caused by trauma either directly to the joint or by twisting motion to the leg causing a sprain or strain. Treatment involves complete rest and confinement and soaking or bandaging to reduce the swelling.

Another common cause of lameness is either a **cut** or **puncture wound** to the hoof or leg area. Nails or wire or string around the leg are common causes of these wounds. Treatment involves removal of the cause if needed, thorough cleansing, application of antibiotic ointment, possible bandaging, and rest. Antibiotic injections are also helpful.

Laminitis or **founder** occurs when there is an abrupt change in feed, usually from a high fiber ration to a high energy (grain) or protein ration. This primarily affects the two front feet which have elongated hooves and are very tender. The affected animal moves painfully and prefers to lie down. Treatment is usually unsuccessful.

Bloat (Hoven)

Bloating occurs in ruminants when gas accumulates in the rumen and the animal cannot get rid of it. This may be caused by rapid gas formation, paralysis, or obstruction of the esophagus. Normally the animal gets rid of this gas by belching. Some nutritional causes of bloat include grazing legume pastures which ferment rapidly and also rapid consumption of cereal grains.

Symptoms

Symptoms of bloat are: the left side of the animal may be greatly enlarged; the animal will stand with its feet apart, mouth open, and drooling; the animal will have difficulty breathing to the point of gasping; the animal will eventually lie down and die due to inability to breathe.

If the animal is having difficulty breathing, it is considered an emergency and needs immediate attention. This involves puncturing the rumen with a knife, scissors, or trocar. The knife or trocar is inserted through the skin in the left side at a point halfway between the last rib and the point of the hip and the same distance below the lumbar vertebrae. The instrument should be directed with force downwards. If a knife or scissors are used, a hallow tube or piece of bamboo should be inserted in the opening to allow air to escape. If the animal is excited or stressed considerably before removal of the gas, this greatly increases the chances of losing the animal.

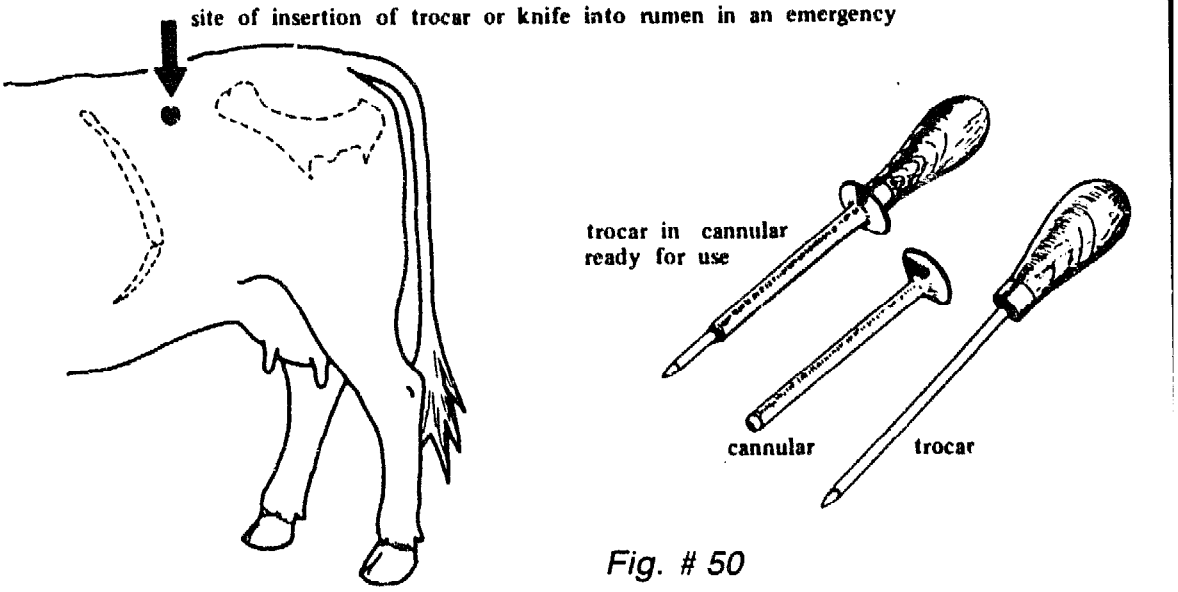


Fig. # 50

USE OF TROCAR AND CANNULAR IN CASES OF BLOAT

Sometimes cattle will have a frothy bloat as opposed to a grassy bloat. This occurs when air is trapped in numerous bubbles which will not pass through a stomach tube or trocar. The only solution in these cases is to

administer medications which will dissolve the air bubbles. These might include 10 gm household detergent dissolved in water, 100 ml formalin in 2 liters water, 2-4 liters of linseed oil, or mineral ol adminstered orally.

If the affected animal is still not breathing normally, any of the following methods may be tried:

(1) walk the animal to help belching
(2) tie a thick rope or block of wood in the mouth to encourage chewing and belching
(3) stand the animal uphill
(4) pass a stomach tube to relieve the bloat

Esophageal Obstruction (choke)

"Choke" occurs when foreign objects such as potatoes, apples, beets, etc. become lodged in the esophagus or food tube. The symptoms are the animal may stand away from the others with its head stretched forward and mouth slightly open. The animal will be drooling and may be bloated. It usually cannot eat or drink.

Treatment involves blocking the mouth with a block of wood between the teeth and fishing the obstruction out with a looped wire or hand. Or if this is unsuccessful, you may attempt to push the obstruction on into the stomach with a stiff tube. Great care must be observed with either of these procedures as tearing or rupture of the esophagus is usually fatal.

Urinary Calculi (Waterbelly)

This occurs most always in castrated males. It is caused by the formation of caluli (small mineral deposit stones) in the bladder and subsequent lodging in the urethal tube (penis). This causes the urine to back up and bladder enlarges and may rupture.

If the condition is noticed before the bladder ruptures, the animal will be seen acting very uncomfortable, wringing the tail, standing up, and lying intermittently, and straining. If the condition is noted after the bladder or penis rupture, the animal will be seen dull and depressed with a large swelling underneath the skin of the belly or within the abdominal cavity.

This condition is treated surgically by redirecting the penis to discharge above the scrotum. This must be done by a qualified person. Prevention involves keeping plenty of water available for cattle and also the proper mineral balance.

Lightning Strike

This condition occurs during a thunderstorm with severe lightning. The signs generally seen are a dead animal or group of animals, sometimes lying on top of a hill or near some trees. One may also find scorch marks on adjacent trees, marks along the ground, or burns on the animal itself. Post-mortem examination usually shows no significant lesions.

Hardware Disease (Traumatic Pericarditis)

In this disease the animal will consume pieces of wire or metal in their eating process. These metal pieces will locate in the second stomach (Reticulum) and may penetrate into the heart sac causing a severe in-

fection. The symptoms are depression, off feed and milk production. They stand with the back slighty arched; they may be reluctant to move, and there may be a grunting sound. The body temperature may be elevated slightly.

Treatment involves the use of a cattle magnet administered orally along with antibiotics. Also, the wire may be removed surgically by a veterinarian in valuable animals.

Naval Ill (Joint Ill, Umbilical Infection)

Naval ill is generally seen in calves during their first week of life. Early, the calf's naval cord will be enlarged and painful with a purulent odor. Later the calf's temperature will be raised and he will be depressed and reluctant to move. The joints in the legs may be swollen.

Treatment involves the use of daily antibiotic infections. If the joints become swollen, the condition is very difficult to treat. Prevention is accomplished by treating the naval cord with iodine upon birth and also ensuring that the birth takes place in clean surroundings.

Abortion

Abortion occurs when a fetus dies and is expelled from the uterus for a variety of causes. If early fetal death occurs, the fetus is usually reabsorbed in the uterus and nothing else is seen. With the absence of infectious disease the abortion rate can approach 2%. Rates higher than this may indicate the presence of an infectious disease or toxicity problem. Diseases which are commonly involved in abortions are: Brucelosis, Vibrosis, IBR, BVD, Leptospirosis, Fungal Infections, and Salmonellosis. High nitrates in feed sources can also cause abortion.

Positive diagnosis of the cause of the abortion would have to be determined by a laboratory. So if the entire fetus cannot be submitted to the laboratory, samples of the lung, kidney and liver from a fresh fetus should be collected and frozen before delivery to the laboratory. Also, blood samples from the cow that aborted may be helpful. Even under the best conditions only about 50% of abortions are diagnosed by a laboratory.

Mastitis (Mammitis)

Mastitis is any inflammation of the udder. It occurs in all countries and breeds but is more prevalent in dairy breeds. The usual cause is the entrance of bacteria into the udder by the teat opening. The symptoms are a swollen, tense, hot and painful udder. The milk flow is diminshed and the milk is discolored and sometimes stringy. One or more quarters may be affected and they will feel hard and knoblike. In severe cases the cow will have an elevated temperature, go off feed and lose condition.

Treatment, if started early is usually successful. This involves completely milking the affected quarter or quarters and then injecting antibiotics. The antibiotics are applied into the teat canal with a special needle or syringe. The needle or syringe needs to be thoroughly disinfected as does the end of the teat before applying the antibiotic. Analysis of the milk by a laboratory can help in deciding which antibiotic to use. Prevention involves keeping cows in clean dry surroundings and disinfection of teats, hands, and equipment at milking time. In herds where

mastitis is a persistent problem, the teats of all cows should be dipped in a cup containing a chlorine-type disinfectant immediately after they have been milked.

Vaginal and Rectal Prolapse

These conditions can occur together or separately. A vaginal prolapse can occur either immediately before calving or afterwards. Only the vagina and cervix are everted as opposed to a uterine prolapse where the uterus also everts. This condition is much less serious than a uterine prolapse but requires attention. If left unattended for any length of time, the cow will strain because it cannot urinate and also may result in a rectal prolaspe. A rectal prolapse can occur by itself and is when 4-8 inches of rectum evert.

Both of these conditions require a trained professional to correct. The animal will have to be given an epidural anesthetic injection (spinal block) to relieve straining and pain. Then the vagina and/or rectum will need to be everted and sutured to prevent recurrence.

General Wound Treatment

Oftentimes, animals are injured from sharp horns, bites, wire cuts, kicks, or sharp objects such as knives or machetes. These injuries are oftentimes infected with bacteria.

The first concern in treating any wound is to stop the bleeding if it has not stopped by itself. This can be done by these steps:

(1) direct pressure on the wound with a clean cloth or bandage (This pressure may need to be applied for considerable length of time until bleeding stops)

(2) tie a rope or a cord above the wound to cut off the blood circulation (This is a temporary solution as you stop the bleeding)

(3) clamp the bleeding vessel with forceps or tweezers and then tie a piece of suture (Fishing line or strong sewing thread will also work) around the vessel and tie tightly with 3 overhand knots.

The first concern in treating a wound is to cleanse it. Clean water can be used initially. If there is long hair on the edge of the wound it should be trimmed. Be very careful to remove all hair, dirt, straw, etc. from the wound as these will retard healing. Next, apply a mild disinfectant (alcohol, iodine, or 2 teaspoons salt in ½ litre of water) as cleansing is repeated. If the wound is less than 12 hours old and has well-defined edges, it may be sutured.

After the wound is clean, daily treatments with antibiotic powder or ointments is best. Sufanilamide or Nitrofurazone works good for this. A clean bandage, changed every 2-3 days is excellent. **Never** use salt or pine tar in a wound as these destory tissue and are extremely painful.

Another problem to be avoided is a screwworm infestation of the wound. THis can be avoided by thorough cleaning of the wound and application of screw repellant, tick grease (grease plus asuntal powder) or Stockholm tar applied around the edge of the wound to prevent flies from laying eggs.

In treating **puncture wounds** where something has penetrated the skin and muscle, antibiotics should be given by injection. Oftentimes, the

skin will close over the wound and it cannot drain causing an internal infection. If drainage can be established by opening the wound with a knife, this should be done. The wound should then be kept open and treated with disinfectants or antibiotics. Tetanus is a consideration in puncture wounds.

If wounds are severe involving joints, large blood vessels, or tendons, some animals may have to be slaughtered. Animal bites to cattle should be treated with caution because of the possibility of rabies developing.

Treatment of Abscesses

Abscesses develop as a result of a small puncture wound and the growth of pus-producing bacteria. These result in round swellings developing anywhere from the jaw, to the back, and/or to the feet. The animal needs to be secured by ropes or a crush and examined. If possible, one should tap the abscess with a 14-16 gal. needle to determine if the abscess is ready to open. If pus drains out of the needle the abscess should be lanced with a knife. Always open the abscess at the lower most point of the swelling so that it will drain well. Cut a triangle-shaped opening approximately 1-2 cm across with a sharp knife. Throughly rinse out the abscess with disinfectants and apply screwworm repellant until the wound heals.

Treatment of Broken Bones

The decision of whether to slaughter an animal with a broken leg depends on several factors. If there is any bone penetrating the skin, infection will develop and the only alternative is to slaughter the animal. Also, if the animal with the broken leg is an adult or weighing over 200 kg, the chances of the bone mending is considerably diminished. In a younger and lighter animal if the bone can be stabilized and the animal confined, the bone can mend properly.

If the choice is made to try to treat the fracture, the animal needs to be kept quiet and secured either with ropes or a crush. The primary concern is to stabilize or immobilize the leg so the bones can fuse back together. Any movement at the site of fracture keeps the bones from mending. Thus the joint above and below the fracture should not move.

If plaster of paris or comparable cast material is available, this works best to immobilize the bones. If sufficient padding of cotton or other material is available, splint boards, broom sticks, or metal pipes can be taped in place for support. The supporting material must be strong enough to stabilize the leg but not too heavy and bulky. Be sure to align the bones correctly while applying the splint. The supporting material may need to be changed periodically due to sudden lameness or pressure sores developing. Leave the splint material in place for a minimum of 6 weeks. If the bones are kept perfectly aligned with rigid material and the animal is kept confined, the bones should heal in a younger animal.

Malnutrition

Malnutrition probably ranks as the number 1 cause of death and loss of production in Third World countries. This is understandable considering that the people are malnourished as well. However when the animals are properly cared for they can better provide for the needs of the people — meat, milk, or work.

It is most important to provide first enough forage and then to see that the forage is properly balanced for protein, energy, vitamins and minerals. (Refer to nutrition section)

Meeting the livestock's nutritional needs is especially difficult in the dry seasons. This is where hay production is needed for times of low forage availability.

Internal and external parasites also play a large role in the malnutrition complex. Even if cattle are provided with all the necessary nutrients parasites can cause the animal to be malnourished. Specific guidelines for control are given in the section on parasites.

Plant Poisoning

Plant poisoning is especially common in tropical areas. Usually a high temperature and high humidity favor the growth and development of the poisonous principle. Lack of good grazing (drought) causes animals to eat poisonous plants which they might not otherwise consume. Also, younger animals are usually more susceptible to poisonous plants.

The symptoms resulting from plant poisoning vary according to the type of plant involved. These symptoms vary from hyper-excitability to dullness, convulsions, skin blistering, jaundice, etc. Generally, however, the symptoms of dullness, abdominal pains, and possible nervous signs may indicate poisoning. If you suspect a certain plant poisoning, it is hard to identify this specifically even if laboratory facilities are available. One should be careful not diagnose plant poisoning unless the specific poisonous plant is seen.

Because there are no specific antidotes for most plant poisonings, general treatments to prevent absorption and treat the symptoms are recommended. Oxidizing agents such as potassium permanaganate deactivates some poisons. Charcoals will absorb many poisons whereas limewater or alum prevent the poisons from being absorbed. Linseed oil, cottonseed oil, or mineral oil relieve irritation and speed the removal of poison from the body. Convulsions are treated with sedatives (ex. barbituates) while paralysis and depression are treated with stimulants.

Control involves avoidance of areas with poisonous plants. Also careful management to avoid over-grazing of pastures is important. Remember prevention is the best way to avoid losses due to plant poisoning.

Some common plants and plant materials:

Lantana Shrub—Animals show jaundice and severe skin infection
Jequirity—Asia, Australia, South America; symptoms: blood poisoning
Castor Oil Plant—symptoms: blood poisoning and convulsions
Lillies—acute digestive upset and convuisions
Tribulus—variable symptoms and localities
Oleander (Ceylon Rose)—Diarrhea and convulsions
Salanines—(thron apples) - dullness and depression
Milkweed—widespread in tropical areas
Mexican Poppy— weakness and labored respiration
Ground-Nut Meal—toxic with the presence of a fungus
Bracken Poisoning—anemia and hemorrhage

Ragwort—severe straining
Yew Tree—immediate death
Acorn and Oak Leaves—dullness and diarrhea

Common Mineral and Chemical Poisonings

Arsenic

This element was commonly used in dips and sprays. It causes severe gut inflammation leading to abdominal pain, colic, and scouring. Treatment involves 60-120 gm of sodium thiosulphate given as a drench in a liter of water

Copper

Copper poisoning usually results with improper cooper supplementation or spraying plants with copper salts. Symptoms usually occur following long periods of intake and include jaundice, pain, and blood in the urine. Treatment involves removal of the source and are symptomatic.

Lead Poisoning

Sources of lead poisoning might include old paint, lead plates from batteries, oil, etc. Symptoms are blindness, excitability, alternated with dullness, abdominal pain, constipation, and possible death. Treatment includes 100 gm magnesium sulphate (epsom salts) by mouth.

Creosote (Diesel, Paraffin)

Symptoms are dullness, abdominal pain, and convulsions. Lower levels of consumption cause poor haircoat and reduced growth. Treatment involves removal of the source.

Nitrates

Nitrates can accumulate in plants during periods of drought and/or lack of sunlight. Also, heavy fertilization causes plants to accumulate large quantities of nitrates. These plants are then consumed by cattle and the nitrates cause symptoms of panting, gasping, bloat, etc. Death can occur very rapidly and the blood is brownish colored. Abortions may result in pregnant animals. Treatment includes I.V. administration of 5% methylene blue.

Insecticides

The two main groups of insecticides which cause poisoning are Chlorinate Hydrocarbons and Organophosphates. Chlorinated Hydrocarbons include DDT, BHC (louse powder), and Dieldrin. Symptoms of excitability and muscle spasms can occur quite suddenly. Treatment is symptomatic to control convulsions.

Organophosphorus insecticides, (such as occurs in grub and tick control medication) fly repellants, cattle wormers, and many crop chemical are common causes of poisoning. The symptoms are salivation, abdominal pain and diarrhea with possible convulsions. Atropine is recommended for treatment.

Moldy Feed

When feeds are stored under unsatisfactory conditions, especially high humidity and high temperature, molds may grow. Many of these molds are not harmful if consumed; however, some molds may produce

toxins which produce poisoning. Symptoms range from decreased appetite and depression to abdominal pain, diarrhea, and even death. Treatment involves removal of the contaminated feed.

Snakebite

Snakebite is a common occurrence is many tropical countries. Animals are usually bitten on the face or legs when grazing. Diagnosis includes demonstration of puncture marks on the face or legs, severe swelling at the site of the bite, depression and possible sudden death. The severity of the bite depends upon the location the bite, size and type of snake, and the amount of venom injected. The treatment involves rest and administration of antibiotics to counteract infection.

Malnutrition

Malnutrition accounts for more loss of production and death loss than any other single factor. Correction of cause involves better feeding and management, which does cost money, but yields much better returns.

MINERAL AND VITAMIN DEFICIENCIES

In order to obtain optimum health, it is necessary that proper amounts of minerals and vitamins be provided. The requirements and needs are discussed in the section on nutrition and we will only discuss the specific deficiencies in this section. These deficiencies usually arise as a result of animals kept in areas where soils are deficient or because of overstocking and/or poor quality feed. These deficiencies can be corrected by supplying the deficient minerals in the form of a supplement or lick.

Acute Calcium Deficiency (Milk Fever, Hypocalcemia, Puerperal Paresis)

Acute calcium deficiency usually occurs in high producing cows in good condition that are receiving a high protein diet. It usually occurs after the second lactation period. Most cases occur during the first 3 days following calving.

After a short period of excitement, the cow shows weakness of the hind quarters and loses its appetite. The cow is generally found lying down and very depressed with the neck bent sideways. The eyes are half closed and the body temperature may be below normal.

Treatment involves the administration of 500-1000 ml of Calcium-phosphorous solution intravenousiy. This should be given slowly and response is usually quite rapid. Proper mineral supplementation prior to calving helps to eliminate this disease.

Fig. # 51
Milk fever, the neck is bent sideways, a characteristic sign. (Stock Diseases — Bayer)

Calcium and Phosphorous Deficiency

Most tropical soils have a low phosphorous content and consequently grasses growing on them are deficient in this mineral. Even the young growing stage of a plant may be lacking in phosphorous, and this level

will drop even further during maturity stages or drought.

An inadequate intake of calcium causes weakened bones, slow growth, low milk production and severe deficiences, and convulsions. Phosphorus deficiencies result in fragile bones, general weakness, weight, loss, stiffness, reduced milk production and chewing of wood, rocks or bones. A phosphorous deficiency can result in chewing of bones leading to botulism. Under conditions of extreme phosphorous shortage, cattle may go for years without producing a calf or even coming into estrus.

Calcium and phosphorous deficiencies can be overcome by supplementation in the diet. Di-Calcium phosphate is an example of a mineral supplement to prevent these deficiencies.

Cooper and Molybdenum Deficiency

In this condition there is usually a deficiency of copper and an excess of molybdenum. Symptoms involve change in the haircoat (loses color especially around the eyes), irregular breeding, incoordinaton and scouring. In some areas of severe deficiency, animals may collapse and die due to heart failure.

Diagnosis is made by clinical signs and laboratory analysis of blood and/or liver. This deficiency can be prevented by licks containing copper, supplementation of fertilizer to soil, or injections.

Fig. # 53
Hair color changes as a result of copper deficiency. The darl color is normal when animals receive adequate copper. (Courtesy Bernardo Jorge Carillo, C.I.C., INTA, Castelar, Argentina.)

Cobalt Deficiency (Engoatic Maramus, Nakuruitis)

Like many deficiencies, this one only occurs in certain areas of the world. Symptoms include a gradual loss of appetite and decreased growth rate. This is followed by extreme depression, depraved (abnormal) appetite, severe anemia and death Diagnosis is by laboratory analysis of blood and/or liver samples. Supplementation involves treatment of the soil or pasture with cobalt or feeding or drenching animals individually.

Fig. #54 Cobalt deficiency. The top left photo shows a cobalt-deficient heifer that had access to an iron-copper-salt supplement. Note the severe emaciation. The top right photograph is the same heifer fully recovered with an iron-copper-cobalt salt supplement while on the same pasture. (Florida Experiment Station Bulletin 699, 1965. R. B. Becker, J. R. Henderson and R. B. Leighty, University of Florida, Gainesville, Florida, U.S.A.)

Sodium Chloride Deficiency

This is a very common deficiency in tropical areas. The signs are a craving for salt demonstrated by licking of wood or soil. The cattle will be restless, drink more water, lose weight, become unthrifty, have a rough haircoat, and the eyes will be dull. The easiest method of diagnosis is to provide a source of salt with granular or block salt. Supplementation of salt can lead to a rapid and full recovery from the signs of deficiency. **Salt should be provided at all times for grazing animals.**

Iodine Deficiency (Goiter)

This deficiency occurs on all continents. It is characterized by stunted growth, loss of hair, abortion and decreased reproductive performace. The thyroid gland is enlarged, helping to make diagnosis. Prevention involves using iodized mineral supplements.

Selenium Deficiency (White Muscle Disease)

This deficiency is widespread occurring more in young animals. The affected animals are often born weak and may die shortly after birth. If able to move, they are stiff. The muscle of the legs and head can be examined following death and reveals very pale to white color. Because there is a relationship between selenium and vitamin E, these substances can be supplemented to prevent this deficiency.

Magnesium Deficiency (Grass Tetany, Grass Staggers and Hypomagnesemia)

This condition occurs when nursing cows and sometimes calves graze young green forage in the spring. Small grain and rye grass pastures are often involved. Associated with the disease are low levels of magnesium and high levels of protein and potassium. The symptoms resemble milk fever and include nervousness, lack of coordination, muscle spasms, staggering and death. Treatment involves administration of magnesium solutions intravenously. This therapy results in immediate response to treatment. Prevention involves supplementing Magnesium Oxide in the feed or included in salt as a 10-15% mixture.

Vitamin A Deficency

This deficiency occurs when animals do not receive enough green feed and during dry conditions, when feeds may contain low levels of vitamin A. Vitamin A deficiency is characterized by a decreased fertility. There is a lowered resistance to infection and a deformity of bones. Treatment and control involves supplementation of vitamin A by either injection or feed supplementation. A rich source of vitamin A is fish liver oil.

Vitamin D Deficiency (Ricketts, Osteomalacia)

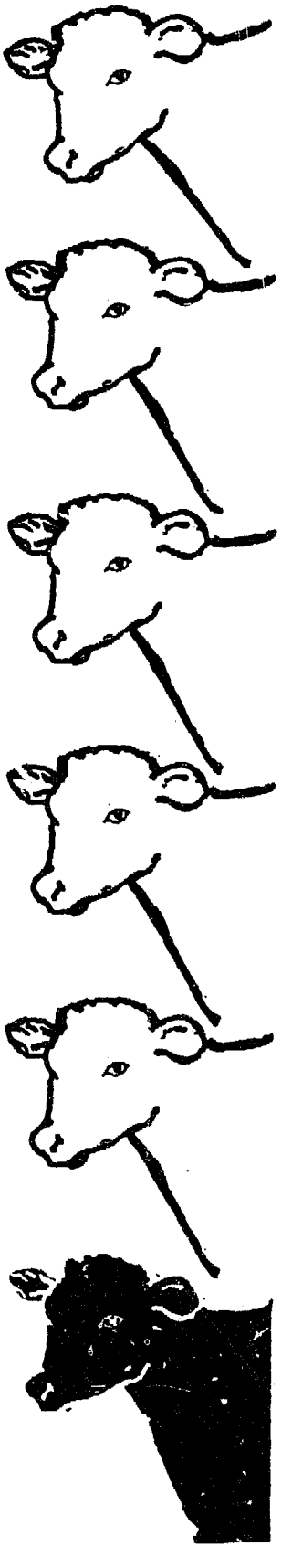
Ricketts affects young animals and is caused by a deficiency of vitamin D. There is an incomplete calcification of boney tissue resulting in a deformity of the ends of the long bones. The animal finds standing painful, it stumbles, moves stiffly and rises with difficulty.

Osteomalacia occurs in adult animals and results from a decalcification of mature bones which become brittle. The symptoms are stumbling, lameness and difficulty in rising. The animal will often lick wood, walls, bricks, carcasses, manure, etc. There is a rapid loss of condition.

Treatment and prevention involve supplementation of vitamin D and calcium-phosphorous preparations.

Section 6

Consultation



If specific problems arise whereby more information is needed, the author is available for consultation by mail. One should, however, first try to seek information from local sources such as veterinarians, extension workers, universities, etc. If additional information is needed please provide the following:

1) **Farm Location**
   a. country
   b. state or province
   c. distance and direction

2) **Climate by Season**
   a. temperatures, rainfall and variations by season

3) **Description of the Area** where farm is located (example: mountainous, swampy, or tropical)

4) **Description of the Farm**
   a. acres in farm
   b. total number of cattle on farm by age group (example: cows, bulls, calves, yearling)
   c. other animals on farm
   d. crops grown on farm

5) **Management Practices**
   a. nutrition in detail—feeds consumed, grazing practices, minerals and salt
   b. water source
   c. general condition of animals (thin, poorly cared for, presence of parasites, etc.)
   d. worming, insect control, and vaccination procedures

6) **Sickness**
   a. describe the specific problem and symptoms in detail (body temperature, appetite, etc.)
   b. number of animals affected, by age
   c. number of animals died, by age
   d. length of time problem observed
   e. is the problem worse in certain seasons
   f. length of time sickness noted until death
   g. what are the after-affects if the animals recover
   h. describe treatments used and results

7) **Any Other Observations**

mail to: CVM, World Concern
Box 33000,
Seattle, Washington 98133, USA

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   b. Clemson University
   c. Colorado State University
   d. University of Florida
   e. University of Georgia
   f. Mississippi State University
   g. University of Nebraska
   h. North Carolina State University

8) United States Department of Agriculture

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Household measure equivalents to some common dosage forms:

1 teaspoonful = 5 cc (ml)

3 teaspoonful = 1 tablespoonful

1 tablespoonful = 15 cc

2 tablespoonful = 30 cc = 1 fluid ounce

2 cups = 1 pint = 16 fluid ounces = 500 cc (approx.)

1 cup = 8 ounces

2 pints = 1 quart = 32 fluid ounces

1 quart = approx. 1 liter (1000 cc)

1 liter = 1000 ml (cc)

4 quarts = 1 gallon = approx. 4000 cc

1 pt. = approx. 1 pound of fluid

1 cup = approx. 250 cc

1 ounce = 30 cc

METRIC MEASUREMENTS

1 millilter (ml) = 1 cubic centimeter (cc)

1000 ml = 1 liter

1 gram = 1000 milligrams (mg)

1 kilogram = 2.2 pounds (lb)

1 ounce = approx. 30 grams

1 pound = 16 ounces = 454 grams

THE AUTHOR

JAMES CARLSON, D.V.M., graduated from Colorado State University in 1974 with a Doctor of Veterinary Medicine degree. He has practiced in a rural community in Colorado for the past fifteen years. In addition, he has done veterinary and nutritional consultation work.

Dr. Carlson, who has made several short-term missionary tours to Haiti, is currently involved in a livestock and farming enterprise with his family.

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