



# **IDM Management Program**

## **Free Choice Minerals & Enzyme Products**



**Bill Johnson**

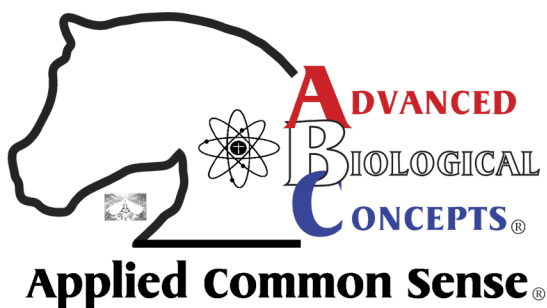
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## **Nutrition and Product Guide**

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# TABLE OF CONTENTS

Ration Management - The “Mineral World” Diagram.....	1
Individual Free Choice Minerals: The Instincts of Animals Are Superior to the Research of Man.....	2
Vitamins and Minerals.....	3
Factors Affecting Vitamin A Consumption.....	5
The Optimum Ration.....	6
Rules of Thumb for Balancing Ruminant Rations in the Field.....	7
What is the Value of the Feed?.....	7
Setting up a Ration.....	11
Some Effects of Excesses and Deficiencies.....	12
The Reasons You Need Free Choice Minerals.....	25
Rumination.....	26



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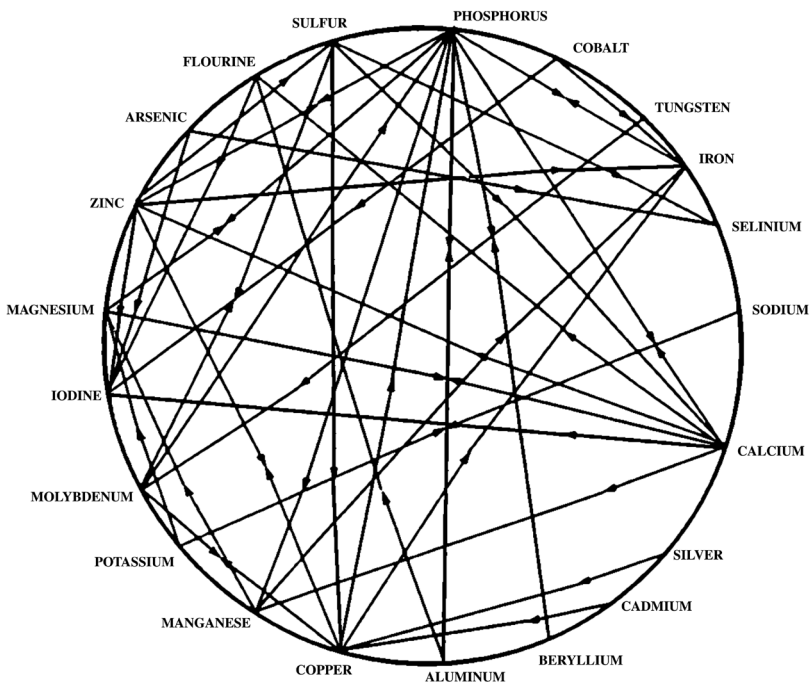
# Ration Management

## The Mineral World

Based on research by several investigators, these mineral relationships appear to be well established.

### How to Interpret the Mineral Wheel:

If a mineral has an arrow pointing to another mineral, it means a deficiency of that mineral or interference with its metabolism may be caused by excesses of the mineral from whence the arrow **originates**.



**MINERAL INTERRELATIONSHIPS** in the animal body are very complex. No one completely understands the process. The best authority on animal nutrition, we believe, is the animal itself, left to its instincts. Advanced Biological Concepts® Management Programs are built on this principle. It has worked for a great many livestock men. We think it will work for you.

# Individual Free Choice Minerals

## The Instincts of Animals Are Superior to the Research of Man

Animal nutritional instincts are aided by taste bud systems more complex and more finely tuned than man's.

In their natural state, wild animals instinctively seek the food nutrients they need from a wide variety of natural sources. The American bison, for instance, roamed the vast prairies of middle America eating a great variety of grasses plus mineral-rich earth.

Domesticated animals today are restricted to ranches, pastures, feed lots and confinement buildings. The availability of natural sources for minerals and vitamins dwindles in relation to the degree of confinement.

Individual minerals are the best, and the most convenient, way of providing the essential mineral elements for livestock. Individual minerals are fed in a mineral feeder with individual compartments, providing the animal with free choice access to individual nutrients.

Concentrated natural minerals are provided in separate compartments. They are natural in composition and in taste, with no additives. Livestock can choose their minerals and vitamins by instinct and taste alone, as they always have.

The nutrient content of silage, haylage, hay, or grass can vary dramatically depending on things like:

1. Stage of forage at harvest
2. Weather conditions
3. Fertilization programs
4. First, second, or third cutting of alfalfa
5. Area of the farm crop comes from
6. Storage conditions

Individual minerals fed free choice allows the animal to balance his or her mineral requirements based on the changing mineral content of the ration, and the needs of the individual animal.

Raw ingredient selection is very important. The mineral element must be both tasteable and available to the animal. Substitution of cheaper, less available mineral elements can be very detrimental to the program. No artificial flavors can be added to individual minerals.

This concept is as old as animal history, but as new as modern feeding conditions.

# Vitamins and Minerals

## **PHOSPHORUS: Growth and Reproduction**

Phosphorus and calcium together make up 75% of the total amount of minerals in the bodies of farm animals, 90% of the minerals in the skeleton, and half of the minerals in milk. Phosphorus is especially important, as more bodily functions are tied to it than to any other nutrient. Besides building strong bones and teeth, it is an important part of many proteins, including the casein in milk. Phosphorus regulates enzyme activity and helps maintain vital pressure balances between cells. If a cow is starved of phosphorus, she is very unlikely to bear a calf. Phosphorus is the only mineral known to significantly affect the eating quality of beef.

## **IODINE: Metabolism Regulation**

Approximately half of the iodine in the body is located in the thyroid glands, which produce important hormones, such as thyroxin, which have a regulating effect on body metabolism. Thyroxin, which contains 65% iodine, is also needed for growth, development, and the reproductive process. Iodine deficiency causes birth of weak and deformed offspring which fail to survive, abortion, infertility, and other reproductive problems. Severe iodine deficiency results in goiter or lumpy jaw.

## **CALCIUM: Bone Growth and Vigor**

Calcium is necessary, along with phosphorus, for sturdy bones and teeth, and for maximum growth, gain, and production. Calcium regulates how well tissue cells absorb nutrients and is vital in the blood clotting process. Calcium and phosphorus team up together in a ratio of approximately one or two parts calcium to one part phosphorus (1-2:1). Vitamin D is necessary for proper utilization of these minerals.

## **MAGNESIUM: Bone and Blood Development**

Magnesium improves calcium and phosphorus metabolism and calcification of bone. Magnesium is needed by the body in relatively small amounts but is very important to life. About 70% of the magnesium in the body is in the bone, combined with calcium and phosphorus. Muscle contains more magnesium than calcium. Magnesium is present in the blood, organs, and tissue fluids of the body. A deficiency of magnesium in the blood causes grass tetany in cattle, an often fatal disease.

## **SODIUM: Nutrient Transfer**

Sodium aids in maintaining correct pressure in body cells, upon which depends the transfer of nutrients to the cells and removal of waste materials. Blood is richer in sodium than in other minerals. Many body functions produce strong acids. Some alkaline chemical is needed to “balance” all of the acidity in the body. Sodium aids that function. Sodium helps to control muscle tension in the heart. It helps in production of liver bile, a digestive aid, and it aids in hair coat formation.

### **VITAMIN A: Healthy Tissue Growth**

Three very important vitamins in animal nutrition are A, D, and E. Vitamin A maintains the skin and the linings of the digestive, respiratory and reproductive tracts. Healthy tissues resist invasion by disease. Vitamin A is needed for normal sight and to prevent night blindness. Colostrum is high in Vitamin A. Vitamin D is the “Sunshine Vitamin.” It prevents rickets and is essential for proper bone growth and consistent reproduction. It is linked importantly with calcium-phosphorus utilization. Vitamin E aids in the absorbing and storing of Vitamin A. It is part of the enzyme and hormone systems.

### **POTASSIUM:**

Potassium is required by the animal body for normal nutrition and is linked with calcium and phosphorus in bone building processes. Its presence affects feed efficiency by aiding rumen bacterial growth and proper cell pressure for nutrient utilization. Muscle and nerves need potassium for proper maintenance.

### **SULFUR: Protein Formation**

Sulfur is necessary for the life of animals, since it is an essential part of most proteins. A deficiency limits nonprotein nitrogen utilization. Sulfur aids in production of healthy hair coats and in hoof and horn development.

### **TRACE ELEMENTS: Catalyst and Enzyme Systems**

Trace elements iron, copper, cobalt, zinc and manganese are minor but essential minerals in livestock nutrition. The need for trace element supplementation has increased in recent years due to the gradual depletion of minerals in farm soils.

- **Iron and copper** work together to form hemoglobin in the blood. Deficiencies cause depraved appetites in cattle, anemia, and calves born weak or dead.
- **Cobalt** is needed to enable rumen bacteria to synthesize Vitamin B12. Cobalt deficiency causes loss of appetite, weakness, anemia, decrease in fertility, and reduced milk production.
- **Zinc** helps to increase gains through good feed efficiency. Deficiency causes poor growth, weak legs, and skin lesions.
- **Manganese** affects the metabolism of calcium and carbohydrates.

### **BENTONITE: Excretion of Mineral Excesses**

Bentonite is a source of silicon, which is found in the tissues of all mammals. Its purpose is not well defined, but its presence would indicate a need. Sodium bentonite can absorb excess mineral ions from the digestive medium and by doing so, aid the mammal to dispose of the mineral element excesses that may result from the ingestion of imbalanced feedstuffs.

### **BUFFER PLUS:**

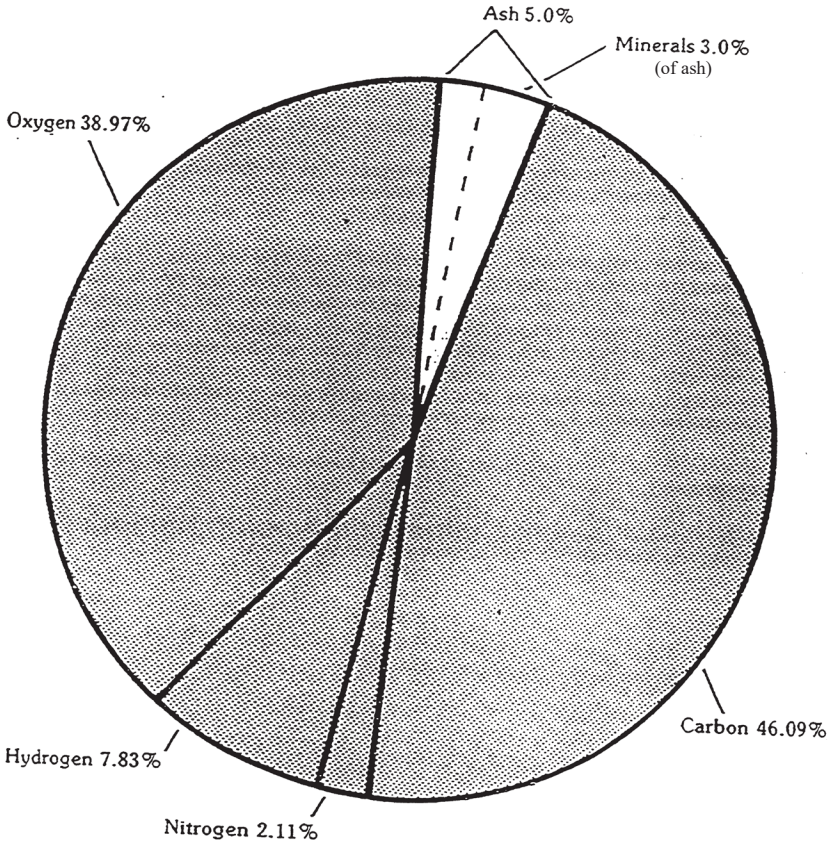
The Buffer Plus is very successful in counteracting low rumen pH and increases utilization of protein. The combination of sodium, magnesium, potassium and

calcium make this a very valuable additive to the ration. A dose of enzyme is added to facilitate bacterial growth in the rumen. One ounce per head per day of Buffer Plus will provide the same buffering as 4-6 ounces of sodium bicarbonate, plus it will produce a remarkable increase in the rumen 'bug' crop.

## Factors Affecting Vitamin A Consumption

- 1. Nitrates** - Can interfere with the thyroid's ability to convert carotene to Vitamin A. Weed sprays trap nitrates, and some think nitrates destroy some carotene in plants.
- 2. Protein Deficiency** - Lowers ability of the blood to transport Vitamin A and interferes with liver storage of Vitamin A.
- 3. High Concentrate Ration** - Intensifies Vitamin A needs.
- 4. High Producing Animals** - A minimum of 1200 IU Vitamin A is necessary to produce each pound of milk.
- 5. Liver Storage** - Low Vitamin A levels in liver create high consumption of Vitamin A in order to satisfy demands and supply blood level and liver storage.
- 6. Carbon-Hydrogen-Oxygen** - An imbalance in the ration (Energy Index), causes increased Vitamin A consumption.
- 7. Mineral Balance of Ration** - All major and trace elements are involved, either directly or indirectly, through enzyme systems in Vitamin A utilization.
- 8. High Temperature** - Depresses thyroid activity and thus interferes with conversion of carotene to Vitamin A.
- 9. Vitamin D and E Level of Ration** - If either is deficient or excessive, then Vitamin A demands go up.
- 10. Rumen pH** - As the rumen becomes more acidic, Vitamin A consumption goes up.
- 11. Stress** - Weather, mud, rain, cold, hot, dry matter deficiency, diseases, parasite load, etc., can all increase Vitamin A consumption.

# The Optimum Ration



**Ash: 5.0%**

Ash content is a measurement of the oxides of minerals in the ration. Mineral content, minus combined oxygen is 3.0%. Optimum is between 4.86 - 5.5%.

**Nitrogen: 2.11%**

Convert nitrogen to protein equivalent by multiplying 6.25 x total nitrogen (13.18%). Optimum protein range: 12.5 - 13.75%.

**Energy: 92.89%**

Oxygen (38.97%), carbon (46.09%) and hydrogen (7.83%) make up 92.89% of the total ration. They provide energy in the form of carbohydrates and fats.



# Rules of Thumb for Balancing Ruminant Rations in the Field

We believe that many ruminant health problems are first allowed to occur because of a poor nutritional plan and/or an imbalanced ration. Therefore, we have devised certain “Rules of Thumb” and memory short cuts to aid you in providing suggestions for more balanced nutrition of ruminant animals.

Like any Rule of Thumb, there has to be a little knowledge and a lot of common sense exerted to properly use this simplified system. We do not expect this to supplant, or to even supplement, existing systems of ration balancing, but offer it only as a mechanism for the busy man or woman to make an educated guess regarding an existing problem ration.

For the purpose of this discussion, we are not concerned with hereditary ability to gain or produce, since this becomes a matter of record and selection beyond our ability to supervise. Consequently, we are concerned only about optimum feeding for the kind and purpose of livestock involved.

Good feed utilization and efficiency depends in a great part upon good cattle management as well as well-balanced rations. Therefore, maximum benefits from an improved ration will result when attention is given to, and improvements are made in, certain stress-inducing situations such as internal and external parasites, water supply, nitrates, deep and muddy lots, continued exposure to extreme heat or cold, noise, commotion, and many others too numerous to mention. With this in mind, you are ready to start.

Step 1: Find out or estimate the weight, age, and condition and ascertain the production goals of the cattle involved.

Step 2: Ascertain the kinds, quality and quantity of feedstuffs presently fed, and determine the ration being fed, and what additional feedstuffs are available.

## What is the Value of the Feed?

We have completed more than 70,000 feed tests in the past several years, and, as a matter of course, we have measured nitrogen in all of these. There are higher nitrogen levels in the feeds than we had formerly estimated. We are not yet trying to determine what sources of nitrogen are present, but are using the factor of 6.25 x total nitrogen to get protein percent. The following table reflects our estimates of protein content, based on these tests. The prediction is, of course, better done by feed analysis, but very few of us carry a nitrogen analyzer in our pick ups. Consequently, we have to use averages.

The ash values are also based upon results from the tremendous number of samples tested in our laboratory, and though no two samples are the

same, definite trends are established, dependent upon the amount of rainfall, fertilizer, time of harvest, method of storage, variety of seed, and so many other variables that it would be ponderous to enumerate them.

The Energy Index is an energy estimate based on an analysis of carbon, hydrogen, nitrogen, and oxygen. We do not use this Energy Index in this application, but merely lump all feeds into three general categories or energy levels, to give an easy memory point to approximate total digestible nutrients.

1. High energy feeds - Grains
2. Medium energy feeds - Good hay, silage and grass legume pasture
3. Low energy feeds

In summary, the best values will be obtained from an accurate sampling, and subsequent testing of, the feedstuffs in the ration being balanced. When this is impossible, however, the next best solution is to use several tests from your area to gain knowledge regarding the trends during a particular season. Those values that occur with the greatest frequency are the best ones to use. Average the values you have, and exclude the extreme highs and extreme lows.

## Estimated Feed Values

Feedstuff	Ash	Protein	Energy
Prairie-Brome-Timothy Hay .....	9.00%	7%	Med. to Med. Low
Alfalfa Brome-Red Clover Hay.....	8.00%	12%	Med. to Med. Low
Alfalfa Hay .....	8.00%	17%	Medium
High Quality Leafy Alfalfa Hay .....	7.00%	21%	Medium
Sorghum Silage .....	4.50%	7%	Medium High
Oats-Alfalfa-Grass Silage.....	7.00%	15%	Medium
Ground Ear Corn .....	2.25%	8%	Med. High to High
Shelled Corn .....	1.25%	10%	High
Milo .....	1.25%	11%	High
Oats .....	1.50%	12%	High
Corn Cobs .....	9.00%	2%	Low
Straw.....	11.00%	4%	Low
Winter Grass Pasture .....	9.00%	4%	Low
Summer Grass Pasture .....	9.00%	8%	Medium Low
Early Summer Grass Pasture .....	7.00%	10%	Medium
Spring Grass Pasture .....	6.00%	15%	High
New Stalk Fields with tip, leaves, etc..	9.00%	9%	Medium Low
Molasses, Dried Beet Pulp .....	5.00%	8%	Medium Low
Cottonseed Meal .....	6.00%	41%	Medium

Since figuring dry matter requires some pencil calculation, we disregard the term and concept of dry matter in favor of thinking in terms of dry feed.

Consider all hay, grain, winter pasture, etc., as dry feed. Consider silage as 33-1/3% dry feed, unless they seem to be unusually dry, then figure 45% dry feed. Figure spring grass, 25%, dry feed and summer grass, wilted haylages, etc., as 50% dry feed. The protein and ash percentage are based on total weight of dry feed consumed.

From the estimated weight, age and condition of the cattle, the probable dry feed consumption of the animal can be predicted with some accuracy.

Type	Condition	Dry Feed Intake Per 100 lbs. of Body Weight
Light Calves	excellent	2.5 lbs.
Finished Cattle	prime	2.5 lbs.
Stockers	gaining well	3.0 lbs.
Feeders	gaining good	3.0 lbs.
Dairy Cows	good flesh	3.0 lbs.
Stock Cows	good flesh	3.0 lbs.
Cattle on Full Feed	gaining rapidly	3.0 lbs.
2-Year Old Steers	thin	3.5 lbs.
Dairy Cows	poor flesh	3.5 lbs.
Stock Cows	thin	3.5 lbs.

The estimated weight of the animal in hundreds of pounds x the above listed pounds x the above listed pounds of dry feed per 100 pounds of body weight (dependent on condition of the animal), will give a fair approximation of the total daily feed intake, including waste. Thus we may expect a 700-pound steer on a good growing ration to eat 21 pounds of dry feed per day, according to this calculation.

It is very important that the animal be fed plentifully or nutritional problems can result. Keep in mind that in balancing a ration, you are working with total amount of feed needed. You can often have a correct carbohydrate to protein balance, but still be short in total feed volume needed.

The goal is to get the animal to the health and nutritional plane necessary for it to produce all of which it is hereditarily capable. Then, if the animal cannot be an economic benefit: CULL!

## THE RULES OF THUMB

**1. Dry Feed** - If given the opportunity, a ruminant animal will consume about 3 lbs. of dry feed per 100 lbs. of body weight per day.

**2. Dry Matter** - The total dry matter in a ration for ruminant animals expected to produce must be 40% or above, or the physical capacity of the animal can become a limiting factor in nutrition.

**3. Ash** - A properly balanced ration will contain about 4.85% mineral ash. For simplicity of calculations, use the figure 5.00%. Higher levels of ash will begin to reduce overall palatability, and lower levels will leave the animal with a mineral deficiency that will tend to reduce feed efficiency, performance, and animal health.

**4. Protein** - Cattle rations will be best balanced at 13.18% protein to dry matter. The great majority of all cattle including growing cattle, maintenance cattle, normally producing cattle in early fattening stages, will use about 13.18% protein rations. Protein starved animals, such as cows very late in gestation, cows early in lactation, or rapidly growing animals, will all use slightly higher protein levels. Extremely fat, nonproducing or low producing animals will use slightly lower protein, so for practical purposes, we will consider all cattle to use 12.5% protein to dry feed intake, or an 8 to 1 nutritive ration, as these figures are easy to use in mental or non-machine calculations.

## 5. Energy

(a) Animals not expected to produce (bulls, stock cows, wintering yearling, all on a maintenance basis) can maintain themselves on a medium to medium-low energy ration, consisting primarily or wholly of roughage.

(b) Young animals, growing animals, animals rapidly gaining weight, producing dairy cows late in gestation, bulls just prior to - and during - breeding season, or any animal expected to produce, needs minimum grain, or equivalent energy source, of 1 lb. per 100 lbs. of animal body weight.

(c) High producing animals, finishing animals, etc., need a medium-high to high energy ration, but the absolute maximum grain, or equivalent energy source, fed is 2 lbs. per 100 lbs. of body weight. Any amount over this creates stress that the average feeder is ill-equipped to handle.

## Setting Up a Ration

Let's figure a ration for a herd of weaner calves to see what they should eat, and about how much grain, mineral and protein supplementation they will need.

The herd consists of 100 weaned calves, average weight being about 500 lbs., mixed heifers and steers, and most of them black-white face crossed breeding.

Dry feed needs:	3 lbs. D.M. x 500 lbs.	=	15 lbs. dry feed needed
Protein needs:	12.5% x 15 lbs. dry feed	=	1.875 lbs. protein needed
Ash needs:	5% x 15 lbs. dry feed	=	0.75 lbs. ash needed
Grain needs:	0.5 - 1.5 lbs. x 500 lbs.	=	2.5 lbs. to 7.5 lbs. grain

### Feeds available:

Ground Ear Corn	10% Protein	1.25 Ash	All dry feed
Grass Hay	8% Protein	9 Ash	All dry feed
Alfalfa Hay	14% Protein	8 Ash	All dry feed

Let's use 3 lbs. of ground ear corn so as not to put too much grain on these young calves. From a total ration of 15 lbs., that leaves us 12 lbs. which we will divide between the grass hay and alfalfa hay for roughage. This split will vary depending on the available supply of each, the lowest cost, and the amount of protein and mineral supplementation necessary. You may feed more alfalfa for ash, but you will increase the protein. You may want to increase corn to reduce protein and/or ash.

You may feed minerals individually free-choice. You may want a sample of your exact feedstuff tested to determine your protein and ash levels with greater accuracy. Your local dealer can assist you with this testing.

# Some Effects of Excesses and Deficiencies

It has been known for quite a few years that certain minerals play an important role in animal nutrition. During recent years the list of minerals deemed “necessary to life” has grown steadily. Minerals not only furnish structural material for the growth of bones, teeth, blood and tissue, but also are necessary components of many of the enzymes which regulate vital life processes.

Not having enough of any one of the “essential” minerals may cause a lack of thrift, poor gains, poor feed conversion, low production of meat or milk, or poor reproduction. Having too much of many of these minerals may result in toxic poisoning which can impair the health of an animal or even kill it. Not having a balanced ratio of many of the minerals may cause symptoms of either excesses or deficiencies or both. Usually these symptoms are noticed only when they are serious enough to cause death or excessive veterinary bills. Excesses in deficiencies result in the loss of millions of dollars of profit to farmers, feeders, and ranchers in the livestock and horse industries.

This list is by no means meant to be a diagnostic guide but rather a broad outline of some conditions which may be encountered.

## **DRY MATTER**

This includes everything that is not water. Less than 40% dry matter is too wet for proper nutrition. When a feedstuff is too wet, the ruminant usually does not obtain adequate nutrition because it is forced to choose between having excess water in the rumen for a time or obtaining sufficient dry matter somehow.

## **ASH**

The ash content of the ration should be in a range of 4.85-5.5% of dry matter. The ash content of the ration is a measurement of the oxides of the minerals in the ration - however, if minerals have not been added to the ration, the ash content of the ration is a very good measurement of the fiber content of the ration. A ration should contain some natural roughage such as hay or dehydrated alfalfa which is high in ash, and not depend entirely on inorganic minerals.

A. EFFECT OF AN EXCESS OF ASH OR FIBER - Excess ash or fiber usually means that a ration is low in energy and should be corrected by increasing feedstuffs low in ash.

1. Ration may be unpalatable.
2. Digestibility of the ration is low.

3. Butterfat test usually remains high but milk production drops.
4. Rate of gain decreases.
5. Droppings may be stiff and stack up; constipation.
6. Animal cannot eat enough to gain or produce at a maximum rate.

**B. EFFECT OF A DEFICIENCY OF ASH OR FIBER - Solubility**  
 value of the ration is excess. Ration should be rebalanced to increase feedstuffs high in ash. Feed moves through the digestive tract too fast for best absorption. Feed moves out of the rumen too fast for maximum digestion by bacteria. Inadequate scouring action of rumen wall (for oxygen, carbon dioxide transfer) and intestinal wall (for food absorption into bloodstream). Additional minerals needed.

1. Poor fill.
2. Hard to keep on feed.
3. Feed intake varies.
4. Butterfat test drops.
5. Too much feed going through undigested.
6. Rate of gain drops.
7. Bloat.
8. Loose, watery manure.

## **CARBON**

Carbon content of the ration should be in a range of 46.09-51.0% of total dry matter. When a ration contains an excess of protein, there has to be a deficiency of carbohydrates. The total amount of protein, nitrogen, plus primary elements should be 15%. Therefore, 85% of an optimum ration must be carbon, hydrogen, and oxygen, which is usually found in the form of carbohydrates, fats and sugars.

### **A. EFFECT OF AN EXCESS OF CARBON**

1. Increases need for hydrogen, oxygen and nitrogen.

### **B. EFFECT OF A DEFICIENCY OF CARBON**

1. Decreases need for hydrogen, oxygen and nitrogen.

## **HYDROGEN**

Hydrogen content of the ration should be a range of 7.83-8.16% of total dry matter.

### **A. EFFECT OF AN EXCESS OF HYDROGEN**

1. Increases need for nitrogen and oxygen.
2. Energy value of the ration is in excess.
3. Conditions in rumen too far reduced and bloat is likely.
4. Burned rumen-founder.

### **B. EFFECT OF A DEFICIENCY OF HYDROGEN**

1. Carbon and oxygen are wasted because of fermentation.
2. Feed intake is reduced.
3. Rate of gain decreases.
4. Milk and test drops.
5. Amount of undigested feed in droppings increases.

6. Starvation.
7. Nasal discharge (from clear to colored).
8. Watering eyes.
9. Incidence of mucosal disease complex is more prominent.
10. Increases the need for Vitamin A.

## **OXYGEN**

Oxygen content of the ration should be in a range of 41-45% to total dry matter.

### **A. EFFECT OF AN EXCESS OF OXYGEN**

1. Increases need for hydrogen.
2. Easily foundered.
3. Droppings loose.
4. Poor fill.
5. Stiff of gait.
6. Depth of body becomes shallow - “ticked up or snaky” appearance.
7. Amount of undigested grain and roughage in droppings increases.
8. Ration is too soluble.
9. Milk and butterfat drop.
10. Rate of gain decreases or completely stops in severe cases.
11. Osmotic pressure in rumen becomes excessive and slows down digestion.

### **B. EFFECT OF A DEFICIENCY OF OXYGEN**

1. Ration is not soluble.
2. Milk production drops but butterfat test usually stays up.
3. Rate of gain decreases.
4. Digestibility of the ration is low.
5. Droppings may be stiff and stack up too high.

## **NITROGEN**

Nitrogen content of the ration should be in a range of 2.0-2.2% of total dry matter.

### **A. EFFECT OF AN EXCESS OF NITROGEN**

1. Increases need for hydrogen.
2. Ketosis.
3. Scouring.
4. Incidence of mastitis increases.
5. Milk and test drops.
6. Rate of gain decreases.
7. More vulnerable to nitrate poisoning.



**B. EFFECT OF A DEFICIENCY OF NITROGEN**

1. Retarded growth.
2. Inefficient use of nutrients.
3. Reduced appetite.
4. Milk production drops.
5. Rate of gain decreases.
6. Irregular heat periods.
7. Reproductive failure.

**PROTEIN EQUIVALENT (NITROGEN)**

$6.25 \times \text{total nitrogen} = \text{protein equivalent}$ . Nitrogen is probably the most important element in ruminant nutrition, because it is the major component of every living cell. A range of 12.5-13.75% of dry matter is optimum for all ruminants. This was proven at Panhandle A & M and the University of Nebraska.

**A. EFFECT OF AN EXCESS OF PROTEIN**

1. Ketosis.
2. Scouring.
3. Decreased feed efficiency.
4. Requires increase in feedstuff low in protein (corn cobs, straw, ear corn, milo).

**B. EFFECT OF A DEFICIENCY OF PROTEIN**

1. Retarded growth.
2. Inefficient use of nutrient (undigested feed in manure).
3. Reduced appetite, wool production, milk production, and poor hair coat.
4. Irregular heat periods.
5. Requires increase in feedstuff high in protein (legume hay, protein supplement).

**SULFUR**

The optimum amount is in a range of .20-.22% of the total dry matter. Sulfur is acid in nature. Sulfur-Nitrogen ratio should be 1-10. Sulfur is necessary for the synthesis of sulfur bearing amino acids.

**A. EFFECT OF AN EXCESS OF SULFUR**

1. Creates acid rumen.
2. Increases the need for copper.
3. Black scours.

**B. EFFECT OF A DEFICIENCY OF SULFUR - Deficiency of sulfur limits NPN (Non protein nitrogen) utilization.**

1. Shedding wool in sheep.
2. Poor hair coat.
3. Poor hoof, hair and horn development.

4. Excess saliva.
5. Watery eyes.

## **POTASSIUM**

The optimum amount is in range of 0.93-1.02% of total dry matter. Potassium is a strong base. If excessive, the rumen requires more chlorine to excrete the excess as potassium chloride.

A. EFFECT OF AN EXCESS OF POTASSIUM - Excess potassium is excreted quickly in the urine, but this may cause a wash out situation which can disturb the calcium-phosphorus balance and result in secondary effects concerning those elements.

1. Alkaline rumen, unless excess chlorine is also present.
2. Slows down bacterial growth and multiplication.
3. Poor feed efficiency.
4. Pressure inside the cell is too great for movement of food into the cell.

### **B. EFFECT OF A DEFICIENCY OF POTASSIUM**

1. Decreases carbohydrate utilization.
2. Slow growth.
3. Reduced appetite.
4. Muscular weakness.
5. Nervous disorders.
6. Potassium needs to be supplied daily because there is no appreciable reserve.

## **SODIUM**

The optimum amount is in a range of 0.27-0.30% of the total dry matter. 90% of all rations are usually short of this element. Sodium is strongly alkaline.

### **A. EFFECT OF AN EXCESS OF SODIUM**

1. Swelling due to excess water retention.
2. Creates alkaline rumen-may be excessive.
3. Slows down bacterial growth.
4. Poor utilization of non-protein nitrogen.

### **B. EFFECT OF A DEFICIENCY OF SODIUM**

1. Decreases utilization of protein and energy.
2. Rough hair coat.
3. Retarded growth.
4. Loss of appetite.
5. Poor reproduction.
6. Depraved appetite.
7. Acidosis.

## CALCIUM

The optimum amount is in a range of 0.48-0.53% of the total dry matter. Calcium is alkaline.

### A. EFFECT OF AN EXCESS OF CALCIUM

1. Decreases availability of protein, phosphorus, iodine, iron, manganese, zinc and magnesium.
2. Birth paralysis.
3. Depresses rate and economy of gain.
4. Increased incidence of milk fever.
5. Ties up fatty acids in a form which is not usable.

### B. EFFECT OF A DEFICIENCY OF CALCIUM

1. Bone growth severely impaired, resulting in lameness.
2. Increases need for Vitamin D<sub>2</sub>.
3. Depressed appetite.
4. Arched back.
5. No vigor.
6. Reduced milk production.
7. Increased milk fever.

## MAGNESIUM

The optimum amount is in a range of 0.29-0.32% of the total dry matter. Magnesium is alkaline.

### A. EFFECT OF AN EXCESS OF MAGNESIUM

1. Increases need for phosphorus and other elements.

### B. EFFECT OF A DEFICIENCY OF MAGNESIUM

1. Irritability.
2. Irregular gait or shifting lameness.
3. Weak pastern.
4. Muscle tremors.

## SILICON

The optimum amount is in a range of 0.33-0.36% of total dry matter. Excess amounts will slow down passage of food through the rumen. Silicon is acidic in nature.

### A. EFFECT OF AN EXCESS OF SILICON

1. Decreases digestibility and palatability.

### B. EFFECT OF A DEFICIENCY OF SILICON

1. Slows down growth and multiplication of rumen bacteria.
2. Poor fill.
3. Depressed appetite
4. Rumenitis.

## PHOSPHORUS

The optimum amount is in a range of 0.37-0.41% to the total dry matter. An excess amount of calcium will increase the need for phosphorus. These elements go hand in hand. There is a definite ratio between calcium and phosphorus. When calcium is excessive, cattle will eat phosphorus to an excess and then excrete both calcium and phosphorus down to optimum. Phosphorus is acidic in nature.

A. EFFECT OF AN EXCESS OF PHOSPHORUS - Excess phosphorus causes an imbalance of zinc, manganese, magnesium, calcium, iron and other elements, and symptoms of excess phosphorus are the same as deficiencies of these other elements because it ties them up as insoluble phosphate salts which are not usable by an animal.

1. Increases need for iron, aluminum, calcium, magnesium, zinc and manganese.
2. Poor skeletal growth.

B. EFFECT OF A DEFICIENCY OF PHOSPHORUS - Increases need for Vitamin D. Deficiency can be created by excess of iron, aluminum, calcium and magnesium.

1. Depraved appetite-chewing wood, bones, dirt, etc.
2. No heat period, delayed heat period, silent heat period and prolonged interval between calving and first heat period.
3. Depresses the appetite, reduced rate of gain, milk production falls off.
4. Undigested grain in manure.
5. Higher incidence of bloat.
6. Milk fever in dairy herds.

## CHLORINE

The optimum amount is in a range of 0.42-0.46% of the total dry matter. Chlorine is a strong acid.

A. EFFECT OF AN EXCESS OF CHLORINE

1. Swelling due to excess water retention in the tissue.
2. Creates acid rumen.
3. Increases need for iodine.
4. Increased incidence of downer cows and grass tetany.

B. EFFECT OF A DEFICIENCY OF CHLORINE

1. Loss of appetite and weight.
2. Poor hair coat.
3. Hyper-alkalinity - tetany - death.

## TRACE MINERALS

Trace minerals are reported as parts per million (ppm) on a dry matter basis (1% equals 10,000 PPM).

The range of optimum amounts of trace elements measured as parts per million of total dry matter are as follows:

Iron	100-200 ppm
Aluminum	60-120 ppm
Manganese	60-120 ppm
Zinc	60-120 ppm
Copper	10-20 ppm
Molybdenum	1.0-2.0 ppm
Cobalt	0.5-1.0 ppm
Nickel	0.5-1.0 ppm
Selenium	0.1-0.5 ppm
Chromium	0.5-1.0 ppm
Fluorine	30-50 ppm
Boron	10-20 ppm
Iodine	0.5-1.0 ppm

### A. EFFECT OF AN EXCESS OF IRON

1. Interferes with phosphorus absorption.
2. Requires use of sodium or potassium bicarbonate to precipitate iron excess.
3. Dark, almost black manure.

### B. EFFECT OF A DEFICIENCY OF IRON

1. Anemia - most likely to occur in calves because milk is low and little iron passes across fetal membranes.
2. Cows and calf operation can show anemia and be more susceptible to diseases.
3. Calves born weak or dead.

### A. EFFECT OF AN EXCESS OF ALUMINUM

1. Increases need for phosphorus.

### B. EFFECT OF A DEFICIENCY OF ALUMINUM - Because

of its prevalence, a deficiency of aluminum is not usually a practical problem. Under controlled clinical conditions it has been tied in with conversion of energy.

1. Leg deformities with over-knuckling in calves.
2. Egg not formed correctly.
3. Degeneration of testicles.
4. Offspring born dead.
5. Delayed heat periods.
6. Shortage created by excess of calcium and phosphorus.
7. Sterility.

A. EFFECT OF AN EXCESS OF ZINC

1. Interferes with utilization of copper and iron, bringing about anemia.

B. EFFECT OF A DEFICIENCY OF ZINC

1. Growth failure.
2. Lesions of the skin.
3. Legs tender, easily injured, raw, bleeding and weak
4. Poor hair coat, bald spots.
5. Poor feed efficiency.
6. Poor reproduction.

A. EFFECT OF AN EXCESS OF BORON

1. Diarrhea.
2. Increased flow of urine.
3. Visual disturbances.

B. EFFECT OF A DEFICIENCY OF BORON

1. Reduces rate of growth and rumen bacteria.

A. EFFECT OF AN EXCESS OF COPPER

1. Degeneration of liver, distended, gall bladder and swollen, black kidneys.
2. Blood in urine.
3. Poor utilization of nitrogen.
4. Yellowish brown mucous membranes about the eye and mouth.

B. EFFECT OF A DEFICIENCY OF COPPER

1. Created by excess of molybdenum and cobalt.
2. Anemia due to poor iron utilization.
3. Depressed growth.
4. Depigmentation of hair and abnormal hair growth.
5. Impaired reproductive performance, heat failure, abortion.
6. Scouring.
7. Bones become fragile.
8. Retained placenta and difficulty in calving.
9. Muscular incoordination in young lambs and stringy wool.

A. EFFECT OF AN EXCESS OF MOLYBDENUM

1. Makes copper unavailable.
2. Depigmentation of hair.
3. Severe scouring.
4. Dehydration.
5. Arching of back.
6. Weakness.
7. Brittle bones.

**B. EFFECT OF A DEFICIENCY OF MOLYBDENUM**

1. Created by excess of sulfur.
2. Slows down cellulose digestion.
3. Calcium deposits in kidneys.
4. Chronic copper poisoning - depending on level of copper.
5. Slows down the conversion of nitrogen to protein.

**A. EFFECT OF AN EXCESS OF IODINE**

1. Secretion of mucus from lungs and bronchial tubes.
2. Rapid pulse.
3. Nervous tremors.

**B. EFFECT OF A DEFICIENCY OF IODINE**

1. Young born weak, hairless, or dead die soon after birth.
2. Abortion at any stage or re-absorption.
3. Retention of fetal membrane.
4. Irregular or suppressed heat period; infertility and sterility.
5. Decline in sex drive, deterioration in semen.
6. Lumpy jaw, goiter.

**A. EFFECT OF AN EXCESS OF COBALT**

1. Reduces availability of copper, aluminum, iron, manganese, molybdenum and iodine if very severely excessive.
2. Ability of the bacteria to convert nitrogen to protein is reduced.

**B. EFFECT OF A DEFICIENCY OF COBALT**

1. Rumen bacteria fail to manufacture enough Vitamin B12.
2. Starved appearance with pale skin.
3. Decreased fertility, milks, or wool production.
4. Necessary for utilization of propionic acid.
5. Cellulose digestion is sharply reduced.
6. Decreased appetite and growth rate.
7. Rough hair coat.

**A. EFFECT OF AN EXCESS OF NICKEL**

1. Ration unpalatable.
2. Excess nickel reduced by chelated iron.

**A. EFFECT OF AN EXCESS OF SELENIUM**

1. Lameness.
2. Loss of vitality.
3. Elongated hooves.
4. Loss of hair.
5. Sloughing of hooves.
6. Blind staggers.
7. Mottled teeth.

B. EFFECT OF A DEFICIENCY OF SELENIUM

1. Slow growth.
2. Poor reproduction.
3. White muscle disease.
4. Chronic scouring.

A. EFFECT OF AN EXCESS OF CHROMIUM

1. Growth depression.
2. Liver and kidney damage.

B. EFFECT OF DEFICIENCY OF CHROMIUM - Level of chromium is closely associated with glucose metabolism.

1. Impaired growth.
2. Opacity of cornea of eye.
3. Corneal lesion.

A. EFFECT OF AN EXCESS OF FLUORINE

1. Dental abnormalities such as mottled enamel, size, shape, etc.
2. Severe reduction in feed intake.
3. Reduced production.
4. Stiffness in legs, enlarged joints.
5. Enlarged bones.
6. Rapid decline in health.
7. Death.

B. EFFECT OF A DEFICIENCY OF FLUORINE

1. Tooth decay.
2. Poor microbial growth.

**VITAMIN A: Anti-infection vitamin.**

A. EFFECT OF AN EXCESS OF VITAMIN A

1. Stored in liver and fat tissue.
2. Works against Vitamin D.

B. EFFECT OF A DEFICIENCY OF VITAMIN A

1. Nasal discharge, coughing, scouring and watering eyes, due to drying and hardening of the mucous membranes which line the lungs, throat, eyes and intestines.
2. Severe diarrhea in young calves.
3. Redness and swelling around dewdaws.
4. Stiffness in hock and knee joints and swelling in the brisket.
5. Increased incidence of mastitis and other udder problems, due to drying and hardening of the mucous membranes of the udder.
6. Decline in sexual activity; sperm decrease in number and mobility.
7. Loss of appetite.
8. Zinc deficiency, nitrates, and low ash rations increase the need for Vitamin A.



## VITAMIN D

### A. EFFECT OF AN EXCESS OF VITAMIN D

1. Deposit of calcium in heart and kidneys.
2. Works against Vitamin A.

### B. EFFECT OF A DEFICIENCY OF VITAMIN D

1. Joints and hocks swell and stiffen.
2. Back arches.
3. Increases need for calcium and phosphorus.
4. Stiffness of gait, dragging hind feet.
5. Rickets.

## VITAMIN E

### A. EFFECT OF A DEFICIENCY OF VITAMIN E

1. Usually occurs in young animals.
2. Muscular dystrophy (white muscle disease).
3. Heart failure, paralysis varying in severity from slight lameness to complete inability to stand.
4. Poor reproduction.

## VITAMIN K

### A. EFFECT OF A DEFICIENCY OF VITAMIN K

1. Failure of blood to clot.
2. Sweet clover disease.

## NITRATES

When nitrates are present in feed or water, the following precautions should be taken regardless of the results of the feed test:

- A. Check to see that phosphorus, iodine and Vitamin A are available, since nitrates increase the need for these substances.
- B. Increase the energy value of the ration since extra energy is required to convert nitrates to ammonia.
- C. Feed free choice low protein roughage in liberal amounts (corn cobs, grass, hay and corn stalks) to reduce the nitrogen content of the ration.
- D. Dilute or discontinue feed and/or water high in nitrates.

## Level of Nitrates and Expected Animal Response

Level of NO <sub>3</sub> ion in Feedstuff on Dry Matter Basis		Animal Response
PPM	%	
0-3000	0 - 0.3	Normal if on adequate ration.
3000-6000	0.3 - 0.6	Milk production drops; slow at first, increasing after 6 to 8 weeks. Typical Vitamin A deficiency symptoms in the 6th to 8th week.
6000-9000	0.6 - 0.9	Milk production loss in 4 to 5 days. Reproduction could become very difficult, and if conditions continue over a long period of time, abortion is possible.
9000-over	0.9 - over	Death, usually several head and suddenly.
Level as in NO <sub>3</sub> ion in water		Animal Response
PPM	%	
0-44	0 - 0.0044	Normal.
45-132	0.0045 - 0.0132	Normal if no nitrates in feed.
133-220	0.0133 - 0.0220	Milk production drops; slow at first.
220-660	0.0220 - 0.0660	Rapid milk production loss, abortion at high levels, some death.

# The Reasons You Need Free Choice Minerals

*Livestock today are subjected to more nutritional stresses than ever before.*

**DEMAND FOR RAPID GAINS:** Feeder cattle and hogs need to be finished for market as fast as possible. Increased amounts of minerals/ vitamins are needed to cope with rapid and heavy growth. Proper mineral nutrition aids the feeder in making the most economic conversion of feed to saleable meat.

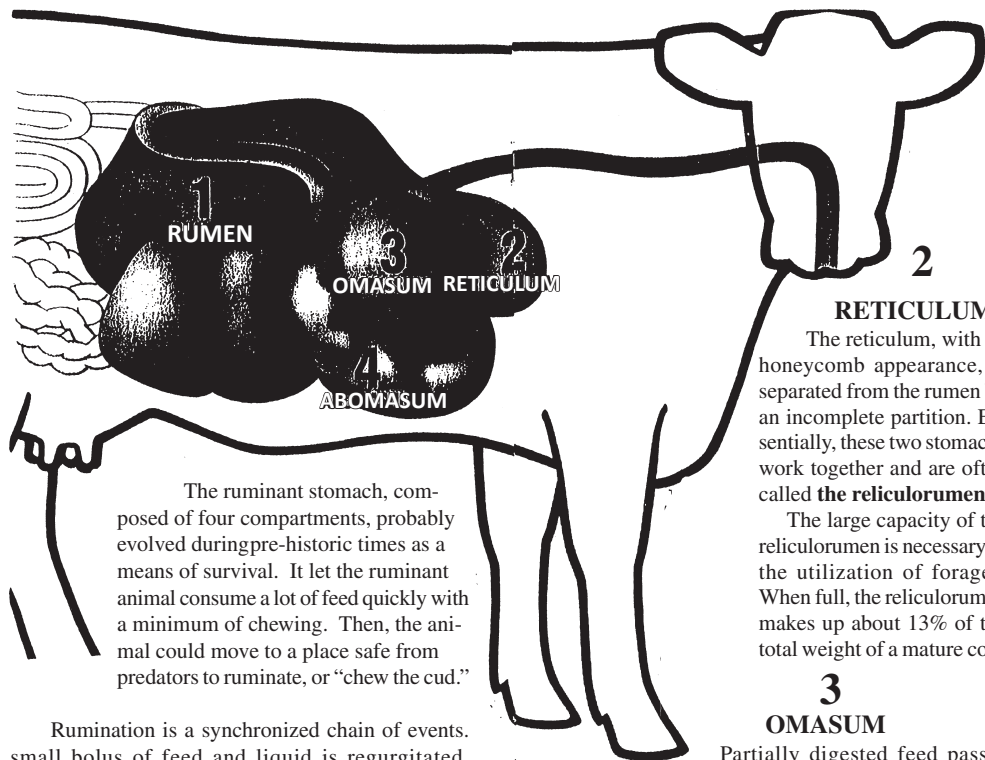
**DEMAND FOR HIGH MILK PRODUCTION:** With the continuing rise in milk and butter fat test levels, the pressure is on dairy cows to maintain very high performance. Minerals and vitamins are essential for such high production.

**DEMAND FOR HIGH CONCEPTION RATES:** Both the cow/calf man and the dairy herd owner need every calf they can get, with a minimal number of repeats and calving difficulties. The same is true for the swine breeder. Rations with the proper vitamin and mineral traces are essential.

**MINERAL DEPLETION OF SOILS:** While pressure to perform is greater than ever, feedstuffs contain less and less of the essential nutrients so necessary. Heavy crop production has deleted much of the natural mineral content of soils, and if it isn't in the soil, it can't be in the feedstuffs. Chemical fertilizers aid in replenishing major minerals, but minor minerals tend to be neglected. Heavy use of nitrogen fertilizers may cause excessive levels of nitrates in feedstuffs and in water, with resultant mineral imbalance in livestock.

**FREE CHOICE MINERALS:** Free choice is the easiest, most economical, and **most accurate** method of providing minerals for today's increased nutritional needs. And minerals are the **BEST** - they have the balance. **Advanced Biological Concepts®** minerals are formulated with the skill and experience of decades of livestock nutrition experience.

# Rumination



The ruminant stomach, composed of four compartments, probably evolved during pre-historic times as a means of survival. It let the ruminant animal consume a lot of feed quickly with a minimum of chewing. Then, the animal could move to a place safe from predators to ruminate, or “chew the cud.”

Rumination is a synchronized chain of events. A small bolus of feed and liquid is regurgitated, rechewed, mixed with saliva and reswallowed. Rechewing decreases the size of the feed particles, increasing the surface area for microbial action and digestion.

## 1

### RUMEN

The rumen is like a complex, semi-liquid fermentation valve. It combines billions of microbes per milliliter. These microorganisms cause a multitude of reactions. They “attack” the feed, and through the fermentation process, break down feedstuffs into compounds. The organisms themselves are then digested in the last stomach.

Numbers of microbes change a great deal when different types of feed are eaten. Because of their specialized stomachs, cattle can adapt to a wide variety of feeds. However, letting cattle adapt to certain changes in microbial numbers on their own takes time. For the sake of efficiency you can either help them adapt or you can avoid drastic and sudden changes.

### RETICULUM

The reticulum, with its honeycomb appearance, is separated from the rumen by an incomplete partition. Essentially, these two stomachs work together and are often called the **reticulorumen**.

The large capacity of the reticulorumen is necessary in the utilization of forages. When full, the reticulorumen makes up about 13% of the total weight of a mature cow.

## 3

### OMASUM

Partially digested feed passes from the reticulorumen to the omasum. Here, most of the water is removed. Some volatile fatty acids (VFA's) are absorbed. Then, the partially digested feed, or digestion, goes into the abomasum, or true stomach.

## 4

### ABOMASUM

Digestion in the abomasum is a lot like digestion in simple-stomached animals. Any remaining VFA's are absorbed here. Most other nutrients are absorbed by the small intestines.

Except for fats taken up by the lymphatic system. Most of the nutrients absorbed from the rumen and small intestine enter the blood stream and are transported to the liver and to all tissues of the body.

Anything that has not been absorbed by the time it reaches the large intestine is waste and is excreted as feces.

Many nutrients, especially water and minerals are secreted back into the digestive tract at various points. Saliva (estimated at about 100 quarts per day per cow) is one example. Such secretions are vital to the overall digestive and absorption processes.

**Notes:**

**Notes:**

# “The Nutrition Box”

These feeders make it easy to feed  
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“Low Boy” 12-Hole  
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- Weather-Proof
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Upright Feeder

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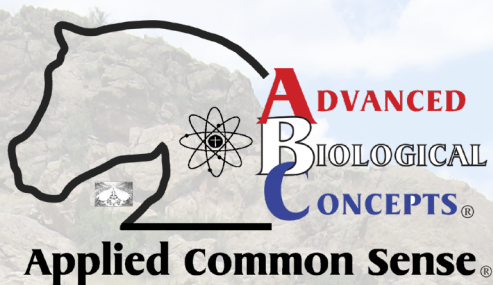
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