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NebGuide

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TEACHING RESEARCH EXTENSION

G77-350

Mineral Nutrition of Range Beef Cattle

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Minerals play a very important role in the well-being of the range beef herd. Minerals are essential for practically all of the metabolic functions of the beef animal. Minerals are classified as 1) major and 2) minor or trace. The major minerals include calcium, phosphorus, magnesium, sodium, potassium, chlorine and sulfur. The trace minerals include copper, cobalt, iodine, iron, manganese and zinc.

Each mineral is discussed below in terms of its function, deficiency symptoms and availability in the range beef cattle diet.

Major Minerals

Salt (sodium chloride)

Salt is the most important mineral in terms of need for the beef animal. Its functions are as follows:

1. Acid base balance.
2. For formation of gastric juice (hydrochloric acid).
3. Maintenance of osmotic pressure in body cells.

Deficiency symptoms include:

1. Loss of and/or abnormal appetite.
2. Decrease in digestibility of feedstuffs.
3. Reduction in growth rate.
4. Reproduction may be impaired.

Sodium and chloride ordinarily do not appear in natural feedstuffs in adequate amounts to meet the needs of the animal, so they must be supplied. The common practice is to provide salt free-choice at all times.

Calcium

Calcium is one of the most important minerals for cattle and has the following functions:

1. Skeletal or bone formation and maintenance.
2. Important in blood clotting.
3. Important in the nervous system.
4. Activation of enzymes.

Deficiency symptoms include:

1. Improper bone growth resulting in a disease called rickets in young cattle and osteomalacia in mature cattle.
2. Improper absorption of nutrients through the gut.
3. Poor growth and reproductive performance.

Calcium is usually not a problem in most areas of the Great Plains because most forages usually contain adequate levels of calcium throughout the year. However, during the winter periods in some states, dry weathered forage can be slightly deficient. Calcium deficiencies can also occur when limited roughage is fed with heavy grain rations.

Phosphorus

Phosphorus has been called the "master mineral" by many due to the fact that it is involved in practically all the metabolic processes of the body. Its functions are:

1. Skeletal or bone formation and maintenance.
2. Involved in the metabolism of feedstuffs.
3. Component part of the energy transformation process.
4. Component of nucleic acid.
5. Maintenance of the acid-base balance of the body.
6. Involved in the conversion of carotene to Vitamin A,
7. Necessary for proper utilization of Vitamin D.

Deficiency symptoms include:

1. Poor growth.
2. Reduced appetite.
3. Reduced digestibility of feedstuffs.
4. Skeletal deformities.
5. Possible poor reproduction.

Phosphorus is deficient during much of the year in most areas of the Great Plains. During the growing season, range forage usually contains adequate levels of phosphorus. However, on some ranges phosphorus is de-

ficient even during the active growing season; in these situations, it is recommended that this mineral be supplemented free-choice at all times. Because most sources of phosphorus also contain some calcium, both minerals are usually provided at the same time.

There has been much discussion of the calcium-phosphorus ratio that a ration should contain for the maximum utilization of both minerals. Since the animal's body contains a two-to-one ratio (Ca:P), many people have suggested this is the optimum ratio for the animal. Under range conditions, data has indicated that ratios as high as five to one are not detrimental; thus, under normal conditions cowmen should be concerned primarily about meeting phosphorus requirements. Because most calcium-phosphorus sources such as bone-meal and di-calcium phosphate have a ratio similar to a 2:1, wide ranges are seldom encountered unless high levels of calcium are added to the supplement. Do not allow total daily phosphorus intake to exceed daily calcium intake for young beef animals as this may provoke urinary calculi problems.

Magnesium

Magnesium is closely related to calcium and phosphorus in the distribution and functions in the body. Functions of magnesium are:

1. A constituent of bones and teeth.
2. Activator of various enzyme systems.

Deficiency symptoms are:

1. Improper metabolism and deposition of calcium.
2. Nervousness, irritability and tetany. (A discussion of grass tetany can be found in fact sheet GPE-3453.)

Potassium

Potassium is needed for proper acid-base balance of the body. Because there isn't evidence of a deficiency of potassium in the forages found in the Great Plains, it is not considered a problem in beef cow herds.

Sulphur

The primary role of sulphur is for the formation of the sulphur-containing amino acids methionine and cystine. However, no known deficiency of this mineral occurs in the Great Plains area.

Trace Minerals

Cobalt

Cobalt is a component part of the Vitamin B-12. Vitamin B-12 is synthesized by the ruminants provided cobalt is adequate in the ration. Vitamin B-12 is important as a coenzyme in several enzyme systems. A cobalt deficiency can also be called a Vitamin B-12 deficiency. Deficiency symptoms include:

1. Anemia.
2. Loss of appetite.
3. Loss of weight.
4. Weakness and death.

Cobalt is not deficient in most areas of the Great Plains. However, it is possible that isolated parts of some states could be deficient, particularly during periods of drought.

Copper

Copper is essential for the following functions:

1. Formation of hemoglobin in the blood.
2. Important in several enzyme systems.

Copper deficiency symptoms are:

1. Iron anemia.
2. Stunted and slow growth.
3. Loss of hair color.
4. Rough hair coat.
5. Diarrhea.
6. Lameness and swelling of joints.

There are very few areas in the Great Plains in which a copper deficiency does occur. However, high levels of molybdenum can cause a tie-up of copper and thus create a copper deficiency. Forages grown in some wet meadow valleys have a higher-than-normal level of molybdenum and a low level of copper in the forage, thus creating a deficiency. Deficiencies are satisfied by copper supplementation, usually in the salt mixture. Levels of 0.5% copper in the salt appear adequate to correct the deficiency problem. Adding 1 to 2 percent copper sulphate ($CuSO_4$) to salt will meet this requirement. Injections of copper glycinate have been effective in curing copper deficiencies in cattle.

Iodine

Iodine has as its most important function as a component part of thyroxin, a hormone produced by the thyroid gland which controls the metabolic rate of the animal's body. The most marked deficiency symptom is the development of goiter in newborn calves. For the most part there doesn't seem to be any real deficiency areas in the Great Plains, but some parts of Montana, Wyoming and the Red River Valley area of North Dakota could have deficiencies.

Iron

Iron has as its primary function the formation of hemoglobin of the blood; therefore, the most marked deficiency symptom is anemia which manifests itself in slow growth and impaired reproduction. However, iron deficiencies in range forage rarely occur.

Manganese

Manganese has as its main function that of being an enzyme "activator"; thus, it is important in all body functions. Deficiency symptoms include:

1. Poor reproductive rate.
2. Leg deformities.
3. Increased abortions.
4. Dull hair coat.

Due to the fact that roughages all have high levels of manganese it is not considered a problem in the Great Plains area.

Zinc

Zinc functions in several enzyme systems. A general deficiency is mostly manifested as poor hair coat and poor growth and performance. Forages contain adequate amounts of zinc, so the possibilities of deficiencies occurring in the Great Plains area are remote.

Selenium

Until a few years ago, selenium was considered more as a toxic element, especially in many areas of the Great Plains. However, it has been shown that cows grazing forages with less than 0.1 ppm selenium can produce calves with a condition called white muscle disease. Vitamin E and selenium are intimately related so deficiencies of both at the same time will result in a deficiency. Deficiency symptoms include:

1. White muscle in newborn calves.
2. Heart failure.
3. Lameness and paralysis.

Toxic levels range from 20-30 ppm and can result in the following:

1. Loss of appetite.
2. Loss of hair from the tail.
3. Sloughing of hoofs.
4. Eventual death.

Mineral Supplementation

The major supplemental mineral needs in the Great Plains area are for salt and phosphorus. There are many different commercial mineral supplements available to producers. However, a simple mixture of salt and a phosphorus source which the producer can mix himself is probably the cheapest alternative. Dicalcium phosphate and steamed bone meal are two calcium-phosphorus sources that are readily available in the Great Plains area. Mixtures of two parts salt with either material are recommended for most areas and times of the year. However, where phosphorus is very deficient, a mixture of equal parts salt and phosphorus source is recommended. Occasionally, it is necessary to add a small amount (i.e., 5%) of grain, soybean oil meal or other highly palatable feed to assure adequate mineral consumption.

Several minerals that are suitable sources of phosphorus for beef cows are listed in Table 1. Note that calcium carbonate (limestone) and trace mineralized salt contain no phosphorus. Although there are commercial mineral mixes that provide adequate phosphorus, they are often expensive compared to home-blended supplements. Because high-phosphorus minerals are rather costly, cowmen should calculate cost per pound of phosphorus for various supplements to determine the best buy.

Table 1. Composition of Several Mineral Supplements.

Mineral	Composition		Percent P in mixture containing	
	Ca	P	1/3 salt	2/3 salt
	%	%		
Bone Meal	30	14	9.3	4.7
Defluorinated rock phosphate	32	18	12.0	6.0
Dicalcium phosphate	24	18	12.0	6.0
Monocalcium phosphate	18	21	14.0	7.0
Monosodium phosphate	0	25	16.6	8.3
Calcium carbonate	38	0	0	0
Trace mineralized salt	0	0	0	0

Protein and phosphorus deficiencies in forage often occur together. High-protein supplements like cottonseed meal and soybean meal provide considerable phosphorus. Thus, when the protein needs of cows are satisfied with these supplements, needs for phosphorus are also often met.

Trace minerals, if necessary, are best supplied by way of a trace mineral salt. The use of a cafeteria-like program where offerings of up to 10 trace minerals are supplied has not been proven to be an effective means of supplementing trace minerals to ruminants.

Table 2. Mineral Requirements of Range Beef Cattle.[1]

Mineral	% of diet dry matter	Parts per million	Daily requirement gms
Calcium[2]			
Preg. Cow	.18-.23	--	12-20
Lact. Cow	.28-.44	--	25-45
Growing Cattle	.25-.42	--	18
Phosphorus[2]			
Preg. Cow	.18	--	12
Lact. Cow	.28-.40	--	25-42
Growing Cattle	.20-.40	--	16
Salt (Supplement)	.10	--	--
Magnesium	.18	--	--
Potassium	.6-.8	--	--
Sulphur	.1	--	--
Cobalt	--	0.1 ppm	--
Copper	--	10.0 ppm	--
Iodine	--	0.2 ppm	--
Iron	--	50.0 ppm	--
Manganese	--	20.0 ppm	--
Zinc	--	30.0 ppm	--
Selenium	--	0.1 ppm	--

[1]Data from "Nutrient Requirements of Beef Cattle," fifth revised edition, 1976.
[2]The low level of calcium and phosphorus requirements is given for older cows and the higher level for younger ones. For the growing cattle, the more grain expected the higher requirement for calcium and phosphorus.

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