Vitamins for Beef Cattle

NEED

OCCURRENCE

DEFICIENCY SIGNS

TREATMENT

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Summary

Rations for feedlot cattle should include a feed high in vitamin A potency. Calves are born without body reserves of carotene or vitamin A. Day to day requirements must be supplied through the milk or by vitamin A supplements.

Young cattle have less storage capacity than older cattle and on deficient diets become depleted in less time.

Cattle consuming even small amounts of green pasture or browse generally do not become deficient.

Small amounts of green leafy alfalfa hay will protect growing and fattening cattle from vitamin A deficiency.

*B Vitamins.* Cattle make their own B vitamins.

*Vitamin C.* Supplementation is not necessary even with breeding cattle.

*Vitamin D.* Requirements generally are met through exposure to sunlight and feeding of sun-cured hay.

*Vitamin E.* May present a problem during drouth. Green forages and grains are good sources.

*Vitamin K.* Deficiency associated with feeding of moldy sweetclover hay. Discontinue feeding of such hay and administer menadione.

Suggested Reading

2. Keeping Livestock Healthy, 1942 Yearbook of Agriculture.
4. Sorghum Silages and Dehydrated Alfalfa Leaf Meal as Sources of Carotene in Beef Cattle Fattening Rations (1944), Texas Agricultural Experiment Station Bulletin 659.

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Vitamins for Beef Cattle

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Beef cattle need vitamins. They are as necessary for normal growth and reproduction as proteins, carbohydrates, fats and minerals. The proper balance of all nutrients in the ration promotes maximum efficiency. Fortunately for the cattleman, most natural feeds supply vitamins A, D and E except under certain conditions which will be described. Cattle store body reserves of vitamin A potency largely in the liver. Large reserves are stored during the pasture growing season.

Vitamins that are not provided in natural feeds are produced in the body cells or by the micro-organisms in the stomach and intestines. These are vitamins C, K and the B-vitamins.

Vitamin A

Nature and Occurrence

Carotene, which is a source of vitamin A, is formed only in plants and occurs widely in nature. In pure form, it is an orange-red pigment, so named because it was first isolated from carrots. Carotene usually is formed during active growth of the plant and is closely associated with the green coloring matter, chlorophyll. In general, the quantity of chlorophyll is an index of the carotene content of plants. Blanched shoots contain little carotene while green shoots contain much of it. The leaves of fresh green young grasses and legumes, such as alfalfa, contain a large amount of carotene. With the exception of yellow corn, other cereal grains and the oil-bearing seeds are deficient in vitamin A potency.

Both carotene and vitamin A are destroyed in the presence of air and light. The process is hastened at high temperatures, but heat in the absence of oxygen has only a minor effect. Large losses in carotene occur during the curing of roughages, especially when they are dried in direct sunlight. Loss of green color in hays or fodders means that a large percent of the carotene is lost. Carotene is lost almost completely when the leaves of plants dry up and die. Large carotene losses may occur when forages are stored in the silo. In the artificial drying of fresh green forages much less carotene is lost than in curing under natural conditions. The above facts give a new conception of quality in roughage and emphasizes the need for care in harvesting to preserve the color in forages intended for cattle feeds.

Symptoms of Vitamin A Deficiency

A condition which has been called "cottonseed meal poisoning," or "mealiness" occurs among cattle limited to rations such as cottonseed
meal and cottonseed hulls. This condition has been identified as vitamin A deficiency and is not caused by any poisonous substance in the cottonseed meal or other feeds.

Vitamin A deficiency in the early stages is characterized by night blindness. In later stages, the cattle become less alert and lose their appetites. They may manifest other symptoms such as watering at the eyes, swelling at the joints, rapid breathing and staggering gait. Or they may have a nasal discharge, suffer convulsions or develop complete blindness. The steers in Figures 1 and 2 were similar when started on feed. Both groups received a ration of cottonseed meal, ground sorghum grain and cottonseed hulls except those in Figure 1 received daily 1 pound of alfalfa hay. Note the condition of the eyes and sluggish appearance of the steers in Figure 2 as compared with the clear eyes and general alertness of the steers in Figure 1.

In an examination of feedlot cattle for vitamin A deficiency, night blindness, in most cases, is the first visible symptom. Night-blind cattle bump into objects and those only partially night blind walk about cautiously when driven about the lot after dark. Other symptoms previously mentioned may vary in order of occurrence, but watering at the eyes with some swelling at the joints may be noted soon after night blindness occurs. Some watering at the eyes, however, may result from conditions other than vitamin A deficiency. Sluggishness is characteristic, as is loss of appetite. Staggering gait also has been noted while the

Figure 1. (Group 2) Steer calves after 140 days in drylot. These animals were protected from vitamin A deficiency by 1 pound of good green alfalfa hay in their daily ration.
2. (Group 1) Steer calves after 140 days in drylot without alfalfa hay in their ration. Note condition of eyes and sluggish appearance as compared to the clean eyes and general alertness of calves in Figure 1.

animals still had sufficient energy to pitch and frolic when turned out of the lot. If the condition is not remedied, the cattle will become unmarketable and eventually will die.

TIME REQUIRED FOR DEFICIENCY OCCURRENCE

The time required for cattle to become vitamin A deficient varies. Young animals become affected in less time than older ones. There are marked differences also among individuals of the same age who receive the same treatment.

Calves weighing 250 to 400 pounds on a ration deficient in carotene may be expected to show symptoms of deficiency in 40 to 80 days. Those above 400 pounds show symptoms of deficiency in 80 to 140 days and steer yearlings in 100 to 150 days.

Calves or yearlings may go 3 to 5 months in the feedlot on a deficient ration without becoming severely affected. Cattle fed for 200 days or more should be supplied with a carotene supplement.

Calves at birth have practically no body storage of vitamin A and depend on their supply from the colostrum or milk. If the cows are depleted and are on a carotene deficient ration, the calves will be affected by vitamin A deficiency. In order to save the calves the cows must have good green hay, ample silage or vitamin A fortified concentrates. Deficient calves also may be treated with fish oils.
INFLUENCE ON GAINS AND FINISH

Lack of carotene in the ration apparently has little or no effect upon rate of gain as long as the cattle have body reserves of carotene or vitamin A. Figure 3 shows the gains made by the steers shown in Figures 1 and 2 during a 224-day feeding period. Both groups made almost exactly the same gains for the first 140 days, but from that point, Group 1 having shown symptoms of deficiency, suffered loss of appetite and ceased to gain. Group 2, receiving 1 pound of alfalfa per head daily, continued to make comparatively uniform gains for a 224-day period and showed only slight irregularity in gain when their ration was continued unchanged for 203 days. All the steers in Group 1, Figure 3, were affected more or less seriously by the deficiency, and one which did not receive restorative treatment died after 181 days. Three were given 10, 25 and 50cc. of cod liver oil per head daily and showed normal appetite and vigor after about 15 days. The others were fed separately alfalfa hay, green alfalfa and green Sudangrass and these also were effective treatments. Though the various treatments caused improvement, the steers did not completely overtake the control group in weight, Figure 3. Thus it is obvious that fed cattle should not be allowed to reach an advanced stage of vitamin A deficiency.

Figure 3. Weight curves of steers fed a ration of cottonseed meal, white grain and cottonseed hulls. Group 1—Not protected from vitamin A deficiency for the first 140 days. Group 2—Protected from vitamin A deficiency by the addition of 1 pound of alfalfa hay per head daily to their ration.
INFLUENCE ON BREEDING CATTLE

Vitamin A deficiency in bulls of breeding age results in decreased breeding efficiency. Spermatozoa decrease in numbers and motility and there is a marked increase of abnormal forms.

In vitamin A-deficient breeding cows, estrus may continue, but fewer cows become pregnant. Deficiency in the pregnant animal, if severe enough, may cause abortion, birth of dead, weak or blind calves.

TREATMENTS

As little as 1 pound daily per head of green leafy alfalfa hay will protect growing and fattening cattle from vitamin A deficiency. Materials high in vitamin A potency, such as fish liver oils, green grasses and legumes, will prevent and at least partially remedy the condition. Although the carotene in sorghum silage does not appear as available as that in alfalfa hay, the silage may supply sufficient carotene to prevent symptoms of vitamin A deficiency in usual fattening periods. Silage exposed to the wind and sunshine loses its carotene content rapidly. Mechanically dehydrated green forages harvested in early stages of growth are excellent sources of carotene.

Many commercially mixed feeds are fortified with vitamin A sources. Synthetic vitamin A is made on a large scale and its potency is guaranteed by the manufacturer. Commercial feedlots generally use concentrated vitamin A and D supplements, which usually are contained in oils.

The B Vitamins

The B vitamins are thiamine, biotin, niacin, pantothenic acid, riboflavin, folic acid and vitamins B₆ and B₁₂. These vitamins are made by bacteria in the rumen of calves 8 weeks or older. Therefore, cattle eating dry feed do not need supplements of B vitamins. One possible exception is vitamin B₁₂ since this vitamin contains the mineral, cobalt. If there is a cobalt deficiency in the feed, vitamin B₁₂ deficiency will result.

Newborn calves have a requirement for the B vitamins, but colostrum and milk are rich in the B vitamins, including vitamin B₁₂. As long as the calf is getting enough milk for normal gain, a B-vitamin deficiency will not occur.

Vitamin C

Vitamin C (ascorbic acid) is not required in rations for beef cattle. Ample amounts are made in the body tissues from other substances. The feeding of ascorbic acid to cattle does not increase the content in the body because it is destroyed by rumen fermentation.

It is not advisable to inject ascorbic acid into hard-to-settle cows, or into bulls for improving semen potency.
Vitamin D

Vitamin D (activated ergosterol and dehydrocholesterol) is essential for the proper utilization of calcium in the body. Growing animals develop rickets due to a vitamin D and calcium deficiency or if the proportion of phosphorus to calcium is very high. Rickets is a nutritional disease characterized in the early stages by swollen joints.

Certain naturally occurring compounds in plants and animals are converted to vitamin D by the ultraviolet rays of the sun. Vitamin D is produced from sunlight on the skin through which it is absorbed. Sun-cured hays are good sources but the grains are poor sources. Commercial sources of vitamin D are fish oils, irradiated ergosterol, activated animal sterol and irradiated yeast.

Beef cattle, under most management practices, receive direct sun rays and sun-cured hays. Therefore, supplemental feeding of vitamin D usually is not necessary. Calves confined to barns during the day and receiving little or no sun-cured hay may need vitamin D supplementation.

Vitamin E

Vitamin E (alpha-tocopherol) normally is supplied in sufficient quantities to beef cattle by natural feeds. The only deficiencies observed in Texas were during a severe drought. Although a deficiency of vitamin E in the roughage was indicated, apparently there were other chemical forage changes which may have been involved. It is not known definitely what happened to the forage during the drought which caused muscular degeneration of cattle, followed by death.

Grains are high in vitamin E, and deficiencies may be prevented during drought by supplemental grain feeding. Research does not show that the feeding of wheat-germ-oil, a concentrated source of vitamin E, will improve fertility or overcome certain forms of sterility.

Vitamin K

Beef cattle rations normally do not need vitamin K (anti-hemorrhagic) supplementation. It is synthesized in the rumen and found in nature in green, leafy forages, either fresh or dry.

Vitamin K deficiency could occur if moldy sweetclover hay were fed. Sometimes such hays are high in a product called dicumarol which causes internal bleeding. This condition is referred to as sweetclover poisoning or bleeding disease. Dicumarol-like materials (Warfarin) are utilized effectively in rat poisons because of this property. Affected cattle may be treated with menadione (vitamin K₃) but the feeding of moldy sweetclover hays should be stopped.