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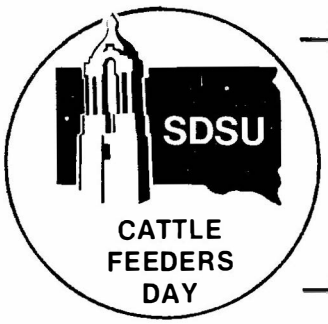

METHODS OF VITAMIN A SUPPLEMENTATION FOR FATTENING BEEF CATTLE

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Rations consisting of corn grain and limited high protein hay such as alfalfa appear to be satisfactory for fattening beef cattle from about 700 lb. to slaughter weights without additional protein supplementation. The intake of carotene, a precursor to vitamin A, could be relatively low under these conditions; and, therefore, a vitamin A supplement would be indicated. Methods of supplementing vitamin A other than through a daily supplement may provide a more practical and economical means of administration. Feeding vitamin A in a free-choice mineral supplement or administering the vitamin as a large one-time injection offers certain convenience and labor-saving advantages to the cattle feeder.

The objective of this experiment was to study the effects of administering vitamin A through a mineral supplement or injection on feedlot performance and liver storage of vitamin A. The feeding trial was conducted at the James Valley Agricultural Research and Extension Center near Redfield during the summer and fall of 1977. The present study also involved a comparison of conventionally-dried, solar-dried and acid-treated corn. Feedlot performance results for these treatments have been reported in the 1978 Progress Report of the Center.

Procedure

Sixty steers averaging 741 lb. were used in the experiment. The steers were ear-tagged, weighed and allotted to six pens of ten steers each. The steers were implanted with 36 mg zeranol at the start of the trial. Initial and final weights were recorded following an overnight stand without feed or water.

The steers were fed either conventionally-dried corn, solar-dried corn or acid-treated corn and 2 lb. of good quality, chopped alfalfa-bromegrass hay. Three pens of steers were allowed free-choice consumption of a mineral mixture containing 65.3% ground limestone, 34.3% trace mineral salt and .4% vitamin A palmitate premix. The vitamin A concentration in the final mixture was calculated to be 546,000 International Units (IU) per pound. Mineral intake was expected to be about 9 g per day based on past observations at this location which would provide approximately 11,000 IU of vitamin A per steer daily. Free-choice mineral was placed in salt boxes equipped with a partial cover.

Three pens of steers were allowed a mineral mixture without vitamin A. These steers were administered 2 million IU of vitamin A as an intramuscular injection at the beginning of the feeding period. This amount would provide a level equivalent to 20,000 IU of vitamin A per steer daily for an expected feeding period of about 100 days.

Supplies of the different corns allowed the experiment to continue for a total feeding period of 138 days. The cattle were weighed following an overnight stand without feed and water and the experiment was terminated. The cattle were fed conventionally-dried corn about a month longer to reach a desirable slaughter weight and quality. Samples of liver tissue were collected at slaughter and frozen for carotene and vitamin A analysis.

Results

The results of vitamin A supplementation are shown in table 1. Weight gains and feed data may be of limited value in evaluating the effects of vitamin A supplementation. Weight gains of cattle fed rations low in vitamin A and carotene are not usually affected to any appreciable degree until body stores are sufficiently depleted and feed intake decreases. However, small differences in performance were observed. Gains of cattle receiving the vitamin A supplement by injection were slightly higher than those of cattle allowed vitamin A in a free-choice mineral supplement. The injected cattle consumed slightly more feed and required less feed per unit of gain than cattle allowed the free-choice mineral.

Mineral consumption for the six pens of cattle averaged about 31 g (range 30 to 34 g between the six pens) per steer daily during the 138-day experiment. This resulted in a vitamin A consumption of about 38,000 IU per steer daily. An average daily dose of injected vitamin A was calculated to be equivalent to 14,500 IU for the feeding period of 138 days.

Carotene and vitamin A concentrations in liver tissue are presented in table 2. The levels indicated adequate vitamin A nutrition for the feeding conditions of this experiment. Vitamin A storage was slightly higher for the cattle receiving the injection. The cattle were held about a month beyond the feeding experiment which may have resulted in lower liver vitamin A levels than at the end of the fattening period. Higher liver stores might have been expected for steers receiving vitamin A in a free-choice mineral supplement because of the higher estimated vitamin A intakes. However, some destruction of vitamin A by mineral elements in the mineral mixture may have occurred, resulting in somewhat lower vitamin A intakes than those which were calculated. Recent stability studies with a vitamin A-trace mineral mixture show vitamin A potency losses of over 60% during a 12-week period under conventional storage conditions. Concentrations of vitamin A in the mineral mixture were not determined during the study.

Summary

Yearling steers were fed a low-carotene ration in a 138-day feeding trial to compare two methods of vitamin A supplementation. Vitamin A was included in a mineral mixture offered free-choice or as a single massive dose injected intramuscularly at the start of the feeding period. The steers were fed a full feed of whole shelled corn and a limited amount of hay. This ration would not provide sufficient carotene to support adequate vitamin A nutrition. Both methods of vitamin A supplementation resulted in comparable weight gains and feed conversion. Concentrations of carotene and vitamin A in liver tissue were slightly higher for cattle receiving the vitamin A injection in comparison to the free-choice mineral treatment in

which vitamin A intake was more than two times greater. However, neither method of administering vitamin A appeared to allow appreciable liver storage.

Supplementation of vitamin A through a free-choice mineral mixture can present some problems when voluntary intake of mineral is low and variable. In this experiment the steers consumed larger quantities of mineral than expected and this resulted in greater vitamin A intake. Mineral elements in such mixtures may cause considerable destruction of vitamin A, resulting in reduced potency. The data suggest that levels of vitamin A provided through a free-choice mineral supplement need to be considerably greater than amounts by injection as measured by liver storage.

Table 1. Methods of Supplementing Vitamin A to Finishing Beef Cattle
(May 18 to October 3, 1977--138 days)

	Free-choice mineral	Injection
No. animals	30	29[a]
Avg init. wt., lb.	741	738
Avg final wt., lb.	1093	1105
Avg daily gain, lb.	2.55	2.66
Avg daily feed, lb. (as fed basis)[b]		
Whole corn	18.82	18.93
Chopped hay	2.49	2.49
Mineral mixture	.07	.06
Total	21.38	21.48
Feed/100 lb. gain, lb.		
Whole corn	738	712
Chopped hay	98	94
Mineral mixture	3	2
Total	839	808

[a] One steer died of unknown causes.
[b] A small quantity of whole oats was fed at the start of the trial.

Table 2. Carotene and Vitamin A Concentrations in Liver Tissue

	Free-choice mineral	Injection
No. animals	30	29
Carotene, mcg/100 g		
Conventionally-dried corn	2.36	2.34
Acid-treated corn	2.21	2.58
Solar-dried corn	2.11	2.14
Average	2.23	2.35
Vitamin A, mcg/100 g		
Conventionally-dried corn	4.19	4.20
Acid-treated corn	6.52	9.50
Solar-dried corn	4.60	5.31
Average	5.10	6.34