

BARLEY FOR BEEF: *Effect of Adding Fat, Vitamins E and Choline, Zinc and Sulfur*

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Barley is an excellent grain for fattening cattle. However, it is known to contain less of certain nutrients than found in other grains. For example, the ether extract (fat) content of barley is lower than in other grains. Barley averages slightly less than two per cent, whereas oats average 4.5, corn 4.3, and proso 3.6 per cent ether extract. Therefore, one objective in these experiments was to see if the addition of a relatively low level of fat, one-half pound per head daily in experiment C-15 and one-quarter pound per head daily in experiment C-16, would improve performance. About one-quarter pound daily intake would be necessary to equal the ether extract intake on a similar ration based on corn. Soybean oil was used in both experiments. Fancy tallow, a by-product of the packing industry, was compared to soybean oil in experiment C-16.

Dehydrated alfalfa was substituted for one-half of the suncured alfalfa in the supplement in experiment C-15 to see if this would have any benefit.

Data from studies on animals with rumen fistulas had indicated a poor retention of minerals on high-energy, low roughage type rations. It had also been observed that cattle on "barley-supplement" type rations would consume large amounts of a mineral mix if offered free choice in addition to the "required" amount force-fed in the ration. So, a second objective of these experiments was to see if doubling the calcium, phosphorus, salt and trace minerals would increase efficiency and gain.

Reports in farm magazines have suggested that other nutrient additions might be beneficial in rations for fattening cattle. Therefore, a "shot-gun" approach was used to determine whether additions of two vitamins, Vitamins E and Choline, and two minerals, zinc and sulfur, would have any effect.

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PROCEDURE

Experiment C - 15:

Thirty-six yearling steers (12 crossbred and 24 Hereford) were allotted on basis of weight, breed and where possible, sire groups into six lots of six steers each.

The steers were individually weighed every 21 days. Cattle were kept off feed, but not water, for at least 12 hours prior to weighing, so the recorded weights were shrunk weights. At the close of the experiment slaughter and carcass data was obtained.

The barley was dry-rolled and fed once daily with the supplement allowance spread over the grain. The grain was fed in amounts that would be almost cleaned up by the following feeding, so for practical purposes, the cattle were "self-fed." The cattle were started on feed with alfalfa and oats, four pounds of each per steer daily. Barley was added to this ration as rapidly as the steers would consume it. Within 10 days the alfalfa was withdrawn (except that in the supplement) and the oats were withdrawn before the 21st day, leaving the cattle on barley and supplement. The data presented on feed per day refers to 2 pounds of supplement and the remainder barley.

The barley used in this experiment varied somewhat but averaged about 44 pounds per bushel and averaged about 12 per cent protein.

The supplement formulas are given in Table 1. The supplement was formulated to be fed at two pounds per head daily. Thus the control lots and those getting dehydrated alfalfa received about

Table 1. Supplement Formulas - Experiment C-15.

Supplement Numbers	15-A	15-B	15-C
Suncured Alfalfa, per cent	50	25	25
Dehydrated Alfalfa, per cent	—	—	—
Soybean Oil, per cent	—	25	—
Wheat Bran, per cent	20	20	20
Molasses Beet Pulp, per cent	10	10	10
Salt, per cent	3.0	3.0	3.0
Trace Minerals, per cent	0.1	0.1	0.1
Stilbestrol Source, per cent	0.5	0.5	0.5
Dicalcium Phosphate,	2.0	2.0	2.0
Limestone, per cent	2.5	2.5	2.5
"A" 6000 IU/lb.	Yes	Yes	Yes
"D" 500 IU/lb.	Yes	Yes	Yes
SBOM, per cent	—	12	—
Barley, per cent	12	—	12
Protein by Analysis, per cent	14.4%	14.5%	15.4%

one pound per head of alfalfa daily. Soybean oil was substituted for one-half of the alfalfa in supplement 15-B and to keep the protein at a similar level to the other two supplements. Soybean oil meal was used instead of the barley in 15-A and 15-C. As reported, dehydrated alfalfa was substituted for one-half of the suncured alfalfa in supplement 15-C. Wheat bran was used as a carrier for the vitamins.

Experiment C - 16:

Forty-eight Hereford steer calves were allotted by weight and sire groups into eight lots of six steers each in a 2 x 4 factorial design. The same procedures for feeding, handling and weighing were used as for the cattle on experiment C-15.

The barley varied in quality, weighing from 40 to 46 pounds per bushel (average for experiment, 44.8 pounds per bushel). The protein content of the barley ranged from 11.3 to 15 per cent (average 12.8 per cent).

The supplement formulas are given in Table 2. No effort was made to equalize protein in the different supplements because the barley contained enough protein for fattening cattle. The supplements were fed at two pounds per head daily. Each animal received at least 1.2 pounds of ground alfalfa in the supplement allowance. Wheat bran was used as a carrier for the vitamins. As shown in the supplement formulas, each treatment was fed to at least two lots of cattle.

RESULTS AND DISCUSSION

Experiment C - 15:

The pertinent data is summarized in Table 3. The cattle were yearlings when started on this experiment and had been "warmed up" on grain and silage prior to purchase. The experiment lasted 147 days. The averages reported are for 2 lots of 6 steers each.

The steers in lots 2 and 5, receiving the one-half pound of soybean oil (SBO), and those in lots 3 and 6, receiving one-half pound of dehydrated

alfalfa in place of one-half pound of suncured alfalfa, gained about one-quarter pound (10 per cent) faster than the controls. However, the statistical analysis of variance used to assist in interpretation show these differences to be non-significant — that is, the steers varied too much in response within lot or treatment. The increase in efficiency of feed conversion was 6 per cent greater for those receiving the soybean oil as compared to the controls. This was not enough to pay for cost of the oil. Thus, neither the oil nor the dehydrated alfalfa addition improved performance or carcass excellence enough to be economically feasible.

The dressing percentage was calculated on final weights off experiment and hot carcass weights obtained the next morning. Using this method, a dressing percentage of 57.5 was average for choice cattle. The thickness of backfat was as desired for choice carcasses but the marbling was slight, resulting in grades between high good and low choice.

These cattle had received massive doses of vitamin A previous to purchase. The supplement sup-

Table 3. Summary of Results, Experiment C-15 (147 days).

Lots	1 & 4	2 & 5	3 & 6
Number Steers	12	12	12
Treatment	Basal Barley	½ lb. SBO	½ lb. Dehi Alf.
Initial Wt. Lb.	691	697	692
Final Wt. Lb.	1024	1070	1056
Ave. Daily Gain, Lb.	2.26	2.54	2.48
Feed Per Day, Lb. ¹	16.3	16.9	17.3
Feed Per Lb. Gain Lb.	7.2	6.7	7.0
TDN for Gain, Lb. ²	2.72	2.59	2.74
Bloat, Cases	0	0	2
Foot Rot, Cases	0	1	0
Urinary Calculi, Cases	1	0	1
Abscessed Livers	2	0	0
Vitamin A (mcg/gm liver) ³	30.1	14.9	19.9
Dressing Per Cent (hot wt.)	57.2	57.6	58.3
Back Fat, Inches	0.40	0.46	0.47
Average Grade ⁴	9.3	9.6	9.5

¹Supplement was 2 lb. per day, rest was barley.

²TDN per lb. gain, maintenance requirement removed.

³Micrograms of A per gram of wet liver.

⁴9 equals high good, 10 equals low choice, 11 equals average choice, etc.

Table 2. Supplement Formulas - Experiment C-16.

Supplement Numbers	16-1	16-2	16-3	16-4	16-5	16-6	16-7	16-8
Alfalfa, per cent	75	63	63	66	73	61	61	64
Wheat Bran, per cent	12	12	12	12	12	12	12	12
Limestone, per cent	3	3	3	6	3	3	3	6
Dicalcium Phos., per cent	3	3	3	6	3	3	3	6
Malt Sprouts, per cent	3	3	3	3	3	3	3	3
Trace Mineral Salt, per cent	4	4	4	8	4	4	4	8
Vitamin "A", IU	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000
Vitamin "D", IU	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Soybean Oil, per cent	—	12	—	—	—	12	—	—
Fancy Tallow, per cent	—	—	12	—	—	—	12	—
Choline Chloride	—	—	—	—	200 gms	200 gms	200 gms	200 gms
Zinc Sulfate	—	—	—	—	250 gms	250 gms	250 gms	250 gms
Vitamin "E"	—	—	—	—	300 mgms	300 mgms	300 mgms	300 mgms
Sodium Sulfate, per cent	—	—	—	—	½	½	½	½
Average Protein, per cent	14.5	13.5	13.7	14.2	14.1	13.5	13.4	13.4

plied 12,000 IU of Vitamin A palmitate per steer per day and the steers in lots 1 and 4 received a pound of suncured alfalfa in the supplement, whereas the steers in lots 3 and 6 received one-half pound of suncured and one-half pound of dehydrated alfalfa per head daily. Those in lots 2 and 5 received only one-half pound of suncured alfalfa. In any event, these stores in the liver were abundant, even at the lowest level.

Experiment C-16:

To more critically evaluate the additions of fat, calves were used in an experiment that lasted 252 days. A long feeding period would more critically evaluate the nutrients added as treatments in this experiment. The pertinent results are summarized in Table 4.

The daily gains, feed intake, and feed per pound of gain show no differences between any treatments. The quarter pound of oil or tallow (which was the amount necessary to have daily intake of fat about equal to that on similar rations based on corn or other grains) did not give any response except in dressing percentage and increased backfat. Carcass grade was not improved over that in the controls because of lack of marbling.

Doubling the calcium, phosphorus, salt and trace minerals was of no benefit. In fact, during the early part of the feeding period it seemed to depress feed intake, but after a few days this effect tapered off and the intake for the entire experiment was similar for all lots. The carcass grades appear to be slightly lower for this treatment and some of the steers had less backfat. In any event, feeding an excess of minerals did not have any great effect except possibly increase the cost of grain.

Fortifying the supplement with Vitamins E and choline and the minerals, zinc and sulfur, was of no benefit. There were fewer cases of foot rot, only three, as compared to ten for the steers receiving the standard supplement. However, it is likely this difference was due to chance.

The vitamin A stores in the liver were worthy of comment. All lots received 12,000 IU of Vitamin A palmitate in addition to the carotene in the alfalfa in the supplement. It is likely that the alfalfa provided from 3,000 to 6,000 units of Vitamin A activity per steer per day, although no analyses were made for carotene. In previous research at this station it was found that 15,000 IU per day was necessary to promote liver storage of "A" on rations of this type. The values reported for the Vitamin A stores do not indicate much storage. It is likely that had the Vitamin A been omitted from the supplement, or if the supplement had been withdrawn for a few days, these cattle would have started to show symptoms of a Vitamin A deficiency.

SUMMARY

1. Additions of soybean oil at levels of one-quarter pound to calves, or one-half pound to yearlings, or tallow at a level of one-quarter pound per day for calves was of questionable benefit.

2. Substituting one-half pound of dehydrated alfalfa for equal amounts of suncured alfalfa was of no benefit.

3. Force-feeding double the calcium, phosphorus, salt and trace mineral requirements in the supplement had no appreciable effect.

4. Fortifying the supplement with vitamin E, choline, zinc and sulfur, did not improve the performance of cattle fattened on high-energy rations based on dry-rolled barley and supplement.

Table 4. Summary of Results, Experiment C-16 (252 Days).

Lots	1 & 5	2 & 6	3 & 7	4 & 8	1, 2, 3, 4	5, 6, 7, 8
Number Steers	12	12	12	12	24	24
Treatment	Basal Barley	½ lb. SBO	¼ lb. Tallow	2 x Mineral	Standard Supp.	Fortified Supplement
Initial Wt. Lb.	498	527	500	506	514	502
Final Wt. Lb.	1003	1050	1021	1012	1030	1016
Ave. Daily Gain, Lb.	2.03	2.08	2.07	2.01	2.05	2.04
Feed Per Day, Lb. ¹	14.5	14.9	14.5	14.4	14.7	14.5
Feed Per Lb. Gain, Lb.	7.13	7.15	7.00	7.16	7.16	7.06
TDN for Gain, Lb. ²	2.12	2.15	2.06	2.12	2.15	2.07
Bloat, Cases	0	1	0	0	0	1
Foot Rot, Cases	2	4	1	6	10	3
Abscessed Livers	0	2	2	2	2	4
Vit. A (mcg/gm liver) ³	1.12	1.73	1.69	1.56	1.46	1.27
Dressing % (hot wt.)	58.4	60.1	61.1	58.7	59.4	59.5
Back Fat, Inches	0.44	0.62	0.52	0.42	0.49	0.50
Average Grade ⁴	10.0	10.1	9.9	9.6	9.9	10.0

¹Supplement was 2 lb. per day, rest was barley.

²TDN per pound gain, maintenance requirement removed.

³Micrograms of A per gram of wet liver.

⁴9 equals high good, 10 equals low choice, 11 equals average choice, etc.