Cobalt and Zinc Supplementation of "All-Barley" Rations for Fattening Steers

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Research work clearly demonstrates that steam rolled barley properly supplemented with soybean meal, calcium, vitamin A and certain trace minerals can constitute the entire feedlot ration. Previous investigations conducted at the Ft. Reno station[1] over the past several years substantiate this. These same investigations have been directed towards defining the trace mineral deficiencies of an "all-barley" fattening ration.

Results of the trial reported in 1964 demonstrated that supplemental cobalt, zinc and iron improved average daily gain and feed efficiency as much as a cobalt, zinc, iron, copper, manganese and iodine combination or a combination of dehydrated alfalfa and molasses, which are known to be rich sources of trace minerals.[2] These results, combined with the results of five earlier trials, indicated that barley is definitely deficient in cobalt, is probably marginal in zinc, but probably adequate in iron, copper, manganese and iodine.

The trial reported herein was conducted to determine the effects of cobalt, zinc and cobalt plus zinc supplementation of all-barley fattening rations.

Procedure

Sixty Hereford steers averaging fifteen months of age were equally allotted by weight and grade to twelve pens, with five steers per pen. There were four ration treatments, with three replications of each. Composition of the basal ration is given in Table 1. Experimental design and ration treatments are given in Table 2.

The steers were placed on feed May 5, and the trial continued for 136 days. Fifty percent cottonseed hulls were added to all rations initially, but were gradually withdrawn at weekly intervals until all hulls had been removed from the ration by the end of the fifth week. No supplemental minerals other than salt, free choice, were available to the cattle.

Table 1. Composition of the basal ration.

Soybean meal[1]	1.6 lb./head/day
Steam rolled barley	ad lib

[1] Composition: soybean meal—93.6 percent, calcium carbonate—6.2 percent, 21,000 IU vitamin A/lb.

Overnight shrunk weights were taken at the beginning and end of the trial as well as at twenty-eight day intervals throughout the course of the trial. During the final phase of the trial, rumen fluid samples were taken for volatile fatty acid analyses and blood samples for mineral and other routine analyses. At the completion of the trial, carcass data were obtained and liver samples were taken for mineral analyses.

Results

The results of this trial are presented in Table 3. The addition of cobalt alone, or cobalt plus zinc tended to increase weight gain and feed consumption. Noted responses obtained from cobalt approached significance ($P<.10$). However, zinc supplementation was apparently without effect on weight gain and feed intake.

Table 2. Experimental design[1]

	Basal	Basal + 3 mg cobalt	Basal + 300 mg zinc	Basal + 3 mg cobalt 300 mg zinc
Lots[2]	2, 6, 10	4, 8, 12	1, 5, 9	3, 7, 11[3]

[1] Supplemental cobalt and zinc as mg/head/day.
[2] Five animals per lot.
[3] Due to bloat, one steer in lot 11 was replaced on May 19 with another steer.

Table 3. Experimental results.

	Basal	Basal + 3 mg Co	Basal + 300 mg Zn	Basal + 3 mg Co 300 mg Zn
No. of steers	15	15	15	15
Av. weights, lb.				
Initial	718	719	723	726
Final	1015	1031	1022	1047
Av. daily gain, lb.	2.18	2.30	2.19	2.36
Av. daily feed intake, lb.	18.9	20.8	20.2	20.1
Feed/gain	8.68	9.06	9.20	8.57
Carcass grade[1]	8.9	9.5	8.9	9.5
Marbling score[2]	11.6	12.8	11.9	12.6
Dressing percent	60.7	60.2	60.6	60.8
Ribeye area, in.^{2}	10.9	11.0	10.8	11.5
Fat thickness, in.	0.95	0.92	0.95	0.96
C_2/C_3[3]	1.27	1.25	1.24	1.44

[1] 8 = Av. Good, 9 = High Good, 10 = Low Choice.
[2] 11 = Slight, 12 = Slight +, 13 = Small −.
[3] C_2/C_3 = acetate/propionate ratio in rumen fluid.

While both cobalt and zinc supplementation decreased feed efficiency, no depression was noted with combined cobalt-zinc supplementation. Results showed, as expected, adding cobalt to a cobalt deficient diet would improve appetite and consequently gain. However, feed efficiency would not necessarily increase if another trace mineral or minerals were limiting. Under these conditions, it appears that zinc becomes the limiting trace mineral when cobalt level is made adequate.

Regarding carcass traits, cobalt supplementation significantly improved carcass grade ($P<.01$), marbling score ($P<.05$) and ribeye area ($P<.01$), but was without effect on dressing percent and fat thickness. Noted effect of cobalt should be interpreted as cobalt being a limiting growth and fattening factor, but not as a specific agent to improve carcass grade and ribeye area. Zinc supplementation did not affect the carcass traits. However, combined cobalt-zinc supplementation increased the ribeye area over cobalt alone ($P<.05$), which again suggests that zinc becomes the limiting trace mineral when the ration cobalt level is adequate.

Neither cobalt nor zinc nor combined cobalt-zinc supplementation had any effect on acetate-propionate ratios in rumen fluid.

Trace mineral analyses of barley used in this trial (Stillwater 1964) and the preceding trial (Ft. Reno 1963 and North Central Oklahoma 1963) are presented in Table 4. These data definitely indicated submarginal amounts of cobalt, if we consider the minimal requirement for cobalt to be 0.1 ppm. Regarding zinc, although some recent work suggests the zinc requirement to be in the neighborhood of 100 ppm, other work indicates the requirement to be somewhere between 15 and 30 ppm. Therefore, with a low calcium level as used in these trials (approximately 0.35 percent), this level of zinc is perhaps adequate or nearly adequate.

These indicated levels of cobalt and zinc lend explanation to the consistent response obtained from cobalt in all trials, and a somewhat more variable response obtained from zinc alone or in combination with other trace minerals. Determined levels of iron, copper, manganese and iodine are probably marginal to sub-marginal. Therefore, in an all-barley

Table 4. Trace Mineral Analyses of Various Barleys

	Ft. Reno 1963	North Central Okla. 1963	Stillwater 1964
		ppm	
Co	0.07	0.02	0.02
Zn	17.0	31.0	33.0
Fe	43.0	52.0	Not determined
Cu	5.0	5.0	Not determined
Mn	14.0	10.0	Not determined
I	0.10	0.04	Not determined

fattening type ration, it would probably be advisable to not only add cobalt and zinc, but supplemental iron, copper, manganese and iodine to supply adequate amounts with necessary safety margins.

Summary

In an "all-barley" ration supplemented with soybean meal, calcium and vitamin A, cobalt supplementation tended to increase weight gain and feed consumption, and improved carcass grade, marbling score and ribeye area. On the other hand zinc supplementation alone was without effect on growth performance and carcass traits. Combined cobalt-zinc supplementation interacted in such a way on feed/gain and ribeye area as to suggest that zinc becomes the limiting trace mineral when cobalt level is adequate.

These results indicate that an "all-barley" type fattening ration is deficient in cobalt and perhaps marginal in zinc.

The Performance of Western vs Dorset x Western Crossbred Ewes for Fall Lamb Production

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In the production of fall born lambs the breed of ewe is of utmost importance. Ewes of many breeds do not exhibit estrus (heat) during the spring and, consequently, cannot be used in such an enterprise.

Oklahoma sheepmen have traditionally purchased replacement ewes from Texas and, to a lesser extent, other western states. Most of the Texas ewes have been of Rambouillet breeding, but many of the imported ewes have been of mixed breeding of Columbia, Panama or Corriedale with Rambouillet. These mixed ewes have not lambed as well during the fall as have straight Rambouillet ewes. Further, neither group has been consistently efficient producers in terms of percent lambing during a short period of time nor the number of lambs born per ewe lambing.

The question might logically be asked: can one raise better ewes than he can buy? Since ewe lambs that are raised are usually worth more as fat lambs at five months of age than Western (Rambouillet and the mixed types mentioned above) yearling ewes cost, it is obvious that the ewe that is raised must be more productive on a lifetime basis than the ewe that is purchased.