During the first grazing season, May 6 to October 10, 1958, both groups of steers made essentially the same total gain. Performance of the two groups during the winter period, October 10, 1958, to May 4, 1959, was also quite similar. The control animals as well as those receiving trace mineral salt just about maintained a constant body weight during the period.

At the end of the second grazing season, August 1, 1959, steers receiving trace minerals averaged 8 pounds per head heavier than control calves. During the period from May 4 to August 1 they gained an average of 203 pounds per head while the control group had an average gain of 192 pounds. This difference in favor of the steers receiving trace mineral salt was not statistically significant.

The cattle were weighed off pasture onto a trailer-truck and hauled directly to Manhattan (134 miles). On arrival at Manhattan they were again weighed. The control steers showed an average shrink of 47.5 pounds (5.3%) during the trip, while the steers receiving trace mineral salt showed an average shrink of only 25.8 pounds (2.9%). During the following week the control calves showed a further loss of 16 pounds each and those receiving trace mineral salt a further loss of only 11 pounds each.

Both groups of steers made satisfactory gains during the finishing period. Calves receiving trace mineral salt gained an average of 0.26 pound more per day than controls. However, gains of individual calves within groups varied greatly. Therefore, this large difference in average daily gain between groups was not statistically significant.

A summary of the over-all gains from May 6, 1958, to November 6, 1959, shows that calves receiving trace mineral salt averaged 56 pounds heavier than control calves at the end of the period. However, here again the great difference between gains of individuals within each group causes one to question the validity of the average figures. This is especially true because of the small number of animals involved.

Shrink was again measured when the cattle were shipped to market (125 miles). Control calves showed an average shrink of 65 pounds (5.7%) while those receiving trace minerals showed an average shrink of only 54 pounds (4.5%). All cattle were handled the same and rode in the same truck.

When viewed with other data accumulated at this station, the feeding of trace minerals in a finishing ration based on corn certainly appears to have some value. Results with rations based on sorghum grain have generally been less favorable and inconsistent. Pasture tests conducted up to now have not shown that trace mineral supplementation increases pasture gains.

Further work is being carried on in an effort to determine which specific trace minerals might be involved and also to determine under what specific feeding conditions trace mineral supplementation might be of value in increasing gain and reducing shrink.

Table 10

Trace mineral salt for steers on pasture and in the fattening lot.

Phase 1—Grazing—May 6, 1958, to October 10, 1958—157 days.

Treatment	Control	T. M. salt
Number of steers	12	12
Av. initial wt., lbs.	551	550
Av. final wt., lbs.	701	697
Av. total gain, lbs.	150	147
Av. daily gain, lbs.	0.96	0.94
Phase 2—Wintering—October 10, 1958, to May 4, 1959—206 days.		
Av. initial wt., lbs.	701	697
Av. final wt., lbs.	697	694
Av. total gain, lbs.	−4	−3
Phase 3—Grazing—May 4, 1959, to August 1, 1959—89 days.		
Av. initial wt., lbs.	697	694
Av. final wt., lbs.	889	897

Table 10 (Continued)

Av. total gain, lbs.	192	203
Av. daily gain, lbs.	2.16	2.28
Standard error of mean	±0.15	±0.13
Phase 4—Finishing—August 1, 1959, to November 6, 1959—90 days.		
Number of steers	12	11[1]
Av. initial wt., lbs.	826	859
Av. final wt., lbs.	1143	1199
Av. total gain, lbs.	317	340
Av. daily gain, lbs.	3.52	3.78
Standard error of mean	±0.15	±0.26
Av. daily ration, lbs.:		
Ground corn	18.2	20.3
Soybean oil meal	1.0	1.0
Prairie hay	7.1	7.4
Salt	0.07	0.06
Salt + bonemeal	0.03	0.04
Av. feed per cwt. gain, lbs.:		
Ground corn	517	537
Soybean oil meal	28.4	26.5
Prairie hay	201.7	195.8
Salt	1.98	1.59
Salt + bonemeal	0.85	1.06
Feed cost per cwt. gain	$13.93	$14.28
Carcass grade, USDA:		
Low choice	3	1
High good	2	2
Av. good	1	3
Low good	4	5
High standard	2	0
Av. USDA grade[2]	11.0	10.9
Av. marbling score[3]	7.50	7.45
Av. firmness score[4]	4.25	4.0
Av. fat thickness, in.[5]	0.60	0.60
Av. ribeye, sq. in.[5]	12.02	12.89
SUMMARY—May 6, 1958, to November 6, 1959—549 days.		
Av. initial wt., lbs.	551	550
Av. final wt., lbs.	1143	1199
Av. total gain, lbs.	592	649
Av. daily gain, lbs.	1.08	1.19
Standard error of mean	±0.04	±0.05

1. One steer died September 6, 1959.

2. Average grade determined as follows: Low choice, 13; high good, 12; av. good, 11; low good, 10; high standard, 9.

3. Visual marbling score: moderate, 5; modest, 6; small amount, 7; slight amount, 8.

4. Firmness of ribeye: firm, 2; moderately firm, 3; modestly firm, 4; slightly firm, 5.

5. Measured at the 12th rib.

Cobalt "Bullets"[1] [2] for Beef Cattle. Project 430. Progress Report

B. A. Koch, E. F. Smith, D. Richardson, and R. F. Cox

Earlier work at this station indicated that supplemental trace minerals may be of value in some instances. Introduction of the so-called cobalt "bullet" has made it possible to study one of these trace minerals alone as a dietary supplement.

When the cobalt "bullet" is introduced into the fore part of the ruminant

1. Permaco cobalt "bullets" supplied by Nicholas International, Ltd., Toronto, Ontario, Canada.

2. Each "bullet" weighed 20 grams and contained 90% of cobalt oxide.

stomach (rumen), it remains there and slowly releases its cobalt. The cobalt requirement of cattle is very small (approximately 0.03 to 0.05 mg. per pound of feed) but this small amount is very important, since the rumen bacteria need it in the production of vitamin B_{12} needed by animals.

Procedure

It is possible to superimpose a study of this type on another basic study by giving half the animals in each treatment group a cobalt "bullet." Thus additional research information is obtained without increasing the number of animals or the facilities. This technique was applied with four different studies reported here. The cattle used, specific test conditions, and diets are detailed in those reports. Cattle involved are those receiving supplemental enzymes in their diet composed primarily of corn grain, those receiving corn grain artificially dried at different temperatures, those receiving either cracked or pelleted sorghum grain, and those receiving whole plant grain sorghum silage or pellets made from green grain sorghum plant.

Each cobalt "bullet" weighed 20 grams and contained 18 grams of cobalt oxide when placed in the digestive tract of the animal. All treated animals were given one cobalt bullet each with a balling gun in early December, 1959. The supplier priced the "bullets" at $1.60 each.

Observations

This is a progress report; final conclusions will be made after the cattle reach slaughter weight. Each individual animal will be followed through slaughter and complete carcass data will be collected.

The additional cobalt apparently is not stimulating gain of cattle receiving sorghum grain. The cattle receiving sorghum grain are also receiving rations rather high in roughage content.

Cobalt supplementation apparently is increasing gains in both groups of cattle receiving corn grain. Their fattening ration is rather low in roughage content.

The cattle receiving a pound of alfalfa hay per day apparently are not responding so much to the supplemental cobalt as those receiving only sorghum silage as roughage.

Table 11

Cobalt "bullets" for beef cattle—Progress Report—Project 430.

Item	Supplemental enzymes with corn		Artificially dried corn		Cracked or pelleted sorghum grain		Grain sorghum silage or pellets	
Treatment	Control	Cobalt	Control	Cobalt	Control	Cobalt	Control	Cobalt
Animals per treatment	15	15	15	15	10	10	10	10
Days on test	112	112	112	112	112	112	112	112
Av. initial wt., lbs.	467	466	463	469	558	564	566	554
Av. total gain, lbs.	195	213	184	216	204	206	212	210
Av. daily gain, lbs.	1.74	1.90	1.64	1.93	1.82	1.84	1.89	1.88
Standard error of mean	±0.04	±0.06	±0.03	±0.08	±0.10	±0.07	±0.12	±0.09
Av. daily ration, lbs.:								
Cracked corn	10.0	10.0	10.0	10.0				
Soybean oil meal	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Alfalfa hay	1.0	1.0	0	0	1.3	1.3		
Atlas sorghum silage	10.0	10.0	10.0	10.0	28.0	28.0		
Sorghum grain					4.0	4.0		
Dehyd. alfalfa pellets							1.0	1.0
Grain sorghum silage or pellets							37.6 or 13.2	37.6 or 13.2

A Comparison of Salt-protein Blocks and Salt-protein Loose Mixtures with and without Additional Phosphorus, 1958-59 (Project 253-1).

E. F. Smith, F. W. Boren, and B. A. Koch

Salt-meal mixtures, with enough salt to limit protein intake, have been used for some time to supply protein on a self-service basis to range cattle. By pressing the salt-protein mixture into block form, there is the possibility of limiting intake mechanically and thereby reducing the salt content of the mixture which would be desirable.

In addition to comparing protein supplied in block form with that supplied by a salt-meal mixture, the value of additional phosphorus supplied in the form of bonemeal was also studied.

The following experimental treatments were compared:

Pasture 1. Salt and soybean meal in block form.
Pasture 2. Salt, soybean meal, and phosphorus in block form.
Pasture 3. Salt and soybean meal mixture.
Pasture 4. Salt, soybean meal, and phosphorus mixture.

The mixtures or blocks listed above were kept before the animals throughout the winter period. The salt content of the blocks varied from 10 to 20 percent; molasses was included as a binding agent in the blocks, so equal quantities were included in the mixtures. When bonemeal was omitted from the ration, sorghum grain was substituted to make the total feed consumed comparable.

The bluestem pastures had large amounts of mature dried grass on them; each was 60 acres in size, and an attempt was made to equalize the pastures by rotating the animals each 30 days. The experimental treatments for the animals remained the same.

The 40 heifer calves, 10 per treatment, used in the experiment were good to choice quality Herefords from near Fort Davis, Texas, and were assigned randomly according to weight to their treatments.

The experimental treatments were discontinued April 18 but the heifers continued on grass until July 23.

Observations

Salt content in both blocks and loose mixtures was varied in attempting to maintain consumption of the supplemental feed at the same level for all lots. Salt content of the blocks varied from 10 to 20 percent and that of the loose mixtures from about 15 to 25 percent. Salt required to control intake of supplemental feed in block form was 0.29 pound per head daily (lots 1 and 2) compared with an average of 0.49 pound per heifer daily (lots 3 and 4) for those on the loose mixture. Most of the difference occurred early in the feeding period when the heifers readily consumed the salt-meal mixtures but were not accustomed to the blocks.

The only variable in animal response among any of the treatments was the somewhat depressed gain of the pasture heifers fed the salt-protein-phosphorus mixture, which would seem to indicate the salt-protein-phosphorus block fed to pasture 2 was superior; however, the gains were about the same in the comparison of the block and mixture where additional phosphorus was omitted in lots 1 and 3. In these trials, it is doubtful if any difference in animal response between blocks and mixtures was obtained.

Additional phosphorus supplied in the form of bonemeal failed to improve animal performance.

Table 12

A comparison of salt-protein blocks and loose salt mixtures with and without additional phosphorus.

Pasture number	1	2	3	4
Treatment	Salt-protein block	Salt-protein block plus phosphorus	Salt protein, loose mixture	Salt protein, loose mixture plus phosphorus
Wintering—December 16, 1958, to April 18, 1959—137 days.				
Number heifers	10	9[1]	9[1]	10
Initial wt. per heifer, lbs.	447	444	449	446
Gain per heifer	−5	−2	−5	−28
Daily gain per heifer	− .04	− .01	− .04	− .20
Daily ration per heifer, self-fed, lbs.:				
Soybean meal	1.31	1.19	1.36	1.26
Salt	.30	.28	.52	.46
Molasses	.09	.09	.07	.07
Ground sorghum grain	.19		.21	
Bonemeal		.18		.19
Total	1.89	1.74	2.16	1.98
Bluestem pasture	Free choice			
Feed cost per heifer[2]	$10.93	$11.21	$11.55	$11.87
Grazing—April 18, 1959, to July 23, 1959—96 days.				
Initial wt. per heifer, lbs.	442	442	444	418
Gain per heifer	162	153	161	161
Daily gain per heifer	1.69	1.59	1.68	1.68
Grazing cost per heifer	$14.00	$14.00	$14.00	$14.00
Summary—December 2, 1958, to July 23, 1959—233 days.				
Initial wt. per heifer, lbs.	447	444	449	446
Final wt. per heifer, lbs.	604	595	605	579
Gain per heifer	157	151	156	133
Daily gain per heifer	.67	.65	.67	.57
Feed cost per heifer	$24.93	$25.21	$25.55	$25.87
Feed cost per cwt. gain	$15.88	$16.69	$16.38	$19.45

1. One heifer removed from pasture 2 because of pregnancy and one from pasture 3 due to unthriftiness.
2. Feed prices used are on inside back cover.

A Comparison of Dry Rolled and Steam Rolled Sorghum Grain, 1959 (Project 253-2).

E. F. Smith, D. Richardson, B. A. Koch, and F. W. Boren

Good to choice quality yearling Hereford heifers originating near Fort Davis, Texas, were used in the trial. They had been on bluestem pasture prior to the test and were allotted to treatments on the basis of prior treatment and weight.

The two lots were fed in an identical manner except one lot received dry rolled sorghum grain (resembling cracked grain, as rollers were set to crack rather than roll the grain) and the other lot received steam rolled grain. Some difficulty was encountered in removing sufficient moisture from the steam rolled grain after rolling to prevent it from heating.

Observations

Results are reported in Table 13. The two treatments produced only minor differences. Results of this test indicate that steam rolled grain is about equal to dry rolled grain for fattening yearling heifers. However, due to failure to remove sufficient moisture from the steam rolled grain after it was rolled, part of it heated and developed a musty aroma which may have affected test results.