# Beef Cattle

## Response of Previously Implanted[1] Cattle to Oral Diethylstilbestrol[2] (Project 430).

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

Steer calves used in a trace mineral study reported elsewhere in this publication were also used in a study designed to further determine the effect of previous implantation with diethylstilbestrol on feedlot performance.

### Experimental Procedure

May 4, 1959, steers on the trace mineral study in Woodson county were randomly divided. A 12-mg. implant of diethylstilbestrol was placed in the left ear of each of six calves in either treatment group. All calves grazed on native pasture until August 1, 1959. They were then weighed off pasture and trucked to Manhattan. After a one-week adjustment period they were started on full feed., The fattening period lasted 90 days; during that time all steers received 10 mgs. of oral diethylstilbestrol per head per day.

The ration fed included ground corn, prairie hay, and 1 pound of soybean oil meal per head per day. Corn was increased gradually for the first three weeks until the cattle were on full feed. Thereafter corn and prairie hay were available at all times on a free-choice basis.

Salt and a mixture of salt and bonemeal were available at all times, as was water from automatic waterers.

### Observations

Gain and carcass data are summarized in Table 7. Since control and implanted steers were fed together, feed efficiency could not be calculated.

During the 89-day grazing period, the implanted calves gained 19 pounds more each than control calves in the same pastures. That is an advantage of 0.22 pound per day for the implanted calves during the grazing period.

During the fattening phase the control calves and the previously implanted calves were fed together. Average daily gains for the two groups were very similar. A summary of the carcass data also failed to show any differences that might have occurred from implants prior to the grazing period.

1. Stimplants furnished by Chas. Pfizer & Co., Inc., Terre Haute, Ind.
2. Stilbosol furnished by Eli Lilly & Co., Indianapolis, Ind.

**Table 7**

**Response of previously implanted steers to oral diethylstilbestrol in the fattening ration.**

| Treatment | Control | 12-mg. DES implant |
|---|---|---|
| Phase 1—Grazing—May 4, 1959, to August 1, 1959—89 days. | | |
| Number steers | 12 | 12 |
| Av. initial wt., lbs. | 703 | 687 |
| Av. final wt., lbs. | 891 | 894 |
| Av. total gain, lbs. | 188 | 207 |
| Av. daily gain, lbs. | 2.11 | 2.33 |
| Phase 2—Fattening—August 8, 1959, to November 6, 1959—90 days. | | |
| Number steers | 12 | 11[1] |
| Av. initial wt., lbs. | 845 | 840 |
| Av. final wt., lbs. | 1168 | 1172 |
| Av. total gain, lbs. | 323 | 332 |
| Av. daily gain, lbs. | 3.59 | 3.69 |

1. One calf died September 5, 1959.



**Table 7 (Continued)**

| | | |
|---|---|---|
| Standard error | ±0.12 | ±0.28 |
| Carcass grades, USDA: | | |
| Low choice | 1 | 3 |
| High good | 3 | 1 |
| Av. good | 3 | 1 |
| Low good | 4 | 5 |
| High standard | 1 | 1 |
| Av. USDA grade[2] | 10.9 | 11.0 |
| Av. marbling score[3] | 7.6 | 7.4 |
| Av. firmness score[4] | 4.0 | 4.3 |
| Av. fat thickness, in.[5] | 0.62 | 0.58 |
| Av. ribeye, sq. in.[5] | 12.59 | 12.24 |

2. Average grade determined as follows: Low choice, 13; high good, 12; average 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 12th rib.

## Trifluomeprazine Fed to Fattening Steers. Project 626*

B. A. Koch, E. F. Smith, D. Richardson, and M. M. McCartor

Trifluomeprazine (TFL) fed to fattening steer calves at the rate of 5.0 mgs. per day apparently increased gains significantly in an earlier trial. However, the tranquilizer gave no increase in gain when fed at the rate of 2.5 mgs. per day. This study was designed to again check the response at the 5.0-mg. level and also to determine if a higher level (10.0 mgs. per day) would give a response.

### Experimental Procedure

The steers used in this study were good to choice grade Herefords, averaging 980 pounds, that originated in New Mexico. They had been wintered in central Kansas at a rather high level of feeding. The steers were randomly allotted, according to weight, into four groups of 10 animals each. Treatment groups were as follows:

1. Control ration.
2. Control plus 10.0 mgs. of oral diethylstilbestrol (DES) per head per day.
3. Control plus 5.0 mgs. of trifluomeprazine (TFL) per head per day.
4. Control plus 10.0 mgs. of trifluomeprazine per head per day.

The steers were brought to a full feed of cracked corn plus alfalfa hay and soybean oil meal during the first three weeks of the feeding period. Sorghum silage was mixed with the grain during this preliminary period. Silage was decreased daily and grain was increased until the cattle were on a full feed of grain. After they were on full feed, cracked corn was available at all times on a free-choice basis. One pound of soybean oil meal per head per day was scattered over the grain each day. Additives were carried in the soybean oil meal. Alfalfa hay was limited to 3 or 4 pounds each per day throughout the feeding period.

The cattle were kept in concrete-floored lots with open sheds on the north. Water was available from automatic waterers at all times. Salt and a mixture of salt and bonemeal were also available at all times.

### Observations

Feedlot and slaughter data are summarized in Table 8. Feeding 10 mgs. of oral stilbestrol per day resulted in a significant increase in average

* Partially supported by a grant from Smith, Kline, and French Lab., Philadelphia, Pa.

1. Stilbosol furnished by Eli Lilly & Co., Indianapolis, Ind.
2. Trifluomeprazine furnished by Smith, Kline, & French Lab., Philadelphia, Pa.

daily gain of approximately 4/10 pound per day. Feeding trifluomeprazine at the rate of either 5.0 mgs. per head per day or 10.0 mgs. per head per day did not increase average daily gain. None of the cattle receiving tranquilizer showed any evidence of sedation or quieting. There is some evidence in the literature that tranquilizers will alleviate heat stress. However, the cattle in this study did not seem to be able to stand high temperatures better when they were fed trifluomeprazine. Carcasses from cattle receiving either diethylstilbestrol or trifluomeprazine were equal in measurement and grade to carcasses from control animals.

**Table 8**

**Trifluomeprazine fed to fattening steers.**

June 16, 1959, to October 24, 1959—120 days.

| Treatment | Control | DES 10.0 mgs. | TFL 5.0 mgs. | TFL 10.0 mgs. |
|---|---|---|---|---|
| Steers per lot | 10[1] | 10[1] | 10[2] | 10 |
| Av. initial wt., lbs. | 989 | 972 | 984 | 976 |
| Av. final wt., lbs. | 1240 | 1274 | 1238 | 1233 |
| Av. total gain, lbs. | 251 | 302 | 254 | 257 |
| Av. daily gain, lbs. | 2.09 | 2.52 | 2.12 | 2.14 |
| Standard error | ±0.08 | ±0.13 | ±0.08 | ±0.10 |
| Av. daily ration, lbs.: | | | | |
| Ground corn | 15.2 | 16.5 | 15.9 | 16.5 |
| SBOM | 1.0 | 1.0 | 1.0 | 1.0 |
| Alfalfa hay | 3.3 | 3.3 | 3.3 | 3.3 |
| Sorghum silage | 1.2 | 1.2 | 1.2 | 1.2 |
| DES, mgs. | 0 | 10 | 0 | 0 |
| TFL, mgs. | 0 | 0 | 5 | 10 |
| Av. feed per cwt. gain, lbs.: | | | | |
| Ground corn | 771 | 681 | 807 | 771 |
| SBOM | 51 | 41 | 51 | 47 |
| Alfalfa hay | 166 | 135 | 166 | 153 |
| Sorghum silage | 63 | 52 | 63 | 58 |
| DES, mgs. | 0 | 397 | 0 | 0 |
| TFL, mgs. | 0 | 0 | 236 | 467 |
| Feed cost per cwt. gain | $20.46 | $18.03 | $21.53 | $20.44 |
| Shrink to market, % | 3.9 | 3.7 | 3.5 | 4.1 |
| Packer yield, % | 63.7 | 64.0 | 62.0 | 64.1 |
| Carcass grade, USDA: | | | | |
| Low prime | 1 | 0 | 0 | 0 |
| High choice | 2 | 0 | 0 | 0 |
| Av. choice | 0 | 4 | 2 | 1 |
| Low choice | 4 | 5 | 5 | 7 |
| High good | 3 | 1 | 3 | 2 |
| Av. USDA grade[3] | 13.4 | 13.3 | 12.9 | 12.9 |
| Av. marbling score[4] | 5.6 | 5.6 | 6.1 | 6.1 |
| Av. firmness score[5] | 3.6 | 3.0 | 3.3 | 3.6 |
| Av. fat thickness, in.[6] | 1.11 | 1.08 | 0.91 | 1.03 |
| Av. ribeye, sq. in.[6] | 11.51 | 11.97 | 11.76 | 12.09 |

1. One steer foundered; not used in calculating gain data.

2. Two steers foundered; not used in calculating gain data.

3. Average grade determined as follows: Low prime, 16; high choice, 15; av. choice, 14; low choice, 13; high good, 12.

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

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

6. Measured at the 12th rib.



## Trifluomeprazine[1] in Fattening Steer Calf Rations (with and without Diethylstilbestrol).[2] Project 626.*

**B. A. Koch, E. F. Smith, D. Richardson, and M. M. McCartor**

A preliminary report of this tranquilizer study, and a description of the cattle used, appeared on page 32 of Kansas Circular 371, May 2, 1959. That report was based on results obtained during the first 108 days of the fattening period.

### Experimental Procedure

Sixty head of steer calves were randomly allotted according to weight into six groups of 10 each. Treatment groups were as follows:

1. Control ration.
2. Control plus 10.0 mgs. oral diethylstilbestrol per head per day.
3. Control plus 2.5 mgs. trifluomeprazine per head per day.
4. Control plus 5.0 mgs. trifluomeprazine per head per day.
5. Control plus 10.0 mgs. diethylstilbestrol plus 2.5 mgs. trifluomeprazine per head daily.
6. Control plus 10.0 mgs. diethylstilbestrol plus 5.0 mgs. trifluomeprazine per head daily.

The daily ration fed included 10 pounds of sorghum silage, 1.5 pounds of alfalfa hay, 1.0 pound of soybean oil meal, and a variable quantity of cracked corn—varied according to appetite of the steers. The corn, soybean oil meal, and silage were mixed together in the feed bunk each day. Additives were carried in the soybean oil meal.

The cattle were kept in concrete-floored lots which had open sheds on the north. Water was available from automatic waterers at all times. Salt and a mixture of salt and bonemeal were also available to the animals at all times.

### Observations

Feedlot data and slaughter data are summarized in Table 9. Feeding 10.0 mgs. of diethylstilbestrol (DES) or 5.0 mgs. of trifluomeprazine (TFL) resulted in a significant increase in average daily gain (probability of 0.01). Feeding 2.5 mgs. of trifluomeprazine did not increase average daily gain. Feeding trifluomeprazine in addition to diethylstilbestrol did not increase gains obtained with diethylstilbestrol alone. Feeding 5.0 mgs. of trifluomeprazine apparently improved feed efficiency and decreased feed costs in this trial.

Feed additives did not produce undesirable side effects in any of the animals. Cattle receiving the tranquilizer showed no visible evidence of sedation or quieting. Carcasses from cattle receiving diethylstilbestrol, trifluomeprazine, or a combination of the two were equal in measurement and grade to carcasses from control animals.

* Partially supported by a grant from Smith, Kline, & French Lab., Philadelphia, Pa.

1. Trifluomeprazine furnished by Smith, Kline, & French Lab., Philadelphia, Pa.

2. Stilbosol furnished by Eli Lilly & Co., Indianapolis, Ind.

**Table 9**

**Trifluomeprazine in fattening steer calf rations (with and without oral diethylstilbestrol).**

December 5, 1958, to July 8, 1959—215 days.

| Treatment | No diethylstilbestrol | | | 10 mgs./day diethylstilbestrol | | |
|---|---|---|---|---|---|---|
| | TFL, None | TFL, 2.5 mgs./day | TFL, 5.0 mgs./day | TFL, None | TFL, 2.5 mgs./day | TFL, 5.0 mgs./day |
| Number steers | 8[1] | 10 | 10 | 9[1] | 10 | 10 |
| Av. initial wt., lbs. | 571 | 580 | 562 | 567 | 580 | 574 |
| Av. final wt., lbs. | 1018 | 1029 | 1061 | 1107 | 1081 | 1116 |
| Av. total gain, lbs. | 447 | 449 | 499 | 540 | 501 | 542 |
| Av. daily gain, lbs. | 2.08 | 2.09 | 2.32 | 2.51 | 2.33 | 2.52 |
| Standard error | ±0.02 | ±0.07 | ±0.05 | ±0.08 | ±0.08 | ±0.05 |
| Av. daily ration, lbs.: | | | | | | |
| Ground corn | 12.01 | 13.10 | 13.03 | 13.98 | 13.45 | 14.31 |
| Soybean meal | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Alfalfa hay | 1.65 | 1.65 | 1.65 | 1.65 | 1.65 | 1.65 |
| Sorghum silage | 9.55 | 10.21 | 10.09 | 10.03 | 10.37 | 10.35 |
| DES, mgs. | 0 | 0 | 0 | 10 | 10 | 10 |
| TFL, mgs. | 0 | 2.5 | 5.0 | 0 | 2.5 | 2.5 |
| Av. feed per cwt. gain: | | | | | | |
| Ground corn | 604 | 627 | 562 | 576 | 577 | 568 |
| Soybean meal | 50 | 48 | 43 | 41 | 43 | 40 |
| Alfalfa hay | 83 | 79 | 71 | 68 | 71 | 66 |
| Sorghum silage | 502 | 489 | 435 | 413 | 445 | 411 |
| DES, mgs. | 0 | 0 | 0 | 400 | 430 | 400 |
| TFL, mgs. | 0 | 120 | 215 | 0 | 108 | 200 |
| Feed cost per cwt. gain | $17.19 | $17.92 | $15.41 | $16.20 | $16.41 | $15.97 |
| Carcass grade, USDA: | | | | | | |
| Av. choice | 0 | 1 | 2 | 0 | 0 | 3 |
| Low choice | 1 | 3 | 1 | 5 | 4 | 2 |
| High good | 3 | 2 | 4 | 1 | 4 | 3 |
| Av. good | 2 | 2 | 1 | 1 | 0 | 2 |
| Low good | 2 | 2 | 2 | 2 | 1 | 0 |
| High standard | 0 | 0 | 0 | 0 | 1 | 0 |
| Av. USDA grade[2] | 11.3 | 11.9 | 12.0 | 12.0 | 11.9 | 12.4 |
| Av. marbling score[3] | 7.1 | 6.8 | 6.7 | 6.7 | 6.9 | 6.5 |
| Av. firmness score[4] | 4.2 | 3.3 | 3.7 | 3.6 | 3.7 | 3.1 |
| Av. fat thickness, in.[5] | 0.67 | 0.78 | 0.77 | 0.76 | 0.76 | 0.72 |
| Av. ribeye, sq. in.[5] | 10.95 | 10.35 | 10.56 | 11.90 | 11.14 | 11.17 |

1. Three animals not used in gain or carcass calculations because they were foundered.
2. Average grade determined as follows: Av. choice, 14; 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 twelfth rib.



## Trace Mineral Salt[1] for Steers on Pasture and in the Fattening Lot (with Observations on Shrink). Project 430.

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

A preliminary report of this trace mineral study and a description of the cattle used appeared on page 28 of Kansas Circular 371 (May 2, 1959). That report included data obtained during the summer of 1958 while the cattle were grazing native pasture in Woodson county, Kansas.

### Experimental Procedure

Twenty-four Hereford steers were wintered together at Manhattan from November 18, 1957, to May 16, 1958. May 6, 1958, the cattle were randomly allotted according to weight into two test groups. The two groups of steers were placed on adjoining pastures in Woodson county, Kansas.

One group had access to a mixture of plain salt and bonemeal while the other group had access to a mixture of trace mineral salt and bonemeal. The cattle remained on pasture during the summer of 1958, the winter of 1958-1959, and the summer of 1959. During the winter period each steer received 1.5 pounds of soybean oil meal per day. Native prairie hay was also fed on days when snow covered the pastures.

Cattle were weighed at regular intervals throughout the test period. May 4, 1959, half of the calves in each group received a 12-mg. diethylstilbestrol implant[2] in the left ear.

August 1, 1959, the cattle were weighed off pasture, trucked to Manhattan, and again weighed individually off of the truck.

After a one-week rest and readjustment period the two groups of steers were started on a full-feed finishing ration. The finishing period lasted 90 days, during which time the control animals had access to plain salt and also to a plain salt-bonemeal mixture, while the others had access to trace mineral salt and also to a trace mineral salt-bonemeal mixture.

The ration fed included ground corn, prairie hay, and 1 pound of soybean meal per head daily. Each pound of soybean meal contained 10 mgs. of diethylstilbestrol.[3] Corn was increased gradually for the first three weeks until the cattle were on full feed. Thereafter corn and prairie hay were available at all times on a free-choice basis.

At the conclusion of the finishing period the cattle were weighed onto a truck and taken to the Kansas City stock yards. Sale weights obtained in Kansas City were used to determine the shrink to market.

### Observations

Complete gain and carcass data are summarized in Table 10. Feed consumption data for the finishing period are also included.

The soil profile of the pastures in Woodson county was classified by R. L. Goggins of the Soil Conservation Service as being typical of Dennis soils. This soil type generally develops on sandy shale.

Soil samples were analyzed in the soil testing laboratory of the Kansas State University Department of Agronomy. The analysis indicated that the soil was acidic (pH of 5.6) and also that the available phosphorus was rather low.

Forage samples were collected from the pastures by Dr. D. B. Parrish of the Kansas State Chemistry Department and Dr. K. C. Beeson of the U.S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y., as part of a more comprehensive mineral study. Preliminary results indicate that the forages in the area may contain above-normal amounts of some trace elements and low amounts of others. Detailed results of the study are not yet available.

Feeds used in the feedlot phase of the study were analyzed for trace minerals by the Calcium Carbonate Company, Carthage, Mo. The corn grain was rather low in cobalt content (0.07 part per million). Since corn grain made up the major portion of the finishing ration, the total ration was also rather low in cobalt. However, the daily requirement for cobalt is very low compared with most other minerals.

1. Trace mineral salt furnished by Morton Salt Company, Chicago, Ill.
2. Stimplants furnished by Chas. Pfizer & Co., Inc., Terre Haute, Ind.
3. Stilbosol furnished by Eli Lilly & Co., Indianapolis, Ind.

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.