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Antibiotics and stilbestrol for cattle on high roughage rations

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CONCLUSIONS

Studies were conducted to determine the effect of antibiotics administered in salt and implanted stilbestrol in weanling and yearling cattle. One hundred ninety four animals were used in five experiments with three studies in the last experiment.

Gains of heifers or steers were not significantly affected by aureomycin, terramycin or zinc bacitracin on oat-ryegrass pasture. However, in all experiments where animals were fed high roughage rations, except experiment 3 which was self-fed ground shelled corn, there appeared to be a slight advantage in increased gain for the antibiotic fed animals. An overall consistent response to antibiotics appeared to be obtained only from aureomycin and terramycin. In this study where aureomycin or terramycin was used there appeared to be an economic benefit from the antibiotics in that for each dollar spent for antibiotics an increase in gain valued at about two dollars was returned.

In one wintering study aureomycin fed heifers gained significantly faster than controls; however, in a similar trial neither aureomycin, terramycin or zinc bacitracin significantly affected gains of heifers on a wintering ration. Gains of steers on a wintering ration were not significantly affected by aureomycin, terramycin or zinc bacitracin. The lack of statistical significance in some of the experiments can perhaps be attributed to small numbers of experimental animals.

The animals in tests 1 and 3, where the greatest response to aureomycin was obtained, were subjected to more severe winter conditions than the animals in experiments 4 and 5. From the results of these experiments it appears that administration of antibiotics may be beneficial where clinical or subclinical disease conditions may occur or exist.

Neither of three antibiotics improved weight gains of steers receiving corn on oat-ryegrass pasture over the controls. Stilbestrol did not significantly affect weight gains of heifers in a wintering study, but significantly improved gains of steers on oat-ryegrass pasture plus corn and significantly improved gains of other steers on wintering rations. Stilbestrol improved weight gains of steers in another trial on oat-ryegrass pasture plus corn at a highly significant rate.

Antibiotics were successfully administered in salt at a constant rate.

ANTIBIOTICS AND STILBESTROL FOR CATTLE ON HIGH ROUGHAGE RATIONS

By J. N. WILLIAMS, II And H. W. ESSIG

Beef cattle on high roughage rations have usually shown the greatest response to antibiotics (6) (8). In many experiments, the antibiotics have been administered in the feed, but in recent work they have been given in the salt (1) (9). The favorable effect of the synthetic female hormone stilbestrol (DES) on the growth rate of cattle has been demonstrated by many workers (3) (5) (7).

The experiments reported herein were conducted to determine: (1) if certain antibiotics would provide more economic production of beef cattle on high roughage rations; (2) if antibiotics could be successfully administered in the salt at a relatively constant rate; (3) the effect of antibiotics in the growth of beef animals receiving grain while on pasture; and (4) the effect of the use of subcutaneously implanted stilbestrol with antibiotics.

Experimental Procedure

One hundred ninety-four animals were involved in five experiments with three phases in the last experiment. Loose salt was provided free-choice in sheltered boxes for all animals on test. Antibiotics were mixed with the salt at twice weekly intervals to provide 70 milligrams of antibiotic per head daily to treated animals in the first and third experiments. Seventy-five mg. of antibiotic per head daily was provided in the same manner to treated animals in all other experiments. The experiments were as follows:

Experiment 1 Aureomycin in salt and implanted stilbestrol for heifers on oat-ryegrass pasture.

Experiment 2 Aureomycin in salt for heifers on a wintering ration.

Experiment 3 Aureomycin in salt and four levels of implanted stilbestrol for steers receiving ground shelled corn on oat-ryegrass pasture.

Experiment 4 Aureomycin, terramycin, and zinc bacitracin in salt for heifers on a wintering ration.

Experiment 5 Aureomycin, terramycin and zinc bacitracin in salt for steers:

Phase A, on oat-ryegrass pasture.

Phase B, on a wintering ration.

Phase C, on pasture with a full feed of ground ear corn.

Experiment 1. Twenty-eight yearling heifers were divided into two groups and each group was placed on a 10-acre oat-ryegrass pasture for 61 days starting March 30, 1960. One group received 70 mg. aureomycin per head daily and the other heifers received no aureomycin. Seven in each lot were subcutaneously implanted with 24 mg. of stilbestrol 132 days before the beginning of the trial.

Results of this experiment are shown in Table 1. Gains of heifers receiving aureomycin were greater than those not receiving the antibiotic. However, the differ-

Table 1.—Effect of aureomycin administered in salt and stilbestrol implants for heifers on oat-ryegrass pasture for 61 days.

	Antibiotic			No antibiotic		
Treatments	No DES	DES	Av.	No DES	DES	Av.
Heifers per treatment	7	7	14	7	7	14
Av. init. wt. (lb.)	537.3	561.3	549.3	533.1	567.1	550.1
Av. final wt. (lb.)	661.0	687.3	674.4	633.4	687.3	660.4
Av. total gain (lb.)	123.7	126.5	125.1	100.3	120.2	110.3
Av. daily gain (lb.)	2.03	2.08	2.05	1.64	1.97	1.81
Aureomycin (mg. per head daily)	70	70	70	----------	----------	----------
DES* (mg.)	----------	24	----------	----------	24	----------
Av. daily salt consumption** (gm.)	----------	----------	35.9	----------	----------	35.4

*DES - Stilbestrol (diethylstilbestrol).

**Salt consumption records were kept only on antibiotic and no antibiotic treatments.

ence due to aureomycin was not as great with the animals receiving stilbestrol as with those not receiving the hormone. Animals implanted with stilbestrol with and without aureomycin gained more than those not receiving stilbestrol. Animals receiving aureomycin gained an average of 2.05 lb. per head daily while the controls gained 1.81 lb. per head daily. There were no significant differences in rate of gain due to treatments.

Experiment 2. Fifty yearling heifers were divided into two groups of 25 each, weighed and placed on a wintering ration in drylot for 81 days beginning January 15, 1960. The group in treatment 1 received no aureomycin, while heifers in treatment 2 were given 75 mg. aureomycin per head daily in loose salt. The wintering ration given these animals consisted of approximately 20 lb. sorghum silage, 1.5 lb. cottonseed meal and 2 lb. ground shelled corn per head daily throughout the experiment.

Results of this 81-day wintering trial are reported in Table 2. Heifers receiving 75 mg. of aureomycin per head daily gained faster than the controls. The difference in rate of gain of the two groups was tested by the analysis of variance and found to be highly significant.

Experiment 3. During the spring of 1960, a group of 40 yearling steers were randomly assigned to two treatments of 20 steers each, weighed and placed on two 12.5 acre pastures. The experiment began April 2, 1960 and continued 56 days. All steers received a full feed of ground shelled corn. Animals in treatment 1 received 70 mg. of aureomycin per head daily in loose salt, while those in treatment 2 received no antibiotic. Each of the two treatment groups involved four sub-groups of five steers each which received the following levels of stilbestrol as implants: none; 12 mg.; 24 mg.; and 36 mg. The pasture consisted of an oat-ryegrass mixture, and the two groups of steers were exchanged between pastures each two weeks to eliminate any differences that might exist between the pastures.

Steers receiving aureomycin made an average daily gain of 2.00 pounds while those receiving no aureomycin gained 2.04 lb. per head daily (Table 3). One steer receiving aureomycin gained only 0.25 lb. daily and this could easily account for the slightly lower gain of the antibiotic steers. There was no significant difference for average between the two levels of antibiotics. The stilbestrol implanted steers at all levels significantly

Table 2. Effect of aureomycin administered in salt for heifers on a wintering ration for 81 days.

Treatments	1	2
Heifers per treatment	25	23*
Av. initial wt. (lb.)	438.7	414.7
Av. final wt. (lb.)	486.7	492.3
Av. total gain (lb.)	47.5	77.6
Av. daily gain (lb.)	0.59	0.96**
Aureomycin (mg. per heifer daily)	—	
Av. daily salt consumption (gm.)	41.2	58.7

*Two animals died in this treatment group. **Highly significant (P0.01).

Table 3.—Effect of aureomycin administered in salt with four levels of stilbestrol implanted for steers receiving ground shelled corn on pastures — 56 days.

Treatments	1	2
Steers per treatment	20	20
Av. initial wt. (lb.)	544.7	572.7
Av. final wt. (lb.)	656.5	689.7
Av. total gain (lb.)	111.8	114.7
Av. daily gain (lb.)	2.00	2.04
Aureomycin (mg. per steer daily)	70	—
Av. daily salt consumed (gm.)	16.2	18.4

Table 4.—Effect of four levels of stilbestrol implants across two levels of aureomycin in experiment 3.

Treatments	1	2	3	4
Stilbestrol, mg.	0	12	24	36
No. of steers	10	10	10	10
Av. initial wt., lb.	574.7	563.0	543.5	553.5
Av. final wt., lb.	659.5	684.4	662.4	680.0
Av. total gain, lb.	84.8	121.4	118.9	126.5
Av. daily gain, lb.	1.51*	2.17	2.12	2.26

*Significant (P0.05)

Table 5.—Effect of aureomycin, terramycin, and zinc bacitracin administered in the salt to heifers on a wintering ration for 111 days.

Treatments	1	2	3	4
Heifers per treatment	12	12	12	12
Av. initial wt. (lb.)	422.0	436.8	435.5	521.7
Av. final wt. (lb.)	539.8	562.7	561.8	533.5
Av. total gain (lb.)	117.8	125.9	126.3	111.8
Av. daily gain (lb.)	1.06	1.13	1.14	1.01
Antibiotics (mg. per head daily)				
Aureomycin	—	75	—	—
Terramycin	—	—	75	—
Zinc bactracin	—	—	—	75
Av. daily salt consumption (gm.)	21.9	18.3	19.2	30.3
Av. daily feed consumption (lb.)				
Silage	22.2	26.2	25.7	22.7
Cottonseed meal	1.47	1.47	1.47	1.47
Ground shelled corn	1.96	1.96	1.96	1.96
Total	25.63	29.63	29.13	26.13

outgained the non-implanted controls (Table 4). There was no difference within the three levels of stilbestrol administration.

Experiment 4. A group of 48 Hereford and Angus heifers were placed on a wintering study in drylot which lasted 111 days. Animals were randomly allotted to four groups of 12 heifers each. Treatments provided the following levels per head daily of antibiotics: None; 75 mg. aureomycin; 75 mg. terramycin, and 75 mg. zinc bacitracin. Animals were fed a ration consisting of 2 lb. ground shelled corn and 1.5 lb. cottonseed meal per head daily plus a full feed of sorghum silage.

Results of the administration of antibiotics to heifers in this series of trials (Table 5) agree with the results of Experiment 1 and Experiment 3, inasmuch as there were no significant differences in the antibiotic treatments. These results agree with those of other workers (4) (1). However, in this experiment, the use of aureomycin and terramycin (but not zinc bacitracin) was economically beneficial as the returns for the use of these antibiotics were approximately two dollars for each dollar value of antibiotic used. No difficulty was experienced in obtaining a constant rate of antibiotic intake with any group during this experiment.

The amount of concentrates was kept constant in this experiment, but the silage was fed ad libitum. Examination of Table 5 shows that all antibiotic-fed heifers consumed more feed per head daily than the controls. This, too, agrees with other findings (2).

The general health of the animals in all treatments was very good during this wintering study. The winter was reasonably mild. This could account for the low response to antibiotics as compared to Experiment 2 when the winter was more severe.

Experiment 5. Since the gains of antibiotic treatment groups (Experiment 3 and 4) were not significantly different

from gains of controls it was apparent that studies were needed to determine if these increased gains over controls were consistent in repeated experiments. This experiment was designed to study the effect of three antibiotics and stilbestrol on weanling steers receiving high roughage rations during three phases which differed in: (1) period of time, and (2) feeding regimen. Twenty-eight steers were randomly assigned to four treatments of seven animals each and received the following treatments: (1) no antibiotic; (2) 75 mg. aureomycin per head daily; (3) 75 mg. terramycin per head daily, and (4) 75 mg. zinc bacitracin per head daily. Four steers in each group were subcutaneously implanted with 12mg. of stilbestrol at the beginning of the experiment and three animals in each group received no stilbestrol. The steers were kept in the same treatment groups throughout the experiment. The grazing paddocks consisted of an oat-ryegrass mixture, and the four treatment groups were exchanged between pastures each two weeks to minimize differences that might exist between the pastures. The three phases of the experiment were as follows:

Phase A. The steers in each treatment group during this 84-day period beginning October 24, 1960 were allowed to graze five-acre paddocks of oat-ryegrass pasture.

Phase B. The four treatment groups were placed in four drylots for a 39-day wintering period beginning January 16, 1961. The ration was the same as that for heifers in Experiment 4.

Phase C. Treatment groups were again placed on the grazing paddocks February 24, 1961 and full fed ground snapped corn for 87 days. On April 7, 1961, steers in each lot that had previously received stilbestrol were again implanted with 12 mg. of stilbestrol per head.

Results Experiment 5. Phase A. Results of this 84-day pasture phase are presented in Tables 6 and 7. There were no significant differences among antibiotic treatments and controls. Stilbestrol treated animals gained an average of 2.25 lb. per head daily compared to 1.92 lb. per head daily for those not receiving stilbestrol. These differences were highly significant.

Phase B. The antibiotic treatments in this 39-day wintering phase did not significantly affect the rate of gain of steers.

Table 6.—Effect of chlortetracycline, oxytetracycline and zinc bacitracin administered in the salt for steers on oat-ryegrass pastures for 84 days.

Treatments	1	2	3	4
Steers per treatment	7	7	7	7
Av. initial wt. (lb.)	428.8	441.6	387.6	411.8
Av. final wt. (lb.)	599.4	618.3	577.6	582.8
Av. total gain (lb.)	169.6	176.7	190.0	171.0
Av. daily gain (lb.)	2.02	2.10	2.26	2.04
Antibiotic (mg. per head daily)				
Aureomycin	—	75	—	—
Terramycin	—	—	75	—
Zinc bacitracin	—	—	—	75
Av. daily salt consumption (gm.)	24.2	24.5	17.7	23.4

Table 7.—Effect of subcutaneously implanted diethylstilbestrol over all antibotic treatments in phase A — experiment 5.

Treatments	1	2
Steers per treatment	16	12
Av. initial wt. (lb.)	421.4	412.8
Av. final wt. (lb.)	610.1	573.7
Av. total gain (lb.)	188.7	160.9
Av. daily gain (lb.)	2.25**	1.92
Diethylstilbestrol (mg.)	12	0

**Highly significant (P0.01)

Table 8.—Effect of aureomycin, terramycin and zinc bacitracin in the salt for steers on wintering rations on two levels of stilbestrol for 39 days.

Treatments	1	2	3	4
Antibiotic (mg. per head daily)				
Aureomycin	—	75	—	—
Terramycin	—	—	75	—
Zinc bactracin	—	—	—	75
Steers per treatment	7	7	7	7
Av. daily gain (lb.)	0.94	1.12	0.86	0.71
DES* (mg.)	0	0	0	0
Steers per treatment	3	3	3	3
Av. daily gain (lb.)	0.94	1.28	0.33	0.17
Des (mg.)	12	12	12	12
Steers per treatment	4	4	4	4
Av. daily gain (lb.)	0.95	1.00	1.25	1.11
Feed per 100 lb. gain (lb.)	3570	2696	3661	3762
Salt consumption per head daily (gm.)	57.8	55.6	49.3	45.5

*DES — Stilbestrol

Table 9.—Effect of aureomycin, terramycin and zinc bacitracin in the salt for steers fed corn on pastures and on two levels of stilbestrol for 87 days.

Treatments	1	2	3	4
Antibiotic (mg. per head daily)				
Aureomycin	—	75	—	—
Terramycin	—	—	75	—
Zinc bacitracin	—	—	—	75
Steers per treatment	7	7	7	7
Av. daily gain (lb.)	2.10	2.23	2.17	2.16
DES* (mg.)	0	0	0	0
Steers per treatment	3	3	3	3
Av. daily gain (lb.)	1.75	2.15	2.40	2.09
DES (mg.)	24	24	24	24
Steers per treatment	4	4	4	4
Av. daily gain (lb.)	2.36	2.30	1.99	2.22
Salt consumption per head daily (gm.)	20.2	17.4	14.4	15.6

*DES — Stilbestrol

However, stilbestrol treatments resulted in a significant increase in weight gains, and the interaction between stilbestrol and antibiotics was significant. This significant interaction was caused by the increased gain for the non-implanted steers which received aureomycin, whereas in all other treatments those animals which received stilbestrol outgained those which did not receive stilbestrol A possible explanation for this inconsistency in gain was the small number of animals and the extremely short period of time that this phase of the study was conducted The results are given in Table 8.

Phase C. In this study when steers were receiving corn on pasture for 87 days, neither antibiotics nor stilbestrol treatments resulted in significantly different gains. However, the interaction between antibiotics and stilbestrol was highly significant according to the analysis of variance, which means that there was inconsistency in the results of the various treatments. Steers receiving terramycin and implanted gained less than any of the steers on the other stilbestrol treat ments. A possible explanation for this inconsistency is the small number of animals per treatment. Results of this phase are shown in Table 9.

Summary of Experiment 5. The results of treatments administered to 28 steers over the entire 210-day experiment are summarized in Tables 10 and 11.

Steers receiving stilbestrol gained 2.02 lb. per head daily compared to a daily mean gain of 1.76 lb. for steers not receiving stilbestrol. Neither the antibiotic treatments nor the interaction between antibiotics and stilbestrol were significant. However, the rate of gain of the animals which received the aureomycin and terramycin treatments resulted in a slight increase over the controls and zinc bacitracin. Slaughter grades were not significantly affected by any of the treatments. Health of the animals was generally good throughout the experiment.

Salt consumption among treatments was not greatly different. No difficulty was experienced in adjusting for salt consumption at biweekly intervals. The antibiotic intake by each group of animals was uniform throughout the experiment.

Table 10.—Results of experiment 5 — all phases.

Treatments	1	2	3	4
Steers per treatment	7	7	7	7
Av. initial wt. (lb.)	429.8	441.6	387.6	411.8
Av. final wt. (lb.)	819.1	856.6	799.6	798.7
Av. total gain (lb.)	389.3	415.0	412.0	386.9
Av. daily gain (lb.)	1.85	1.98	1.96	1.84
Antibiotic (mg. per head daily)				
Aureomycin	—	75	—	—
Terramycin	—	—	75	—
Zinc bacitracin	—	—	—	75
Av. daily salt consumption (gm.)	28.8	27.3	22.2	24.3
Av. slaughter grade*	9.07	9.29	8.93	9.07

*Code: 8 — High Standard; 9 — Low Good; 10 — Medium Good.

Table 11.—Results of stilbestrol treatments in experiment 5 — all phases.

Treatments	1	2
Stilbestrol (mg.)	24	0
Steers per treatment	16	12
Av. initial wt. (lb.)	421.4	412.8
Av. final wt. (lb.)	845.4	782.7
Av. total gain (lb.)	424.0	369.9
Av. daily gain (lb.)	2.02**	1.76
Av. slaughter grade*	9.22	8.92

*Code: 8 — High Standard; 9 — Low Good; 10 — Medium Good.
**Highly significant (P0.01)

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