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Effect of Sex, Castration and Hormonal Compounds on Feedlot
Performance and Carcass Merit of Cattle

L. B. Embry

Bulls gain faster and more efficiently than heifers. Removal of the gonads (bulls or heifers) reduces rate of gain, increases feed requirements and results in changes in carcass characteristics. Some hormone and hormone-like compounds are commonly used for feedlot cattle. Effects on feedlot performance have been shown to vary between male and female and between intact and castrated animals. In addition, comparative performance between males and females and response to growth promoting compounds have been shown to be influenced by the diet, age and stage of finish.

It becomes apparent that feedlot performance of bulls, steers, intact heifers and spayed heifers should be studied under a variety of conditions as to diet, stage of growth and finish and with various growth stimulating compounds. A series of experiments was started a few years ago to do this. This report summarizes results of those experiments conducted to date. The experiments are numbered for reference purposes, but the number does not necessarily indicate the order in which conducted.

Experiment 1 - Synovex and Diethylstilbestrol Implants for Steers
and Heifers During Growing and Finishing at Two Final Weights

This experiment was conducted to obtain information on the comparative performance of steers and heifers of similar breeding and the response of each to Synovex and diethylstilbestrol (DES) when fed growing type diets and during finishing to two final weights.

Procedures

Seventy-two steer and 75 heifer calves were purchased direct from three producers with an equal number of steers and heifers being obtained from each herd. They were fed corn silage and sorghum silage for about 2 months before starting on the experiment.

The calves were allotted into 3 pens of 25 each for each sex group on basis of weight and origin. Experimental treatments for steers and heifers were a control, DES implant or Synovex implant.

Steers were implanted with 24 mg. DES at the beginning of the experiment and again with 36 mg. after 155 days. Heifers were implanted with 24 mg. DES at each time. Synovex implants were administered on the same dates using Synovex-S (200 mg. progesterone and 20 mg. estradiol benzoate) for steers and Synovex-H (200 mg. testosterone propionate and 20 mg. estradiol benzoate) for heifers.

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Diets were the same for all cattle. During a 99-day growing phase, corn silage was full-fed with 4 lb. alfalfa hay and 1 lb. of soybean meal.

After this growing phase, diets were changed to a full feed of ground ear corn, 4 lb. of chopped alfalfa hay or 5 lb. of 50% moisture alfalfa haylage and 1 lb. of soybean meal with 10,000 I.U. of vitamin A per pound. The change from a full feed of corn silage to a full feed of ground ear corn was made over a period of 13 days.

The cattle were fed in outside, unpaved pens without access to shade or shelter. Feeding was twice daily in fence-line feed bunks. Trace mineral salt and a mineral supplement were offered free choice.

The cattle were marketed on two dates. One-half of the cattle from each pen were marketed after a total of 250 days on feed (151 days on the finishing diets). This time was selected as one representing typical marketing weight (about 950 lb.) and finish for heifers. Selections for marketing within pens were made so the average initial and final weights were similar for the cattle sold and those held for further feeding. Feed consumption data at this time was based on an average per head for the pen of 25.

The remaining cattle were sold 40 days later when the steers were considered to have reached a typical market weight and grade for steers (about 1125 lb.). Final weights for both groups represent a market weight following an overnight stand without feed and water and a 50-mile haul.

Results

The experiment was a continuous one but divided into the growing phase and the finishing phase of two lengths. Age of cattle, energy content of diets, market weight and market finish are factors likely having an influence on comparative performance of steers and heifers and their response to DES or Synovex. Therefore, the results have been separated by phases for presentation in the tables.

Growing Phase

Results of the growing phase of 99 days are shown in table 1 with a summary of percentage differences presented in table 4.

Steers implanted with DES gained at the fastest rate, 0.29 lb. (16.2%) more daily than the controls. They consumed the same amount of air-dry feed as the control group, resulting in an improvement in feed efficiency of 13.8%. Steers implanted with Synovex gained at a slightly lower rate than the DES steers. In comparison to controls, Synovex-implanted steers gained 13.4% more with a 9.1% improvement in feed efficiency.

Response by heifers to the implant treatments was quite different than the steers during this phase of the experiment. When implanted with DES, they gained at a lower rate than the controls (0.06 lb. daily or 3.6% less) and had 7.1% higher feed requirements. Heifers implanted with Synovex gained at a faster rate than those implanted with DES. In comparison to control heifers, there was a 5.4% improvement in rate of gain and a 4.5% reduction in feed requirements.

Table 1. Performance of Heifers and Steers Fed Corn Silage During Growing Phase (99 Days)

Treatment	Steers			Heifers		
	Control	DES	Synovex	Control	DES	Synovex
Number	25	25	25	25	25	25
Initial filled wt., lb.	527	528	532	477	479	476
Final filled wt., lb.	704	734	733	640	637	649
Avg. daily gain, lb.	1.79	2.08	2.03	1.66	1.60	1.75
Avg. daily ration, lb.						
Corn silage	31.2	31.3	32.3	28.1	29.2	28.3
Alfalfa hay	4.0	4.0	4.0	4.0	4.0	4.0
Protein suppl.	1.0	1.0	1.0	1.0	1.0	1.0
Total	36.2	36.3	37.3	33.1	34.2	33.3
Feed/cwt. gain, lb.						
Corn silage	1744	1502	1591	1695	1825	1620
Alfalfa hay	221	191	196	240	249	228
Protein suppl.	55	48	49	60	62	57
Total	2020	1741	1836	1995	2136	1905

It is evident that comparative performance between steers and heifers in this experiment was influenced by the implant treatments (table 4). Control steers gained 0.13 lb. (7.8% more daily than control heifers). Steers consumed more feed resulting in feed required per unit of gain being about equal for steers and heifers when not implanted.

The marked response by steers and the slight reduction in gain by heifers to the DES implant resulted in large differences between steers and heifers in this comparison. Steers gained 0.48 lb. (30.0%) more daily. While steers consumed more feed, there was an improvement in feed efficiency of 18.5%.

Since heifers showed a more favorable response to Synovex than to DES, differences between steers and heifers were not as great with Synovex as with DES. In this comparison, steers gained 16.0% faster with 3.6% lower feed requirements. Differences between steers and heifers under most favorable treatment for each during this phase of the experiment, DES-implanted steers and Synovex-implanted heifers, amounted to 18.9% greater gain with 10.0% reduction in feed requirements for steers.

Finishing Phase - 151 Days

During this phase of the experiment with the finishing diet of ground ear corn, protein supplement and a limited amount of alfalfa, rate of gain was at a higher level for all cattle than during the growing phase with corn silage. The increase in daily gain over the growing phase was of a similar amount for each treatment group of steers. Thus, percentage improvements for implanted groups over the control were at a slightly lower level than during the growing

Table 2. Performance of Steers and Heifers During Finishing - 151 Days

	Steers			Heifers		
	Control	DES	Synovex	Control	DES	Synovex
Number	13	12	12	12	13	12
Final shrunk wt., lb.	994	1068	1055	916	943	956
Avg. daily gain, lb.	2.10	2.40	2.32	2.02	2.19	2.22
Avg. daily ration, lb.						
Corn silage	2.4	2.5	2.5	2.1	2.2	2.1
Ear corn	18.2	19.2	19.9	16.7	18.9	18.2
Alfalfa hay	1.5	1.5	1.5	1.5	1.5	1.5
Low moisture alfalfa silage	3.0	3.0	3.0	3.0	3.0	3.0
Protein supplement	1.0	1.0	1.0	1.0	1.0	1.0
Total	26.1	27.2	27.9	24.3	26.6	25.8
Feed required/cwt. gain, lb.						
Corn silage	114	104	108	104	101	96
Ear corn	868	801	857	828	864	821
Alfalfa hay	72	63	65	75	69	68
Low moisture alfalfa silage	142	124	129	148	136	134
Protein supplement	47	41	42	49	45	44
Total	1243	1133	1201	1204	1215	1163
Avg. carcass weight, lb.	613	665	653	572	586	590
Dressing percent	61.7	62.2	61.9	62.5	62.1	61.8
Marbling score ^a	5.77	5.17	4.83	5.42	5.46	5.42
Carcass grade score ^b	19.0	18.6	18.2	18.6	18.5	18.4
Fat thickness, in.	0.50	0.55	0.54	0.60	0.51	0.59
Rib eye area, sq. in	11.4	12.4	12.3	11.2	12.1	11.6

^aMarbling score: 4 = slight, 5 = small, 6 = modest and 7 = moderate.

^bCarcass grade score: 17 = avg. good, 18 = high good, 19 = low choice and 20 = avg. choice.

phase (table 4). DES-implanted steers gained 14.3% more than controls with 8.8% reduction in feed requirements. When implanted with Synovex, gain and feed efficiency favored implanted steers by 10.5 and 3.4% over controls.

Heifers showed a greater response to the higher energy finishing diets than did steers, especially when implanted. Percentage improvements from the implant treatments were greater than during the growing phase of the experiment. Heifers implanted with DES gained 8.4% more daily than controls. They consumed more feed resulting in about equal feed requirements as for controls. Heifers implanted with Synovex gained 9.9% more than control heifers. While they also consumed more feed than controls, they required 3.4% less feed per unit of gain.

When marketed at the same time after 151 days on the finishing diets, DES- and Synovex-implanted steers averaged 74 and 61 lb. more in market weight than the controls. Differences in carcass characteristics shown in table 2 were small between the implanted groups. In comparison to controls, there was a larger rib eye, more fat covering, less marbling and a lower carcass grade. The differences in rib eye area and fat thickness were about the same when adjusted for differences in carcass weight. Therefore, the main effect of the implant treatments on steers at this stage of marketing appeared to be a reduction in amount of marbling.

Heifers implanted with DES or Synovex and marketed after 151 days averaged 27 and 40 lb. more, respectively, than control heifers. Implanted heifers had a larger rib eye but evident only for the DES group when adjusted for differences in carcass weights. Fat thickness was also less for DES-implanted heifers. There were only small differences between treatment groups in other carcass characteristics measured.

When marketed after 151 days with an average market weight of 938 lb. for heifers and 1022 lb. for steers, heifers generally had more marbling and fat covering but a smaller rib eye. These differences were not large. When adjusted to basis of carcass weight, rib eye area was larger for heifers but the thicker fat covering was more pronounced in comparison to steers.

Finishing Phase - 191 Days

Results for the cattle fed an additional 40 days are presented in table 3. Good weather conditions prevailed during this period.

Daily gains for steers fed for the longer period did not change appreciably from those at 151 days. Response to DES or Synovex implants was at a slightly lower level than during the shorter feeding period. However, the differences were small and indicate no appreciable decrease in response to these compounds by steers with increasing weight and finish up to the maximums in this experiment.

Control heifers and those implanted with Synovex gained at a lower rate for the longer feeding periods. DES-implanted heifers gained about the same during each finishing period. Improvement for DES over control for gain and feed efficiency amounted to 12.4 and 3.8% in comparison to 8.4% more gain with about the same amount of feed for the 151-day finishing phase. There were only small differences between controls and heifers implanted with Synovex during the two phases of finishing.

Table 3. Performance of Steers and Heifers During Finishing - 191 Days

	Steers			Heifers		
	Control	DES	Synovex	Control	DES	Synovex
Number	12	13	13	12	12	12
Final shrunk wt., lb.	1080	1166	1144	982	1021	1020
Avg. daily gain, lb.	2.13	2.42	2.31	1.94	2.18	2.10
Avg. daily ration, lb.						
Corn silage	2.0	2.0	2.1	1.7	1.7	1.5
Ear corn	18.5	19.9	20.3	17.2	19.1	18.5
Alfalfa hay	1.3	1.3	1.3	1.3	1.3	1.3
Low moisture alfalfa silage	3.3	3.3	3.3	3.3	3.3	3.3
Protein supplement	1.0	1.0	1.0	1.0	1.0	1.0
Total	26.1	27.5	28.0	24.5	26.4	25.6
Feed required/cwt. gain, lb.						
Corn silage	89	82	90	87	79	72
Ear corn	869	822	879	886	878	882
Alfalfa hay	59	52	55	65	58	60
Low moisture alfalfa silage	157	138	144	172	153	159
Protein supplement	46	41	43	51	45	47
Total	1220	1135	1211	1261	1213	1220
Avg. carcass weight, lb.	678	728	709	630	642	647
Dressing percent	62.8	62.4	62.0	64.2	62.9	63.4
Marbling score ^a	6.40	5.40	5.40	6.50	5.80	5.70
Carcass grade ^a	19.8	18.8	18.5	20.0	18.9	18.7
Fat thickness, in.	0.68	0.59	0.60	0.75	0.78	0.64
Rib eye area, sq. in.	11.2	12.1	11.9	11.6	12.3	12.4

^aSee footnotes for table 2.

The advantage for control steers over control heifers became greater with the longer feeding period. With DES implants, comparative performance between steers and heifers was about the same at 151 and 191 days of finishing. Synovex-implanted steers showed about the same advantage over similarly treated heifers as was obtained in the control groups.

There was an increase in fatness for steers and heifers with the longer feeding period as evidenced by a greater fat thickness and more marbling. These effects were more evident for controls in comparison to implanted groups and more for heifers than for steers. Apparently the heifers fattened faster and finished to a choice grade at a lighter weight than did the steers. Growth rate was increased and fat deposition appeared to be delayed by treatment with DES or Synovex.

Summary

Improvement in rate of gain by steers implanted with DES over controls amounted to 16.2 to 13.6% with 13.8 to 7.0% improvement in feed efficiency. Most improvement as percentage of control was obtained during a growing phase with high roughage diets. Response was at a lower percentage of control during finishing and at the higher finish to which fed in the experiment. Response by steers to Synovex-S was similar to DES but at a slightly lower level.

DES implants did not improve weight gains and feed efficiency of heifers during the high roughage growing phase. There was an improvement in weight gains (8.4%) during the shorter feeding period but essentially no change in feed efficiency. When fed to heavier weights and finish, DES resulted in the greatest response by heifers over the controls. Heifers appeared to show more response to Synovex-H in weight gains (5.4%) and feed efficiency (4.5%) than to DES during the high roughage growing phase. Results were quite similar for the two compounds for the shorter feeding period but favored DES for the longer one.

The comparative performance between steers and heifers was influenced by market weight and finish and implant treatment. Heifers compared more favorable to steers during the shorter period on the higher energy finishing diets. The advantage for steers became greater with the longer period of finishing.

Results of the experiment support conclusions by others that heifers show more response to increasing levels of energy than do steers and finish at a lighter weight and that DES or Synovex reduces rate of fat deposition in relation to lean.

Table 4. Percentage Differences in Performance Between Steers and Heifers as Affected by DES and Synovex

	Steers			Heifers		
	Growing	Finishing		Growing	Finishing	
	99 days	151 days	191 days	99 days	151 days	191 days
DES vs. control						
Daily gain	16.2	14.3	13.6	- 3.6	8.4	12.4
Daily feed	2.8	4.2	5.4	3.3	9.5	7.8
Feed eff.	-13.8	- 8.8	- 7.0	7.1	0.9	- 3.8
Synovex vs. control						
Daily gain	13.4	10.5	8.5	5.4	9.9	8.2
Daily feed	3.0	6.9	7.3	0.6	6.2	4.5
Feed eff.	- 9.1	- 3.4	- 0.7	- 4.5	-3.4	- 3.3
Steers vs. heifers						
Control						
Daily gain	7.8	4.0	9.8			
Daily feed	9.4	7.4	6.5			
Feed eff.	1.3	3.2	- 3.3			
DES						
Daily gain	30.0	9.6	11.0			
Daily feed	6.1	2.3	4.2			
Feed eff.	-18.5	- 6.7	- 6.4			
Synovex						
Daily gain	16.0	4.5	10.0			
Daily feed	12.0	8.1	9.4			
Feed eff.	- 3.6	3.3	- 0.7			

Experiment 2 - Spayed Heifers Compared to Steers When Implanted With Diethylstilbestrol or Synovex

Experiment 1 showed steers gained faster than heifers and comparative performance between steers and heifers depended upon energy level of diets, age of cattle, weight, stage of finishing and administration of hormonal compounds. As a continuation of the research, this experiment divided into a growing phase and a finishing phase was conducted with steers and heifers. Diethylstilbestrol (DES) and Synovex were administered to steers and spayed heifers with a group of nonimplanted steers and nonimplanted intact heifers for controls.

Procedures

Seventy-five steer calves and 75 heifer calves were purchased for this experiment balanced as to numbers of each from herd where purchased. They were allotted into 3 pens of 25 for each sex group on basis of weight and origin. Experimental treatments were control, DES implant and Synovex implant for steers and for heifers. Intact heifers served as controls while those implanted were spayed.

Sixty-five days after the beginning of the growing phase of the experiment, one pen each of steers and heifers were implanted with 24 mg. DES, one pen of steers implanted with Synovex-S (200 mg. progesterone and 20 mg. estradiol benzoate),

one pen of heifers implanted with Synovex-H (200 mg. testosterone propionate and 20 mg. estradiol benzoate) and one pen of each served as controls. The day following implanting, the implanted heifers were spayed while the control group remained intact. Implanted cattle were reimplanted after another 134 days with the same level of implants except DES steers received 36 mg.

Diets during a 170-day growing phase consisted of ground sorghum grain up to a maximum of 8 lb. per head daily, 1 lb. of protein supplement (soybean meal) and sorghum silage or corn silage to appetite.

Following this growing phase, diets were changed to finishing type ones of 5 lb. alfalfa haylage (4 lb. alfalfa hay for 1 month), 1 lb. of soybean meal with 10,000 I.U. vitamin A and a full feed of ground grain. Ear corn was fed for about 3 months. Thereafter, the grain was about 2 parts of ground shelled corn to 1 part ground oats.

Feeding was twice daily in outside, unpaved pens without access to shade or shelter. The experiment was terminated following 146 days of the finishing phase for steers and 147 days for the heifers.

Results

It was apparent that comparative performance between steers and heifers and the response to the implant treatments varied between the two phases of the experiment. Results are therefore presented separately for the two phases.

Growing Phase - 170 Days

Results for the high roughage growing phase are presented in table 5 with percentage differences between steers and heifers and implant treatments shown in table 7.

There was an improvement in rate of gain when steers were implanted with either compound. A greater increase was obtained in this experiment with Synovex (0.29 lb. daily or 17.9%) than with DES (0.19 lb. daily or 11.7%). There was also an improvement in feed efficiency, amounting to 13.8% for Synovex and 10.0% for DES.

Spayed heifers also gained faster when implanted than intact controls. However, they showed a much smaller response to either implant than did steers during this phase of the experiment. Highest rate of gain was obtained when spayed heifers were implanted with Synovex, 0.14 lb. daily (8.9%) more than for nonimplanted intact heifers with an improvement in feed efficiency. Improvements for DES-implanted heifers over the controls amounted to 4.5% for gain and 4.3% for feed.

Steers gained faster than heifers in all comparisons during this phase of the experiment. However, the difference between control steers and control heifers was small, only 3.2% more gain with about the same amount of feed.

Differences between steers and spayed heifers were greater with either DES or Synovex implants. Type of implant did not appear to make much difference in the comparative performance between steers and heifers. The advantage for steers in gain was 10.4 and 11.7% with 5.2 and 7.2% less feed, respectively, for DES and Synovex.

Table 5. Performance of Cattle During First 170 Days
(December 14 to June 2)

Treatment	Steers			Steers		
	Control	DES	Synovex	Control	DES (spayed)	Synovex (spayed)
Number of animals	25	25	25	25	25	25
Init. wt. (filled), lb.	446	446	446	423	424	423
Final wt. (filled), lb.	722	754	772	690	703	713
Avg. gain per head, lb.	276	308	326	267	279	290
Avg. daily gain, lb.	1.62	1.81	1.91	1.57	1.64	1.71
Avg. daily ration, lb.						
Corn and sorghum silage ^a	26.4	26.7	27.5	24.2	24.4	25.6
Sorghum grain	6.4	6.4	6.4	6.4	6.4	6.4
Alfalfa ^b	3.5	3.5	3.5	3.5	3.5	3.5
Protein supplement	1.0	1.0	1.0	1.0	1.0	1.0
Total	37.3	37.6	38.4	35.1	35.3	36.5
Feed per cwt. gain, lb.						
Corn and sorghum silage	1629	1474	1434	1542	1485	1492
Sorghum grain	397	355	336	411	388	372
Alfalfa	211	189	179	219	209	200
Protein supplement	61	55	52	63	60	58
Total (air-dry basis)	1242	1118	1071	1232	1179	1154

^aSorghum silage fed for 35 days and corn silage fed remainder of period.

^bFive lb. low moisture alfalfa silage per head daily fed for 52 days and 3 lb. alfalfa hay fed remainder of period.

Finishing Phase - 146 or 147 Days

Results for the finishing phase are presented in table 6 with percentage differences between steers and heifers and implant treatments shown in table 7. Rate of gain was higher than during the growing phase. Similar improvement in rate of gain for DES (10.4%) was obtained with steers as for the previous phase but less for feed efficiency (2.5%). Response from Synovex (10.0%) by steers was similar to DES but at a lower rate than during the growing phase.

Spayed heifers implanted with DES gained 4.0% more than nonspayed controls. Improvement was greater (7.4%) for Synovex. Improvement over control nonspayed heifers was about the same during this phase of the experiment as during the growing phase. The implant treatments had only small effects on feed efficiency during this finishing phase.

There was a greater improvement in rate of gain for control steers than for control heifers over the previous growing phase (3.2%) when offered the higher energy finishing rations (8.9%). Improvement in feed efficiency amounted to 3.5%.

Difference between steers and spayed heifers implanted with DES was also greater during this phase of the experiment. Steers gained 15.7% faster than heifers with 6.4% improvement in feed efficiency.

Table 6. Cattle Performance During Finishing Phase
(June 2 to October 27-28)

	Steers 146 days			Heifers 147 days		
	Control	DES	Synovex	Control	DES (spayed)	Synovex (spayed)
Number of animals ^a	25	25	25	25	25	24
Init. wt. (filled) lb.	722	754	772	690	703	713
Final wt. (filled) lb.	1044	1109	1125	987	1011	1032
Avg. gain/head, lb.	322	355	353	297	308	319
Avg. daily gain, lb.	2.20	2.43	2.42	2.02	2.10	2.17
Avg. daily ration, lb.						
Ground ear corn	9.4	10.4	10.7	8.7	9.3	9.8
Grain (rolled shelled corn and oats)	7.8	8.5	8.8	7.4	7.8	8.4
Low moisture alfalfa silage ^b	5.4	5.4	5.4	5.4	5.4	5.3
Protein supplement	1.0	1.0	1.0	1.0	1.0	1.0
Total	23.6	25.3	25.9	22.5	23.5	24.5
Feed per cwt. gain, lb.						
Ground ear corn	426	425	442	431	441	453
Grain (rolled shelled corn and oats)	355	351	363	365	371	384
Low moisture alfalfa silage	245	222	223	267	259	250
Protein supplement	45	41	41	49	47	46
Total (air-dry basis)	1003	978	1008	1039	1045	1063
Avg. carcass weight, lb.	647	690	700	623	629	641
Dressing percent ^c	62.0	62.2	62.2	63.1	62.2	62.1
Marbling score ^d	6.2	5.8	5.5	7.4	6.6	5.8
Carcass grade ^e	19.9	19.4	19.2	21.0	20.3	19.6
Percent kidney fat	3.6	3.0	3.0	3.5	3.3	3.2
Fat thickness, in.	0.64	0.69	0.68	0.80	0.79	0.73
Rib eye area, sq. in.	11.65	12.48	12.00	11.94	11.34	11.96

^aOne heifer removed with prolapse. No problem was encountered with other heifers.

^bAlfalfa hay fed was put on an equal moisture basis and included as low moisture alfalfa silage.

^cDressing percent based on hot carcass weight minus 1.75 percent.

^dMarbling scores: 5 = small; 6 = modest; 7 = moderate and 8 = slightly abundant.

^eCarcass grade scores: C- = 19; C = 20; and C+ = 21.

Steers gained 11.5% faster than spayed heifers and had 5.2% lower feed requirements when both were implanted with Synovex. These results are similar to those obtained between steers and heifers implanted with Synovex during the period with high roughage diets.

Differences in carcass characteristics between treatment groups for steers were small. There was a trend toward faster fattening for the controls as evidenced by more marbling and kidney fat. However, fat thickness was not increased over implanted groups, but they did have a smaller rib eye.

Implant treatments appeared to also reduce rate of fat deposition in spayed heifers in comparison to intact controls. DES appeared to have a greater effect in this regard than did Synovex.

It is quite apparent that heifers finish at a lighter weight than steers. Control heifers fed equal time as control steers averaged 50 lb. less in market weight. They graded one-third of a grade higher and had a higher dressing percent, more marbling, more fat covering and larger rib eye. Differences between steers and heifers in carcass characteristics were smaller when implanted, with DES appearing to have more effect in reducing fat deposition in steers than in spayed heifers.

Summary

Steers implanted with DES and fed a growing type diet for 170 days gained 11.7% more than control steers with 10.0% lower feed requirements. Response to Synovex was greater, 17.9% faster gain with 13.8% lower feed requirements. During a finishing period of 146 days, improvement in rate of gain was about the same for DES and Synovex (about 10%) with only a small effect on feed efficiency.

Spayed heifers implanted with DES gained 4.5% more than intact nonimplanted controls with 4.3% improvement in feed efficiency. Response to Synovex was greater, 8.9% greater gain with 6.3% improvement in feed efficiency. During the finishing period of 147 days, responses to the implant treatments were of similar magnitude as during the growing phase except for only a small difference in feed requirements.

Differences between control steers and intact control heifers were small. Differences in favor of steers and heifers became greater during the finishing period and with the implant treatments.

Carcass data again show that heifers finish at a lighter weight than steers. Implant treatments appeared to reduce fat deposition with DES having more effect in steers than spayed heifers.

Table 7. Percentage Differences in Performance Between Steers and Heifers as Affected by DES and Synovex

	Steers		Heifers	
	Growing 170 days	Finishing 146 days	Growing 170 days	Finishing 147 days
DES vs. control				
Daily gain	11.7	10.4	4.5	4.0
Daily feed	0.8	7.2	0.6	4.4
Feed eff.	-10.0	- 2.5	-4.3	0.6
Synovex vs. control				
Daily gain	17.9	10.0	8.9	7.4
Daily feed	2.9	9.7	4.0	8.9
Feed eff.	-13.8	0.5	-6.3	2.3
Steers vs. heifers				
Control				
Daily gain	3.2	8.9		
Daily feed	6.3	4.9		
Feed eff.	0.8	-3.5		
DES				
Daily gain	10.4	15.7		
Daily feed	6.5	7.7		
Feed eff.	- 5.2	- 6.4		
Synovex				
Daily gain	11.7	11.5		
Daily feed	5.2	5.7		
Feed eff.	- 7.2	- 5.2		

Experiment 3 - Diethylstilbestrol and Synovex for Spayed and Nonspayed Heifers

This experiment was conducted to determine the effects of spaying and implanting with diethylstilbestrol (DES) and Synovex-H (200 mg. testosterone and 20 mg. estradiol benzoate) on feedlot performance and carcass characteristics of feedlot heifers.

Procedure

This experiment was conducted as a wintering phase and a finishing phase. One hundred forty-four heifer calves were purchased for the experiment and wintered at two locations. Eight pens of calves were wintered at one location and four at the other with 12 head per pen.

Experimental treatments were spayed and nonspayed heifers implanted with DES, Synovex or served as nonimplanted control. Heifers in one-half of the pens at each location were spayed. Four head in each pen made up the implant treatments.

Spaying was done following allotment to treatments for the growing phase of the experiment at the location with four pens. Weather conditions prevented the operation until 6 weeks later at the other location.

The calves at each location were full-fed prairie hay and a protein supplement of soybean meal. The supplement was fed at 1.5 lb. daily at one location and at 2.0 lb. at the other because of differences in protein content of the hay. Trace mineral salt and dicalcium phosphate containing 1,000 mg. chlortetracycline and 100,000 I.U. vitamin A per pound were offered free choice.

Calves at each location had access to sheds with outside pens. They were fed once daily with the hay fed in mangers inside the sheds and the supplements in outside feed bunks. Because of the allotment procedure, feed data could not be determined for the implant treatments during the growing phase of the experiment.

Upon termination of the wintering phase of the experiment, the cattle were trucked to Brookings for the finishing phase of the experiment. They were allotted into 12 pens of 11 or 12 each on basis of weight, wintering location and spaying and implant treatments. Each implant treatment was replicated two times with spayed and nonspayed heifers.

Diets during the finishing phase consisted of 2 parts corn silage, wet basis, to 1 part corn-protein supplement mixture. This concentrate mixture contained 92.5% rolled corn grain and 7.5% soybean meal. Vitamin A and chlortetracycline were added to supply 1,500 I.U. and 6 mg., respectively, per pound of the concentrate mix. Mineral supplements were offered free choice.

The heifers were fed once daily in outside paved pens without shelter. They were implanted with the appropriate implant after 89 days of the finishing phase of the experiment using the same levels as initially.

Results

Wintering Trial

Results of average weight gains for each treatment during the wintering phase are shown in table 8. Data were not obtained on feed by implant treatments since the heifers were separated into pens only on basis of spayed or nonspayed groups.

Table 8. Gains During Wintering Trial
(Cottonwood - 125 Days, Highmore - 118 Days)

	<u>Spayed</u>			<u>Nonspayed</u>		
	<u>Control</u>	<u>DES</u>	<u>Synovex-H</u>	<u>Control</u>	<u>DES</u>	<u>Synovex-H</u>
Number of heifers	23	23	24	24	24	24
Avg. init. wt. (shrunk), lb.	381.3	380.7	381.1	381.4	381.6	384.4
Avg. final wt. (shrunk), lb.	494.7	522.2	520.8	507.0	529.2	533.7
Avg. gain/head, lb.	113.4	141.5	139.7	125.6	147.6	149.3
Avg. daily gain, lb.	0.93	1.15	1.14	1.04	1.22	1.23

Rate of gain was reduced by spaying in comparison to nonspayed heifers for all implant groups. Implant treatments increased rate of gain with the response being slightly greater with spayed heifers. The increase over the control amounted to 23.7 and 22.6%, respectively, for DES and Synovex with spayed heifers and 17.3 and 18.3% with the nonspayed ones.

Finishing Trial

Rate of gain of heifers not implanted was reduced by spaying (table 9). When implanted with either DES or Synovex, there were only small differences between spayed and nonspayed heifers.

Rate of gain was increased by the implant treatments. With nonspayed heifers, the increase over controls amounted to 8.8 and 7.0%, respectively, for DES and Synovex. The percentage increase for spayed heifers was greater, 26.3 and 21.0, respectively, for DES and Synovex. However, average rate of gain for spayed and nonspayed animals was about the same when implanted.

Feed consumption was reduced by spaying but increased by the implant treatments for both spayed and nonspayed heifers. Spaying without implanting increased feed requirements. Implant treatments had very little effect on feed efficiency of nonspayed heifers. When spayed, feed efficiency was improved by 13.5 and 11.2% with DES and Synovex, and these heifers were slightly more efficient in feed utilization than comparable nonspayed ones.

Spaying did not appear to affect carcass characteristics except the nonimplanted group making the lowest rate of gain had a lower dressing percent and a smaller rib eye. Implant treatments had only a small effect on carcass characteristics. There appeared to be a slight reduction in amount of marbling and kidney fat but a slight increase in size of rib eye from the implants.

A considerable amount of trouble was encountered from vaginal prolapse. The condition was encountered for the most part during the last 2 months of the experiment. Only one heifer was affected before the reimplanting during the finishing phase of the experiment. The problem was encountered only with implanted cattle, both DES and Synovex and both spayed and nonspayed ones. The condition was encountered with seven spayed and three nonspayed heifers implanted with DES. With Synovex implants, the problem was encountered with two spayed and six nonspayed heifers.

Summary

Spaying heifers following weaning reduced rate of gain and increased feed requirements when not implanted with DES or Synovex.

Implanting nonspayed heifers with 24 mg. DES or Synovex following weaning and again during drylot finishing resulted in 8.8 and 7.0% improvement in rate of gain but had only a slight effect on feed efficiency.

Heifers spayed and implanted performed in about the same manner on weight gain and feed efficiency as nonspayed and implanted heifers. Results were similar for DES and Synovex.

Table 9. Feedlot Performance and Carcass Characteristics During Finishing Trial (192 days)

	Spayed			Nonspayed		
	Control	DES	Synovex-H	Control	DES	Synovex-H
Number of heifers	23	20	23	24	24	22
Avg. init. wt. (shrunk), lb.	494.7	521.0	522.6	507.0	529.2	537.6
Avg. final wt. (shrunk), lb.	851.7	972.8	953.0	919.6	976.3	978.4
Avg. gain/head, lb.	357.0	451.8	430.4	412.6	447.1	440.8
Avg. daily gain, lb.	1.86	2.35	2.25	2.15	2.34	2.30
Avg. daily ration, lb.						
Corn silage ^a	7.10 (2.66)	7.76 (2.19)	7.60 (2.85)	7.53 (2.82)	7.99 (3.00)	7.93 (2.98)
Corn-prot. suppl. mix	14.23	15.54	15.27	15.06	16.02	15.90
Alfalfa hay	0.29	0.30	0.29	0.29	0.29	0.31
Total	21.62	23.60	23.16	22.88	24.30	24.14
Feed/cwt. gain, lb.						
Corn silage	382 (144)	331 (124)	339 (127)	353 (132)	346 (130)	345 (130)
Corn-prot. suppl. mix	765	662	681	703	693	692
Alfalfa hay	16	13	13	13	12	13
Total	1163	1006	1033	1069	1051	1050
Carcass data						
Chilled carcass wt.	516	597	587	566	603	600
Dressing percent	60.5	61.2	61.6	61.5	61.8	61.4
Conformation score ^b	19.2	20.3	20.3	20.0	22.2	20.5
Marbling score ^c	6.9	6.2	6.3	6.3	6.0	5.5
Carcass grade ^b	20.2	19.9	19.8	20.0	19.6	19.2
Percent est. kidney fat	3.2	2.9	2.8	3.3	3.0	3.0
Fat depth, in.	0.65	0.71	0.71	0.69	0.68	0.70
Rib eye area, sq. in	9.57	10.99	11.15	11.05	12.38	11.57

^a Values in parenthesis are for silage on a 12% moisture basis.

^b Good = 17; Choice = 20. Graded to 1/3 grade.

^c Marbling scores: Moderate, 7; modest, 6; small, 5.

Implant treatments had only a slight effect on carcass characteristics. There did appear to be a slight reduction in amount of marbling and kidney fat but with a slightly larger rib eye for each implant treatment.

Considerable trouble was encountered from vaginal prolapse with DES and Synovex and with spayed and nonspayed heifers.

Table 10. Percentage Difference Between Spayed and Nonspayed Heifers Implanted With DES or Synovex

	Nonspayed		Spayed	
	Wintering 118 or 125 days	Finishing 192 days	Wintering 118 or 125 days	Finishing 192 days
DES vs. control				
Daily gain	17.3	8.8	23.7	26.3
Daily feed	--	6.2	--	9.2
Feed eff.	--	-1.7	--	-13.5
Synovex vs. control				
Daily gain	18.3	7.0	22.6	21.0
Daily feed	--	5.5	--	7.2
Feed eff.	--	-1.8	--	-11.2

Experiment 4 - Melengestrol Acetate and Diethylstilbestrol for Feedlot Heifers

Several experiments have shown an improvement in weight gain and feed efficiency by heifers from diethylstilbestrol (DES) but not as large as for steers. There is some question as to the value of long time treatment for heifers in comparison to a shorter period only during drylot finishing. Weight gains and feed efficiency are also improved for feedlot heifers by feeding melengestrol acetate (MGA). MGA is a progesterone-like compound effective in suppressing heat periods of cattle when administered at low levels.

This experiment was part of a series to study feeding methods for heifers and their response to various hormones or hormone-like compounds.

Procedures

This experiment consisted of two feeding trials. One was a two phase feeding trial with a growing phase with a high roughage diet for about 4 months followed by a finishing phase of 5 months. The other trial consisted of only a finishing period of 5 months.

One hundred sixty heifer calves were purchased for the experiment. They were divided into 2 groups of 80 for the 2 feeding trials. One group was allotted to 8 pens of 10 each for the growing and finishing trials. Four replicated treatments were as follows:

- 1 - Control
- 2 - 10 mg. DES daily in the protein supplement
- 3 - 12 mg. DES implant during growing phase and 24 mg. implant during finishing phase
- 4 - 0.35 mg. MGA daily in protein supplement during growing phase and 0.70 mg. daily during finishing phase

Diets during the growing phase consisted of 5 lb. rolled corn grain, 1 lb. protein supplement (20%) and a full feed of alfalfa-bromegrass hay or haylage. DES or MGA were added to the protein supplements to furnish 10 and 0.35 mg., respectively, of each for the appropriate pens of cattle. Implanted heifers received 12 mg. of DES at the beginning of this phase of the trial and were fed the supplement for the control cattle. The cattle were fed in outside, paved pens without access to shelter. Feeding was once daily.

The second group of 80 head was selected at the initial allotment to be similar to those used in the growing experiment. The two groups were to be fed in the same type of finishing experiment. Rations for this second group were similar as for the control group of the growing trial until beginning of the finishing trial.

After 126 days of the growing phase of the experiment, diets were changed to a limited amount of alfalfa-bromegrass hay or haylage, 1 lb. of a 40% protein supplement and a full feed of rolled corn grain. Experimental treatments remained the same except the level of MGA was inadvertently doubled (0.70 mg. daily). Rather than change the level during the course of the experiment, this higher level was fed throughout the finishing trial. Implanted heifers were reimplanted with 24 mg. DES.

When heifers on this growing trial were changed to the finishing diets, the other group was allotted to 8 pens of 10 each. Diets and experimental treatments were as for the groups from the growing trial.

Results

Trial 1 - Growing Phase

Results of the growing phase of trial 1 are shown in table 11 with percentage differences between treatments presented in table 14. DES in the feed or implanted and MGA resulted in similar improvements in rate of gain and feed efficiency (about 5.0-5.5%) over the controls.

Table 11. Response of Heifer Calves to MGA and DES During Growing Phase
(Trial 1 - 126 Days)

	Control	Oral DES (10 mg./head daily)	Implant DES (12 mg./head)	Oral MGA (0.35 mg./head daily)
Number of heifers	20	20	20	20
Avg. init. wt., lb.	437	434	435	437
Avg. final wt., lb.	642	652	652	654
Avg. gain, lb.	206	217	216	217
Avg. daily gain, lb.	1.63	1.72	1.71	1.72
Avg. daily ration, lb.				
Alfalfa-brome	15.3	15.3	15.4	15.3
Rolled shelled corn	4.9	4.9	4.9	4.9
Protein supplement	1.0	1.0	1.0	1.0
Total	21.2	21.2	21.3	21.2
Feed/100 lb. gain, lb.				
Alfalfa-brome	935	887	895	890
Rolled shelled corn	301	285	287	286
Protein supplement	61	56	58	58
Total	1297	1228	1240	1234

Trial 1 - Finishing Phase

During this phase of trial 1, heifers implanted with DES had the highest rate of gain (table 12). They gained 6.2% faster than the controls. DES or MGA fed in the protein supplement resulted in weight gains only slightly greater than for the control group. The level of MGA fed was in excess of the maximum level to be fed and about twice the level commonly fed to heifers of the weight in this trial. None of the treatments resulted in any appreciable change from controls in feed efficiency.

Any effects of the treatments on carcass characteristics were small. The control animals having lighter carcasses rated about equal on most carcass characteristics as those receiving DES or MGA treatments.

Table 12. Response of Heifers to MGA and DES During Finishing When Administered from Weaning (Trial 1 - Finishing Phase - 150 Days)

	Control	Oral DES (10 mg./head daily)	Implant DES (24 mg./head)	Oral MGA (0.70 mg./head daily)
Number	20	20	20	19
Avg. init. wt., lb.	643	652	652	653
Avg. final wt., lb.	1004	1025	1036	1021
Avg. gain, lb.	361	372	384	368
Avg. daily gain, lb.	2.41	2.48	2.56	2.45
Avg. daily ration, lb.				
Alfalfa-brome	5.3	5.3	5.3	5.3
Rolled shelled corn	16.1	16.5	17.2	16.3
Protein supplement	1.0	1.0	1.0	1.0
Total	22.4	22.8	23.5	22.6
Feed/100 lb. gain, lb.				
Alfalfa-brome	220	214	206	216
Rolled shelled corn	668	665	674	663
Protein supplement	41	40	39	41
Total	929	919	919	920
Cold carcass weight, lb.	625	644	639	638
Dressing percent	62.1	62.8	61.6	62.4
Conformation ^a	19.9	20.1	20.1	20.1
Marbling score ^b	6.1	6.4	5.9	6.1
Carcass grade ^a	20.1	20.4	19.7	20.1
Color ^c	5.0	5.1	5.0	5.0
Firmness ^d	5.0	5.2	5.0	5.0
Kidney fat, %	2.8	2.6	2.7	2.8
Maturity ^e	23.0	23.0	22.9	23.0
Fat thickness, in.	0.76	0.77	0.74	0.82
Rib eye area, sq. in.	11.92	12.15	12.25	11.02

^aChoice = 20; Good = 17.

^bModerate = 7; modest = 6; small = 5.

^cHigher number represents darker color.

^dHigher number represents firmer meat.

^eLower number represents more mature carcass.

Trial 2 - Finishing Only

Results for heifers receiving the experimental treatments only during finishing are shown in table 13. They had been fed and managed in a manner similar to the control groups in trial 1 during time of the growing phase. Average initial weight for the finishing trial was about the same as for this control group.

Table 13. Response of Heifers to MGA and DES Administered During Finishing Only
(Trial 2 - 148 Days)

	Control	Oral DES (10 mg./head daily)	Implant DES (24 mg./head)	Oral MGA (0.70 mg./head daily)
Number	19	20	20	20
Avg. init. wt., lb.	638	642	646	645
Avg. final wt., lb.	978	1014	1029	999
Avg. gain, lb.	340	372	383	353
Avg. daily gain, lb.	2.29	2.48	2.59	2.39
Avg. daily ration, lb.				
Alfalfa-brome	5.3	5.3	5.4	5.3
Rolled shelled corn	15.6	16.0	16.4	15.6
Protein supplement	1.0	1.0	1.0	1.0
Total	21.9	22.3	22.8	21.9
Feed/100 lb. gain, lb.				
Alfalfa-brome	232	212	207	223
Rolled shelled corn	679	636	633	651
Protein supplement	43	40	39	42
Total	954	888	879	919
Cold carcass weight, lb.	612	635	642	623
Dressing percent	62.4	62.5	62.4	62.3
Conformation ^a	20.2	20.6	20.4	19.9
Marbling score ^b	6.2	6.3	6.2	6.6
Carcass grade ^a	20.0	20.2	19.9	20.2
Color ^c	5.4	5.2	5.2	5.2
Firmness ^d	5.3	5.5	5.2	5.3
Kidney fat, %	3.9	4.1	4.1	4.1
Maturity ^e	23.4	23.1	23.2	23.1
Fat thickness, in.	0.63	0.70	0.65	0.76
Rib eye area, sq. in.	11.89	12.33	12.36	10.80

^aChoice = 20; Good = 17.

^bModerate = 7; modest = 6; small = 5.

^cHigher number represents darker meat.

^dHigher number represents firmer meat.

^eLower number represents more mature carcass.

Improvement in weight gain over controls for the DES treatments was greater than in trial 1, 13.1 and 8.3%, respectively, for the implant and oral feeding. However, the larger difference in this trial appears to result from a lower performance of the control group in comparison to the control group in trial 1. Average daily gains for DES treatments were about the same in the two trials. Heifers receiving DES also showed more improvement in feed efficiency in this trial, 7.9 and 6.9% for implant and oral DES, respectively.

MGA at 0.70 mg. daily resulted in about the same improvement in weight gain and feed efficiency as for trial 1.

Differences in carcass characteristics were small. There appeared to be a slight trend toward less fat in relation to lean for DES-treated cattle in comparison to controls. On the other hand, MGA-fed cattle tended toward slightly more fat deposition.

Table 13. Response of Heifers to MGA and DES Administered During Finishing Only
(Trial 2 - 148 Days)

	Control	Oral DES (10 mg./head daily)	Implant DES (24 mg./head)	Oral MGA (0.70 mg./head daily)
Number	19	20	20	20
Avg. init. wt., lb.	638	642	646	645
Avg. final wt., lb.	978	1014	1029	999
Avg. gain, lb.	340	372	383	353
Avg. daily gain, lb.	2.29	2.48	2.59	2.39
Avg. daily ration, lb.				
Alfalfa-brome	5.3	5.3	5.4	5.3
Rolled shelled corn	15.6	16.0	16.4	15.6
Protein supplement	1.0	1.0	1.0	1.0
Total	21.9	22.3	22.8	21.9
Feed/100 lb. gain, lb.				
Alfalfa-brome	232	212	207	223
Rolled shelled corn	679	636	633	651
Protein supplement	43	40	39	42
Total	954	888	879	919
Cold carcass weight, lb.	612	635	642	623
Dressing percent	62.4	62.5	62.4	62.3
Conformation ^a	20.2	20.6	20.4	19.9
Marbling score ^b	6.2	6.3	6.2	6.6
Carcass grade ^a	20.0	20.2	19.9	20.2
Color ^c	5.4	5.2	5.2	5.2
Firmness ^d	5.3	5.5	5.2	5.3
Kidney fat, %	3.9	4.1	4.1	4.1
Maturity ^e	23.4	23.1	23.2	23.1
Fat thickness, in.	0.63	0.70	0.65	0.76
Rib eye area, sq. in.	11.89	12.33	12.36	10.80

^aChoice = 20; Good = 17.

^bModerate = 7; modest = 6; small = 5.

^cHigher number represents darker meat.

^dHigher number represents firmer meat.

^eLower number represents more mature carcass.

Improvement in weight gain over controls for the DES treatments was greater than in trial 1, 13.1 and 8.3%, respectively, for the implant and oral feeding. However, the larger difference in this trial appears to result from a lower performance of the control group in comparison to the control group in trial 1. Average daily gains for DES treatments were about the same in the two trials. Heifers receiving DES also showed more improvement in feed efficiency in this trial, 7.9 and 6.9% for implant and oral DES, respectively.

MGA at 0.70 mg. daily resulted in about the same improvement in weight gain and feed efficiency as for trial 1.

Differences in carcass characteristics were small. There appeared to be a slight trend toward less fat in relation to lean for DES-treated cattle in comparison to controls. On the other hand, MGA-fed cattle tended toward slightly more fat deposition.

Summary

Heifer calves fed high roughage rations for about 4 months following weaning gained at about the same rate when fed 10 mg. DES daily, implanted with 12 mg. DES or fed 0.35 mg. daily of MGA. Differences in rate of gain and feed efficiency over controls amounted to 5.0 and 5.5%.

When fed high concentrate diets during a final finishing period of about 5 months, heifers not previously treated with DES appeared to show more response to DES than those treated during both growing and finishing. The percentage improvement in gain during this finishing phase from oral and implanted DES amounted to 6.2 and 2.9%, respectively, for heifers receiving DES during growing and finishing in comparison to 13.1 and 8.3% for those treated during the finishing phase only. However, this effect resulted mainly from a difference in performance between control groups in the two trials rather than between DES-treated groups.

MGA at 70 mg. daily during the finishing phase of the trials did not improve feedlot performance. However, the level is about double the commonly used level (0.35 to 0.40 mg.).

The longer time on DES presented more problems with vaginal prolapse with implants causing more trouble than when fed.

Differences in carcass characteristics between heifers treated with DES or MGA and controls were small. There appeared to be a trend toward larger rib eyes with less fat covering for DES-treated heifers and for smaller rib eyes and more fat covering when fed MGA.

Table 14. Percentage Differences Between Treatment Groups of Heifers During Growing and Finishing

	Growing 126 days	Finishing	
		Treated Growing and finishing	Treated Finishing only
DES implant vs. control			
Gain	4.91	6.22	13.10
Feed consumed	0.47	4.91	4.11
Feed eff.	-4.39	-1.08	- 7.86
DES oral vs. control			
Gain	5.52	2.90	8.30
Feed consumed	0	1.79	1.83
Feed eff.	-5.32	-1.08	- 6.92
MGA vs. control			
Gain	5.52	1.66	4.37
Feed consumed	0	0.89	0
Feed eff.	-4.86	-0.97	- 3.67

Experiment 5 - Melengestrol Acetate and Diethylstilbestrol During Growing and Finishing of Feedlot Heifers

This experiment was a continuation of the research to compare effects of diethylstilbestrol (DES) and melengestrol acetate (MGA) when administered to feedlot heifers during growing and finishing or only during finishing. It differed from the previous experiment in that DES was used only as an implant and a combination of DES and MGA was used as one treatment.

Procedures

One hundred twenty-eight heifer calves were purchased from one herd. They were allotted into 16 pens of 8 each on basis of weight. Eight pens of the calves were to be used in a two-phase growing and finishing trial and the other 8 pens in a finishing trial. Four replicated treatments for each trial were control, DES, MGA and a combination of DES and MGA.

Trial 1 - Growing Phase

Diets during this growing phase of 141 days consisted of a full feed of corn silage and 2 lb. of a 40% protein supplement. The supplement was a corn-soybean meal-urea type fortified with minerals and 10,000 I.U. of vitamin A per pound. MGA was added to the protein supplement for the appropriate treatments to furnish 0.35 mg. per head daily. The DES treatment was a 12 mg. implant administered on the first day of the experiment.

The cattle were fed once daily in outside, paved pens without shade or shelter.

Trial 1 - Finishing Phase

Following the 141-day growing phase, diets were changed to high energy ones. Corn silage was gradually reduced to 10 lb. per head daily. Ground shelled corn was added and increased to a full feed over a period of 14 days. Protein supplements of similar ingredient composition and protein content as during the growing phase were fed at 2 lb. per head daily. The MGA treatment was continued at 0.35 mg. daily. Heifers previously implanted with DES were reimplanted with 24 mg.

When a full feed of corn grain was reached, the corn silage was replaced with 5 lb. of alfalfa-bromegrass haylage. Protein content of the supplements was reduced to 30%.

The finishing phase of the trial was terminated after 130 days.

Trial 2 - Finishing Phase

Sixty-four of the heifers from the original group of 128 were fed and managed during a growing phase as the control group in trial 1. These heifers were allotted into 8 pens of 8 each on basis of weight. Experimental treatments were as for trial 1. The finishing phase of the two trials was conducted at the same time and in the same manner.

Results

Trial 1 - Growing Phase

Results of the growing phase of the trial when the heifers were full-fed corn silage are shown in table 15. Percentage differences between treatments are shown in table 18.

Table 15. Experiment 1 - Growing Phase. Weight and Feed Data (January 25 to June 14 - 141 Days)

Item	Control	Treatment		
		MGA ^a	DES ^b	MGA + DES
Number of heifers	16	16	16	16
Avg. init. wt., lb.	424	412	417	423
Avg. final wt., lb.	679	686	682	683
Avg. daily gain, lb.	1.80	1.94	1.87	1.85
Avg. daily ration, lb.				
Corn silage	34.0	34.5	34.1	34.6
Supplement	2.0	2.0	2.0	2.0
Total	36.0	36.5	36.1	36.6
Feed/cwt. gain, lb.				
Corn silage	1890	1773	1820	1871
Supplement	110	102	106	107
Total	2000	1875	1926	1978

^a 0.35 mg. MGA per head daily.

^b 12 mg. implant in ear.

Improvement in rate of gain (3.9%) and feed efficiency (3.7%) over controls from the DES during this phase of the experiment was small. More response was obtained from MGA, 7.8% faster gain with 6.2% less feed. Heifers implanted with DES and fed MGA gained at about the same rate as the DES-implanted heifers.

Trial 1 - Finishing Phase

Rates of gain were considerably higher during this finishing phase than during the growing phase (table 16). Heifers in all treated groups gained at a faster rate than the controls.

Table 16. Experiment 1 - Finishing Phase. Weight, Feed and Carcass Data
(June 14 to October 22 - 130 Days)

Item	Treatment			
	Control	MGA ^a	DES ^b	MGA + DES
Number of heifers	16	16	16	16
Avg. init. wt., lb.	679	686	682	683
Avg. final wt., lb.	962	1004	984	997
Avg. daily gain, lb.	2.18	2.44	2.32	2.41
Avg. daily ration, lb.				
Haylage	4.0	4.0	4.0	4.0
Corn silage	3.2	3.2	3.2	3.2
Supplement	2.0	2.0	2.0	2.0
Ground shelled corn	14.8	15.8	15.6	16.0
Chopped hay	0.3	0.3	0.2	0.2
Total	24.3	25.3	25.0	25.4
Feed/cwt. gain, lb.				
Haylage	185.0	165.0	173.0	166.0
Corn silage	149.0	133.0	140.0	135.0
Supplement	91.8	81.9	86.1	82.8
Ground shelled corn	679.0	648.0	670.0	665.0
Chopped hay	12.4	10.9	10.0	9.9
Total	1117.2	1038.8	1079.1	1058.7
Dressing percent	60.6	62.0	61.5	61.9
Conformation ^c	21.3	22.1	21.6	22.1
Marbling ^d	5.4	5.2	4.7	5.5
Carcass grade ^c	19.4	18.9	18.1	19.0
Maturity ^e	22.6	22.6	22.5	22.3
Firmness ^f	5.2	5.4	5.3	5.5
Color ^g	5.1	5.2	5.1	5.2
Kidney fat, %	3.5	3.7	3.4	3.4
Fat thickness, in.	0.60	0.72	0.61	0.74
Rib eye area, sq. in.	11.45	11.29	12.20	11.15

^a 0.35 mg. MGA per head daily.

^b 24 mg. implant in ear.

^c Prime = 23; Choice = 20; Good = 17.

^d Moderate = 7; modest = 6; small = 5; slight = 4.

^e 22 = B; 23 = A.

^f Firm = 6; moderately firm = 5; slightly soft = 4.

^g Light cherry red = 5; cherry red = 4; moderately dark red = 3.

Heifers reimplanted with 24 mg. DES gained 6.4% more than controls with 3.4% saving in feed requirements. When fed MGA, rate of gain and feed efficiency were improved by 11.9 and 7.0%. Results obtained with the combination of DES and MGA were similar as for MGA.

Differences in carcass characteristics measured were small. The main effect of DES appeared to be a slight reduction in amount of marbling, depth of fat covering and carcass grade but a larger rib eye. Heifers fed MGA had a slightly higher dressing percent. Otherwise, they were similar to control heifers. Color of lean was about the same as for controls.

Trial 2 - Finishing Phase

Rates of gain during this trial were very similar as for the finishing phase of trial 1 except for a lower rate of gain by the DES-implanted group (tables 17 and 18).

Table 17. Experiment 2 - Weight, Feed and Carcass Data
(June 14 to October 22 - 130 Days)

Item	Treatment			
	Control	MGA ^a	DES ^b	MGA + DES
Number of heifers	16	16	16	16
Avg. init. wt., lb.	676	672	677	681
Avg. final wt., lb.	964	981	962	1002
Avg. daily gain, lb.	2.22	2.38	2.20	2.49
Avg. daily ration, lb.				
Haylage	4.0	4.0	4.0	4.0
Corn silage	3.0	3.0	3.0	3.0
Supplement	2.0	2.0	2.0	2.0
Ground shelled corn	15.0	15.6	15.0	15.5
Chopped hay	0.2	0.2	0.2	0.3
Total	24.2	24.8	24.2	24.8
Feed/cwt. gain, lb.				
Haylage	181.0	170.0	183.0	162.0
Corn silage	134.0	125.0	135.0	119.0
Supplement	90.3	84.2	90.9	80.2
Ground shelled corn	676.0	656.0	684.0	621.0
Chopped hay	11.6	9.4	11.1	10.4
Total	1092.9	1044.6	1104.0	992.6
Dressing percent	60.5	61.3	61.7	61.6
Conformation ^c	21.9	21.5	21.7	21.8
Marbling ^d	5.9	5.7	5.6	5.4
Carcass grade ^c	19.5	19.3	19.4	18.5
Maturity ^e	22.8	22.3	22.6	22.6
Firmness ^f	5.6	5.6	5.4	5.7
Color ^g	5.3	5.1	5.3	4.7
Kidney fat, %	3.5	3.5	3.8	3.7
Fat thickness, in.	0.55	0.63	0.68	0.71
Rib eye area, sq. in.	12.00	11.24	11.70	11.63

^a 0.35 mg. per head daily.

^b 24 mg. implant in ear.

^c Prime = 23; Choice = 20; Good = 17.

^d Moderate = 7; modest = 6; small = 5; slight = 4.

^e 22 = B; 23 = A.

^f Firm = 6; moderately firm = 5; slightly soft = 4.

^g Light cherry red = 5; cherry red = 4; moderately dark red = 3.

In this trial, heifers implanted with DES gained at about the same rate with similar feed requirements as the control group. Heifers fed MGA gained 7.2% more than controls with a 4.4% improvement in feed efficiency. The improvement from MGA in this case was slightly less than in trial 1. The combination of MGA and DES resulted in the highest rate of gain over controls (12.2%) with the most improvement in feed efficiency (9.2%). Effects of DES and MGA on carcass characteristics were small. Carcasses from heifers receiving the combination treatment graded slightly lower, had slightly darker meat and more fat covering.

Summary

This experiment showed a larger response in gain and feed efficiency from MGA than DES during both growing and finishing of feedlot heifers. Feeding MGA from shortly after weaning to about 680 lb. did not appear to affect the response to the compound during a final finishing phase in comparison to heifers fed MGA during finishing only. More total benefit was obtained when MGA was fed during both phases. The response to DES was quite variable in this experiment.

A combination of DES and MGA did not appear to offer any advantage over MGA alone.

Effects of the treatment on carcass characteristics were small. DES appeared to reduce fat deposition in relation to lean, but this was less evident when administered over a short period such as finishing only. Carcasses from heifers fed MGA were similar to the controls.

Table 18. Percentage Differences Between Treatment Groups of Heifers During Growing and Finishing

	Growing 141 days	Finishing	
		Treated Growing and finishing	Treated Finishing only
DES vs. control			
Gain	3.9	6.4	- 0.90
Feed consumed	0.28	2.9	0
Feed eff.	- 3.7	- 3.4	1.0
MGA vs. control			
Gain	7.8	11.9	7.2
Feed consumed	1.4	4.1	2.5
Feed eff.	- 6.2	- 7.0	- 4.4
DES + MGA vs. control			
Gain	2.8	10.5	12.2
Feed consumed	1.7	4.5	2.5
Feed eff.	- 1.1	- 5.2	- 9.2

Experiments 6 and 7 - Zeranol and Diethylstilbestrol Implants for Finishing Steers

Previous experiments had shown that a growth stimulating effect of about the magnitude commonly reported from diethylstilbestrol (DES) was obtained with 36 mg. implants of zeranol administered to finishing steers. Lower levels appeared less effective. A comparison between 36 mg. DES and 36 and 72 mg. zeranol was made in two experiments with finishing steers. Results of the two experiments have been combined for this report.

Procedures

Procedures for the two experiments were essentially the same but differed in starting date, length of experiment, initial weights and source of cattle. One experiment was started in November and conducted over a period of 154 days. The other one was initiated in January and was terminated after 144 days. Average weights for the steers for the two experiments were approximately 720 and 785 lb.

Seventy-two yearling steers were used in each experiment. They were allotted into 8 pens of 9 each for four experimental treatments replicated two times. Treatments were control and implants of 36 mg. zeranol, 72 mg. zeranol and 36 mg. DES. Each group had been on pasture the past summer and late fall. DES had not been given to any of the cattle.

Diets for each experiment consisted of a full feed of ground ear corn and 2 lb. of a soybean meal-urea-dehydrated alfalfa meal supplement with about 40% protein fortified with minerals, vitamin A and bacitracin.

Results

Average results for the two experiments are shown in table 19. Results obtained with 36 mg. DES and 35 mg. zeranol were about the same, approximately 13 and 8.5% improvements in rate of gain and feed efficiency. Zeranol implants at 72 mg. appeared to offer considerable advantage over the 36 mg. level in these two experiments. There was an improvement of 19.4% in rate of gain with 13.3% lower feed requirements in comparison to the control group.

Effects of implant treatments on carcass characteristics were small. Implanted cattle had slightly higher dressing percent, larger rib eye area and more fat covering. However, the implanted cattle were heavier at slaughter.

Summary

Zeranol and DES appeared to give about the same improvement in weight gain and feed efficiency for finishing yearling steers when implanted at 36 mg. Increasing the level of zeranol to 72 mg. resulted in further improvement in weight gain and feed efficiency over finishing periods of about 5 months.

Effects of zeranol on carcass characteristics appeared similar to DES except for slightly more fat covering.

Table 19. Response of Yearling Steers to Zeranol and DES Implants
(Average of Two Experiments - 144 and 154 Days)

	Control	36 mg. RAL	72 mg. RAL	36 mg. DES
Number of steers	36	35	36	36
Init. shrunk wt., lb.	751	752	752	754
Final shrunk wt., lb.	1097	1143	1166	1147
Avg. daily gain, lb.	2.32	2.62	2.77	2.63
Avg. daily ration, lb.				
Ground ear corn	24.9	25.7	26.0	25.0
Protein supplement	2.0	2.0	2.0	2.0
Feed/100 lb. gain, lb.				
Ground ear corn	1049	949	911	952
Protein supplement	83	73	70	73
Dressing percent	59.8	60.1	60.3	60.2
Marbling ^a	5.5	5.5	5.5	5.4
Carcass grade ^b	19.4	19.3	19.4	19.1
Kidney fat, %	1.7	1.7	1.7	1.7
Fat thickness, in.	0.58	0.63	0.63	0.55
Rib eye area, sq. in.	11.26	11.68	11.79	11.72

^a Modest amount = 6; small amount = 5.

^b Choice = 20, Good = 18. Graded to one-third of a grade.

Experiment 8 - Zeranol Implants for Finishing Steers and Heifers

This experiment was a continuation of the research to evaluate zeranol implants for finishing cattle. Steers and heifers were used. The level of implant was 36 mg. initially followed by a reimplant of 36 mg. about midway through the experiment.

Procedures

Yearling heifers and steers from Hereford dams artificially bred to the same Angus bull were used in the experiment. They were wintered on diets composed largely of hay and grazed one season as a group prior to the experiment. The cattle were allotted on basis of sex and weight into 4 pens of steers and 4 pens of heifers each with 8 head. Two pens within each sex group were implanted with 36 mg. zeranol at the beginning of the experiment.

Diets consisted of ground ear corn and 2 lb. of a 40% protein supplement fortified with vitamin A and minerals. The ear corn was increased to a full feed by increases of 1 lb. per head daily from an initial level of 4 lb. Corn silage was fed at 20 lb. per head daily at the beginning of the experiment. It was gradually reduced and eliminated after 10 days. After 78 days, the implanted cattle were reimplanted with another 36 mg. of zeranol. They were fed in concrete-paved pens without shade or shelter. Feeding was once daily with feed available at all times once on full feed.

Results

Steers implanted with 36 mg. zeranol initially and after 78 days gained 0.17 lb. (7.0%) more than control steers during the 166-day experiment (table 20). Feed consumed was about the same as for the control group, but there was an improvement of 5.8% in feed efficiency.

Table 20. Zeranol Implants for Finishing Steers and Heifers
(December 5 to May 20 - 166 Days)

	Control group		Zeranol group	
	Steers	Heifers	Steers	Heifers
Number	15	16	16	16
Init. shrunk wt., lb.	751	717	742	721
Final shrunk wt., lb.	1154	1098	1174	1102
Avg. daily gain, lb.	2.43	2.29	2.60	2.29
Avg. daily ration, lb.				
Ground ear corn	25.8	25.7	26.0	25.9
Protein supplement	2.0	2.0	2.0	2.0
Total	27.8	27.7	28.0	27.9
Feed/100 lb. gain, lb.				
Ground ear corn	1062	1122	1002	1126
Protein supplement	82	86	76	87
Total	1144	1208	1078	1213
Dressing percent	59.4	59.5	59.6	60.7
Conformation ^a	21.2	20.7	21.2	21.3
Marbling ^b	6.3	7.0	6.5	6.7
Carcass grade ^a	19.9	20.2	20.2	19.9
Kidney fat, %	3.7	3.8	3.5	3.6
Fat thickness, in.	0.60	0.63	0.56	0.66
Rib eye area, sq. in	12.82	12.78	12.82	13.31

^a Choice = 20; Choice+ = 21.

^b Modest = 6; Moderate = 7.

Implanted heifers gained at the same rate as nonimplanted heifers. Feed consumption and feed efficiency were also about the same for control and implanted heifers.

The lack of a response by heifers to zeranol in the experiment resulted in a greater difference between implanted steers and heifers than between control steers and heifers. Implanted steers gained 13.5% more with 11.1% less feed per unit of gain than did implanted heifers. For controls, the advantage in gain and feed efficiency for steers amounted to 6.1 and 5.3%, respectively.

The response in weight gains and feed efficiency by steers to the two 36 mg. zeranol implants was less than obtained with zeranol in previous experiments, especially when implanted with 72 mg. Weather conditions were unfavorable during a large part of the experiment and weight gains were lower than expected for the diets fed. This may have had an effect on the growth promoting potential of the test compound.

Carcass grade was approximately average choice for both steers and heifers. However, the slightly higher dressing percent, marbling score and fat thickness would indicate the heifers to be fatter. The feeding period was of the same length for these steers and heifers of similar age and by the same sire. Zeranol did not appear to have any appreciable effects on carcass characteristics measured.

Summary

Steers implanted with 36 mg. zeranol initially and again after 78 days gained 7.0% faster with 5.8% improvement in feed efficiency over nonimplanted controls. There was no apparent response in weight gain and feed efficiency by heifers to the zeranol treatment. The implant treatment did not affect the several carcass characteristics measured in steers or heifers. The response by steers to the implant was less than obtained in previous experiments. Adverse weather conditions may have had an influence on the outcome of the experiment.

Steers gained 6.1% faster than heifers with 5.3% improvement in feed efficiency when neither were implanted with zeranol. Differences in favor of steers were about twice these amounts when both were implanted. Heifers were slightly fatter than steers when fed in the same manner for the same time.

Experiment 9 - Feedlot Bulls, Heifers and Steers Treated With Various Growth Stimulating Compounds

Bulls gain faster and more efficiently than heifers. However, comparative feedlot performance and carcass characteristics may be influenced by castration, administration of hormone or hormone-like compounds and dietary conditions during growing and finishing. This experiment was conducted to compare bulls, heifers and steers during a finishing period with high-concentrate diets and various growth stimulating compounds. Control, diethylstilbestrol (DES) and zeranol groups were included for bulls, heifers and steers with an additional melengestrol acetate (MGA) group for heifers.

Procedures

Bulls, heifers and steers used in the experiment were progeny from a herd of Hereford cows artificially bred to the same Hereford bull. No culling was made from the calves, but the bulls were selected at weaning as representing the top end of the male calves. The remaining male calves were castrated after selection of the bulls. The bulls were used as cleanup bulls the following summer with 8 to 10 cows each after an artificial insemination program of about 6 weeks. The cattle were wintered with high roughage diets and pastured for one season prior to the experiment.

Experimental treatments were control, 36 mg. DES implants or 36 mg. zeranol implants for bulls, heifers and steers with an additional treatment of 0.4 mg. MGA daily for heifers. Diets consisted of 3 lb. alfalfa-brome haylage, 2 lb. 40% protein supplement and a full feed of whole corn grain. A MGA premix was added to the protein supplement to furnish 0.40 mg. per head daily for the appropriate pens of heifers.

Two pens of cattle received each of the treatments. Number and initial weights are shown in the table of results. Feeding was once daily in paved outside pens without shade or shelter. The experiment was terminated after 125 days. All the cattle were marketed at this time.

Results

Results of feedlot performance and carcass characteristics are shown in table 21. Percentage differences between bulls, steers and heifers and effects of the growth stimulating compounds are shown in table 22. It is apparent that feedlot performance of cattle is affected by sex and by castration. It is also quite apparent that comparative performance between bulls, heifers and steers may vary considerably depending upon treatments administered.

DES and zeranol appeared to cause a slight reduction in weight gain of bulls. The treatments were accompanied by slightly higher feed consumption and, therefore, higher feed requirements. There were only small differences in carcass characteristics between treatment groups of bulls except for slightly more fat covering for those treated with DES or zeranol.

Steers implanted with 36 mg. DES gained 18.2% faster than control steers and had 7.3% lower feed requirements. The main effects of DES implants were more fat covering and a larger rib eye as observed in several previous experiments. However, these were more a reflection of a heavier carcass resulting from the faster gain and marketing at the same time.

Zeranol resulted in a smaller response than DES with steers, 10.9 and 5.6%, respectively, for improvement in gain and feed efficiency over controls. Effects of zeranol on carcass characteristics were small.

Heifers implanted with 36 mg. DES or fed 0.4 mg. MGA daily gained at about the same rate, 7.8 and 7.0% more than controls with 5.4 and 6.5% improvement in feed efficiency. The highest rate of gain by heifers was obtained when implanted with 36 mg. zeranol. These heifers gained 12.4% more than controls with 8.0% lower feed requirements. Carcasses of treated heifers were slightly fatter than controls as indicated by more kidney fat and fat covering. Rib eyes were larger for those implanted with DES or zeranol. MGA appeared to have less effect on size of rib eye than did DES or zeranol.

Comparative feedlot performance of bulls and steers varied with treatment. When compared under the most favorable conditions for each--control bulls and DES-treated steers--bulls gained 24.1% faster, consumed 4.7% more feed but required 15.7% less feed per unit of gain. These bulls and steers were about the same age (about 20 months) when put in the feedlot and were fed high grain diets for the same period of time. Slaughter weights of bulls were considerably greater. Under these conditions, dressing percent was higher for bulls, they had less marbling, kidney fat and fat covering but a larger rib eye in comparison to steers.

Control steers gained 6.2% more than control heifers and had 4.7% lower feed requirements. Steers showed a greater response to DES than did heifers. Advantage for steers in gain and feed efficiency amounted to 16.5 and 6.5% with DES implants. Zeranol resulted in a greater response than for DES with heifers but less than for DES with steers. In this comparison, steers gained only 4.8% more (0.4 lb. daily) than heifers. There were only small differences in carcass

Table 21. Growth Stimulating Compounds for Bulls, Heifers and Steers
December 19-April 23 - 125 Days

	Bulls			Steers			Heifers			MGA 0.4 mg. daily
	Control	DES 36 mg.	Zeranol 36 mg.	Control	DES 36 mg.	Zeranol 36 mg.	Control	DES 36 mg.	Zeranol 36 mg.	
Number	10	10	10	15	16	15	13	13	13	14
Init. shrunk wt., lb.	778	792	785	731	744	733	686	689	685	682
Final shrunk wt., lb.	1281	1274	1268	1074	1149	1113	1009	1038	1047	1027
Avg. daily gain, lb.	4.02	3.85	3.86	2.74	3.24	3.04	2.58	2.78	2.90	2.76
Avg. daily ration, lb.										
Corn	23.15	24.31	23.67	19.51	21.91	20.56	19.23	19.51	20.01	19.24
Haylage	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Supplement	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Total	28.15	29.31	28.67	24.51	26.91	25.56	24.23	24.51	25.01	24.24
Feed/100 lb. gain, lb.										
Corn	575	632	612	712	676	679	745	705	691	697
Haylage	74	78	77	109	92	99	116	109	103	108
Supplement	50	52	51	73	61	66	77	73	69	72
Total	699	762	740	894	829	844	938	887	863	877
Dressing percent	62.4	62.5	61.8	61.3	62.4	61.6	61.1	62.5	62.0	61.3
Conformation ^a	21.9	21.3	21.3	20.9	21.1	21.0	20.0	20.7	20.4	20.4
Marbling ^b	3.5	4.1	3.6	4.6	4.5	4.7	4.8	5.2	4.8	4.6
Carcass grade ^a	17.4	17.4	18.0	18.3	18.2	18.5	18.5	18.6	18.7	18.5
Color ^c	4.1	4.2	4.0	4.4	4.5	4.2	4.4	4.2	4.6	4.5
Maturity ^d	22.2	22.0	22.5	23.0	22.6	22.7	22.3	22.0	22.3	22.1
Firmness ^e	4.9	4.8	5.0	4.8	5.0	5.1	4.9	5.4	5.0	5.3
Kidney fat, %	2.8	2.9	2.8	3.1	3.0	3.1	3.3	3.7	3.6	3.7
Fat thickness, in.	0.41	0.60	0.59	0.47	0.65	0.62	0.55	0.66	0.63	0.6
Loin eye area, sq. in.	13.57	13.55	13.46	12.26	12.41	11.70	11.42	12.54	12.46	11.1

^a Choice = 20, Good = 17. Graded to one-third of a grade.

^b Trace = 3, slight = 4, small = 5.

^c Higher number represents lighter meat, cherry red = 4, light cherry red = 5.

^d Higher number represents younger carcass, A+ maturity = 22, A maturity = 23.

^e Higher number represents firmer meat, slightly soft = 4, moderately firm = 5, firm = 6.

characteristics between steers and heifers under conditions of this experiment. Heifer carcasses appeared slightly fatter as evidenced by marbling, kidney fat, fat covering and grade.

Summary

Yearling bulls weighing about 785 lb. initially and fed a high grain diet for 125 days gained at a lower rate with higher feed requirements when implanted with 36 mg. DES or 36 mg. zeranol than did nonimplanted bulls.

Steers implanted with 36 mg. of DES gained 18.2% more than control steers and required 7.3% less feed per unit of gain. Zeranol implants at 36 mg. per head improved gain and feed efficiency by 10.9 and 5.6%.

Heifers implanted with 36 mg. DES or fed 0.4 mg. MGA daily gained at about the same rate, 7.8 and 7.0% more than controls with 5.4 and 6.5% less feed. Those implanted with zeranol gained 12.4% more than control heifers with 8.0% improvement in feed efficiency.

Control bulls gained 24.1% faster than DES-treated steers and had 15.7% lower feed requirements. While bulls were considerably heavier than steers at slaughter, they had a higher dressing percent, less fat as indicated by marbling, kidney fat and fat covering but with a larger rib eye.

The advantage for steers over heifers was greater when steers were treated with DES. The advantage over heifers implanted with DES or fed MGA amounted to about 16.5% in gain and 6.5% in feed efficiency. In the comparison between DES-treated steers and zeranol-implanted heifers, steers gained 11.7% more with 3.9% lower feed requirements. Differences in carcass characteristics between steers and heifers were small under conditions of this experiment. Heifers appeared some fatter as evidenced by marbling and grade.

Table 22. Comparative Performance of Bulls, Heifers and Steers Treated With Various Growth Stimulating Compounds

	Control		DES 36 mg.		Zeranol 36 mg.		MGA 0.4 mg./head daily	
	<u>Gain</u>	<u>Feed</u>	<u>Gain</u>	<u>Feed</u>	<u>Gain</u>	<u>Feed</u>	<u>Gain</u>	<u>Feed</u>
	%	%	%	%	%	%	%	%
Treated vs. control ^a								
Bulls	--	--	- 4.2	9.0	- 4.0	5.9	--	--
Heifers	--	--	7.8	- 5.4	12.4	- 8.0	7.0	- 6.5
Steers	--	--	18.2	- 7.3	10.9	- 5.6	--	--
Bulls vs. steers ^b	46.7	-21.8	18.8	8.1	27.0	-12.3	--	--
Bulls vs. heifers ^c	55.8	-25.5	38.5	-14.1	33.1	-14.3	--	--
Heifers vs. steers ^b	- 6.2	4.7	-16.5	6.5	- 4.8	2.2	--	--

^a Percent change from control.

^b Percent change from steers.

^c Percent change from heifers.

Experiment 10 - Feedlot Bulls and Steers Treated
With Diethylstilbestrol and Zeranol

The previous experiment showed no response by yearling feedlot bulls (about 785 lb.) to diethylstilbestrol (DES) or zeranol implants at 36 mg. per head when fed high grain finishing diets. While a pronounced response to these compounds was obtained with steers, bulls still gained faster and more efficiently than steers. The research was repeated under similar conditions with the heifer comparisons being eliminated in this experiment.

Procedures

The animals used in this experiment were 42 bulls and 64 steers. They were from Hereford cows where an A.I. program with semen from one Hereford bull was used for about 6 weeks. Yearling Hereford bulls which were half-sibs or from half-sib sires were then turned with the cows with one bull to each experimental pasture of 8 to 10 cows.

At weaning, the bulls used in the experiment were selected from the top end of the calves. Those remaining were then castrated. Bulls and steers were wintered with high roughage diets and pastured one season before being finished in the feedlot.

The bulls were allotted to 6 pens of 7 each and the steers to 6 pens of 9 each for the finishing experiment. Diets consisted of 3 lb. alfalfa-brome haylage, 2 lb. 40% protein supplement and a full feed of whole corn grain. A higher level of haylage was fed initially, and it was gradually reduced to the desired level while the grain was increased to a full feed. Feeding was one time daily in outside paved pens.

Experimental treatments were control, 36 mg. DES implant or 36 mg. zeranol implant. The implants were administered one time at the beginning of the experiment. Treatments were replicated two times for bulls and steers. The experiment was conducted over a period of 158 days.

Results

Weight gains for both bulls and steers were considerably less than obtained in the previous experiment. The lack of a response to the implant treatments by bulls is in agreement with the previous results. This experiment resulted in a smaller response by steers to DES and also a smaller difference between bulls and steers (tables 23 and 24).

Control bulls gained 0.32 lb. (13.2%) more than control steers with 4.5% lower feed requirements. Steers implanted with 36 mg. DES gained 5.3% more than control steers with 2.5% less feed. The response to DES is somewhat less than generally obtained with steers fed finishing type diets. These DES-implanted steers gained 7.0% less than bulls with 2.7% higher feed requirements.

Zeranol implants of 36 mg. resulted in the largest daily gain by steers. Improvement in rate of gain amounted to 11.5% over controls with 5.4% lower feed requirements. In this comparison, rate of gain and feed efficiency varied only slightly between steers and bulls.

Effects of implant treatments on carcass characteristics were small. Bulls rated higher on dressing percent, conformation grade and size of rib eye. Bull carcasses had less marbling, kidney fat and fat covering. The bull carcasses also were rated slightly older, darker and less firm in comparison to steer carcasses.

Summary

Weight gains, feed efficiency and carcass characteristics of yearling (about 775 lb.) feedlot bulls were not affected by implanting with 36 mg. DES or 36 mg. zeranol when fed high grain finishing diets for a period of 158 days.

Weight gains and feed efficiency of steers were improved by 36 mg. of either implant. More improvement was obtained from zeranol in weight gains (11.5%) and feed efficiency (5.4%) than with DES (5.3% for gain and 2.5% for feed).

Control bulls gained 13.2% faster than control steers and had 4.5% lower feed requirements. Steers implanted with DES gained 7.0% less than bulls and required only 2.2% more feed. When implanted with zeranol, there were only small differences between gain and feed efficiency of bulls and steers.

When bulls and steers of the same approximate age were fed the same number of days in the feedlot, bulls had heavier carcasses, higher dressing percent, less marbling, less kidney fat and thinner fat covering. However, they had a larger rib eye largely because of heavier carcasses, and the meat appeared darker and less firm in comparison to steers.

Table 23. Growth Stimulating Compounds for Bulls and Steers
November 4-April 12 - 158 Days

	Bulls			Steers		
	Control	DES 36 mg.	Zeranol 36 mg.	Control	DES 36 mg.	Zeranol 36 mg.
Number	14	14	14	18	18	18
Init. shrunk wt., lb.	773	774	774	702	705	707
Final shrunk wt., lb.	1206	1207	1210	1087	1109	1134
Avg. daily gain, lb.	2.75	2.74	2.76	2.43	2.56	2.71
Avg. daily feed, lb.						
Corn	20.02	21.18	19.99	18.33	18.77	19.48
Haylage	3.44	3.43	3.44	3.45	3.44	3.44
Supplement	2.00	2.00	2.00	2.00	2.00	2.00
Total	25.46	26.53	25.43	23.78	24.21	24.92
Feed/100 lb. gain, lb.						
Corn	731	773	724	751	737	720
Haylage	126	125	125	141	135	127
Supplement	72	72	71	91	77	73
Total	929	970	920	973	949	920
Dressing percent	62.8	63.4	62.4	61.2	61.7	62.2
Conformation ^a	22.0	22.0	21.8	20.8	20.8	20.6
Marbling ^b	4.5	4.6	4.7	5.6	5.5	5.1
Carcass grade ^a	19.6	19.3	19.5	19.6	19.9	20.2
Color ^c	4.2	4.0	4.3	4.9	4.9	5.1
Maturity ^d	22.3	22.3	22.0	23.0	22.9	22.9
Firmness ^e	4.9	4.9	5.1	5.4	5.6	5.0
Kidney fat, %	2.3	2.4	2.3	3.1	2.6	3.0
Fat thickness, in.	0.38	0.50	0.52	0.58	0.60	0.75
Rib eye area, sq. in.	13.37	13.20	13.08	12.18	12.30	11.95

^a Choice = 20; Good = 17. Graded to one-third of a grade.

^b Trace = 3; slight = 4; small = 5.

^c Higher number represents lighter meat, cherry red = 4; light cherry red = 5.

^d Higher number represents younger carcass, A+ maturity = 22, A maturity = 23.

^e Higher number represents firmer meat, slightly soft = 4, moderately firm = 5, firm = 6.

Table 24. Comparative Performance of Bulls and Steers Treated With Various Growth Stimulating Compounds

	Control		DES 36 mg.		Zeranol 36 mg.	
	Gain %	Feed %	Gain %	Feed %	Gain %	Feed %
Treated vs. control ^a						
Bulls	--	--	- 0.36	4.4	0.36	1.0
Steers	--	--	5.3	- 2.5	11.5	- 5.4
Bulls vs. steers ^b	13.2	- 4.5	7.0	2.2	1.8	--

^a Percent change from control.

^b Percent change from steers.

General Summary and Comments

The objectives of this series of experiments were to determine the effects of various hormone or hormone-like compounds on feedlot performance and carcass characteristics of bulls, steers, intact heifers and spayed heifers under various conditions of diets and stage of growth and finish. A large amount of data has been reported on the response of steers and heifers to diethylstilbestrol (DES). Additional information on this compound was not a major objective of these experiments. However, a DES treatment was considered an important part of the experiments to be used as a measure of response of other compounds tested. Since response to these hormone or hormone-like compound may be quite variable, a nontreated control was included to measure degree of response obtained from the compounds.

Synovex-H

Synovex-H (200 mg. testosterone propionate and 20 mg. estradiol benzoate) was implanted during a growing phase and during a finishing phase in three experiments with heifers. Implant treatments were administered to intact and spayed heifers in one experiment. In another experiment, implanted heifers were spayed.

Spaying reduced rate of gain and increased feed requirements. More response was obtained from DES and Synovex-H implants administered to spayed than to intact heifers. When implanted, there was essentially no difference between spayed and intact heifers or between DES and Synovex-H as measured by rate of gain, feed efficiency or carcass characteristics.

Response of heifers to Synovex-H, like that to DES, was quite variable. Average improvements in rate of gain, feed consumed and feed efficiency over controls in three experiments during a growing phase with high roughage diets amounted to 10.9, 2.3 and 5.4%, respectively. Comparable values for DES implants under similar conditions were 6.4, 1.9 and 5.7%.

When these growing phases were followed by a high grain finishing phase, results for Synovex-H and DES implants administered during this time were essentially the same. Improvements in rate of gain, feed consumed and feed efficiency amounted to approximately 8.5, 7.0 and 1.5%, respectively.

Effects of Synovex-H and DES on carcass characteristics were small and not consistent between experiments. In general, effects of the two implants appeared similar. The implants generally resulted in a larger rib eye in comparison to controls. However, this was largely a reflection of heavier carcasses because of the faster rate of gain and marketing at equal times on feed. Effects on fatness as evidenced by kidney fat, fat covering and marbling were influenced by time on the finishing diets and final weight. Synovex-H, like DES, appeared to delay rate of fat deposition. Less fat in relation to lean was more evident with Synovex-H or DES when heifers were fed to higher weights and finish. However, no difficulty was encountered in getting implanted heifers into the choice grade, but a heavier slaughter weight was required than for nonimplanted animals.

Synovex-H and DES presented problems from vaginal prolapse in some experiments. Trouble was encountered with both spayed and intact heifers with no major difference between the two compounds. This problem occurred during the finishing phase for the most part after the heifers had been reimplanted. This problem appears more troublesome with increases in time and dosage level.

Synovex-S

Synovex-S (200 mg. progesterone and 20 mg. estradiol benzoate) was implanted during a growing phase and during a finishing phase in two experiments with steers. DES-implanted steers were also used along with nonimplanted controls.

During the growing phase with high roughage diets of corn silage, steers implanted with Synovex-S gained 15.6% more than controls. Implanted steers consumed more feed and required 11.4% less feed per unit of gain. Improvements over controls for DES implants in gain and feed efficiency amounted to 13.6 and 11.9%. During the following finishing phase, DES gave 12.6% faster gain with 6.1% lower feed requirements than controls. Comparable values for Synovex-S were 9.7 and 1.5%. Since faster gains were made during the finishing period, the overall advantage for both phases was in favor of DES.

Effects of Synovex-S and DES on carcass characteristics were small under conditions of these experiments. There did not appear to be any important or consistent differences between the two implants. Implanted cattle making the faster rates of gain had a larger rib eye and frequently a greater fat covering. However, these effects were not evident when adjusted for equal carcass weights. Implanted steers rated lower on marbling. It would thus appear with steers as with heifers that Synovex-S and DES reduce the rate of fat deposition. In order to obtain equal grading as for nonimplanted cattle, those implanted with Synovex-S or DES must be fed to heavier weights.

Melengestrol Acetate (MGA)

MGA was administered to heifers at 0.35 or 0.40 mg. daily (except for 0.70 mg. daily in one finishing trial) in 4 experiments. DES implants were included as one of the treatment groups. Comparisons were made between treatments during growing and finishing in comparison to finishing only in two of the experiments for MGA and in three for DES.

Heifers fed MGA during a growing phase with high corn silage diets gained 6.6% more than controls. They consumed only slightly more feed than controls but required 5.6% less feed per unit of gain. Heifers implanted with DES gained 4.4%

more than controls and had 4.0% lower feed requirements. These growing phases represented for the most part the prepubertal stage of the heifers. Response to the progestin compound appeared at least equal to DES during this stage of growth of the heifers.

During the finishing phase when preceded by the MGA treatments, improvements in rate of gain, feed consumption and feed efficiency amounted to 6.8, 2.5 and 4.0%, respectively. Comparable values for DES-implanted cattle also implanted during the growing phase were 5.3, 2.8 and 3.4%.

MGA or DES administered only during a finishing phase resulted in slightly more improvement in feedlot performance by heifers than when administered during both growing and finishing. For MGA, there was 7.5% faster gains with 4.7% improvement in feed efficiency over controls. Heifers implanted with DES showed an improvement in gain of 8.5% with 3.9% lower feed requirements.

Effects of MGA and DES on carcass characteristics were small. Effects of DES in this group of experiments were about as discussed for Synovex-H in this summary. Carcasses of heifers fed MGA were quite similar to carcasses from control heifers. The reduction in marbling frequently associated with DES implants was not evident with MGA. There appeared to be no effect of MGA on color of the lean meat.

Problems with vaginal prolapses were encountered with both MGA and DES. The problem was greater when the compounds were administered during both growing and finishing. In view of this and the small difference obtained between the treatments during both growing and finishing in comparison to finishing only, administration other than during finishing might be questioned, especially for DES implants. Lower levels of DES such as 12 or 15 mg. during growing and 24 or 30 mg. at one time only during finishing appear to cause less trouble.

Zeranol

This compound (a resorcylic acid lactone) is marketed as an implant for growth stimulating properties for feedlot cattle and lambs. It is not a sex hormone but has been shown to result in growth stimulating properties similar to DES as implants. It was tested in several experiments for steers, heifers and bulls in a series of experiments summarized for this report.

Steers. Zeranol implants were tested with yearling steers fed finishing type diets in five experiments. Implants of 36 mg. were compared to 36 mg. implants of DES in four of the experiments. In two experiments, 72 mg. zeranol appeared more effective than 36 mg. However, this greater response from the higher level apparently has not been a consistent finding and 36 mg. is the approved level for implanting.

In five experiments, steers implanted with 36 mg. zeranol gained 11.0% more than controls and had 7.2% lower feed requirements. In four of the experiments where similar steers were implanted with 36 mg. DES, improvements in rate of gain and feed efficiency amounted to 12.6 and 7.2%. It would thus appear on basis of weight gains and feed efficiency that there is little difference in the response to 36 mg. zeranol or 36 mg. DES.

There appeared to be only small differences between carcasses of implanted steers and controls. Effects of DES were about the same as discussed for Synovex-S in this summary. Carcasses from steers implanted with zeranol varied only slightly from controls.

Heifers. In the first experiment testing zeranol implants for heifers, no comparable group receiving DES was included. Heifers implanted with 36 mg. zeranol gained at the same rate as control heifers with similar feed requirements.

In two other experiments during the finishing of yearling heifers, those implanted with zeranol gained 9.3% faster than controls with 5.8% lower feed requirements. Those implanted with DES gained at a 6.8% faster rate with 4.4% less feed. This response to DES by feedlot heifers during a finishing period is of about the order obtained throughout this series of experiments.

During a growing phase, heifer calves implanted with 36 mg. zeranol gained 9.3% more than controls while the advantage for 36 mg. DES was only 4.7%. During subsequent finishing with the implants, the advantage for zeranol over controls in rate of gain amounted to 4.2% but with no difference in feed efficiency. Comparable values for DES were 3.4 and 5.8%.

Effects of zeranol on carcass characteristics in these experiments were small. Those implanted with zeranol appeared to have slightly more marbling and kidney fat than those implanted with DES.

Problems from vaginal prolapses were encountered when heifers were implanted with DES during both growing and finishing at the 36 mg. level. Four of the 16 heifers receiving this treatment were affected. One of 16 heifers receiving 36 mg. zeranol during growing and finishing suffered from this problem. While fewer heifers received zeranol than DES in this series of experiments, the problem appears to be of much smaller magnitude with zeranol than with DES.

While the data with heifers implanted with zeranol are less than for steers, these few experiments indicate it compares quite favorably to DES in improved feedlot performance of heifers.

Bulls. Zeranol and DES implants were tested with yearling feedlot bulls in two experiments and with bull calves in one experiment. In the first experiment, the bulls averaged about 885 lb. initially. Implanting with either 36 mg. zeranol or 36 mg. DES resulted in slightly lower rates of gain (about 4.0%) than for control bulls and feed requirements were higher. In the second experiment with bulls averaging about 775 lb. initially, rate of gain was at a much lower rate than in the first experiment. There was no improvement in rate of gain or feed efficiency from 36 mg. implants of zeranol or DES.

Younger bulls were used in a third experiment (about 490 lb. initially). DFS implants were also tested at 60 mg. All bulls were reimplanted at the initial level after 4 months of the 231-day experiment. After 2 months of the experiment, there was a 7 and 10% advantage in rate of gain for zeranol and 60 mg. DES. These advantages gradually became less during the course of the experiment. At termination of the experiment, differences between implanted groups and controls were very small.

Yearling bulls implanted with either zeranol or DES had more fat covering than control bulls. There was slightly more marbling for the DES-implanted bulls

in one experiment. With the younger bulls, those implanted with zeranol or either level of DES had less marbling than nonimplanted controls. However, effects of the implant treatments on carcass characteristics should be determined with larger numbers than used in these experiments.

Zeranol at 36 mg. or DES up to 60 mg. as implants did not appear to have any appreciable effect on weight gain or feed efficiency of bulls as yearlings or calves into the feedlot.

Steers, Heifers and Bulls

Results of experiments summarized herein show that comparative performance between steers and heifers and between bulls and steers is influenced by hormone or hormone-like compounds, dietary conditions and stage of growth and finish. It therefore becomes important to specify conditions in any comparisons. While numbers of experiments and animals are small in some of the comparisons made in the experiments summarized, a table showing results of comparisons is presented (table 25).

Control steers showed an advantage of 5.5 to 7.0% in weight gain over control heifers. The steers consumed more feed resulting in only slight differences in feed requirements. Comparative performance did not vary much between a growing phase and a finishing phase. When marketed after equal days of finishing, steers and heifers graded about the same but heifers were fatter as evidenced by more marbling, kidney fat and fat covering.

Steers showed a much greater response to DES than did heifers. The advantage for steers was much greater with DES than between control steers and control heifers. The advantage for steers on basis of weight gain and feed efficiency appeared greater during a growing phase than during finishing. Heifers have a higher energy requirement and fatten faster than steers and apparently responded better to the higher energy diets than did steers. When marketed after equal days in the feedlot, heifers had more marbling and kidney fat. Heifers had a small rib eye but larger than the rib eye of steers per 100 lb. of carcass weight. DES reduced marbling and increased size of rib eye for both steers and heifers. The effect on rib eye appeared mainly an effect of increased carcass weight. These effects of DES were more pronounced for steers than for heifers.

Synovex-S resulted in slightly less improvement in gain and feed efficiency than did DES for steers. The response by heifers to Synovex-H was slightly greater than for DES. Thus, the advantage of steers over heifers with Synovex was slightly less than with DES. Differences in carcass characteristics between steers and heifers implanted with Synovex was similar as for DES.

Only two comparisons were made between steers and heifers when implanted with zeranol. Values shown in table 25 and results obtained with steers and heifers implanted with zeranol, but where no direct comparisons between steers and heifers were made, indicate that performance between steers and heifers treated with zeranol was similar as when treated with DES. Zeranol appeared to have less effect in reducing rate of fat deposition than did DES.

In only one experiment was there a direct comparison between heifers fed MGA and DES-treated steers. There appeared to be a slight advantage for MGA in other experiments where MGA and DES were tested with heifers. In this case, DES-treated steers would have slightly less advantage over MGA-treated heifers than over DES-treated ones as indicated by the one experiment shown in table 25.

Since bulls have shown no response to DES or zeranol in these experiments, only control bulls have been compared to steers in this summary. The two experiments shown were conducted with yearling bulls and yearling steers. The advantage in weight gain and feed efficiency for bulls over control steers was quite large. It was reduced considerably by use of DES for the steers. Even with DES treatment for steers, the advantage for bulls appeared to be about as great as for steers over heifers when both received one of the growth stimulating compounds. When fed for equal times, carcasses of bulls were much heavier because of a heavier initial weight and a faster rate of gain. Rib eye area was greater for bulls but not per 100 lb. of carcass weight. Bull carcasses were leaner as evidenced by less marbling, kidney fat and fat covering.

Our research with younger bulls has been rather limited. Research in progress indicates that energy level of diet and final weight and finish influences comparative performance of bulls, steers and heifers.

Table 25. Comparisons Between Bulls, Steers and Heifers Under Various Conditions

	No. of experiments	Cattle per treatment group	Percent advantage for steers		
			Weight gain	Feed consumed	Feed efficiency
<u>Control heifers vs. control steers</u>					
Growing	2	50	5.5	7.8	-0.5
Finishing	5	80	7.0	4.0	2.7
<u>DES heifers vs. DES steers</u>					
Growing	2	50	20.2	6.3	11.8
Finishing	4	65	13.2	6.0	6.5
<u>Synovex heifers vs. Synovex steers</u>					
Growing	2	50	13.8	8.6	5.4
Finishing	3	50	8.7	7.7	0.9
<u>Zeranol heifers vs. zeranol steers</u>					
Finishing	2	31	9.1	1.1	6.5
<u>MGA heifers vs. DES steers</u>					
Finishing	1	15	17.4	11.0	5.5
<u>Control bulls vs. control steers</u>					
Yearlings	2	24B	-21.7	- 9.7	-16.3
		33S			
<u>Control bulls vs. DES steers</u>					
Yearlings	2	24B	-13.1	- 4.6	-10.4
		33S			