EFFECTS OF DIETHYLSTILBESTROL IMPLANTS, ESTRADIOL-PROGESTERONE IMPLANTS, AND ORALLY ADMINISTERED STILBESTROL ON FEEDLOT PERFORMANCE, BODY CHARACTERISTICS AND CARCASS QUALITY OF FEEDER LAMBS

by

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B. S., Kansas State College
of Agriculture and Applied Science, 1952

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1957

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INTRODUCTION AND REVIEW OF LITERATURE

Profitable lamb feeding is largely dependent upon efficient feed utilization and rapid feed-lot gains. The use of hormones and hormone-like compounds has been shown to stimulate rate of gain and feed efficiency in fattening lambs. Diethylstilbestrol, administered subcutaneously or orally, has significantly increased rate of gain and feed efficiency in numerous lamb feeding experiments. Although beneficial in these respects, many investigators have reported several undesirable side effects from the subcutaneous implantation of diethylstilbestrol in feeder lambs. These include the lowering of carcass grades, losses of lambs in commercial feed-lots from prolapse of the rectum and vagina, and losses from urema.

Less work has been done with estradiol-progesterone implants though there are indications that when this preparation is implanted subcutaneously, rate of gain and feed efficiency are increased perhaps without decreasing carcass grades as much as diethylstilbestrol.

Hale et al. (1955) reported that feeding 2 mg of diethylstilbestrol per lamb daily to wether lambs increased rate of gain 32 per cent over the controls and did not affect the carcass quality. Higher rates of 3.6 mg per lamb per day failed to stimulate rate of gain as satisfactorily as did the lower level, and the higher level of administration appeared to decrease carcass quality. Treated lambs showed an enlargement of the prepuce, mammary development, and edema of the anal area. The degree of these

conditions appeared to be associated with the level of administration.

Light et al. (1956) made similar studies with Columbia feeder lambs. These lambs were fed June grass hay ad libitum and all the grain they would consume during a 20-minute feeding period (morning and night). Diethylstilbestrol was fed at the following rates per lamb per day: .5 mg, 1.0 mg, and 2.0 mg. Control lambs were included in the feeding experiment. All levels of diethylstilbestrol administration gave significant increases in rate of gain over the controls. With each increase in level administered, there was a corresponding increase in rate of gain. The use of diethylstilbestrol tended to increase the concentrate but not the hay consumption of the lambs. Treatments did not have a significant effect upon the carcass grades of the lambs included in these experiments.

Jordan et al. (1956) studied the effects of the oral administration of diethylstilbestrol at the rate of 2 mg per lamb per day on grade Columbia lambs fed concentrate roughage ratios of 35-65 per cent and 45-55 per cent. This treatment did not result in a significant increase in rate of gain, feed consumption, or feed efficiency. Carcass evaluation showed no significant effects of diethylstilbestrol administration upon carcass grades or yields.

The subcutaneous implantation of 12 mg of diethylstilbestrol has been reported by several workers to increase rate of gain, increase feed efficiency, and lower feed consumption.

Andrews et al. (1949) subcutaneously implanted lambs with 12 and 24 mg of diethylstilbestrol. Upon slaughter, the implanted

lambs had a lower average dressing percentage and their carcass grades were not as high on the average as the controls. The implanted lambs required less feed per pound of gain.

Means et al. (1953) also studied the effects of 12 and 24 mg of diethylstilbestrol. The implanted lambs had a lower average dressing percentage and their carcass grades were not as high on the average as the controls. The implanted lambs required less feed per pound of gain. Later studies of the effects of 12 and 24 mg implants gave similar results.

Perry et al. (1951) studied the implantation of diethylstilbestrol at these same levels in suckling ewe and wether lambs which were with their dams on pasture. The rate of gain was increased significantly over the controls; however, there was no difference in the response between the two levels of administration. Implanted lambs of both sexes possessed mammary development. Jordan (1953) found no growth stimulating effects when the suckling lambs were implanted from two and one-half to three months of age. General body type was not affected by treatment but an increase in the size of the mammary glands, accompanied by the presence of normal appearing milk, was evident.

O'Mary et al. (1952) conducted an experiment in which 12 mg implants were administered at the start of the experiment and repeated again if the lambs did not reach 90 pounds within 28 days. Thirteen of the 40 experimental lambs failed to reach this weight within 28 days. It was concluded that the growth stimulating action of diethylstilbestrol is well portrayed in lambs implanted only once. All lambs were fed to the same final weight of 100

pounds. The implanted lambs showed an increased rate of gain over the controls when self fed or hand fed according to the amount that they would consume. The implanted lambs required less time to reach the standard market weight, although their average carcass grade was approximately one-third of a grade lower than that of the controls, and their dressing percentages were likewise somewhat lower than the controls. The seminal vesicles and ampullae of the lambs were measured at time of slaughter. Analyses of the measurement data revealed a highly significant increase in the size of the seminal vesicles of the implanted lambs over the controls.

Clegg et al. (1955) conducted experiments in which the administration of implants of diethylstilbestrol up to 36 mg did not cause an increase in rate of gain over 12 and 15 mg implants. The results indicated a significant increase in rate of gain due to implantation with diethylstilbestrol regardless of age, sex, or dietary regime of the lambs. The lambs of younger ages responded as effectively to treatment as those which were older.

Jordan (1953) found but little difference in the growth response of lambs implanted with 6 or 12 mg of diethylstilbestrol. In both cases the lambs gained significantly faster than the controls and were more efficient in feed utilization. Carcass yields and grades were consistently lower among the implanted lambs.

Pope et al. (1950) reported that a group of black-face lambs having an average initial weight of 76 pounds and implanted with 15 mg diethylstilbestrol and then fed to 100 pounds, made more rapid gains than the controls and required significantly less feed

per pound of gain. Their carcasses had significantly less finish than the controls. The wethers of the implanted group had significantly less external fat than similarly treated ewes.

Bell et al. (1954) implanted lambs subcutaneously with 15 mg of diethylstilbestrol at the beginning of the feeding period. A second implant over 70 days of feeding did not increase the rate of gain over the single initial implant. Carcass grades were slightly lower in the implanted lambs than in the controls.

Of the 517 lambs included in the experiment, 12 were lost from prolapse of the rectum, excessive swelling and inflammation in the rectal or peritoneal regions, or symptoms similar to those resulting from urinary calculi. All of the lambs which died from these causes had received two 15 mg implants of diethylstilbestrol. Nearly all of the implanted wethers exhibited preputial swelling and showed visible swelling in the peritoneal region.

Measurements taken on parts of the urogenital systems of the implanted and control wether lambs revealed an enlargement of the seminal vesicles, bladder, ampullae, urethra, prostrate gland, and bulbo-urethral glands in the treated lambs. The most pronounced change was observed in the Cowper's glands of the implanted lambs in which, in several cases, a cul-de-sac filled with urine was present.

Wilkinson et al. (1955) implanted 200 wether lambs with 15 mg of diethylstilbestrol and controlled the feeding to produce control and implanted lambs of similar carcass weights without having a great difference in length of the feeding period or age. The implanted lambs gained faster but had lower dressing percentages

than the control lambs. Limited feeding of approximately 85 per cent of their ad libitum intake in treated lambs gave gains comparable to those of ad libitum fed control lambs. Limited feeding appeared to intensify the effects of diethylstilbestrol in retarding development of the late-maturing tissues, particularly external fat. In the lambs which were full fed for 84 days instead of 49 days, the live grade score and thickness of external fat were increased and the percentage of water in the external fat was decreased in the implanted lambs so that there were no significant differences in these characteristics between implanted and control lambs.

Several investigators have studied the effects of 12 mg of diethylstilbestrol implanted subcutaneously.

Andrews and Beeson (1953) reported that the carcasses of lambs which were implanted at this level did not grade as high as the control lambs although 28 per cent less grain per unit of live body weight gain was required by the implanted lambs in comparison with the controls. Marked mammary stimulation resulted from the implantations. Jordan et al. (1955) reported that 12 mg diethylstilbestrol implants in feeder lambs increased gains. Jordan (1950) observed that the subcutaneous implantation of a 12 mg pellet of diethylstilbestrol in four-month-old feeder lambs or seven- to eight-month-old feeder lambs significantly increased the rate of gain. The feed required per 100 pounds of live body weight gain was reduced 16 per cent in the four-month-old lambs, and the seven- to eight-month-old lambs required 21 per cent less feed per 100 pounds of gain than the controls. There was little or no

difference in the daily feed consumption of the implanted or control lambs, but the treated lambs were easier to keep on full feed than the controls. The carcass grades did not show a significant difference between the implanted and the control lambs four months of age, but the implanted lambs, seven months of age, produced carcasses grading lower than the controls.

Richard et al. (1954) implanted Columbia lambs with 12 mg of diethylstilbestrol subcutaneously. In both the growing and fattening lambs, the implantation resulted in significantly increased growth rate and more economical gains. Unlike the work previously cited, carcass grade and dressing percentages were not lowered by the implantations. Klosterman et al. (1954) reported similar results.

Andrews et al. (1953) implanted 12 mg of diethylstilbestrol in three body locations in lambs: the neck, the scrotum, and beneath the eye. They found each location equally effective in significantly increasing the rate of growth and improving feed utilization. The carcass grades of the implanted lambs tended to be inferior.

The scrotum afforded a site of implantation in wether lambs which was effective and is a part of the animal which is completely discarded at the time of slaughter.

Henneman et al. (1957) reported that lambs implanted with a combination of 250 mg of progesterone and 10 mg of estradiol exhibited more rapid and more economical gains and a higher daily feed intake than the control lambs. Analyses of slaughter data revealed that there were no significant differences in the carcass

grades between controls and progesterone-estradiol implanted lambs, although the implanted lambs tended to have lower dressing percentages and carcass grades than the controls.

Implants consisting of 100 mg of progesterone and 10 mg of estradiol compared favorably in regard to growth stimulation with the 250 mg progesterone-10 mg estradiol implants.

Hormone-treated wether lambs exhibited a condition of hypertrophy of the secondary sex organs and both wether and ewes posessed pronounced mammary development. Difficulty in pelting and obtaining the break joint was experienced at the time of slaughter in the hormone-treated lambs. The absorption of progesterone was low in comparison to other hormones. For this reason the implanting of progesterone in the ear is less efficient than implanting in the sub-maxillary region.

Jordan et al. (1951) reported that lambs implanted with a combination of estradiol and progesterone responded only to a very slight degree, as measured by rate of gain and feed efficiency. Carcass grade was not lowered by the implants.

Significant increases in rate of gain were obtained by Andrews et al. (1956) from the usage of 10 mg of estradiol and 250 mg of progesterone as an implant. Carcass grades of the implanted lambs tended to be somewhat lower.

MATERIALS AND METHODS

The data used in this study were obtained on experimental lambs which were placed on feeding trials at the Garden City Branch Agricultural Experiment Station during the fall of 1954, 1955, and

1956.

Each year the lambs included in these tests consisted of four experimental lots of 50 lambs each which had been previously allotted from initial groups which had been procured for experimental purposes.

All four of the experimental lots each year received a standard ration which consisted of whole milo grain, ground Axtell sorgo stover, cottonseed meal, and ground limestone. Salt was provided free choice. The feeding periods were over 100 days in duration.

The treatments each year were as follows:

(1) Control - no hormone

(2) Diethylstilbestrol, implanted subcutaneously

(3) Diethylstilbestrol, administered orally

(4) Synovax (progesterone and estradiol), implanted subcutaneously.

The subcutaneous implants were made under the skin below the lower jaw, and the orally-administered stilbestrol was included in the ration.

In all three years the lambs receiving diethylstilbestrol implants were implanted at the start of the feeding period with 6 mg pellets. Likewise, in all three years the lambs receiving diethylstilbestrol orally were fed diethylstilbestrol in their ration at the rate of 2 mg per head per day throughout the experimental feeding periods.

The lambs implanted with Synovex pellets were implanted at the start of the feeding periods. Individual lambs received 10 mg

of estradiol and 250 mg of progesterone in 1954; 3.5 mg of estradiol and 200 mg of progesterone in 1955; and 2.5 mg of estradiol and 200 mg of progesterone in 1956. The levels of administration were not consistent from one year to the next.

The lambs used in 1954 were obtained from Wyoming. They were mostly white-face crossbreds although some black-face crossbreds were included. Approximately one-third of these lambs were ewes and the remainder were wethers. These lambs were allotted according to sex and breed type into the four experimental lots on November 10, 1954 and were continued on feed until February 23, 1955. No lambs were lost during the feeding period.

The average initial weight of the 1954 experimental lambs was 73 pounds.

The lambs used in 1955 were predominantly fine wool wethers purchased in Wyoming. These were randomly allotted into the four experimental lots on October 22, 1955. The average initial weight of these was 80 pounds and the four lots were continued on feed until March 7, 1956. No ewes were included in these experimental groups. Three lambs were lost during the tests.

The lambs placed on the experiments in 1956 were obtained from New Mexico. These were primarily fine wools although some black-face crossbreds were included in the group. One-half of these were wethers and the other half were ewes. These were allotted according to breed type and sex on November 2, 1956 into the four experimental groups. The average initial weight of these was 72 pounds, and the four lots were continued on feed until February 11, 1957. One lamb was lost during the feeding period.

Upon the completion of the feeding periods, ten wether lambs were selected from each of the experimental lots in all three years and taken to Kansas State College, Manhattan, Kansas and slaughtered in the Meats Laboratory. These lambs were selected on the basis of average final weights at the termination of the feeding periods.

Carcass data were collected on these lambs and measurements of the reproductive tracts were made at the time of slaughter. No carcass grades were recorded on the lambs which received Synovex in 1954. The measurements taken on the reproductive tracts included the diameter of the urethra and prostate gland, the diameter of the Cowper's gland, length of the bladder, width of the bladder, width of the seminal vesicles, length of the seminal vesicles, and the diameter of the vasa deferentia. Measurements of the left- and right-paired structures were taken and averages of the two sides were used in the statistical analyses of the data. In some instances the reproductive tracts were lost during the slaughtering process and were not available for measurement.

Because of the inconsistency of treatment among the three years, the data were analyzed within each of the three years. The data included total feed-lot gains, carcass grades, and measurements of the reproductive tracts of wether lambs. These data are summarized in Tables 1, 2, and 3.

Table 1. Summary of the data relative to total gains made by the experimental lambs in 1954, 1955, and 1956.

Treatment	No. of lambs: Wethers	Ewes	Days fed	Average total gains: Wethers	Ewes	Total
		1954				
(1) Control	34	16	105	30.0	16.7	20.9
(2) Diethylstilbestrol, oral	34	16	105	36.0	29.0	33.8
(3) Diethylstilbestrol, implants	33	17	105	36.1	28.4	33.5
(4) Synovex	33	17	105	35.5	32.8	34.5
		1955				
(1) Control	48		137	32.3		
(2) Diethylstilbestrol, oral	50		137	41.8		
(3) Diethylstilbestrol, implants	50		137	37.6		
(4) Synovex	49		137	39.6		
		1956				
(1) Control	25	25	101	26.7	20.5	23.6
(2) Diethylstilbestrol, oral	24	25	101	30.7	25.9	28.3
(3) Diethylstilbestrol, implants	25	25	101	29.7	25.7	27.7
(4) Synovex	25	25	101	30.7	27.8	29.3

Table 2. Summary of the average carcass grades[1] for the ten lambs slaughtered from each of the experimental lots in 1954, 1955, and 1956.

Years	Treatments			
	Control	Diethyl-stilbestrol, oral	Diethyl-stilbestrol, implants	Synovex
1954	13.2	14.2	12.4	----[2]
1955	14.4	16.6	14.2	15.0
1956	15.4	14.2	14.0	15.2

[1] The numerical values assigned to the U.S.D.A. lamb carcass grades were as follows

	Prime	Choice	Good	Utility
High	2	8	14	20
Medium	4	10	16	22
Low	6	12	18	24

[2] None of the lambs which received Synovex in 1954 were graded in the carcass.

Table 3. Summary of the measurements on the reproductive tracts of the wether lambs slaughtered in the 1954, 1955, and 1956 experimental groups. All measurements were taken in millimeters.

Part of reproductive tract	Treatment			
	Control	Diethyl-stilbestrol: oral	Diethyl-stilbestrol: implants	Synovex
1954				
Prostate and Urethra	13.7(10)	18.3(10)	16.1(8)	21.3(10)
Cowper's gland	8.5(10)	16.3(10)	16.7(8)	19.7(10)
Bladder, length	41.6(10)	50.1(10)	47.5(8)	62.8(10)
Bladder, width	25.3(10)	29.0(10)	29.5(8)	35.8(10)
Seminal vesicle, width*	7.5(10)	13.3(10)	12.6(8)	15.5(10)
Seminal vesicle, length*	16.0(10)	27.0(10)	20.4(8)	25.6(10)
Vas deferens*	3.4(10)	5.7(10)	5.3(8)	6.6(10)
1955				
Prostate and Urethra	12.1(10)	17.7(10)	15.62(10)	18.2(10)
Cowper's gland	7.7(10)	14.9(10)	14.52(10)	15.4(10)
Bladder, length	48.9(10)	52.4(10)	54.8 (10)	56.9(10)
Bladder, width	28.3(10)	33.4(10)	33.8 (10)	31.0(10)
Seminal vesicle, width*	7.6(10)	15.0(10)	11.3 (10)	14.2(10)
Seminal vesicle, length*	17.3(10)	25.0(10)	38.9 (10)	24.7(10)
Vas deferens*	3.5(10)	6.0(10)	4.6 (10)	6.1(10)
1956				
Prostate and Urethra	11.1(7)	16.6(10)	15.6(8)	15.3(10)
Cowper's gland	9.5(2)	15.4(10)	11.7(8)	13.6(10)
Bladder, length	38.4(7)	44.2(10)	44.4(8)	40.4(10)
Bladder, width	19.6(7)	25.3(10)	23.0(8)	23.4(10)
Seminal vesicle, width*	8.0(6)	15.3(10)	12.0(8)	12.6(10)
Seminal vesicle, length*	15.3(6)	24.9(10)	18.0(8)	19.9(10)
Vas deferens*	3.0(7)	5.0(10)	4.6(8)	4.6(10)

* Averages of the paired structures of the reproductive tracts. The numbers in the parentheses designate the number of lambs from which measurements were taken.

RESULTS

The data used on the experimental lambs are presented in Tables 1, 2, and 3. These are summarized on a within year basis because of the fact that the Synovex (estradiol-progesterone) treatment varied during the three years of the experiment. Likewise all analyses were computed on a single year basis to avoid complications as a result of this inconsistency. Analyses were computed in accordance with the procedures described by Snedecor (1946).

The variances of the total gains made by the lambs in each experimental lot for all three of the years were computed. These were tested for homogeneity on a single year basis. The results of these tests are presented in Table 4.

The variances for both the wether and ewe lambs together and the wethers alone were not homogeneous for 1954. The variances for the total gains of the 1955 lambs which were all wethers were homogeneous. The variances for both the wether and the ewe lambs together for 1956 were not homogeneous. The variances for the wether lambs alone for 1956 were not homogeneous at the 5 per cent level of probability.

One assumption in conducting an analysis of variance is that the error variances are homogeneous. If the variances are not homogeneous, and significant differences are obtained, one can be certain that the differences are real; however, confidence limits for the differences are biased. In this study, analyses of variance were conducted in those instances where variances were not

Table 4. Tests for homogeneity of variances of total gains made by lambs in 1954, 1955, and 1956.

(1) 1954

(a) Wethers and ewes - corrected $x^2 = 28.70^{**}$

d.f. = 3

(b) Wethers only - corrected $x^2 = 24.59^{**}$

d.f. = 3

(2) 1955

(a) All wethers (no ewes) - corrected $x^2 = 2.03$ N.S.

d.f. = 3

(3) 1956

(a) Wethers and ewes - corrected $x^2 = 18.76^{**}$

(b) Wethers only - corrected $x^2 = 10.59^{*}$

** Significant at the 1% probability level.
* Significant at the 5% probability level.

homogeneous, although confidence limits were not computed.

Analyses of variance of the total gains made by the experimental lambs were computed on a single year basis. In 1954 and 1956 both wether and ewe lambs were used and, as indicated in Table 1, there was an unequality of subclass number of sexes in both of these years. In 1955 only wether lambs were used.

The analyses of variance for the total gains made by the lambs in 1954 and 1956 were made on the basis of disproportionate

subclass numbers by the method of fitting constants, assuming the sex x treatments interaction negligible. The total gains made by the lambs in 1955 were analyzed by using the ordinary analysis of variance.

The analyses of variance for the total gains made by the lambs in 1954 are presented in Table 5; that for the 1955 lambs, in Table 6; and that for the 1956 lambs, in Table 7.

The mean differences for treatments and sexes are highly significant for the 1954 experimental lambs. The F value for the sex x treatments source of variance was not significant. The least significant difference for a treatment mean (4.48 pounds) indicated that the lambs which received diethylstilbestrol orally and as subcutaneous implants and the lambs which received the Synovex implants made highly significant greater total gains than the control lambs.

The mean differences for treatments are highly significant for the 1955 experimental lambs. The least significant difference for a treatment mean (3.56 pounds) indicated that the lambs which received diethylstilbestrol both orally and subcutaneously and the lambs which received Synovex implants made highly significant greater total gains than the control lambs.

The mean differences for treatments are not significant for the 1956 experimental lambs. The mean differences for sexes are highly significant. The F value for the sex x treatments source of variance was not significant.

Table 5a. Analysis of variance for the total gains made by the lambs in 1954. Analysis computed on the basis of disproportionate subclass numbers by the method of fitting constants, assuming the sex x treatments interaction negligible.

Treatment		Sex: Wethers	Sex: Ewes	sk	sx	$\bar{x}r$	b + $\bar{x}$
Control	k	34	16	50	1286.0		24.3625
	$\frac{k}{sk}$	.68	.32			25.7200	
Diethyl-stilbestrol, oral	k	34	16	50	1687.9		32.3925
	$\frac{k}{sk}$	.68	.32			33.7580	
Diethyl-stilbestrol, implants	k	33	17	50	1673.3		33.2522
	$\frac{k}{sk}$	.66	.34			33.4600	
Synovex	k	33	17	50	1723.3		32.2522
	$\frac{k}{sk}$	.66	.34			34.4600	
Sk		134	66	200			
Sx		4599.3	1771.2		6370.5		
a		3.793	-3.793				

Table 5b. Preliminary analysis of variance.

Source of variance	d.f.	SS	MS
Subclasses	7	5710.7898	
Sexes	1	2478.6077)	5012.2203
Treatments	3	2533.6126)	
Individuals	192	24738.4290	128.8460

Table 5c. Completed analysis of variance.

Source of variance	d.f.	SS	MS
Sexes	1	2503.7433	2503.7433
Treatments	3	2558.7482	852.9161
Sex x treatment	3		224.4797
Individuals	192		128.8460

Sex F = 19.4321**
Treatments F = 6.6197**
Sex x treatments F = 1.7422 MS

** Significant at the 1% probability level.

Least significant difference for a treatment mean = 4.48 pounds.

Table 6. Analysis of variance for the total gains made by the lambs in 1955.

Source of variance	d.f.	SS	MS
Between treatments	3	2414.5919	804.8640
Within treatments	193	15371.9205	79.6473
Total	196	17786.5124	

Treatment F = 10.105**

** Significant at the 1% probability level.

Least significant difference for a treatment mean = 3.56 pounds.

Table 7a. Analysis of variance for the total gains made by the lambs in 1956. Analysis computed on the basis of disproportionate subclass numbers by the method of fitting constants, assuming the sex x treatments interaction negligible.

Treatment	Sex: Wethers	Sex: Ewes	sk	sx	$\bar{x}_r$	b + $\bar{x}$
Control						
k	25	25	50	1179.3		23.58600
$\frac{k}{sk}$	.50	.50			23.58600	
Diethylstilbestrol, oral						
k	24	25	49	1385.5		28.227394
$\frac{k}{sk}$	.49	.51			28.27551	
Diethylstilbestrol, implants						
k	25	25	50	1386.2		27.72400
$\frac{k}{sk}$	.50	.50			27.72400	
Synovex						
k	25	25	50	1464.6		29.29200
$\frac{k}{sk}$	.50	.50			29.29200	
Sk	99	100	199			
Sx	2916.6	2499.0		5415.6		
a	2.241	-2.241				

Table 7b. Preliminary analysis of variance.

Source of variance	d.f.	SS	MS
Subclasses	7	2013.9080	
Sexes	1	994.2943)	1936.5361
Treatments	3	942.2418)	
Individuals	191	25075.5127	131.2854

Table 7c. Completed analysis of variance.

Source of variance	d.f.	SS	MS
Sexes	1	868.9958	868.9958
Treatments	3	816.9433	272.3144
Sex x treatments	3		67.5568
Individuals	191		131.2854

Sex F = 6.6191**
Treatment F = 2.0742 NS
Sex x treatments F = .5146 NS

** Significant at the 1% probability level.

Analyses of variance for the carcass grades of the ten lambs slaughtered from each experimental lot are presented in Table 8. The mean differences in carcass grades for treatments were significant only in the 1954 lambs.

The analyses of variance for the reproductive tract measurements obtained on the lambs which were slaughtered are presented in Tables 9, 10, 11, 12, 13, 14, and 15.

The mean differences in the measurements of the diameters of the urethra and prostate glands are highly significant for all three years during which the experiment was conducted. The mean differences in the diameters of the Cowper's glands are also highly significant for all three years. The mean differences in the lengths of the bladder are highly significant for the 1954 lambs but are not significant in the other two years. The mean differences in the widths of the bladder are highly significant for the 1954 and 1956 lambs but are not significant for the 1955 lambs. The mean differences for the widths of the seminal vesicles are highly significant for the 1955 and 1956 lambs and are significant for the 1954 lambs. The mean differences for both the lengths of the seminal vesicles and diameters of the vas deferens are highly significant for all three years.

Table 8. Analyses of variance for the carcass grades of the ten lambs slaughtered from the 1954, 1955, and 1956 experimental lots.

Source of variance	Analysis of variance d.f.	SS	MS
	1954*		
Between treatments	2	16.2667	8.1334
Within treatments	27	57.6000	2.1333
Total	29	73.8667	
	Treatment F = 3.8126**		
	1955		
Between treatments	3	35.5	11.833
Within treatments	36	180.4	5.011
Total	39	215.9	
	Treatment F = 2.36 NS		
	1956		
Between treatments	3	14.8	4.933
Within treatments	36	229.6	6.378
Total	39	244.4	
	Treatment F = 1.0 NS		

* No carcass grades were obtained on the lambs receiving Synovex.

** Significant at the 5% probability level.

Table 9. Analyses of variance for the diameters of the urethra and prostate glands.

Source of variance	Analysis of variance		
	d.f.	SS	MS
	1954		
Between treatments	3	310.163	103.876
Within treatments	34	211.9	6.232
Total	37	522.0632	
	Treatment F = 16.67*		
	1955		
Between treatments	3	230.48	76.826
Within treatments	36	246.00	6.833
Total	39	476.48	
	Treatment F = 11.24*		
	1956		
Between treatments	3	133.15	44.383
Within treatments	31	179.6	5.794
Total	34	312.75	
	Treatment F = 7.66*		

* Significant at the 1% probability level.

Table 10. Analyses of variance for the diameter of the Cowper's glands.

Source of variance	Analysis of variance d.f.	SS	MS
	1954		
Between treatments	3	668.9708	222.990
Within treatments	34	397.8	11.700
Total	37	1066.8158	
	Treatment F = 19.05**		
	1955		
Between treatments	3	219.23	73.077
Within treatments	36	120.52	3.348
Total	39	339.75	
	Treatment F = 21.827**		
	1956		
Between treatments	3	92.31	30.770
Within treatments	26	151.89	5.842
Total	29	244.20	
	Treatment F = 5.267**		

** Significant at the 1% probability level.

Table 11. Analyses of variance for the length of bladders.

Source of variance	Analysis of variance		
	d.f.	SS	MS
	1954		
Between treatments	3	2377.6527	792.551
Within treatments	34	1070.9000	31.497
Total	37	3448.5527	
	Treatment F = 25.163**		
	1955		
Between treatments	3	353.3	117.767
Within treatments	36	3828.2	106.339
Total	39	4181.5	
	Treatment F = 1.07 NS		
	1956		
Between treatments	3	208.3	69.433
Within treatments	31	1337.7	43.152
Total	34	1546.0	
	Treatment F = 1.609 NS		

** Significant at the 1% probability level.

Table 12. Analyses of variance for the width of bladders.

Source of variance	Analysis of variance		
	d.f.	SS	MS
	1954		
Between treatments	3	569.0632	189.688
Within treatments	34	571.7	16.815
Total	37	1140.7632	
	Treatment F = 11.281**		
	1955		
Between treatments	3	192.9	64.300
Within treatments	36	2020.5	56.125
Total	39	2213.4	
	Treatment F = 1.146 NS		
	1956		
Between treatments	3	135.95	45.317
Within treatments	31	226.8	7.316
Total	34	362.75	
	Treatment F = 6.194**		

** Significant at the 1% probability level.

Table 13. Analyses of variance for the width of seminal vesicles.

Source of variance	Analysis of variance d.f.	SS	MS
	1954		
Between treatments	3	142.82	47.607
Within treatments	34	448.77	13.199
Total	37	591.59	
	Treatment F = 3.607*		
	1955		
Between treatments	3	342.06	114.020
Within treatments	36	156.54	4.348
Total	39	498.60	
	Treatment F = 26.224**		
	1956		
Between treatments	3	232.729	77.576
Within treatments	30	239.925	7.576
Total	33	472.654	
	Treatment F = 9.699**		

* Significant at the 5% probability level.
** Significant at the 1% probability level.

Table 14. Analyses of variance for the length of seminal vesicles.

Source of variance	Analysis of variance d.f.	SS	MS
	1954		
Between treatments	3	730.1	243.367
Within treatments	34	372.3	10.95
Total	37	1102.4	
	Treatment F = 22.225**		
	1955		
Between treatments	3	334.31	111.437
Within treatments	36	420.35	11.676
Total	39	754.66	
	Treatment F = 9.544**		
	1956		
Between treatments	3	441.72	147.24
Within treatments	30	309.41	10.314
Total	33	751.13	
	Treatment F = 14.276**		

** Significant at the 1% probability level.

Table 15. Analyses of variance for the diameter of the vasa deferentia.

Source of variance	Analysis of variance d.f.	SS	MS
	1954		
Between treatments	3	54.08	18.027
Within treatments	34	12.79	.3762
Total	37	66.87	
	Treatment F = 47.919**		
	1955		
Between treatments	3	46.24	15.413
Within treatments	36	22.46	.6239
Total	39	68.70	
	Treatment F = 24.704**		
	1956		
Between treatments	3	17.93	5.977
Within treatments	31	19.12	.5975
Total	34	37.05	
	Treatment F = 10.003**		

** Significant at the 1% probability level.

SUMMARY AND CONCLUSIONS

Four lots of 50 lambs each were placed on experimental feeding trials at the Garden City Branch Agricultural Experiment Station in 1954, 1955, and 1956 to compare the feed-lot performance of feeder lambs receiving diethylstilbestrol orally or as subcutaneous implants and Synovex implants with lambs which received no hormone or hormone-like materials. All four experimental lots were placed on a standard ration each year.

The lambs used in 1954 and 1955 were obtained in Wyoming, and those in 1956, New Mexico. Two-thirds of the 1954 lambs were wethers and one-third were ewes. All of the 1955 lambs were wethers and those used in 1956 were one-half wethers and one-half ewes. There was some variation in the breed types represented in the various initial groups from which the experimental lots were allotted. Each year the lambs were allotted according to sex and breed type and were assigned experimental lots at random. The length of the feeding periods for 1954, 1955, and 1956 were 105 days, 137 days, and 101 days, respectively. Records of the total live body weight gains made by all individual lambs were recorded. The limited number of death losses which occurred during the experiments did not appear to be associated with the experimental treatments.

Upon the completion of the feeding trials, ten wether lambs from each experimental lot were taken to the Meats Laboratory at Kansas State College for slaughter. This procedure was followed each year and U.S.D.A. carcass grades were obtained on all groups

except for the one which received Synovex in 1954. Reproductive tracts were obtained from most of these lambs at the time of slaughter and measurement data on the diameters of the urethra and prostate gland, diameters of the Cowper's gland, lengths of bladder, widths of bladder, widths of seminal vesicles, lengths of seminal vesicles, and diameters of vasa deferentia were recorded.

Data relative to total live body weight gains, carcass grades, and measurements of the reproductive tracts were analyzed to study the effects of experimental treatments upon them.

The data were analyzed on a single year basis because of the fact that the Synovex treatment varied among three of the years during which the experiments were conducted.

The variances within each year were tested for homogeneity. The variances for the total gains were not homogeneous for the 1954 and 1956 experimental groups. One assumption in conducting an analysis of variance is that the error variances are homogeneous. In the event that the variances are not homogeneous, and significant differences are obtained, it is certain the differences are real; however, confidence limits for the differences are biased. Analyses of variance were conducted on the total gain data for all three of the years; however, confidence limits were not computed.

The mean differences in total gains for treatments were highly significant for the two years, 1954 and 1955. They were not significant for 1956. The least significant differences for treatment means indicated that the lambs which received diethylstilbestrol either orally or subcutaneously, and the lambs which received Synovex implants made highly significant greater total

gains than the control lambs in both 1954 and 1955. The mean difference in total gains for 1956 followed the same general trend as in the other two years, however, these were not significant probably because of the marked variation in total gains among individual lambs within treatments.

In the two years, 1954 and 1955, both wether and ewe lambs were used. The sex x treatments interaction was not significant, indicating that the response of both sexes was consistent among the four experimental treatments. The wether lambs made highly significant greater total gains than ewe lambs in both 1954 and 1956.

The carcass grade data were analyzed for each year. The mean differences were significant only in the 1954 lambs. The data were limited and likewise the slaughter groups were highly selected. Because of these factors it was impossible to conclude whether or not the treatments affected the carcass grades of the experimental lots. It should be noted that the average carcass grade of the lambs which received diethylstilbestrol implants was the highest of all the treatment means in all three years.

The mean differences in the measurements of the diameters of the urethra and prostate glands, the diameters of the Cowper's glands, widths of the seminal vesicles, lengths of the seminal vesicles, and diameters of the vasa deferentia are either highly significant or significant in all three years. The mean differences in the lengths of the bladder were highly significant in 1954 but were not significant in the other two years. The mean differences in the widths of the bladder were highly significant in 1954

and 1956 but not significant in 1955.

In conclusion it may be stated that the use of diethylstilbestrol, both orally and as subcutaneous implants, and the use of Synovex implants, at the levels of administration employed in these experiments, increased the total feed-lot gains made by feed lambs over lambs which received no similar treatments. It may also be stated that these same materials increased the size of the accessory reproductive organs in the wethers. Conclusions could not be made in reference to the influence of diethylstilbestrol and Synovex administration upon carcass grades except that no specific consistent effects were detected. Ewe lambs displayed an increased growth response similar to wethers as the result of diethylstilbestrol and Synovex administration. The wethers made highly significant greater total gains than the ewes during both years that ewes were included in the experiment.

ACKNOWLEDGMENTS

The writer wishes to express his sincere thanks to his major instructor, Walter H. Smith, for his assistance and guidance throughout the course of study and in preparing this thesis.

Thanks and appreciation are also expressed to Dr. T. Donald Bell, for assembling the data prior to this year and for his counseling.

Thanks are due to David L. Mackintosh for providing the carcass data and his assistance in securing other carcass information.

Appreciation is expressed to Dr. Rufus Cox, Head of the Animal Husbandry Department, for his interest and guidance during the past year.

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EFFECTS OF DIETHYLSTILBESTROL IMPLANTS, ESTRADIOL-PROGESTERONE IMPLANTS, AND ORALLY ADMINISTERED STILBESTROL ON FEEDLOT PERFORMANCE, BODY CHARACTERISTICS AND CARCASS QUALITY OF FEEDER LAMBS

by

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B. S., Kansas State College
of Agriculture and Applied Science, 1952

AN ABSTRACT OF A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1957

The use of hormones and hormone-like compounds has been shown to stimulate rate of gain and feed efficiency of fattening lambs.

To study the effects of diethylstilbestrol administered orally or as subcutaneous implants and Synovex (estradiol-progesterone) subcutaneous implants, four lots of 50 lambs each were placed on experimental feeding trials at the Garden City Branch Agricultural Experiment Station in 1954, 1955, and 1956. All four experimental lots were placed on a standard ration each year.

The lambs used in 1954 and 1955 were obtained in Wyoming, and those in 1956, New Mexico.

Upon the completion of the experiments each year, 10 lambs from each lot were taken to the Meats Laboratory at Kansas State College for slaughter. This procedure was followed each year and U.S.D.A. carcass grades were obtained on all groups except for the one which received Synovex in 1954. Measurements were made at the time of slaughter of the urethra and prostate gland, Cowper's gland, bladder, seminal vesicles, and vasa deferentia.

Data relative to total live body weight gains, carcass grades, and reproductive tract measurements were analyzed to study the effects of experimental treatments upon them. Analyses of the data were done on a single year basis because the Synovex treatment varied from year to year in the experiments.

The variances within each year were tested for homogeneity and were found non-homogeneous for the 1954 and 1956 experimental groups.

The mean differences in total gains for treatments were highly significant for the two years, 1954 and 1955. They were not

significant for 1956. The least significant differences for treatment means indicated that the lambs administered hormones made highly significant greater total gains than the control lambs in both 1954 and 1955. The mean differences in total gains for 1956 followed the same general trend as in the other two years, however, these were not significant, probably because of the marked variation in total gains among individual lambs within treatments.

In 1954 and 1956, both wether and ewe lambs were used. The sex x treatments interaction was not significant, indicating that the response of both sexes was consistent among the four experimental treatments. The wether lambs made highly significant greater total gains than ewe lambs in both 1954 and 1956.

The carcass data were analyzed for each year. The mean differences were significant only in the 1954 lambs. Because the data were limited, it could not be concluded whether or not the treatments affected the carcass grades of the experimental lots. However, the average carcass grade of the lambs which received diethylstilbestrol implants was the highest of all the treatment means in all three years.

Mean differences in the measurements of the diameters of the urethra and prostate and Cowper's glands and vasa differentia and widths of the seminal vesicles are highly significant or significant in all three years. The mean differences in the lengths of the bladder were highly significant in 1954 and 1956 but not significant in 1955.

In conclusion, it may be stated that the use of diethylstilbestrol, administered orally and subcutaneously, and the use of

Synovex implants, at the levels of administration employed in these experiments, increased the total feed-lot gains made by feeder lambs over the control lambs. These same materials significantly increased the size of the accessory reproductive organs in the wethers. No conclusions could be made in reference to the influence of these materials upon the carcass grades except that no specific consistent effects were detected. The wether lambs made highly significant greater total gains than the ewes during both years that ewes were included in the experiments.