

## Applied Animal Science . . .

Dr. Gordon Stewart, Editor

### EFFECT OF FEEDING DIETHYLSTILBESTROL ON GROWTH AND BREEDING EFFICIENCY OF DAIRY HEIFERS<sup>1</sup>

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Diethylstilbestrol<sup>3</sup> (DES) has been shown to be a growth stimulant for fattening beef cattle (2, 9), and is now widely used in the beef industry. Live-stock men are warned against feeding DES to animals kept for breeding purposes due to the undesirable effects on the reproductive tract and mammary gland observed in various studies (3, 4, 5, 6, 7) when DES was either injected or implanted in cattle. Only a small amount of data actually exists concerning the effect of feeding low levels of DES to either beef or dairy heifers. Reuber (11) reported an increase in the growth rate of beef heifers when levels of 10 and 20 mg of DES were fed daily without an impairment of their reproductive performance. When implanting 24 mg pellets of DES in beef heifers, Williams and Baker (15) obtained a small increase in the growth rate without lowering the reproductive performance.

A study (12) in which dairy heifers were fed 10 mg of DES daily while on a high roughage ration indicated a small although not significant increase in growth rate. They observed two barren heifers in this group. When feeding DES to lactating dairy cattle at the rate of 5, 10, and 20 mg daily, Browning *et al.* (1) observed an increase in abortions in the cows fed 20 mg daily.

This study was undertaken to observe the effect of feeding 10 mg of DES daily for a period of 210 days on the growth rate, reproductive tract, and mammary gland of growing dairy heifers.

<sup>1</sup>Data taken from a thesis submitted by the junior author to the Graduate School, Southern Illinois University, in partial fulfillment of the requirements for the Master of Science degree, June, 1961.

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<sup>3</sup>Supplied by Eli Lilly and Company, Indianapolis, Indiana.

#### EXPERIMENTAL PROCEDURE

Fourteen dairy heifers ranging in age from 4 to 14 months were divided in two similar groups. The heifers were paired on the basis of their breed, age, and size. One member of each pair was then randomly assigned to the control and the experimental groups. The data noted at the onset of the experiment are presented in Table 1.

The heifers were housed in a loose housing barn and fed alfalfa-grass hay, salt, and mineral *ad libitum*. Each animal was individually fed 4 lb. of a grain mixture daily. The grain mixture contained 48% shelled corn, 25% oats, 10% wheat bran, 15% soybean meal, (44% protein), 1% steamed bone meal, and 1% trace mineralized salt. The grain mixture contained 15.6% crude protein and 74.3% TDN (8). The grain fed to the experimental group contained 2.5 mg of DES per pound. The total ration was calculated to meet the upper limits of the Morrison feeding requirements for growing heifers (8) and to provide the experimental animals with 10 mg of DES daily. This level of DES was chosen because of the success obtained with this amount when fed to beef cattle (2,9).

The weight and the height at withers of each animal was determined at the onset of the experiment and at monthly intervals for the remainder of the 210 day trial. The mammary glands were measured monthly by the procedure described by Swett (14). The condition of the reproductive tract was observed by rectal palpations, and photographs were taken of the external genitalia at the onset and the close of the experiment.

A record was kept of each estrus, and the heifers were bred on the third ob-

served estrus which was preceded by two normal estrous cycles. A normal estrous cycle was defined as one that ranged in length from 17 to 23 days. Older heifers which were of breeding age at the start of the experiment were bred at the first observed estrus. All breeding was done by artificial insemination.

#### RESULTS AND DISCUSSION

The heifers which were fed 10 mg of DES daily for 210 days had an average daily gain of 1.7 lbs. as compared to the controls which gained 1.51 lbs. daily as shown in Table 1. This difference was greater than that observed by Rumery and Ward (12). Even though the growth rate of the DES-fed heifers was consistently greater throughout the trial, the differences were not statistically significant as determined by the analysis of covariance (13). The rate of gain was 13% greater for the experimentals and compared favorably with the 15% increase observed by Burroughs (2) and the 10% increase which Reuber (11) found when DES was added to the ration of fattening beef heifers. At the onset of the study the controls were found to range in weight from 93 to 124% of the Ragsdale growth standards (10) for an average of 108% as shown in Table 1. The experimentals ranged in size from 87 to 106% of the standard for an average of 97%. The increased rate of gain of the heifers receiving the DES is reflected in the final weight comparison to the Ragsdale standards which was 110% for both groups.

The data on the height at withers which are presented in Table 1 is another indication of the increase in size of DES-fed animals over the controls. The average increase in height at withers was 13.6 cm for the controls

and 16.4 cm for the experimentals. These differences were found not to be statistically significant. As can be seen in Table 1, only one DES-fed heifer (G-19) failed to increase in height over her mate (G-10) who was above normal in height and weight. G-19 was a slow eater and became ill two times during the trial which possibly inhibited her growth.

A comparison of the photographs taken at the onset of the experiment and at the close of the study and palpation of the mammary gland to determine the size showed similar development of the glands in both groups. At the close of the trial, the average width of the mammary glands of the control and DES-fed groups was 9.7 and 8.9 cm, respectively. The average length of the mammary tissue was 17.3 and 17.6 cm, respectively. Even though G-12 was found sucking E-12 on a number of occasions, it did not cause abnormal development of the gland, but it may be the cause of a severe case of mastitis which E-12 developed shortly after calving. It would appear that the undesirable development of the mammary gland when DES is administered by implantation (3) is not a problem when it is administered orally.

Examination of the external genitalia and palpation of the reproductive tracts of both groups did not reveal abnormal development except in one DES-fed heifer. These observations are in general agreement with the findings of Burroughs et al (2) and Reuber (11) but are different from the findings of those studies where stilbestrol was implanted (3, 4). The uterus of H-11 appeared to be infantile while the ovaries were palpated as normal. Although this may not have been caused by the stilbestrol feeding it is similar to a condition observed by Williams et al. (15) when DES was implanted in beef heifers.

The average length of the estrous cycle was 19.0 and 19.3 days for the control and experimental groups respectively as is shown in Table 2. The intensity and the duration of the estrus appeared normal. It was not until G-19 was apparently pregnant for a short period that she began to show signs of estrus every few days. Upon withdrawal of the DES from the feed of G-19, she returned to normal estrous cycles and was bred and conceived on first service. This is the same heifer which failed to grow as rapidly as the others in the study. The tendency to have short estrous cycles has also been reported by those implanting DES in heifers (3, 5, 6, 7, 15).

In Table 2, it may be noted that the DES-fed heifers required 1.8 services per calf as compared to 1.4 services in

TABLE 1  
Age, weight, growth, and percentage of growth standard of heifers in experiment

Herd No.*	Age mo.	Initial		Closing		Av. Da. Gain lb.	Change in hgt. at withers-cm.
		Weight lb.	Standard %**	Weight lb.	Standard %**		
<b>CONTROL</b>							
E-3	14	800	113	1155	121	1.69	8.5
E-21	13	657	93	957	100	1.43	9.0
E-9	12	661	105	1015	116	1.69	12.0
G-12	10	411	96	655	103	1.16	9.5
G-10	7	379	124	670	120	1.39	20.5
H-10	4	296	122	666	112	1.76	17.5
H-9	5	316	106	622	98	1.46	18.5
Avg.	9.3	503	108	820	110	1.51	13.6
<b>STILBESTROL-FED</b>							
E-12	13	717	102	1089	114	1.77	10.5
E-22	12	709	106	1086	118	1.80	12.0
E-28	10	478	87	819	101	1.62	17.5
G-16	10	409	96	802	126	1.87	17.0
G-19	6	264	98	544	104	1.33	10.5
H-11	4	230	95	633	107	1.92	25.0
E-29	5	284	96	623	99	1.61	22.0
Avg.	8.6	441	97	799	110	1.70	16.4

\* Herd numbers with letters E or H are Holsteins; those with the letter G are Guernseys.

\*\* Percentage of growth standard (10)

TABLE 2  
Reproductive performance and present status of heifers used in the experiment

Herd No.	Av. length of estrous cycle da.	No. of services	Age at calving Mo.	Present status of heifer*
<b>CONTROL</b>				
E-3	—**	1	25	In herd
E-21	20	2	25	In herd
E-9	—**	1	23	In herd
G-12	21	2	24	In herd
G-10	21	2	21	Sold-Low production
H-10	15	1	20	Sold-Failed to settle
H-9	18	1	20	In herd
Avg.	19.0	1.4	23	
<b>STILBESTROL-FED</b>				
E-12	18	1	24	Sold-Mastitis
E-22	20	1	24	Sold-Cystic ovary
E-28	18	2	23	In herd
G-16	20	3	26	Sold-Failed to settle
G-19	19	3	26	In herd
H-11	20	***	—	Sold as heifer
E-29	20	1	19	Sold-Aborted
Avg.	19.3	1.8	24	

\* Reasons for disposal during the first lactation is presented.

\*\* Bred and settled on first observed estrus during heat.

\*\*\* Failed to conceive due to infantile uterus.

the control group. These figures do not include the number of services made on H-11 before it was determined that her uterus was infantile.

After this initial 210 day feeding trial, the DES feeding was continued to the experimental animals until one month prior to parturition. These heifers appeared normal throughout the gestation period, calved normally and produced healthy calves. To observe what effect the DES feeding may have

had on the later performance, data were collected on their breeding performance during the first lactation. Note Table 2 for a summary of the performance of both groups.

Although the difference in rate of gain was not significant in this trial nor in the study by Rumery and Ward (12), both studies indicate an increased rate of gain in DES-fed heifers. It may be concluded that no marked differences may be expected in reproduc-

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ferences may be expected in reproduction performance during the DES-feeding period but reproductive problems may arise later which is indicated by the lower reproductive performance of these animals during their first lactation.

#### SUMMARY

A 210 day feeding trial was conducted in which seven heifers were fed 10 mg of diethylstilbestrol (DES) daily. An equal number of heifers served as controls and were fed the same ration minus the DES. During the feeding period the DES-fed heifers had an average daily gain of 1.70 lbs. and the controls 1.51 lbs. This difference was not statistically significant. There was no observable difference in mammary gland development or the external genitalia. One infantile uterus was found in a DES-fed heifer, and irregular estrous cycles were observed in another. The conception rate of the controls was 1.4 services per calf, and of the DES-fed group 1.8 services per calf. Later observations on these heifers show high incidence of poor reproductive performance among the DES-fed heifers when they were bred during their first lactation.

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## Applied Plant Science . . .

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### CAN TEXAS PRODUCE SUGAR BEETS PROFITABLY

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Both farmers and Experiment Station personnel are endeavoring to determine the feasibility of producing sugar beets in various sections of Texas. With the U. S. Market closed to one of the principal sugar producing countries which formerly supplied the needed sugar, the need for a new source of supply has increased. Only slightly more than one-third of the sugar consumed in the U. S. is now produced in this country.

There are many factors involved in success-

ful sugar beet growing. Farnsworth (4) suggested (a) the lack of plant nutrient supply, (b) deterioration of soil structure and (c) disease as being the three chief limiting factors, any one of which would depress sugar beet yields. The same author also states (4) (5) that the air capacity in the soil for optimum sugar beet growth ranges from 12 to 22 per cent. Both Cook (3) and Doneen (3) imply that soil moisture is not limiting, so long as some readily available water is in the soil.

Ulrich (9) and Gregg (6) reported that a nitrogen deficiency produced beets with a high sugar percentage, while an excess of nitrogen resulted in beets with a low sugar percentage.

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