Feeding and Breeding Tests

With Sheep, Swine, and Beef Cattle

Progress Report, 1960-61

Reported at 35th Annual

Livestock Feeder's Day

April 15, 1961

Department of Animal Husbandry and Cooperating Departments, Oklahoma Agricultural Experiment Station, Division of Agriculture, Oklahoma State University, Stillwater, and United States Department of Agriculture.

Miscellaneous Publication MP-64

June, 1961

OKLAHOMA STATE UNIVERSITY
SCIENCE SERVING AGRICULTURE
1891
EXPERIMENT STATION

and
USDA

CONTENTS

Trace-Mineralized Salt and Chlortetracycline (Aureomycin) for Yearling Steers Grazing Native Grass

A. B. Nelson and L. R. Kuhlman

Experiments conducted in several areas of Oklahoma have indicated that under most grazing conditions the provision of supplemental trace minerals has not resulted in increased gains of cattle. Also, certain antibiotics have not been of value in rations of wintering cattle or creep-fed calves. Experiments in certain other states have resulted in increased gains when an antibiotic was mixed with salt and made available to grazing cattle. During the summer of 1960 the value of trace-mineralized salt and chlortetracycline (Aureomycin) was studied with yearling steers grazing native grass.

Procedure

Seventy-two yearling grade Hereford steers were divided into four lots of 18 head on May 31, 1960. They were allowed to graze in the native grass pastures at the Lake Blackwell experimental range area. The four treatments were as follows:

Lot 1. Salt and dicalcium phosphate (2 lbs. : 1 lb.)

Lot 2. Same as Lot 1 plus 94 mg. of chlortetracycline hydrochloride per head daily

Lot 3. Trace-mineralized salt and dicalcium phosphate (2 : 1 ratio)

Lot 4. Same as Lot 3 plus 94 mg. of chlortetracycline hydrochloride per head daily

Morton trace mineralized salt[1] was available in the mixture fed to Lots 3 and 4. The manufacturer's guaranteed analysis was, in percent: salt, not less than 97 nor more than 99; manganese, 0.20; iron, 0.16; copper, 0.03; cobalt, 0.10; iodine, 0.007; and zinc, 0.005.

In Lots 2 and 4, chlortetracycline (Aureomycin)[2] was supplied as Aurofac 25 which was mixed with the salt and dicalcium phosphate in such proportions that an average of 94 mg. of Aureomycin was furnished per head daily.

Results

A summary of weight gains and mineral and antibiotic consumption is given in Table 1. The average 116-day gains were nearly the same

[1] Salt furnished by Morton Salt Co., Chicago.

for all groups. The average gain for those fed plain salt (Lots 1 and 2) was 4 lbs. less than the gain of those fed trace mineralized salt (Lots 3 and 4), and those fed Aureomycin (Lots 2 and 4) gained 3 lbs. less than those not fed Aureomycin. Therefore, the provision of neither trace minerals nor Aureomycin was of any apparent value for increasing gains of yearling steers grazing native grass at the Lake Blackwell experimental range area.

Table 1.—Trace Mineralized Salt and Aureomycin for Grazing Yearling Beef Steers on Native Grass.[1]

Lot number Salt[2] Aureomycin[3]	1 Plain --	2 Plain 94 mg.	3 T.M. --	4 T.M. 94 mg.
Number of steers per lot	18	18	18	18
Average weight per steer (lbs.)				
May 31, 1960	522	525	525	524
September 24	699	692	699	703
Gain (116 days)	177	167	174	179
Average daily intake				
Salt, gms.	20	20	14	20
Dicalcium phosphate, gms.	10	10	7	10
Aureomycin, mgs.	--	94	--	94

[1]Allowed to graze in native grass pastures (Bluestem and associated grasses) which provided about 6 acres per steer.

[2]The salt fed in Lots 1 and 2 was Morton Farm and Ranch clear salt. Morton Trace Mineralized Salt was fed in Lots 3 and 4. In all lots two pounds of salt was mixed with one pound of dicalcium phosphate and fed ad libitum in the pastures.

[3]Aureomycin furnished as Aurofac 25. Mixture available in Lots 2 and 4 was 6900 gms. salt, 3,450 gms. dicalcium phosphate, and 625 gms. Aurofac 25 (55 mg. chlortetracycline per gm.) in the early part of the test. The quantity of Aurofac 25 was 580 gms. in the later part of the test.

Lysine Supplementation of Rations for Sheep

L. H. Harbers and A. D. Tillman

It is well accepted that the first limiting amino acid in the various sorghum grains is lysine. It is also common knowledge that expeller processed cottonseed meal also is deficient in this amino acid, thus a ration composed primarily of the sorghum grains and expeller meal is deficient in lysine. When this ration is fed to non-ruminants, supplemental lysine causes a significant increase in growth. Many workers have reported, however, that lysine supplementation of ruminant rations in which all the ration nitrogen was supplied by urea was not effective in stimulating gains, indicating that ruminant microflora are able to synthesize lysine readily. Recently, workers at Purdue University and Pfizer's Agricultural Research Laboratory reported that lysine supplementation of cattle fattening rations caused increase growth rate, thereby reopening the question of rate of lysine synthesis in the rumen. Thus it appeared desirable to determine the effect of added lysine upon gains of lambs fed fattening-type ration composed primarily of sorghum grain and expeller cottonseed meal.

Experimental Procedure

The composition of the basal ration (ration 1) is shown in Table 1. The experimental ration (ration 2) contained in addition, 445 mg. of L-lysine monohydrochloride per lb. of feed.

Twenty lambs weighing on the average 76 lbs. were divided on the basis of weight into two balanced groups and individually-fed the rations *ad libitum*. The animals were weighed and feed consumption data tabulated at 14-day intervals during the 45-day trial. A 16-hour shrink period during which time, feed, and water were not available preceded the initial and final weights.

Table 1.—Composition of the Basal Ration

Ingredient	Percent
Cottonseed hulls	10.00
Alfalfa meal	10.00
Molasses	5.00
Ground milo	69.30
Cottonseed meal	5.00
Urea	0.20
Sodium Chloride	0.25
Calcium Carbonate	0.20
Vitamins A and D*	0.05

*Quadrex, Nopco Chemical Co., Harrison, New Jersey. Supplied 20,000 I.U. of Vitamin A and 2,500 USP units of Vitamin D_2 per gram.

Results and Discussion

The results are summarized in Table 2 and it is evident that lysine supplementation did not affect rate or efficiency of gain. These results support the earlier results from Cornell University, in which they found that the rumen fluid from sheep fed urea as the sole source of ration nitrogen contained high levels of lysine, indicating that the rumen microflora were able to synthesize lysine quite readily if non-protein nitrogen and a readily available carbohydrate source was provided in the ration. Later results by Oklahoma and Iowa workers indicate that lysine supplementation was of no benefit when fed to sheep receiving a purified diet in which the ration nitrogen was supplied by urea.

These results are not in accord with results reported by the Purdue steers receiving 10 grams of lysine per day in a low protein ration did not perform any better than the control animals; however, when lysine was added to a ration containing a higher level of protein, gains were significantly improved by the same level of lysine. These workers interpreted their results to indicate that a lysine deficiency in ruminants became limiting only if rapid gains were being obtained. Because the sheep in the present experiment were gaining at a fast rate, our results do not support that idea; however, there were differences in ration composition that might have a bearing. Their rations contained ground corn instead of ground milo. Also there were minor differences in the composition of the rations. Basically, it is felt that these differences are not important in the rationalization of the overall problem; however, differences in experimental design may be important. As their animals were group-fed in a single pen for each treatment, the possibilities of pen location affecting grains were much greater than in our experiment in which the animals were individually-fed.

Table 2.—The Effect of Supplementary Lysine Upon Weight Gains and Feed Efficiency by Sheep

Rations	1 Basal Ration	2 Basal Plus Lysine
Total gain	234.00	230.00
Days on feed	45.00	45.00
Gain per animal	23.40	23.00
Average daily gain	0.52	0.51
Feed per 100 lb. gain	701.00	704.00

The Purdue workers reported that lysine supplementation improved gains when urea was included in fattening rations of steers. Again ration differences make a direct comparison impossible; however, it must be pointed out that they obtained increased gains in more than one group of cattle. The major grain in their trial was corn. Even though the preponderance of basic research results would indicate that lysine supplementation does not benefit ruminant animals, there still remains some doubt. Further carefully controlled feeding experiments will be necessary to answer this question.

Summary

Supplementation of a high energy ration containing sorghum grains and expeller processed cottonseed meal with 445 mg. of lysine per lb. of feed did not affect the gains or feed efficiency of lambs in a 45-day

Creep-Feeding Fall Calves

L. R. Kuhlman, A. B. Nelson, and W. D. Campbell

Creep-feeding is a method of increasing the gain and finish of suckling beef calves. In any feeding system increased feed consumption usually results in increased gain. One of the goals in creep-feeding, therefore, is to provide a palatable feed that will be consumed in large quantities as a supplement to the pasture grass and the milk produced by the dam. Creep-feeding is practiced with the expectation of increased profit.

Careful consideration must be given to many factors when deciding whether or not to creep-feed. These factors include the age and milk-producing ability of the dam, season of calving, availability of pasture, the kind of creep-feed, and the market outlook.

One would expect creep-feeding to be of greater importance with fall calves than with spring calves. The fall-calving cow nurses her calf during the winter when the dry forage of the native grass pastures is of lowest nutritive value. Unless the level of supplemental winter feeding is very high, the milk production of the cow would be expected to be lower than if green grass were available. Providing a palatable creep-feed during this season would greatly increase the nutrient intake of the calf.

In a four-year study with mature fall-calving cows (Okla. Agr. Exp. Sta. MP-55:72) creep-feeding increased the calf gains an average of 70 lbs. When the cows were fed an average of 1.5 lbs. of cottonseed meal per head daily, creep-feeding increased gains 87 lbs. Creep-fed calves from similar cows fed on a higher plane (2.5 lbs. cottonseed meal and 3 lbs. of grain) were 52 lbs. heavier at weaning than those which were not-creep-fed. Creep-feeding was not profitable in either comparison but the data indicated that creep-feeding only until spring grass becomes available may be a satisfactory practice.

Procedure

On December 18, 1959, 108 calves born in October and November were divided into 6 lots of 18 head. The calves remained with their dams, high quality grade Hereford cows, in native grass pastures. The cows were fed an average of 2.5 lbs. of pelleted cottonseed meal per head daily.

The calves in Lot 1 were not creep-fed. Those in Lots 2 and 3 were creep-fed a mixture consisting of 55 percent steam rolled milo, 30 percent whole oats, 10 percent cottonseed meal and 5 percent cane molasses. In Lot 2 the calves were creep-fed until weaning in July, while those supplemental feeding of the cows was discontinued because adequate green grass was available. The calves in Lot 4 were fed the above mixture after grinding and pelleting. The calves in Lot 5 received alfalfa hay and those in Lot 6 received pelleted alfalfa hay. Creep-feeding was also discontinued on April 30 for Lots 4, 5, and 6.

Results

In the period from December 18 until April 30 the creep-fed calves in Lots 2 and 3 (see Table 1) gained an average of 167 lbs. (162 and 172 lbs.) This is 44 lbs. more than the 123 lbs. gained by the non-creep-fed calves in Lot 1. The consumption of creep-feed during the winter was 300 and 239 lbs. for Lots 2 and 3, respectively. The average creep-feed consumption of 270 lbs. of the mixture in these two lots cost $6.75.

In the 86-day period from April 30 until weaning (July 25) the calves receiving the creep mixture (Lot 2) gained 194 lbs. and those not creep-fed (Lot 1) gained 159 lbs. The total increase in gain (winter and summer) due to creep-feeding was 74 lbs. (Lots 1 vs. 2). The total creep-feed consumption was 922 lbs. The creep-fed calves were fatter and

Table 1.—Creep-Feeding Fall Calves

Lot Number Creep-Feed	1 None	2 Mixture[1] Until Weaning	3 Mixture[1] Until Spring	4 Pelleted Mixture Until Spring	5 Alfalfa[2] Hay Until Spring	6 Pelleted Alfalfa Hay Until Spring
Number of calves[3]	17	18	17	18	17	17
Average weight per calf, lbs.						
Initial (Dec. 18, 1959)	139	148	136	126	130	134
Spring (Apr. 30, 1960)	262	310	308	276	277	292
Weaning (July 25, 1960)	421	504	454	427	428	434
Gain to spring (134 Days)	123	162	172	150	147	158
Gain April to July (86 Days)	159	194	146	151	151	142
Total gain (220 Days)	282	356	318	301	298	300
Creep-feed per calf						
Pounds	---	922	239	194	308	224
Cost[4]	---	$23.05	$ 5.98	$ 5.04	$ 3.08	$ 3.36
Dollar Values						
Value of total gain[5]	70.50	87.22	19.50	75.25	74.50	75.00
Value of gain minus creep-feed cost	70.50	64.17	73.52	70.21	71.42	71.64

[1] Creep-fed a mixture of 55 percent steam rolled milo, 30 percent whole oats, 10 percent cottonseed meal and 5 percent cane molasses.

[2] Baled alfalfa hay fed in an open bunk.

[3] Originally there were 18 calves per lot. A total of four calves were removed from the experiment due to death of cow or sickness of the calf. The causes were apparently not related to the creep-feeding treatments.

[4] Creep-feed mixture cost $2.50 per 100 lbs. Alfalfa hay cost $20.00 per ton. Pelleted alfalfa hay cost $30.00 per ton. The pelleted mixture cost $2.60 per 100 lbs.

[5] [illegible] value for lot 2 was $24.50 per 100 lbs., while the selling price for the other lots was

heavier and sold at $24.50 per 100 lbs., which was $.50 per 100 lbs. less than the selling price of the other calves. The value of the increased gain due to creep-feeding was not as great as the cost of the creep-feed, therefore, creep-feeding reduced profits.

Although the calves in Lots 2 and 3 received identical treatment until April 30, one group gained 162 lbs. and the other gained 172 lbs. to that date. Creep-feeding was stopped in Lot 3 on this date. In May, June, and July these non-creep-fed calves gained 146 lbs. This was 48 lbs. less than the 194 lbs. gained by the calves creep-fed until weaning. The difference in total gain was 38 lbs. (356 vs. 318 lbs.); however, the cost of the increased gain was greater than the increased value of the calf. Creep-feeding only until spring increased returns more than $9 when compared to creep-feeding until weaning.

Different creep-feeds were compared in Lots 3, 4, 5, and 6. In these lots creep-feeding was stopped on April 30 when adequate green grass was available. The calves fed the mixture until spring (Lot 3) gained 22, 25, and 14 lbs. more than those fed the pelleted mixture, alfalfa hay and pelleted alfalfa hay, respectively. Pelleting the mixture decreased feed consumption, winter gain and profit. Summer gains after creep-feeding were nearly equal in these four groups.

Gains of calves creep-fed alfalfa hay and pelleted alfalfa hay were nearly equal and were nearly the same as gains of those fed the pelleted mix but slightly less than gains of those fed the mixture in the meal form. The calves consumed less alfalfa pellets than long alfalfa hay. The return for these two groups was nearly equal.

Summary

Creep-feeding a concentrate mixture until spring increased gains an average of 44 lbs. The winter gains of calves creep-fed a pelleted mixture, long alfalfa hay and pelleted alfalfa were nearly equal and were an average of 29 lbs. greater than the gain of calves not creep-fed. During the summer, creep-feeding the mixture increased gains 35 lbs. Summer gains of calves creep-fed only until spring were intermediate between those creep-fed until weaning and those not creep-fed. The value of the calf gain minus the cost of the creep-feed was lowest when the calves were creep-fed until weaning, greatest when calves were creep-fed the mixture until spring and intermediate and nearly equal in all other groups (not creep-fed, pelleted mix until spring, alfalfa hay until spring, pelleted alfalfa until spring.)

Winter Feeding Studies With Beef Heifers

Don Pinney, L. S. Pope,
Kenneth Urban, and Dwight Stephens

Supplemental winter feed is the largest "cash cost" to the cow-calf producer. The wintering period is the most critical time in the nutrition of range beef cattle. Obviously, the amount of winter supplement fed may be of great economic significance in terms of growth, and reproductive performance of the female and net returns from the cow herd.

Studies on the optimum amount of supplemental winter feed for developing replacement heifers or wintering beef cows on the range have been in progress at the Oklahoma Station since 1948. To date, about 520 head of cows and heifers have been wintered at different feeding levels. The original group of cows have completed 13 consecutive winters on low, moderate, or high levels of supplemental feed.

In other phases of the study, weaner heifers have been fed varying amounts of supplement so as to produce Low, Moderate, or High rates of winter gain and their growth and reproductive performance have been followed through at least three calf crops. All studies have been conducted under range conditions, similar to the way most cow-calf operations are handled in the Southwest. The yearly results of previous studies are available in Feeder's Day Reports since 1948.

The data from the original group of cows have shown that limited amounts of supplemental winter feed (1 lb. of cottonseed meal per head daily) on dry, weathered native grass pastures resulted in nearly an 8 percent increase in calf crop weaned and almost twice the number of cows surviving to 13 years of age when compared to high levels of supplemental winter feed (2½ lbs. of cottonseed meal plus 3 lbs. of oats per head daily). The cost of producing 100 lbs. of calf was nearly twice as much for the high level as compared to the low level ($7.21 vs. $13.86). Greater fertility and less disease loss were experienced among cows fed limited amounts of supplemental feed. Beef cows so fed from weaning until maturity required a longer time to recover from the low feed level imposed each winter than better fed cows (approximately 1½ years longer to reach maturity). Low level feeding also delayed calving, although weaning weights were only slightly affected.

As a follow-up to this long-term trial, a series of repetitions of the project were started in 1954 using weanling heifer calves out of the original cows and others in the Experiment Station herd. These heifers were alloted to treatment each year according to body weight, age, sire, productivity of dam, and dam's winter feeding level. They were wintered each year at Low, Medium or High levels. Three groups on each treatment were continued until the cows weaned their third calves. In contrast to the older cows, winter performance was reduced by the Low level treatment. A reduction in percent calf crop and weaning weights was observed. Feeding the young, developing heifers at the High level in these experiments hastened time of calving and increased weaning weights, but the additional feed cost more than offset the advantage obtained. The Medium level proved most profitable—considering percent calf crop and weaning weight.

More recently, additional trials have been initiated in which widely different planes of winter nutrition have been studied. In the two trials summarized for this report, weaner beef heifers were started on test at approximately eight months of age, and continued through successive winters on Low, Moderate, High, or Very High feeding levels. Summarized in this report are the growth and reproductive data for the first and second calf crops. Further trials are now underway in which alternate levels of winter feeding (Low the first winter, High the second, etc.) are being studied, but these have not progressed to the point where conclusions can be drawn.

Experimental Procedures

Sixty weaner Hereford heifer calves were selected each fall in 1958 and 1959. They were divided into four groups of 15 each on the basis of dam's productivity, sire, age, shrunk weight, and grade. The heifers started on test weighing approximately 457 lbs. each in early November, and were fed according to the following programs each winter:

Lot 1 (Low)—No gain during the first winter as weaner calves, and fed to lose at least 20 percent of body weight during subsequent winters as bred females.

Lot 2 (Medium)—Gains of 0.5 lbs. per head daily the first winter as weanling calves, and a loss of less than 10 percent of fall weight during succeeding winters.

Lot 3 (High)—Gains of approximately 1.0 lb. per head daily during the first winter, with no weight loss as bred females.

Lot 4 (Very High)—Full-fed a 50 percent concentrate mixture to gain as rapidly as possible, both as weanling calves and bred females.

All heifers started on test between seven and nine months of age. The daily supplement of cottonseed meal and ground milo required to produce the necessary gain was adjusted frequently throughout the winter. Low level heifers were confined to a small trap and fed wheat straw for four to six weeks during the early winter each year to insure the desired weight loss. On the average it required less than 1.0 lb. of cottonseed meal per head daily to achieve the Low level of wintering, 2 lbs. cottonseed meal and 1 lb. ground milo on the Medium level, and 2 lbs. cottonseed meal and 5 lbs. ground milo at the High level. Very High level heifers were placed on self-feeders with a 50 percent concentrate mixture each winter and consumed from 25 to 35 lbs. of the mixture per head daily. A mineral mixture of two parts salt and one part bone meal was available, free choice to all lots throughout the year.

The wintering period extended from early November to mid-April, each year. Following this, the heifers were divided into uniform groups according to level of wintering and previous productivity, and mated to bulls produced in the purebred herd at the Ft. Reno station. The bulls were turned in during the last of April or first week in May; consequently, the heifers calved the following year in February and March. All heifers were bred to calve first as two-year-olds. The calves were castrated at six to eight weeks of age and weaned off when approximately 210 days old in early October. Females were then regrouped into their wintering levels and subjected to the same winter treatment each succeeding year. It was felt that calving the heifers as two-year-olds would impose a greater nutritional strain on the growing and developing female.

Results

All heifers have now weaned one calf, while those in the first group have weaned their second calves. Consequently, the results for the first and second winters for both repetitions up to the fall of 1960 have been summarized in Table 1.

Table 1.—Weight Changes to 1½ Years of Age for Beef Heifers Wintered at Four Levels (Summary of Two Trials)

Lot Number Level of Winter Supplement	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	30	30	30	30
No. of heifers remaining at 1½ yrs. of age[1]	29	30	29	30
Average weights (lbs.)				
Fall—initial weight	474	472	474	472
Winter gain	—13	97	145	274
Spring (1 yr. old)	461	569	619	746
Summer gain	321	260	239	146
Fall weight (1½ yrs.)	782	829	858	892
Average total feed, pasture, and mineral cost per heifer to 1½ yrs.	$20.68	$33.14	$45.17	$57.78

[1]One heifer died in lot 1 at a year of age with an impacted abomasum and one in lot 3 shortly after weaning for unknown reasons.

One heifer was lost in each of the Low and High levels, before 1½ years of age. During the first winter, weaner calves on the Low level lost 13 lbs., whereas Very High heifers gained 274 lbs. High level heifers gained slightly less than planned. Thus at the end of the first winter, there was an average difference of 285 lbs. in weight between these two groups wintered at widely different levels, with other treatments intermediate in body weight.

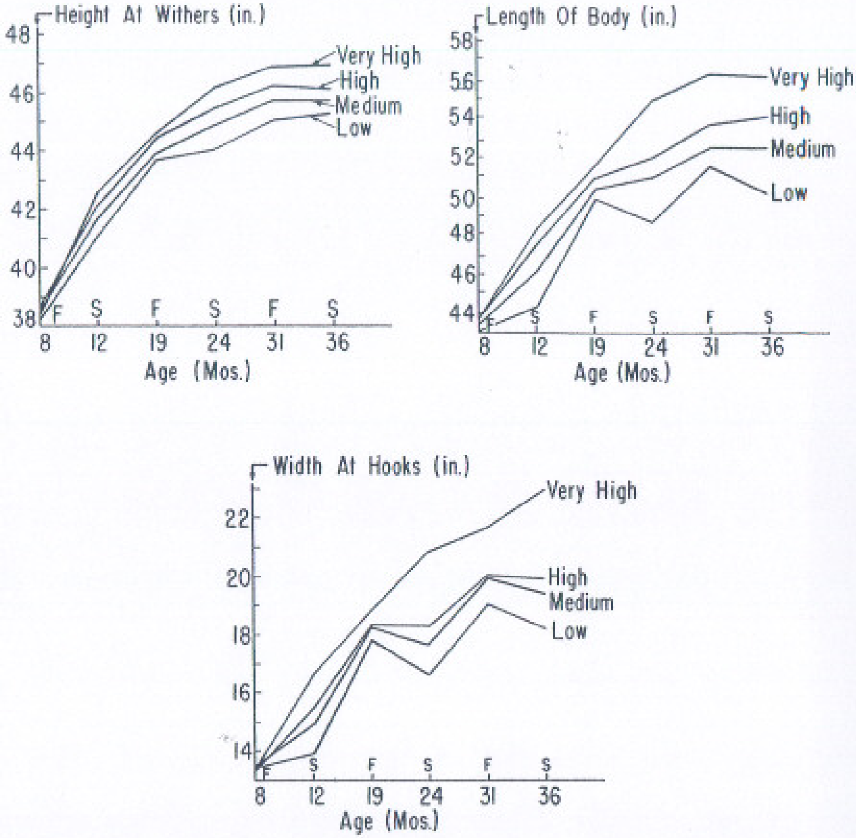


Figure 1.—Body measurement changes before and after winter feeding at four levels of winter supplement, (inches). Abbreviations F and S denote fall and spring.

Summer gains were, of course, inversely related to winter performance. At the end of the following summer, when the heifers were approximately 1½ years of age, there was only 110 lbs. difference in the weight between Low and Very High levels; other treatments were intermediate to these two extremes. Again, as in numerous studies, this demonstrates the tremendous recovery capacity of the Low level heifers when on good-quality native grass the following summer.

Fully as important as the weight changes in the heifers were skeletal changes in terms of height, width and length of body. An attempt was made to study the development of these heifers before and after winter treatment by photographs as well as by actual physical measurements. The most important measurements are shown in Figure 1. It will be noted that there were only small differences in height at the end of the first winter period, whereas the later developing parts of the body (width and length) showed more extreme differences due to treatment. Both width and length seemed to be markedly affected by body fatness. Heart girth was the measurement most affected by treatment, but this would be expected since heart girth varies directly with body size and condition.

It will be seen, however, that at the end of the following summer, there was considerable recovery in these measurements for Low as compared to Very High treatments. There seemed to be little advantage at 19 months of age in terms of skeletal size, from wintering heifers at above the medium level, but differences tended to become greater each year so that at three years of age, significant differences were found for all of these measurements.

First Calving Performance

The two-year-old calving performance of beef heifers in which both repetitions are summarized is presented in Table 2. It will be noted that Low level heifers lost 212 lbs. from fall to spring, which is approximately 27 percent of their body weight. In contrast, Very High level heifers gained 180 lbs., or approximately 20 percent of their body weight from fall to spring, with other groups again intermediate. Thus, at the end of the second winter, there was a difference of 502 lbs. in body weight after calving between Low and Very High level heifers. As had been observed in the past, there was an inverse relationship between winter and summer gains with the Low and Medium level heifers tending to catch up in body weight. Nevertheless, the following fall after weaning their first calves, there was still a difference of 219 lbs. between the extreme groups, but only 109 lbs. between the Low and Highs, and a 63 lbs. average between Medium and High levels.

In summarizing the calving performance, the number of calves born or weaned varied only slightly among the treatments, except for the Very High level where more calves were lost at birth. Two heifers were lost from this group due to calving difficulties. More Medium level heifers calved than in any other lot. Percent calf crop weaned was only slightly different between Low, Medium or High level heifers, while Very High level heifers weaned only a 63 percent calf crop at first calving.

It is significant that in all levels of winter experiments to date, there has been a delayed calving of Low and Medium level heifers as compared to Highs, probably due to failure to show estrus when first exposed. In the two trials summarized in Table 2, a difference of 18 days in average calving date between the Low and High levels existed. Surprisingly, difficulty at first calving was not increased by Low levels of wintering. High and Very High level heifers appeared to have more difficulty, probably because of heavier birth weights and more internal fat in the heifers.

Table 2.—Two-Year-Old Calving Performance of Beef Heifers Wintered at Four Levels (Summary of Two Trials)

Lot number Level of wintering	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	30	30	30	30
No. of heifers remaining at 2½ yrs. of age[1]	29	29	29	28
Average weights (lbs.)				
Fall (1½ yrs. of age)	782	829	859	892
Winter gain	—212	—117	—70	180
Spring (2 yrs. of age)	570	712	788	1072
Summer gain	278	199	169	—5
Fall (2½ yrs. of age)	848	911	957	1067
Calving Performance				
No. of heifers bred to calve	29	30	29	30
No. of calves born	27	30	27	27
No. of calves weaned	24	24	24	19
Percent calf crop	82.8	80.0	82.8	63.3
Average calving date	3/20	3/14	3/2	3/2
Average difficulty at calving score[2]	1.74	1.59	2.15	2.68
Average calf weights (lbs., corrected for sex)				
At birth	59.0	68.2	72.4	69.8
At weaning	332	394	432	407
Financial Results (Average)				
Total feed, pasture, and mineral cost per heifer (1½ to 2½ yrs.)	$25.44	$36.37	$48.83	$105.02
Return above cow cost per heifer (1½ to 2½ yrs.)[3]	48.78	45.58	44.17	—38.04
Return above cow cost per heifer (initial to 2½ yrs.)	28.10	12.44	—1.00	—95.82

[1]Three heifers were lost due to difficulty at first calving; one in Lot 2 and two in Lot 4.

[2]A numerical score was used to evaluate difficulty at calving. A score of 1 indicates cow calved normally without assistance, and 7 indicates extreme difficulty in which both cow and calf were lost.

[3]Assumes a value of $27.00 per cwt. for the "Low's" calves and $26.00 for all other calves. Feed costs for 1½ to 2½ years only, are included; also costs for cows not raising calves are included in this evaluation.

Birth weights have been consistently depressed by Low levels of winter nutrition. In the two trials summarized in Table 2, there was nearly 13 lbs. difference between Low and High calves at birth. Medium and Very High level heifers gave birth to calves of about the same size, and the Very High level of nutrition depressed fetal development as compared to the High level.

Weaning weights were severely affected by the Low feeding regime imposed during the two successive winters before the calves were born. Low level heifers weaned calves weighing 100 lbs. less than those on a High level, with Medium level heifers intermediate. It is also important to note that the Very High level heifers tended to wean calves only slightly heavier than those wintered at the Medium level.

Considering feed costs of the heifers to 2½ years and value of calves weaned, Low and Medium level heifers gave greater returns than High level heifers. Least profitable, of course, were those wintered on Very High level due to the tremendous feed cost. In earlier studies at this station, the Medium level group has produced slightly more calves than the Lows, with heavier weaning weights, and has therefore returned more profit. However, in these trials, percent calf crop weaned for Low and Medium treatments were essentially the same.

Table 3.—Three-Year-Old Calving Performance of Beef Heifers Wintered at Four Levels (Summary of One Trial)

Lot Number Level of Wintering	1 Low	2 Med.	3 High	4 Very High
No. of heifers at start of experiment	15	15	15	15
No. of cows remaining at 3½ yrs. of age	15	15	14	15
Average weights (lbs.)				
Fall (2½ yrs. of age)	828	891	908	1050
Winter gain	—161	—87	—47	132
Spring (3 yrs. of age)	667	804	861	1182
Summer gain	291	229	208	—15
Fall (3½ yrs. of age)	958	1033	1069	1167
Calving Performance				
No. of cows bred to calve	15	15	14	15
No. of calves born	13	14	12	13
No. of calves weaned	12	12	10	13
Percent calf crop	80.0	80.0	71.4	86.7
Average calving date	3/27	3/13	3/1	3/6
Av. calf weights (lbs., corrected for sex)				
At birth	70.9	77.2	81.3	74.5
At weaning	390	458	470	444
Financial Results (Average)				
Total feed, pasture, and mineral cost per cow (2½ to 3½ yrs.)	$28.50	$37.78	$53.87	$118.91
Return above cow cost per cow[1]	55.74	57.48	33.38	—18.83
Return above cow cost from initial to 3½ yrs. of age[2]	83.84	69.92	32.38	—114.65

[1]Assumes a value of $27.00 per cwt. for the "Low's" calves and $26.00 for all other calves. Feed costs for 2½ to 3½ years only are included; costs for cows not raising calves are also included in this evaluation.
[2]Takes into account complete feed costs from weaning to 3½ years.

Second Calving Performance

Summarized in Table 3 is the three-year-old calving performance of one of the two groups. Again noticeable is the relationship of level of winter feed to winter weight loss and summer gain. At the end of 3½ years of age, there was, however, a difference of 209 lbs. in body weight between the average of Low and Very High level females. Smaller differences in body weight can be seen between Medium, High, and Very High level females. Consequently, it appears that at 3½ years of age, heifers wintered on the Medium level will approach the size of those wintered at higher planes, whereas Low level heifers are stunted somewhat in development. Surprisingly, with their second calves, heifers wintered at the Very High level were the most productive in terms of calf crop percentage. Again, the same delayed calving tendency for Low and Medium levels is apparent, as is also the lowered birth weight of their calves.

Weaning weights were again significantly affected, with Low level heifers weaning 80 lbs. lighter calves than those on the High level, and 68 lbs. lighter calves than the Mediums. It is very interesting to note that heifers on the Very High level weaned smaller calves than the Medium level cows. Return above cow cost for the year again favored Low to Medium treatments.

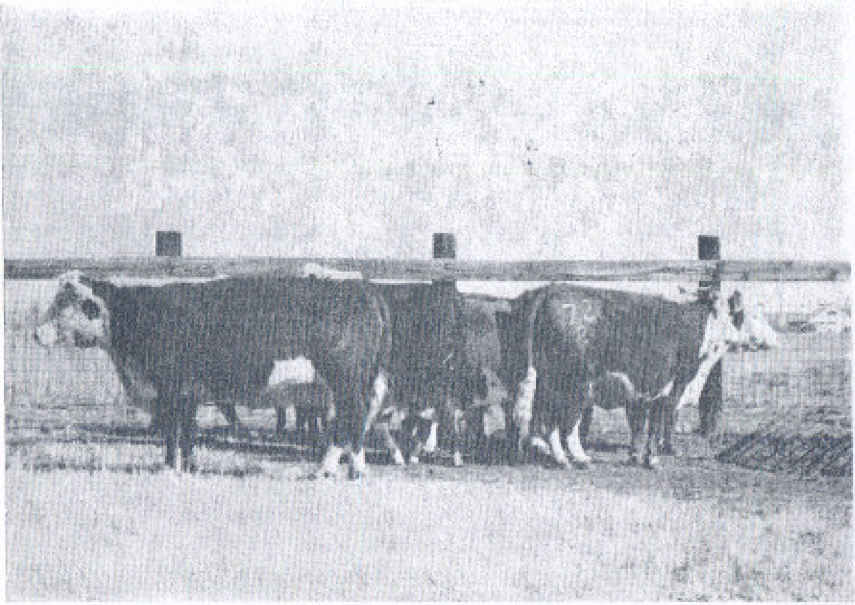
Table 4 summarizes milk production data obtained during the summer of 1960 by separating the calves from the cows and weighing the calves before and after nursing, twice daily, at six week intervals. These results parallel the weaning weight data, in that Low level females appear to be the poorest producers, while Medium or High level females were highest in production. However, two-year-old heifers wintered at the Very High level turned out to be poorer producers than those wintered on Medium or High treatments, corresponding to the differences in weaning weights observed. The high estimates found for the three-year-old Very High level females do not agree with the depressed weaning weights found in this treatment. This might be expected, however, since data was collected from only four heifers per lot.

Table 4.—Twenty-Four Hour Milk Production Estimates for Beef Females Wintered at Four Levels, 1960 (lbs.)

		Level of Wintering			
Age	Date	Low	Med.	High	Very High
Two-Year-Olds	May 24	8.81	13.88	13.31	7.56
	July 18	5.75	7.06	8.88	6.00
	Aug. 29	5.44	8.00	8.06	4.62
Three-Year-Olds	May 24	6.44	9.25	8.25	8.88
	July 18	7.69	9.00	8.88	10.88
	Aug. 29	6.25	8.19	6.31	5.69

Summary

As a part of extensive studies of the effect of plane of nutrition during the winter on growth and productivity of beef females, results of two repetitions with heifers carried to 2½ and 3½ years of age have

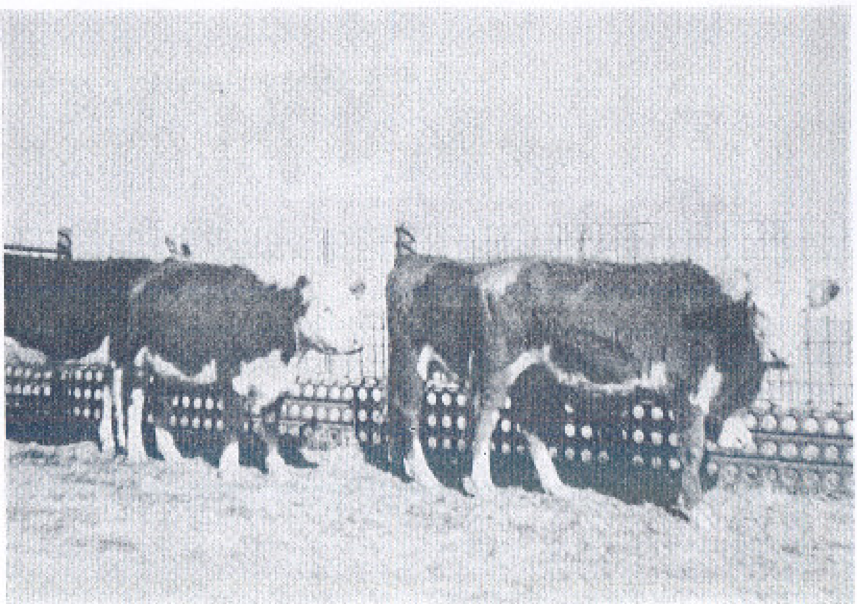


"A" Very High Level

"B" High Level

Figure 2.—Three-year-old beef heifers near the end of the third consecutive winter on different feeding levels. Heifers wintered each year since calves at the Very High level (A) received a fattening type ration for maximum winter gains. High level heifers (B) and Moderates (C) were fed to make good growth and body develop-

"C" Moderates



"D" Low Level

ment. Low level heifers (D) were restricted so that they gained little as calves, and lost nearly 20% of their fall weight as bred heifers. Average body weights of heifers of the four groups shown are 1192, 1020, 928, and 781 pounds, respectively.

been summarized. These results indicate that the cow-calf producer may operate between two "danger areas" in the nutrition of the beef female. Too low a plane of nutrition results in delayed growth and body development, retarded calving date, smaller and weaker calves at birth, poor milking heifers, and calves that wean off decidedly lighter than those from better wintered dams.

In contrast, the Very High level treatment, as practiced here, demonstrates the effect of excessive feed levels in hastening maturity and in causing large stores of body fat. Excessive feed levels may also have a depressing effect on growth of the fetus and milk production. With the tremendous costs of production involved in carrying females at the Very High level, this system is not to be recommended, although it is frequently practiced in farm herds and purebred establishments.

A Medium to High level appears to be most desirable in terms of growth and development of the female and size of her calf at weaning. Of these two, the Medium level which allows the beef heifer to gain approximately 0.5 lb. per head daily the first winter as a weaner calf, and lose less than 10 percent of her body weight each subsequent winter has seemed most desirable and profitable in previous trials due to the advantage in calf crop percentage, weaning weights, and development of the female. In the trials summarized in this paper, however, the Low level resulted in no decrease in calf crop percentage and thus these females were more profitable because of the much lower cost of wintering.

It must be remembered, however, that all cattle had year-round access to approximately six acres of high-quality native grass which permitted remarkable recovery during the summer.

Studies With Sheep Receiving Compounds Having Estrogen Activity

L. H. Harbers and Allen D. Tillman

Stilbestrol and hexestrol have been widely used in feeding ruminants because of increased gains and feed efficiencies when these compounds are given orally or implanted subcutaneously. More intensive studies have indicated that these increases resulted from more efficient storage of dietary calcium, phosphorus, and nitrogen. In many studies, however, undesirable side effects from these compounds have been noted. Diallyldiethylstilbestrol and diallylhexestrol, derivatives of stilbestrol and hexestrol, are of interest because of indications that they contain the potency of the parent compounds without causing the undesirable side effects. The purpose of the following experiments was to study the effect of diallyldiethlystilbestrol and diallylhexestrol upon digestibility of ration components and the retention of dietary calcium, nitrogen, and phosphorus by sheep.

Procedure

Trial I

Fifteen uniform wethers weighing an average of 70 lbs. each were, on the basis of weight, divided into three approximately equal groups of five animals each and were fed the following basal ration:

Ingredient	Percent
Cottonseed hulls	25.00
Cottonseed meal	5.00
Ground milo	59.45
Alfalfa meal	10.00
Sodium chloride	0.50
Vitamins A & D	0.05
Total	100.00

The treatments were as follows:

Ration 1 Basal diet

Ration 2 Basal diet plus 4 mg. of 3, 3'-diallylhexestrol daily

Ration 3 Basal diet plus 4 mg. 3, 3'-diallyldiethlystilbestrol daily

The animals were confined to metabolism stables during successive 14-day preliminary and 10-day collection periods. Feces and urine were collected by standard procedures. Feed and feces were analyzed for proximate components by methods approved by the Association of Organic Agricultural Chemists. In addition the urine was analyzed for nitrogen and the feed, feces, and urine were analyzed for calcium and phosphorus by using acceptable procedures.

Trial II

The second trial was a duplication of the first trial except only four animals in each group were given the following treatments:

Ration 1 Basal diet

Ration 2 Basal diet plus 4 mg. 3, 3'-diallylhexestrol daily

Ration 3 Basal diet plus 4 mg. 3, 3'-diallyldiethyl-stilbestrol daily

Ration 4 Basal diet

Results and Discussion

The results of the first trial are shown in table 1. It is apparent that the added hormones had no significant effects upon the digestibilities of ration components, or upon the retention of calcium, phosphorus or nitrogen.

Table 1.—The Effects of Estrogen-like Compounds Upon Digestibilities of Ration Components and Upon the Retentions of Calcium, Phosphorus, and Nitrogen (first trial).

Rations	Basal	Diallylhexestrol	Diallyldiethylstilbestrol
Percentage Digestibility:			
Dry matter	77.4(1.7)[1]	76.2(6.0)	74.8(2.5)
Organic matter	80.7(2.2)	75.2(14.4)	75.4(2.5)
Crude protein	62.7(2.8)	58.0(5.6)	66.1(5.3)
Crude fiber	52.0(5.3)	54.5(11.6)	43.9(8.1)
Nitrogen free extract	87.0(2.2)	86.4(6.1)	85.3(1.2)
Percentage of intake retained:			
Calcium	28.9(13.1)	28.4(12.5)	41.1(9.5)
Phosphorus	42.6(8.2)	41.1(7.9)	44.7(5.8)
Nitrogen	47.8(10.0)	44.4(5.3)	45.6(4.9)

[1] Numbers in parenthesis are standard deviations of means.

The results obtained in the second trial are shown in table 2. As noted in the first trial, differences between treatment means are not significant.

Table 2.—The Effects of Estrogen-like Compounds Upon Digestibilities of Ration Components and Upon the Retentions of Calcium, Phosphorus, and Nitrogen (second trial).

Rations	Basal	Diallylhexestrol	Diallyldiethylstilbestrol	Diethylstilbestrol
Percentage Digestibility:				
Dry matter	61.8(2.6)[1]	65.9(2.0)	60.8(5.6)	61.1(8.3)
Organic matter	62.5(2.9)	66.8(1.9)	61.8(6.6)	61.4(7.0)
Crude protein	37.7(3.1)	43.9(1.8)	39.0(6.3)	39.4(5.6)
Crude fiber	29.8(3.4)	32.6(2.9)	23.7(6.7)	20.8(9.2)
Nitrogen free extract	75.3(3.2)	77.9(2.4)	73.4(6.0)	73.6(7.0)
Percentage of intake retained				
Calcium	18.0(4.8)	18.8(13.8)	19.4(11.5)	20.8(7.5)
Phosphorus	26.1(12.9)	18.6(10.6)	19.3(13.8)	28.3(20.7)
Nitrogen	22.5(8.8)	27.1(8.2)	26.3(3.5)	20.8(7.5)

... deviations of means

It is apparent that neither 3, 3'-diallylhexestrol nor 3, 3'-diallylethylstilbestrol significantly affected protein, calcium, or phosphorus metabolism in these trials, thus it is assumed that under a longer growth trial, gains likewise would not have been affected. In the second trial, diethylstilbestrol was used as a positive control group because many workers have found that this compound promotes increased gains and feed efficiency in sheep. Further work indicated that these effects are realized because diethylstilbestrol increased the efficiency of calcium, phosphorus, and nitrogen metabolism. Since diethylstilbestrol had no effect upon any of the above criteria, it might be assumed that the basal ration was a poor one for this type of study. Failure to obtain growth responses to diethylstilbestrol when added to sheep rations has been noted by other workers, thus it is not likely that this compound will stimulate gains under all conditions under which animals are maintained. Whether, in the present trial, failure to obtain significant response was caused by the ration or by the extreme amount of animal variation within each treatment is not known.

Summary

The oral consumption of 4 mg. daily of 3, 3'-diallylhexestrol, 3, 3'-diallyldiethylstilbestrol, or diethylstilbestrol in two trials involving thirty-one sheep did not affect ration digestibility, or the retentions of ration calcium, phosphorus, or nitrogen.

A Preliminary Summary of the Performance of Raised One-Half Dorset Vs. Purchased Western Ewes

Joe V. Whiteman, Don G. Brothers,

Rodney B. Harrington, Richard Pittman, and Gene Kennedy

For many years the majority of the sheepmen in Oklahoma have secured replacements for their ewe flocks from the west. These ewes may have been grade Rambouillets or various crosses of Rambouillets with Panamas, Columbias, Corriedales or Merinos. The ewes vary in their willingness to lamb during the fall, in their prolificacy, in their willingness and ability to care for and nurse their lambs and in the amount of wool produced. At the time of purchasing these ewes (usually as shorn yearlings) one cannot evaluate them for any of the above characteristics. Consequently, it is the usual practice to buy big, smooth-bodied, open-faced ewes and hope that they are what is wanted. Results (Whiteman *et al.* 1960[1] have shown that Rambouillet ewes are superior to several crosses of Rambouillet with Columbia, Panama or Merino for fall lambing.

---

[1] Whiteman, Joe V., Richard Pittman and Kenneth Urban. 1960. The lambing performance of

It is generally felt that it is better to buy western yearlings than to raise replacements because western yearlings that are ready to breed cost no more than ewe lambs are worth when marketed. Further, the western yearlings are generally freer of internal parasites than are ewe lambs. This decision has not taken into consideration the relative productivity of purchased vs raised replacements.

This is a preliminary report on a study that is under way at the Ft. Reno Experiment Station[2] to evaluate the question, *ie,* is it economically feasable to raise replacement ewes.

Experimental Procedure

During the spring of 1955 an experimental ewe flock was established at the Ft. Reno Experiment Station. The initial flock was composed of 100 grade Rambouillet and 100 ¼ Panama - ¾ Rambouillet (RPR) yearling ewes. Purebred Dorset rams were mated to these ewes from 1955 through 1959. Dorset rams were used because a higher percentage of Dorset ewes will breed during May and June than will black faced ewes.

During each of the springs of 1957, 1958, and 1959, forty ewe lambs were raised and forty yearlings purchased. In each year the raised replacements were the first 20 ewe lambs to reach market weight from each group of ewes.

Purchased yearlings have included the following groups:

Designation	Breeding	Year purchased
Panama	Panama	1957
N. Mex. Fine Wool	¾ Ramb.-¼ Merino	1957
Rambouillet	Rambouillet	1958
Market White face	Essentially Ramb.	1958
Columbia X	¾ Ramb.-¼ Columbia	1959
Flying H	Rambouillet	1959

The raised and purchased ewes for each year were placed together and have been handled the same since. During their first breeding season all replacement ewes were bred to small Hampshire rams. During later seasons, the rams may have been Hampshires, Dorsets, Suffolks, or Rambouillets but the raised and purchased groups to be compared were always mated to the same rams.

The breeding schedule used during the four years of the study was as follows:

Breeding Dates

Year	Spring	Cleanup
1957	June 3—July 5	Aug. 3—Aug. 23
1958	May 20—June 29	Aug. 11—Sept. 2
1959	May 21—June 30	Aug. 20—Sept. 21
1960	May 21—June 30	Aug. 22—Sept. 23

It should be noted that during 1957, the spring breeding season was for 32 days and cleanup breeding was attempted during 20 days in early August. Poor spring breeding performance resulted in the lengthening of the breeding season to 40 days and the starting of earlier breeding during subsequent years. The cleanup breeding season was lengthened to 32 days after 1958 and moved toward the fall when most effective breeding is generally accomplished in sheep.

Other regular management practices were as follows:

1. Ewes were sheared from five to ten days before the beginning of the spring breeding season. Yearling ewes that were purchased had been sheared before obtaining and were not resheared.

2. All ewes were fed about one-half pound of grain daily for the six weeks before lambing began.

3. All ewes were tagged (crutched) and had their faces sheared about two weeks before lambing began.

4. Ewes were fed one pound of grain daily for six (mature ewes raising single lambs) to nine (young ewes and all ewes raising twins) weeks while on wheat pasture. They also each received about one pound of prairie hay each day.

5. Lambs were self fed in a creep from two to three weeks of age until reaching a market weight of 90 pounds. The creep feed was a mixture of one-third chopped alfalfa hay and two-thirds cracked kafir grain.

6. All of the fall born lambs were marketed for slaughter except for a few ewe lambs that were kept for replacements. Some of the slower gaining winter born lambs did not reach slaughter weight by June 1 and were sold as feeders. It is not known what percentage of the late born lambs could normally be marketed for slaughter.

Reproduction Results to Date

The lambing results obtained thus far are presented in Tables 1 through 4. The summary of the four years lambing and lamb mortality data from the first replacement group (1957) are shown in Table 1.

Table 1.—A Comparison of the Lambing Performance and Lamb Mortality Exhibited by Four Breed Groups of Ewes Contained in the First Replacement Group. (Four Years Production)

	Raised		Purchased	
	Dor. X RPR	Dor. X Ramb.	Panama	N. Mex. Fine Wool
Ewes in breeding flock	77	78	80	77
Ewes lambing in fall	58	59	51	51
Lambs born	80	92	68	57
Lambs raised	72	84	65	51
Ewes lambing in winter	2	6	13	4
Lambs born	3	10	18	5
Lambs raised	3	8	18	5
Total lambs raised	75	92	83	56
Total lambs died	8	10	3	6

It should be remembered that these data represent the production as lambs, yearlings, two year olds, and three year olds for the raised ewes. Yearling, two-year, three year, and four year old production is represented for the purchased ewes. Production was poor for all breed groups the first year which causes all figures to be relatively unsatisfactory. If fall lambing only is considered, the raised ewes have been more productive. This was due largely to their superiority during the third and fourth years. The Dorset X Rambouillet crossbred ewes have out produced the crossbred ewes raised from the one-fourth Panama ewes. The Panama ewes have been superior to the N. Mex. fine wool ewes (part Merino) whose performance has been unsatisfactory.

It should be noted that few raised ewes lambed during the winter. This was mostly because they nearly all lambed during the fall except when lambs. A relatively large number of the Panamas lambed during the winter.

Whereas the first replacement group compares raised replacements to two kinds of purchased ewes that would not be highly recommended, the second replacement group compares raised replacements to the kind of purchased ewes that would be recommended. Table 2 presents the summary of the first three years production of these breeding groups.

After three years of production (lamb, yearling, and two year old for raised ewes and yearling, two and three year old for purchased ewes) the total numbers of lambs raised is essentially the same for the four breed groups of ewes. During their first year of production the purchased yearlings produced more lambs than the raised ewe lambs, but have consistently produced less during later years.

Table 2.—A Comparison of the Lambing Performance and Lamb Mortality Exhibited by the Four Breeding Groups of Ewes Included in the Second Replacement Group. (Three Years Production)

	Raised		Purchased	
	Dor. X RPR	Dor. X Ramb.	Ramb.	Mkt. White Face
Ewes in breeding flock	58	59	59	60
Ewes lambing in fall	43	46	50	43
Lambs born	60	60	58	55
Lambs raised	55	57	54	53
Ewes lambing in winter	7	3	3	10
Lambs born	7	4	5	13
Lambs raised	6	4	5	10
Total lambs raised	61	61	59	63
Total lambs died	6	3	4	5

Results for the third replacement group are presented in Table 3. These results are presented in a different manner for two reasons. First, these are the results obtained when the breeding schedule was as is presently used, *ie.* spring breeding for 40 days starting about May 21 and cleanup breeding for 32 days starting about August 21. Second, we feel that it illustrates about what can be expected during each of the first two years when similar ewes are used.

Table 3.—The First Two Years Reproductive Performance of the Four Breed Groups Represented in the Third Replacement Group.

	Raised		Purchased	
	Dor. X RPR	Dor. X Ramb.	Columbia X	Ramb.
1959 (First year)				
Ewes in breeding flock	20	20	20	20
Ewes lambing	5 (10)*	4 (10)	7 (9)	11 (7)
Lambs born	6 (12)	7 (11)	8 (10)	11 (7)
Lambs raised	5 (10)	7 (11)	8 (8)	11 (7)
1960 (Second year)				
Ewes in breeding flock	19	18	19	20
Ewes lambing	17 (2)	15 (2)	12 (5)	14 (3)
Lambs born	21 (2)	20 (3)	18 (8)	15 (4)
Lambs raised	20 (1)	17 (0)[1]	15 (7)	13 (3)
Total fall lambs	25	24	23	24
Total winter lambs	11	11	15	10
Total lambs raised	36	35	38	34
Total lambs died	5	6	6	3

*Figures in parenthesis represent winter lambing results
[1]all deformed

A quick calculation will show that the accumulated percent lamb crop is 92, 92, 97, and 85 percent for these four breed groups of ewes. Although the total production is not as high as desirable for any of these groups, it is felt that the comparisons among the groups are fair. It appears that during their first year's production the purchased yearlings are more productive of fall born lambs and perhaps of total lambs. During their second year's production the raised ewes are more productive of fall born lambs.

It should be noted that the ewes that are part Columbia do not lamb as well during the fall but lamb better during the winter than do the fine wool (Rambouillet) ewes. This tendency has proved fairly consistent throughout experience with these and other ewes. Table 1 showed that a larger number of the Panama (same breeding as Columbia) ewes did not lamb during the fall but lambed during the winter as a result of conceptions during the cleanup breeding season.

Although information concerning lamb mortality has been included in the tables, it is not presently felt that the limited data accumulated justifys any conclusions or discussion. Some preliminary studies have been made of the date on mortality but no conclusions have been reached.

Table 4 summarizes the time of lambing performance of all raised and purchased ewes during their second and subsequent years of production. These data clearly show the superiority of the half Dorset raised replacements relative to percent lambing. Of the 229 half Dorset raised ewes that were 19 months old or older at breeding time, 99 percent lambed either during the fall or winter and over 93 percent lambed during the fall. Of 235 western purchased ewes two years old or older, 89 percent lambed with only 76 percent lambing during the fall. None of the breeding groups of purchased ewes have shown the ability of the raised ewes to lamb during the fall.

Table 4.—A Summary of the Total Lambing Performance of Purchased Vs Raised Replacements During Their Second and Subsequent Years of Production.

	Raised	Purchased
Ewes in breeding flock	229	235
Ewes lambing during fall	214	179
Ewes lambing during winter	13	29
Ewes not lambing	2	27

Note should be made of the number of ewes in the raised vs. purchased classes. More raised ewes have died for various reasons. The reason for this is not known, but the ability to live is an important characteristic of a breeding animal and continuing observations will be made relative to this trait.

Results to date on rate of early gain of lambs

The rate of gain of lambs until they reach about 50 pounds is most greatly influenced by the lamb's own birth weight and the amount of milk that he gets from his mother. A summary of the information presently available regarding birth weight is presented in Table 5. This summary is presented for both fall and winter born lambs and for single and twin lambs.

The results presented in Table 5 are certainly not conclusive. Both birth weight and rate of early gain are highly variable. Therefore little confidence should be placed in any average value that represents less than 10 lambs. Within this restriction, there seems to be little if any difference in comparing birth weights or rates of early gain between lambs by the raised vs. the purchased ewes. Any difference that exists

Table 5.—A Summary of the Birth Weights and Early Gains[1] of Lambs Produced by the Raised Vs the Purchased Ewes.

Kind of ewe and lambing age	Fall lambs		Winter lambs[2]	
	Singles	Twins	Singles	Twins
Half Dorset raised (12-14 mo.)				
Number	18	10	21	1[3]
Weight at birth (lbs.)	8.3	5.5	9.6	7.4
Av. daily gain (lbs.)	.57	.43	.56	.40
Purchased western (19-21 mo.)				
Number	52	2	13	0
Weight at birth (lbs.)	8.3	6.4	10.1	
Av. daily gain (lbs.)	.55	.60[3]	.56	
Half Dorset raised (24-26 mo.)				
Number	64	49	2	[illegible]
Weight at birth (lbs.)	8.9	7.3	9.5	[illegible].1
Av. daily gain (lbs.)	.63	.52	.66	.47
Purchased western (31-33 mo.)				
Number	68	28	5	4
Weight at birth (lbs.)	9.3	7.4	10.0	7.6
Av. daily gain (lbs.)	.62	.51	.65	.47
Half Dorset raised (36-38 & older)				
Number	45	103	0	0
Weight at birth (lbs.)	10.0	8.2	--	--
Av. daily gain (lbs.)	.67	.56	--	--
Purchased western (43-45 & older)				
Number	51	55	3	5
Weight at birth (lbs.)	9.7	7.7	9.4	9.1
Av. daily gain (lbs.)	.65	.49	.61	.48

[1]Average daily gain from birth to approximately 50 pounds.

[2]1961 winter lambing results not included

[3]These lambs were raised as singles.

in rate of early gain is in favor of lambs from raised ewes two years old or older.

When the ewes were young the birth weights were heavier for the winter born lambs than for the fall born lambs. Also, both the birth weights and the rates of early gain were greater for lambs from older ewes than for lambs from the first year of production ewes. The well known difference between the average birth weight and daily gain of single vs. twin lambs is well illustrated in these data.

Results to date on wool production

The income from wool usually accounts for 20 to 30 percent of the income from the sheep flock. It is therefore important that some evaluation be made of the relative wool production of the raised vs. the purchased ewes. Since the purchased yearlings had been sheared before purchase, their first year's production represented over 12 months wool growth. No correction could be applied because the amount of extra growth was not known. Consequently the first year's production by purchased ewes was not used for comparative purposes.

The ewes that were raised were sheared May 10 to 15. They sheared about five pounds of wool as six to seven month old lambs. Their first full year's production was between the ages of from six to 18 months. The production during such a period is probably not a good measure of their mature production and was not used for comparative purposes.

Table 6 presents such data as we have at this time. Both grease and clean fleece weights are given as both are important. Most wool is sold as grease wool but the percent of the wool that is actual wool (clean wool) should help to determine the price. Since Dorset wool is usually drier wool it yields a higher percent of actual wool than does the grease wool from most kinds of western ewes.

Table 6.—The Grease and Clean Wool Production of Raised and Purchased Ewes.

Kind of ewes and year	No. Fleeces	Grease fleece Av. Wt.	Clean fleece* Av. Wt.	Yield %
1959				
Half Dorset raised ewes	38	9.5	5.6	59
Panama ewes	20	11.1	6.6	60
N. Mex. fine wool ewes	18	12.6	5.0	40
% advantage of western ewes		24%	5%	
1960				
Half Dorset raised ewes	76	8.6	4.9	57
Western ewes (pooled)	79	10.3	4.9	48
% advantage of western ewes		20%	0%	

*Clean fleece weight estimated by a Neale squeeze machine.

As was expected the western ewes sheared heavier fleeces, the difference ranging from 20 to 25 percent. Clean fleece weights were essentially the same. If the squeeze machine properly evaluated yield, the fleeces from the raised (½ Dorset) ewes had a higher percent of actual wool. If all wool were sold at the same price per pound, fleeces from the western ewes would sell for more per fleece. If the buyer differentiates between fleeces with different yields, the wool income would be essentially the same for the two kinds of ewes. It should be remembered that these ewes represent only a small sample of western ewes but the above general conclusion is probably correct *ie.* the loss of grease wool when substituting ½ Dorset for western ewes will probably be greater than the loss of clean or actual wool.

Summary

Three replacement groups of ewes were started at the Ft. Reno Experiment Station during the springs of 1957, 1958, and 1959. Each group was composed of four breeding groups, two of which were raised replacements and two of which were purchased. The first 20 ewe lambs to reach market weight from ¼ Panama X ¾ Rambouillet ewes and from Rambouillet ewes, both of which were sired by Dorset rams, constituted the raised replacements. Two groups of 20 each of southwestern white faced yearling ewes selected to represent the kind of purchased replacements available were purchased. Within replacement groups the ewes were managed the same.

Two breeding seasons were used. The spring breeding season varied between May 20 and July 5 and a varying cleanup breeding season was attempted between August 3 and September 23. The raised replacements were bred first as lambs, whereas the purchased ewes were bred first as yearlings.

Preliminary conclusions can only be drawn at this time. The purchased ewes produced more fall born lambs during the first year of production but decreased thereafter. The one-half Dorset replacement ewes that were producing their second and later lamb crops displayed a greater tendency for both fall and winter lambing than comparable western ewes. Western ewes that are part Columbia or Panama produce fewer fall born lambs but more winter born lambs than Rambouillet ewes.

There has been little or no difference in the birth weight or early rate of gain (birth to 50 pounds) of lambs produced by the raised vs. the purchased ewes. The purchased ewes sheared more grease wool than the raised ewes but the clean wool production as estimated was about the same for the two kinds of ewes. There has been greater mortality among the raised than among the purchased ewes.

Tests will be continued with these ewes until all have died or been marketed due to old age.

Effect of Level of Wintering Fall-Calving Beef Cows and Replacement Heifers

R. D. Furr, A. B. Nelson,

G. R. Waller, Jr. and W. D. Campbell

An increased number of cows calving in the fall has resulted in a need for additional data on feeding and managing such cattle grazing native grass (Bluestem and associated grasses) yearlong. The nutritive requirements of a cow suckling a calf are markedly greater than for a pregnant cow. Thus, the primary problem in a fall-calving program is to determine the most satisfactory level of supplemental winter feed for the cow. The quantity of supplemental feed will vary according to the amount and quality of forage available in a pasture. In many areas of our state the native grasses furnish practically all of the roughage consumed by a cow herd.

For several years we have been feeding different levels of supplemental winter feed to fall-calving cows grazing dry grass. In the original study with mature cows (Okla. Agr. Exp. Sta. MP-55:72), at the Lake Blackwell experimental range area where adequate native grass was available, the low level of wintering (1.5 pounds of cottonseed meal per head daily) was more profitable than the high level (2.5 pounds of C.S.M. plus 3 pounds of grain). In later studies with young cows fed at different levels the production usually has not been satisfactory.

This report summarizes the data collected during 1959-60 using: (1) four-year-old cows producing their third calf, (2) three-year-old cows producing their second calf, (3) two-year-old heifers producing their first calf, (4) yearling heifers, and (5) heifer calves.

Part 1. Results with Four-Year-Old Cows, 1959-60.

Procedure

The four-year-old cows used in this study had been wintered at different levels of supplemental feed the previous two seasons. Thus, they were subjected to different levels of supplemental winter feed as heifers calving in the fall at 2½ years of age (1957-58) and again during the winter of 1958-59 as 3½ year-olds. In both tests neither group of cows produced calves of desirable weaning weight, although the higher level of feed increased calf weights. These same cows were continued on test for another season in order that accumulative effects of the different levels of supplemental winter feed could be studied. Both lots of cows were allowed to graze the native grass pastures yearlong. The stocking rate was approximately 8 acres of pasture per cow. The low level of supplemental feed was increased from 1.1 pounds pelleted cottonseed meal to 2.5 pounds. The high level was 6.58 pounds of pellets consisting of 40 percent cottonseed meal and 60 percent ground milo. Thus, daily consumption per head in Lot 2 (high level) was 2.63 pounds of cottonseed meal and 3.95 pounds of ground milo. These pellets were fed in bunks every other day in amounts to furnish the above pounds per head daily. Supplemental winter feeding started October 13, 1959, and was discontinued April 22, 1960 (192 days).

Hereford bulls were placed with the cows January 8, 1959. Consequently, the first calves were born in mid-October. One cow in Lot 1 was found to be not pregnant upon examination in June and was removed from the experiment. In Lot 2, one cow was open, one cow failed to calve, and one calf was born dead. Therefore, 12 of the 13 cows in Lot 1 which raised calves in 1958-59 weaned calves in 1959-60. In Lot 2, 13 of the 16 cows weaned calves. None of the calves were creep-fed.

Results

A summary of the data collected in this test is given in Table 1. The cows in Lot 1 lost an average of 306 pounds or 28 percent of their body weight. The loss in Lot 2 was 279 pounds or 25 percent.

The average birth weight of the calves was 3 pounds in favor of Lot 2 and these calves were born an average of 3 days earlier than those in Lot 1. The spring weights of both lots of calves were relatively light. These average weights were 201 and 233 pounds for those in Lots 1 and 2, respectively. Thus, the high level of wintering had increased calf weights an average of 32 pounds. This difference decreased to 9 pounds by weaning in July (388 vs. 397 pounds). These weights were an increase of 42 and 10 pounds for Lots 1 and 2, respectively, when compared to the weaning weights of calves from these same cows as three-year-olds (1958-59). However, it should be noted that the quantity of supplemental feed received by the low level cows was more than twice the amount they received in the 1958-59 season, whereas the quantity fed to the high level cows (Lot 2) remained about the same.

Both lots of calves were weaned and sold as feeders in July at the Oklahoma City stockyards. The steers sold for an average of $27 per 100 pounds and the heifers sold for $25. The cost of the increased feed for Lot 2 was greater than the increased value of the calves. The selling value minus feed cost was $11.66 in favor of the low level. ($55.38 vs. $43.72).

In the tests with mature cows (4-year-summary reported in 1959), it appeared that their production might not be greatly affected by losses of 25 to 30 percent of their body weight. However, results with four-year-olds, and with the same cows as two-year-olds and three-year-olds indicate that production of younger animals may be reduced unless the weight losses are considerably decreased. In the test just discussed (1959-60), both cows receiving the low and the high level of supplemental feed failed to produce calves with desirable weaning weights.

Table 1.—Levels of Supplemental Winter Feeding of Four-Year-Old Beef Cows, 1959-60.

Lot Number Level of Feeding	1 Low[1]	2 High[2]
Number of cows per lot raising calves[3]	12	13
Average weight per cow (lbs.)		
Initial 10-13-59	1089	1116
Spring 4-22-60	783	837
Weaning 7-22-60	984	1003
Fall 10-7-60	1037	1070
Winter gain (192 days)	—306	—279
Gain to wea ing	—105	—113
Yearly gain	— 52	— 46
Average weight per calf (lbs.)		
Birth[4]	73	76
Spring[5]	201	233
Weaning[6]	388	397
Average birth date of calves, Nov.	10	7
Supplemental feed per cow (lbs.)[7]		
Cottonseed meal	480	503
Ground milo		699
Total feed cost per cow ($)[8]	40.12	54.12
Selling value ($)		
Per 100 lbs.		
Steers	27.00	27.00
Heifers	25.00	25.00
Per head[9]	95.50	97.84
Selling value minus feed cost ($)	55.38	43.72

[1] Fed 2.5 lbs. pelleted cottonseed meal per head daily.

[2] Fed same as Lot 1 until October 28, at which time the daily feed was increased to 6.58 lbs. of pellets consisting of 40% cottonseed meal and 60% milo. Daily consumption was 2.63 lbs. of cottonseed meal and 3.95 lbs. milo.

[3] There were 13 and 16 cows in Lots 1 and 2, respectively, in the experiment in 1958-59. One cow was open in Lot 1. In Lot 2, 1 cow was open, 1 cow failed to calve and 1 calf was born dead.

[4] Corrected for sex by the addition of 3 lbs. to the weight of each heifer.

[5] Corrected for sex by the addition of 18 lbs. to the weight of each heifer after a 170-day age correction by interpolatin.

[6] Corrected for sex by the addition of 43 lbs. to the weight of each heifer after a 260-day age correction by interpolation.

[7] 192 days of feeding which started 10-13-59.

[8] Includes pasture cost and prices of feeds at the time tests were conducted.

[9] Based on an equal number of steers and heifers in each lot using the age and sex corrected weaning weights as the steer selling weight and this weight minus 43 lbs. (sex correction factor) as the average weight of heifers.

Part 2. Results with Three-Year-Old Beef Cows, 1959-60.

Procedure

A second test was initiated in the fall of 1958 to study the effect of 20 and 30 percent body weight losses upon the production of fall-calving heifers. The heifers calved first as 2½ year-olds in the fall of 1958.

A summary of the results for the 1958-59 season was reported in Okla. Agr. Exp. Sta. MP-57.

The cows as mentioned above were continued in the test in the fall of 1959. Thus, the cows were 3½ years of age and suckling their second calf during the wintering season of 1959-60. The cows were weighed and divided into their respective lots on October 8, 1959. All three lots of cows had access to the native grass pastures. However, some changes were made in the supplemental feed allowances relative to the previous season. The cows in Lots 1 and 2 (low level) were fed an average of 2.5 pounds of cottonseed meal pellets per head daily. This was an increase of approximately 1.1 pounds. Those in Lot 3 (high level) were fed 6.25 pounds of a pelleted mixture consisting of 40 percent cottonseed meal and 60 percent ground milo. Thus, each cow received 2.5 pounds of cottonseed meal and 3.75 pounds of ground milo daily. The calves in Lot 1 were offered creep-feed starting December 31, 1959.

Results

A summary of the data collected in 1959-60 is given in Table 2. The average birth weights of the calves were nearly equal. However, the average birth date is considerably different; those in Lot 3 were 19 days younger than those in Lot 2 and 29 days younger than those in Lot 1. Much of these differences in average calving date were due to the presence of a sterile bull. Bulls were rotated among the lots at 2-week intervals during the breeding season, therefore the presence of the infertile bull is responsible for at least a portion of the later average calving date in both Lots 2 and 3. Both the spring and weaning weights have been corrected for sex and age.

The cows lost an average of 287, 301, and 252 pounds in Lots 1, 2, and 3, respectively. The percentage of body weight loss for the three respective lots was 26, 29, and 25 percent. Since the cows were suckling calves during most of the winter feeding period, any effect of the two levels of supplemental feed on calf weights should be apparent in the weights of the calves in mid-April when supplemental feeding was stopped. The increased level of winter feeding of the cows in Lot 3 increased the average calf weight 45 pounds when compared to the other non-creep-fed calves (Lot 2). Therefore, the high level of winter feeding increased spring weights of the calves in addition to decreasing winter weight losses of the cows. Creep-feeding was also reflected in the average spring calf weights. The difference in favor of creep-feeding calves whose mothers were fed at the low level was 62 pounds. These spring weight differences of 45 pounds (Lot 3 vs. Lot 2) and 62 pounds (Lot 1 vs. Lot 2) correspond very closely with 49 pounds and 61 pounds, respectively, noted during the previous season with these same cows.

The calves were weaned on July 22 and sold at the Oklahoma City stockyards. All calves sold as feeders. The steers sold for $27 per 100 pounds and the heifers for $25. The calves averaged 416, 331, and 392 pounds for Lots 1, 2, and 3, respectively. The high level of winter

Table 2.—Levels of Supplemental Winter Feeding of Three-Year-Old Beef Cows, 1959-60.

Lot Number Level of Feeding	1 Low[1] (Creep-fed)	2 Low[2]	3 High[3]
Number of cows per lot raising calves[4]	11	10	14
Average weight per cow (lbs.)			
Initial 10-8-59	1088	1040	1019
Spring 4-22-60	801	739	767
Weaning 7-22-60	1052	992	1021
Fall 10-7-60	1083	1062	1058
Winter gain (197 days)	—287	—301	—252
Gain to weaning	— 36	— 48	2
Yearly gain	— 5	22	39
Average weight per calf (lbs.)			
Birth[5]	72	71	73
Spring[6]	230	168	213
Weaning[7]	416	331	392
Average birth date of calves[8]	Oct. 19	Oct. 29	Nov. 17
Supplemental feed per animal (lbs.)[9]			
Cow			
Cottonseed meal	493	493	493
Ground milo			578
Calf (Creep-feed)	1042		
Total feed cost per head ($)[10]			
Cow	40.53	40.53	51.51
Calf	2605		
Total	66.58	40.53	51.51
Selling value ($)			
Per 100 lbs.			
Steers	27.00	27.00	27.00
Heifers	25.00	25.00	25.00
Per head[11]	102.78	80.68	96.54
Selling value minus feed cost ($)	36.20	40.15	45.03

[1] Fed 2.5 lbs. pelleted cottonseed meal per head daily. Creep-feeding of calves was started December 31.

[2] Cows fed same as those in Lot 1.

[3] Cows fed same as those in Lots 1 and 2 until November 20, at which time the daily feed was increased to 6.25 lbs. of pellets consisting of 40% cottonseed meal and 60% ground milo.

[4] There were 16, 15 and 15 cows in Lots 1, 2 and 3, respectively, in the experiment in 1958-59. In Lots 1, 2 and 3, respectively, 3, 2 and 1 cows were found to be open upon pregnancy examination 7-6-59 and were therefore removed from the experiment. In addition, 1, 2 and 1 cows failed to calve in Lots 1, 2 and 3, respectively. One calf was born dead in Lot 1 and 1 calf died in Lot 2. In Lot 3 one cow which was not included in the 1958-59 data was used in 1959-60.

[5] Corrected for sex by the addition of 3 lbs. to the birth weight of each heifer.

[6] Corrected for sex by the addition of 18 lbs. to the weight of each heifer after a 170-day age correction.

[7] Corrected for sex by the addition of 43 lbs. to the weight of each heifer after a 260-day age correction by interpolation.

[8] The bulls were rotated among the pastures at 2-week intervals during the calving season. One of the bulls was found to be sterile and this is probably responsible for a major portion of the differences in average calving date.

[9] 197 days of feeding which started 10-8-59.

[10] Includes pasture cost and prices of feeds at time tests were conducted.

[11] Based on an equal number of steers and heifers in each lot using the age and sex corrected weaning weights as the steer selling weight and this weight minus 43 lbs. (sex correction factor) as the average weight of heifers.

feeding increased average calf weights 61 pounds over the low level non-creep-fed calves (Lot 2 vs. 3). The increase in calf value due to the high level of wintering cows was $4.88 ($45.03-$40.15) greater than the increased cost of supplemental feed.

Creep-feeding resulted in an increased gain of 85 pounds for calves from the low level cows (Lot 1 vs. 2). Also creep-feeding and low level feeding of cows (Lot 1) resulted in calves which weighed 24 pounds more than calves from cows on the high level of feeding (Lot 3). The creep-fed calves consumed an average of 1042 pounds of creep-feed which cost $26.05. Subtracting both the cow and creep-feed cost from the selling value per calf resulted in decreased profits of $3.95 for creep-feeding on the low level of wintering. The average increase in return for calves in Lot 1, after subtracting both the cow and calf feed costs, was $8.83 less than the return for calves from Lot 3 cows (high level). Therefore, in contrast to the previous trial with these cows, it was more profitable to offer increased feed to the cows rather than to the calves.

Part 3. Results with Two-Year-Old Heifers, 1959-60.

It appeared from previous results that the production of young cows calving in the fall may be hindered when they are fed to lose 20 to 30 percent of their body weight. Because weaning weights of calves from both two and three-year-old cows were undesirable in previous seasons, the effects of reducing the winter weight losses of young cows calving in the fall are being studied. The nutrient intake of heifers used in this test was increased by feeding of prairie hay rather than allowing the cattle to graze the dry native grass.

Procedure

The heifers used in this test had previously been subjected to different levels of supplemental winter feed as yearlings (1958-59). During the winter as yearlings a certain bull was left in each lot for the entire breeding season. In the 1959-60 season, the 28 pregnant heifers were divided into 2 lots on the basis of weight and previous winter treatment (or breeding group). In Lot 1 (low level) there were 7 heifers which were fed on the low level as yearlings and 7 on the high level. In Lot 2 (high level) the numbers were 6 and 8 for the high and low levels, respectively.

Both lots of cows were retained in adjacent traps (approximately 3 acres per lot) during the supplemental feeding period. Prairie hay was fed ad libitum. The supplement in Lot 1 was 1.43 pounds of pelleted cottonseed meal per head daily. In Lot 2, 6.25 pounds of a mixture consisting of 25 percent cottonseed meal and 75 percent ground milo was fed. The intake was 1.56 pounds cottonseed meal and 4.69 pounds ground milo.

Results

A summary of the results may be found in Table 3. There was only a small difference in the winter weight losses of the two groups of heifers (140 vs. 111 pounds). The reason for the small difference is apparent when one notes the feed intake of the two groups. The cattle in Lot 1 consumed an average of 25.5 pounds of prairie hay and 1.43 pounds cottonseed meal. This 26.93 pounds of feed is estimated to contain 12.15 pounds total digestible nutrients (TDN). The TDN content of the 17.8 pounds of prairie hay and 6.25 of supplemental feed (24.05 pounds total) fed to those in Lot 2 is estimated to be 12.6 pounds. This is a difference of only 0.45 pound estimated TDN intake.

Four calves in Lot 2 were born dead. The assistance of a veterinarian was required for two of these calves. All four calves were in the high level group for the current winter but had been on the low level as yearlings. Whether or not these losses are related to the feeding practice is unknown. Certainly the cause of these losses is not related to the current level of feeding because the calves were born before or shortly after supplemental feeding was started. There were no calving losses in the low level group (Lot 1).

The average spring weights of calves were 193 pounds and 207 pounds for those in Lots 1 and 2, respectively. The spring weights appear to be rather light even though the cows had lost only 15 and 11 percent of their body weight in Lots 1 and 2, respectively, at the end of the wintering period. These spring weights show an increase of 11 pounds over those noted for calves from fall-calving 2½ year old heifers in 1957-58. The increased weight over the calves from the low level (Lot 2) and high level heifers (1958-59) was 41 and 6 pounds, respectively.

The calves were weaned on July 22 and sold as feeders at the Oklahoma City stockyards. The high level of winter feeding increased calf weaning weights an average of only 4 pounds (374 vs. 370 pounds) over the low level. However, practically no difference would be expected at weaning since the difference in the average spring weights was only 14 pounds. The small difference in the average weights of calves from the two groups would be related to the small difference in TDN consumed by the cows. Thus, one would not expect any large differences in weaning weights to exist in this trial.

The steers sold for an average of $27 per 100 pounds and the heifers sold for $25. Subtracting total cow feed cost from the selling value per calf resulted in increased profits of $6.26 ($60.49 vs. $66.75) in favor of the low level of wintering. The increased cost of concentrates for Lot 2 more than offset the increased cost of prairie hay for Lot 1. Therefore, the low level of wintering proved more profitable in this study.

The cows were rebred during the winter of 1959-60 and additional data are being collected during the 1960-61 season. More information on this system of raising fall calves from young cows will be available when the calves are sold in mid-summer.

Table 3.—Levels of Supplemental Winter Feeding of Two-Year-Old Beef Heifers, 1959-60.

Lot Number Level of Feeding	1 Low[1]	2 High[2]
Number of cows raising calves[3]	14	10
Average weight per cow (lbs.)		
Initial 10-8-59	964	976
Spring 4-23-60	824	865
Weaning 7-22-60	948	986
Fall 10-7-60	1005	1038
Winter gain (198 days)	—140	—111
Gain to weaning	— 16	10
Yearly gain	41	62
Average weight per calf (lbs.)		
Birth[4]	64	67
Spring[5]	193	207
Weaning[6]	370	374
Average birth date of calves, Nov.	6	9
Feed per cow (lbs.)[7]		
Cottonseed meal	283	306
Ground milo		835
Prairie hay[8]	5049	3519
Feed cost per cow ($)[9]	60.49	66.75
Selling value ($)		
Per 100 lbs.		
Steers	27.00	27.00
Heifers	25.00	25.00
Per head[10]	90.82	91.86
Selling value minus feed cost ($)	47.83	42.61

[1] Fed 1.43 lbs. of cottonseed meal pellets per head daily in addition to prairie hay.

[2] Cows fed same as those in Lot 1 until October 28, at which time the daily feed was increased to 6.25 lbs. of pellets consisting of 25% cottonseed meal and 75% ground milo. All cows received prairie hay in addition to the pellets.

[3] Originally, there were 14 cows in each of Lots 1 and 2. In Lot 2, 4 calves were born dead.

[4] Corrected for sex by the addition of 3 lbs. to the weight of each heifer.

[5] Corrected for sex by the addition of 18 lbs. to the weight of each heifer after a 170-day age correction.

[6] Corrected for sex by the addition of 43 lbs. to the weight of each heifer after a 260-day age correction by interpolation.

[7] 198 days of feeding which started 10-8-59.

[8] Total pounds of prairie hay consumed per cow. Average daily consumption was 25.5 and 17.8 lbs. per head in Lots 1 and 2, respectively.

[9] Includes prices of feeds at the time tests were conducted. The summer pasture charge was $17.50 per head.

[10] Based on an equal number of steers and heifers in each lot using the age and sex corrected weaning weights as the steer selling weight and this weight minus 43 lbs. [illegible]

Part 4. Results with Yearling Heifers, 1959-60.

Procedure

Heifer calves fed on two levels of supplemental winter feed during 1958-59 were continued on test and fed at the low and high levels during the 1959-60 winter feeding season as yearlings. Those on the low level in 1958-59 were continued on the low level; however, one-half was fed prairie hay in a trap and one-half was allowed to graze the native grass. Of the 35 head on the high level in 1958-59, 18 were fed prairie hay and the remaining 17 grazed the dry range grass in 1959-60.

The supplemental feed for those on the low level (both in traps and on range) was 1.11 pounds cottonseed meal. Those on the high level were fed 6.94 pounds of the 35 percent cottonseed meal and 65 percent ground milo pellet. In addition to a comparison of the two levels of supplementing each roughage, this design will allow a direct comparison of the value of prairie hay vs. dried range grass at two levels of supplemental feeding.

Results

As was true for the two-year-old heifers, the yearlings fed the lower level of supplement consumed more hay than those fed a high level of supplement (see Table 4). The average daily hay consumption was 18.9 pounds in Lot 1 and 10.8 pounds in Lot 2. The total amount of feed consumed was 20 and 17.7 pounds for the two lots, respectively. The estimated TDN intakes were 9.04 and 10.01 pounds. With this difference in TDN intake, a large difference in weight gain should not be expected. At the end of the supplemental winter feeding period in mid-April the difference in winter gain was 23 pounds (43 vs. 66 pounds). The average supplemental feed cost per head was $43.76 and $57.09 for the low and high levels in the traps, respectively. Therefore the supplemental feed cost was $13.33 greater for Lot 2 (high) than for Lot 1 (low level).

When dry range grass was the forage available, the winter gains on the low and high levels of supplemental feeding were —60 and 19 pounds, respectively. The average supplemental feed cost was increased $21.01 per head by increasing the level of feeding.

The gain of heifers fed the low level of supplemental feed was 43 pounds for those fed prairie hay and —60 pounds for those on dry range. This difference of 103 pounds is apparently due to the difference in nutritive value of the roughages. Actually, the difference was considerably greater prior to the appearance of green grass in the spring. Of those fed prairie hay, there was a difference in gain of 47 pounds (66 vs. 19 pounds) in favor of the high level heifers. The subsequent summer gains while grazing the native grass pastures were in favor of the low level heifers. Thus, the summer gains were inversely related to the winter gains. Yearly gains were approximately the same [illegible] since the wintering period whereas the yearly gains for the low level heifers in the trap were 41 pounds greater than the high level.

In this trial, increasing the quantity of concentrates decreased the amount of prairie hay consumed (Lots 2 vs. 1). Based upon these data, we must assume that the dry grass consumption by the cattle on the range was also reduced. These data indicate that when high levels of supplemental feed are offered we are reducing the roughage intake. A sound cow-calf enterprise is usually based on a high intake of roughage because this roughage is usually the cheapest source of energy. Only when the cost of grains is relatively low or when additional winter gains are desirable should a very high level of supplemental concentrate be fed to range cattle.

These heifers were bred to Hereford bulls and calved in the fall of 1959 when they were 2½ years old. They are presently being continued in the test while suckling a calf. These tests will allow a study of the effects of feeding at the different levels for several successive winters during the development of the beef female.

Table 4.—Levels of Supplemental Winter Feeding of Yearling Beef Heifers, 1959-60.

Location	Trap		Range	
Lot Number	1	2	3	4
Level of Feeding	Low[1]	High[2]	Low[1]	High[2]
Number of heifers per lot	18	18	18	17
Average weight per heifer (lbs.)				
Initial 10-23-59	654	720	669	730
Spring 4-23-60[3]	697	786	609	749
Fall 10-13-60	943	968	903	963
Winter gain	43	66	—60	19
Yearly gain	289	248	234	233
Average feed consumption per heifer (lbs.)				
Cottonseed meal	202	445	183	401
Ground milo	---	825	---	744
Prairie hay[4]	3462	1983	---	---
Range	---	---	ad. lib	ad. lib.
Feed cost per head ($)[5]	43.76	57.09	23.76	44.77

[1] Both the heifers in the trap and those on the range were fed 1.11 lbs. of pelleted cottonseed meal per head daily. In addition, the heifers in the trap received prairie hay. Supplemental feeding was started 10-23-59 and 11-10-59 for the heifers in the trap and those on the range, respectively.

[2] Heifers on the range fed 6.94 lbs. of pellets consisting of 35% cottonseed meal and 65% ground milo. Those in the trap were fed the same plus prairie hay. Starting dates for winter feeding were the same as those listed above.

[3] 183 and 165 days of supplemental feeding for the heifers in the trap and those on the range, respectively.

[4] Total pounds of prairie hay consumed per heifer. Average daily consumption was 18.9 and 10.8 lbs. in Lots 1 and 2, respectively.

[5] Yearly pasture cost of $18.00 per head for Lots 3 and 4 is included. Summer pasture cost was $14.00 per head for Lots 1 and 2.

Part 5. Results with Weanling Heifer Calves, 1959-60.

Procedure

On November 6, 1959, 60 heifers were divided into two groups of 30 head. All heifers were fed prairie hay, ad libitum. In addition, those in Lot 1 were fed 0.5 pounds of pelleted cottonseed meal per head daily. During the early part of the test those in Lot 2 were fed 5 pounds of a mixture consisting of 25 percent cottonseed meal and 75 percent ground milo. Although the quantity was increased to 7 pounds per head daily, the average daily consumption for the 161-day feeding period was 5.93 pounds. One heifer drowned in Lot 2 after falling through the ice on the pond which supplies the water for the cattle.

Results

The winter weight gains (Table 5) were —6 and 95 pounds for the low and the high level of wintering, respectively. This 101 pounds of increased gain resulted from feed consumption which cost an additional $15.32 per head. Average daily hay consumption was 10.58 pounds in Lot 1 and 7.58 pounds in Lot 2. The estimated daily TDN was 4.97 pounds for the low level and 7.88 pounds for the high level of supplemental feeding.

Table 5.—Levels of Supplemental Wintering Feeding of Weanling Heifer Calves, 1959-60.

Lot Number Level of Feeding	1 Low[1]	2 High[2]
Number of heifers per lot	30	29[3]
Average weight per heifer (lbs.)		
Initial 11-6-59	435	433
Spring 4-15-60	429	528
Fall 10-21-60	638	701
Winter gain (161 days)	—6	95
Yearly gain	203	268
Average feed consumption per heifer (lbs.)		
Cottonseed meal	80	238
Milo	---	716
Prairie hay[4]	1704	1221
Feed cost per head ($)[5]	28.02	43.34

[1] Supplemental feed was 0.5 lb. pelleted cottonseed meal per head daily.

[2] Quantity of concentrates was gradually increased. Average consumption was 5.93 lbs. per head daily of pellets consisting of 25% cottonseed meal and 75% ground milo. Daily consumption was 1.48 and 4.45 lbs. of these feeds, respectively.

[3] There were originally 30 heifers per lot; however, one heifer drowned after falling through the ice on the pond which supplied the water for the cattle.

[4] Total pounds of prairie hay consumed per heifer. Average daily consumption was 10.58 and 7.58 lbs. in Lots 1 and 2, respectively.

[5] ... pasture cost and prices of feeds at the time tests were conducted.

The high level heifers gained 173 pounds during the subsequent summer grazing season resulting in a yearly gain of 268 pounds. The Lot 1 heifers gained 209 pounds during the summer after approximately maintaining their weight during the supplemental winter feeding period. Their yearly gain was 203 pounds. Therefore, the difference which was present in the spring was reduced but the overall yearly gain was 65 pounds in favor of Lot 2.

These heifers will be fed on a low and a high level of supplemental feeding for successive winters until they have produced two calves in order that accumulative effects of winter losses may be studied.

Summary

Winter weight losses of 20 to 30 percent of body weight appear to be detrimental to the production of young cows calving in the fall. These weight losses and the weaning weights of their calves are related to the quantity of supplemental feed. However, the weaning weights of calves from both the low and high level cows have not been satisfactory.

There are probably many factors related to the low weaning weights obtained in these studies. Certainly, there is a substantial decrease in the nutritive value of the forage during the winter. Also, the nutritive requirements are markedly increased during lactation in addition to the requirements for growth. Apparently, the amount of nutrients consumed by the cows was not adequate for growth and desirable lactation.

A notable reduction in winter weight losses resulted when the dry range grass was replaced by prairie hay. Also, weaning weights were increased by this method. The provision of large quantities of supplemental feed decreases considerably the voluntary intake of prairie hay.

Effect of Feeding Cottonseed Meal At Intervals of Two, Four and Six Days To Yearling Heifers Grazing Dry Range Grass

A. B. Nelson and R. D. Furr

One of the factors to consider in improving range beef cattle production is efficient use of labor. In many areas range cattle are commonly fed supplemental protein every other day instead of daily. In such cases twice the daily allowance is fed every other day. Weekly feeding of sheep in certain sections of Australia during a drouth has satisfactorily furnished a subsistence ration for sheep. We are interested in higher production than was present in these tests. In our area we can usually assume that adequate energy can be obtained from the dry grass in the pastures. When this is true, will cattle fed protein supplement at four or six day intervals gain as well as those fed every other day? An experiment to provide such information was started in November, 1960.

Procedure

Thirty yearling Hereford heifers were divided into three lots of 10 head each on November 22, 1960 and each lot was placed in a pasture of about 100 acres of native grass at the Lake Blackwell range area. All heifers were fed an average of 2 pounds of pelleted cottonseed meal per head daily. Those in Lot 1 were fed an average of 4 pounds per head every other day, those in Lot 2 were fed 8 pounds every fourth day, and those in Lot 3 were fed 12 pounds every sixth day. A mineral mixture of 2 pounds salt and 1 pound defluorinated phosphate was available in all pastures.

Results

A summary of the weight gains of the heifers is given in Table 1. In the 137 day period from November 22 until April 8 the heifers fed protein supplement every other day lost 2 pounds, while those fed every fourth day lost 8 pounds per head. Those fed every six days lost an average of 26 pounds, which is considerably more than the losses in the other groups. There was considerable variation in response of individual animals and recommendations should not be made on the basis of results of this pilot test.

Table 1.—Comparison of Supplemental Feeding of Yearling Heifers at Two, Four, and Six-day Intervals (Preliminary Results, 1960-61).

Lot Number Interval between Feedings Pounds Cottonseed Meal per Head per Feeding[1]	1 2 days 4	2 4 days 8	3 6 days 12
Number of heifers per lot	10	10	10
Average weight per heifer (lbs.)			
Initial 11-22-60	592	600	605
Spring 4-8-61	590	592	579
Gain (137 days)	—2	—8	—26

[1] Each heifer received an average of 2 lb. of pelleted cottonseed meal per day.

An Evaluation of Two Methods Of Measuring External Fat on a Beef Carcass

L. A. Malkus, R. L. Henrickson,
C. J. Christians, and D. F. Stephens

Introduction

Consumers today want a high quality meat product, and have a decided adversion to fat. To meet the consumer demand, the retailer must display beef cuts with a minimum amount of fat trim. This often results in considerable waste and reduces the amount of salable meat. Excessive fat on the beef carcass has become an important factor in determining the actual value of the carcass.

The increasing emphasis on carcass evaluation, consumer preference, and in general a more intense effort to determine the criteria which will define a good beef carcass, makes the measure of carcass fat an important factor.

This investigation was initiated to compare two external fat measurements of the beef carcass with the actual percent fat estimated by separating the 9-10-11th rib section.

Procedure

A total of 117 Angus steers and heifers from the Oklahoma State University performance testing program were used in this study. As calves, they ran to a creep feeder while nursing their dams. The calves were weaned at seven months of age and placed in a feed lot for 159 days. A ration consisting of the following was fed: 350 pounds ground whole corn; 200 pounds cottonseed hulls; 100 pounds chopped alfalfa hay; 100 pounds whole oats; 100 pounds wheat bran; 100 pounds cottonseed oil meal; and 50 pounds blackstrap molasses.

At the end of the 159 day feeding period, the cattle were slaughtered and the routine carcass data were obtained. The age of the cattle at the time of slaughter averaged 13 months. Tracings of the lean and fat areas at the 12th rib were taken on both sides of the carcass. A physical separation of the 9-10-11th rib sections into fat, lean, and bone was made. The amount of fat in the carcass was then estimated from these values.

The external fat covering over the loin muscle was determined by two measurements; *width of fat* and *fat area*. The *width of fat* was determined by the following procedure. (Figure 1.)

1. Measure the length of the loin (*longissimus dorsi*) muscle using the long axis as shown in Figure 1. (A-B)

2. Three measurements were designed to characterize the adjacent external fat. The first measurement was made perpendicular to the center line of the long axis of the loin muscle at a point one-half the length of the muscle (E). The second was parallel to the first at a point one-fourth the length of the loin muscle measured from the ventral edge of the muscle (C). The third was parallel to the first located at a point one-fourth the distance from the dorsal edge of the muscle (D).

3. Measure from the outside of the fat (C^1, E^1, D^1) where the surface of the fat is perpendicular to the three points on the loin muscle that were determined in step two. The average of the three measurements was recorded as the fat thickness.

The *fat area* was determined by the following method. (Figure 1.)

1. Measure from the lateral and dorsal edges of the long axis of the loin muscle at a point perpendicular to the center line (A to A^1) and (B to B^1).

2. Follow the outline of the fat with a compensating polar planimeter to obtain the area in square inches.

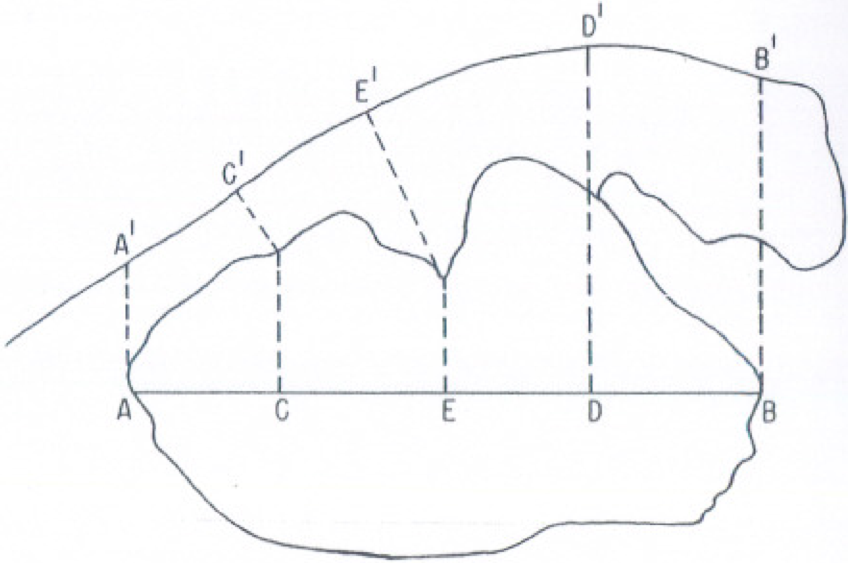


Figure 1.—A Tracing Showing the Points to Use in Making the Width of Fat and Fat Area Measurements.

The 9-10-11th rib section from both sides of each carcass was removed from the wholesale rib and separated into fat, lean, and bone. The percent fat, loin, and bone was then computed for each side. A mean value was obtained for each carcass after combining the percent fat, lean, and bone from the 9-10-11th rib sections from both sides.

Results and Discussion

Data pertaining to width of fat and fat area measurements collected in 1959 and 1960 are shown in Tables 1 and 2. It is interesting to note the similarity between the two groups relative to the amount of fat.

Table 1.—The Mean, Range, and Standard Deviation of Three Fat Measurements of the Beef Carcass[1]

Fat Measurements	Mean	Range	Standard Deviation
Width of fat—inches	0.92	0.63 — 1.33	0.17
Fat area—square inches	4.33	3.16 — 6.00	0.64
9-10-11th rib % fat	43.13	36.08 — 51.66	3.65
Width of fat inches per 100 pounds of chilled carcass weight	0.17	0.09 — 0.25	0.04
Fat area square inches per 100 pounds of chilled carcass weight	0.81	0.57 — 1.09	0.12
9-10-11th rib % fat per 100 pounds chilled carcass weight	8.13	5.13 — 10.74	1.20

[1]Data collected on 58 head in 1959.

Table 2.—The Mean, Range, and Standard Deviation of Fat Thickness, Fat Area, and Physical Separation in the Beef Carcass[1]

Fat Measurements	Mean	Range	Standard Deviation
Width of fat—inches	0.90	0.60 — 1.33	0.17
Fat area—square inches	4.90	3.00 — 7.32	0.90
9-10-11th rib % fat	45.31	36.95 — 58.07	4.15
Width of fat inches per 100 pounds of chilled carcass weight	0.16	0.10 — 0.24	0.03
Fat area square inches per 100 pounds of chilled carcass weight	0.86	0.62 — 1.19	0.14
9-10-11th rib % fat per 100 pounds chilled carcass weight	8.02	6.32 — 10.52	0.97

[1]Data collected on 59 head in 1960.

When cattle of this age, breed, and condition are slaughtered, one may expect to find at least 0.1 of an inch of outside fat cover for each 100 pounds of chilled carcass weight. The range in these cattle which were considered to be uniform was 0.09 to 0.25 inches. With this much variation in animals of similar breeding, it is logical to assume a much wider range would occur in commercial cattle going to market. Once this variation is recognized, steps such as a simple fat measurement will become a tool for detecting these differences.

The fat area indicated that more variation actually existed than was expressed by the linear measurement. When the fat area measurement is used to determine differences, one may expect approximately 0.8 square inches of fat cover for each 100 pounds of chilled carcass weight. The actual range in this group of cattle was 0.57 to 1.19 square inches for each 100 pounds.

The percent separable fat, estimated from the 9-10-11th rib section, was also found to show considerable variation among these carcasses. This variation ranged from 5.13 to 10.74 percent when expressed on a 100 pound basis. When the fat content of a beef carcass varies from five to 11 percent for each 100 pounds of carcass weight, as estimated by the 9-10-11th rib separation, it is easy to see why some carcasses are of more value to the retailer than others.

Correlations between width of fat and percent fat in the 9-10-11th rib section, along with the fat area and percent fat in the 9-10-11th rib section, are presented in Table 3.

Table 3.—Simple Correlations Between Two Fat Measurements and Actual Percent Separable Fat in the 9-10-11th Rib Section*

	Percent Fat In 9-10-11th Rib Section		Percent Fat In 9-10-11th Rib Section[3]	
	1959	1960	1959	1960
Width of fat[1]	.48*	.66*		
Fat area[2]	.32	.67*		
Width of fat[3]			.69*	.62*
Fat area[3]			.53*	.61*

*Significant at 0.01 level.
[1]Measured in inches
[2]Area in square inches
[3]Per 100 lbs. of chilled carcass weight

In most instances, the width of fat had a higher relationship with the percent fat in the 9-10-11th rib section than did the fat area measurement. The data accumulated over a two year period was pooled and the simple correlations were: width of fat (inches) and percent fat in the 9-10-11th rib section .54; fat area (square inches) and percent fat in the 9-10-11th rib section .58; width of fat (inches per 100 pounds chilled carcass weight) and percent fat in the 9-10-11th rib section (per 100 pounds chilled carcass weight) .65; and fat area (square inches per 100 pounds chilled carcass weight) and percent fat in the 9-10-11th rib section per 100 pounds .53. Although most correlations were significant, there seems to be no trend suggesting that one fat measurement is more closely associated with the percent fat in the 9-10-11th rib section than another.

The fat area involved more time and effort to compute than did the width of fat. Thus, it appears that the width of fat would be more useful in practical application than determining the fat area.

Summary and Conclusions

An investigation involving 117 yearling cattle over a two year period was conducted to evaluate two external fat measurements taken at the 12th rib. Primary emphasis was placed on the relationship between a linear fat measurement, and area of fat to the percent separable fat in the 9-10-11th rib section. One may conclude the following relative to these fat measurements.

1. The fat area appears to be more variable within a group than does the width of fat.
2. The linear measurement of fat seems to be an indicator of total carcass fatness. The correlations were significant at the one percent level.
3. Variation in correlation values between each measure of external fat and the percent of fat in the 9-10-11th rib section was considerable between groups. The evidence that one fat measurement is more highly associated with the percent fat in the 9-10-11th rib cut than another is not conclusive.
4. The fat area measurement involves a great deal more time and effort to compute than does the linear measurement.
5. The linear fat measurement appears to be a more practical method for expressing carcass fatness. It takes less time to compute and study thus far indicates that it is just as applicable as the area measurement.

Performance Records on Relatives As Aids in Selecting Boars

J. A. Whatley, Jr.

The boar contributes half the inheritance of all the pigs he sires. Furthermore, more intense selection is possible among boars than among gilts, because fewer boars are needed for replacement. For these reasons the selection of the boar is a critical and important decision. Performance test records are increasing in availability from swine evaluation stations and "on the farm" tests. Although some of these tests may give direct information on the boar himself, much of the information is on his relatives. Thus, it is important to consider the usefulness of such data on relatives in selecting the boar.

Relatives can furnish important information for appraising the breeding worth of a boar. This is true because a boar's own performance is not a perfect guide to his breeding value, and because it is not possible to directly measure a boar's performance in certain traits. The association of individuality or individual merit with breeding value varies with different traits and different circumstances. The best criterion of the degree of association between individuality and breeding value is the heritability of the trait. If heritability is high, then individual merit is a good and perhaps the best single indication of a boar's breeding worth. On the other hand, if heritability is low, individuality is a relatively poor measure of breeding worth of the individual. For traits of low heritability records on relatives become important sources of selection information.

The economically important traits that should be considered in a complete swine selection program are sow productivity, gaining ability, efficiency of gain, meat type, carcass merit, and soundness. These are not listed in any order of importance, and some of these traits are associated with others. Carcass merit, sow productivity, and efficiency of gain are generally the traits for which performance records on relatives are most successful.

Carcass Merit of Relatives

Traits associated with carcass merit such as backfat thickness, loin lean area, percentage of lean cuts, and length are the most highly hereditary traits in hogs. Average heritability estimates on these carcass traits range from 35 to 60 percent. These relatively high heritabilities suggest that selection on individual merit should be reasonably successful. However, most of these traits cannot be measured directly on the live animal. Backfat thickness is an exception. It can be measured with reasonable accuracy by probing the live animal. It is also probable in the near future that ultrasonic measurements may be used to estimate muscling in the live hog. Direct carcass measurements and appraisal, however, can only be made on slaughtered hogs and consequently these measurements must be made on the relatives of breeding stock.

A good group of relatives from which to get carcass data are pigs by the same sire and out of several different dams. Data from such a sire group can be used in two ways in selection. First, they can be used as a progeny test on the sire and a partial progeny test on the dams of the pigs slaughtered. Secondly, data on such a sire group can be used in the selection of full and half brothers and sisters of the carcass individuals. This is called a *sib test*. It can be used very effectively in selecting young boars whose sibs are on a slaughter test.

If the carcass data from sire groups is to be accurate and effective in progeny test and sib test selection, the following items should be considered in planning the test.

1. *The sires of the different groups of pigs should be mated to comparable sows.* This is especially important if the carcass data on the group

are to be used in progeny test selection. Many sires can be made to look good if mated to a selected group of sows.

2. *The pigs in the different sire groups should be fed and managed alike.* Preferably they should be full fed the same ration, in the same season, in the same year, and at the same location. This is necessary in order to reduce environmental differences between groups and thus increase the selection accuracy based on group differences. Comparing the carcasses of pigs fed in different herds where one group may be full fed and another group limited fed does not give reliable evidence of hereditary differences in carcasses.

3. *An adequate number of pigs should be slaughtered from each sire* in order to get a reliable evaluation of the sire's transmitting ability and the hereditary worth of the pigs. Carcasses from one or two pigs from a sire give no more than an interesting lead. The minimum number from a sire group should be six from at least four different sows. Ten or 12 carcasses from at least five or six sows would make an even better test.

4. *The pigs to be slaughtered should be an unselected sample of pigs by each sire.* Choosing the best pigs for a carcass test may greatly bias the results. Such a procedure automatically favors sires that are used most extensively and have the largest number of pigs. If sire groups are from different herds this procedure also biases the results in favor of the sire group from herds whose owners are the best judges of meat type hogs. This is a weakness in the meat type certification program which was not of much importance when the program was young, but will be of greater importance in the years ahead when tests must be made more critical to continue improvement.

5. *Sex differences in carcasses must be taken into account.* Gilts are longer and leaner than barrows. This can be taken care of by slaughtering equal numbers of each sex, or by slaughtering pigs of the same sex, or by correcting the carcass data for sex differences if unequal sex ratios exist in different groups.

Efficiency of Gain

Individual feeding is necessary to measure efficiency of feed conversion on the individual boar. This is a rather expensive test because of the facilities and labor required. A sire group of pigs that are to be slaughtered for a carcass test could also be used for a rate and efficiency of gain test. Sire groups can be separately fed. The feed conversion record on such a group can be used as a progeny test of the sire and also as a sib test for the half brothers of the group. The feed conversion record of the sibs along with the boar's rate of gain gives a fairly effective selection tool for rate and efficiency of gain.

In conducting feeding tests it is essential to keep feed wastage to a minimum. The physical nature and palatability of the test ration and the proper adjustment of self feeders have marked effects on feed wastage. Tests in which there is considerable feed wastage are not worth the trouble of keeping the feed records. Under such conditions, differences in the amount of waste in different lots make it impossible to obtain useful measures of feed efficiency.

Sow Productivity

Sow productivity, measured by pigs per litter and litter weaning weight, has a low heritability. Only about five to 10 percent of the differences in litter size are attributable to heritable differences among sows. Selection of boars for this trait must be based entirely on the performance of relatives. Sow productivity cannot be measured directly on the boar. Litter size is largely a maternal effect dependent on the dam. A boar of normal fertility has little if any effect on the size of litter he sires. The size of litter is chiefly determined by the number of eggs ovulated and the successful implantation and development of the embryos. These are properties of the sow.

The boar does transmit inheritance to his daughters which affect their ability to produce large litters, and, consequently, this trait should be considered in boar selection. The productivity of a boar's dam, his sisters, and his daughters furnish the most useful information on sow productivity in selecting boars. In the initial selection of a young boar the production record of his dam and perhaps his granddams are the only indications of his breeding value for his trait. Although no selection procedure for this trait is highly effective because of the low heritability, selection on the basis of the dam's total production improves the accuracy of selection. All the production records on the boar's dam should be considered and not just the one litter in which the boar is raised. The average production records of the boar's full and half sisters should also be considered when such records are available. When the boar is old enough to have daughters with production records, these probably give the best measure of his breeding worth for sow productivity. Probably at least 10 daughters are needed to give a highly accurate progeny test on the boar for sow productivity.

Although the appraisal of the potential and actual breeding worth of a boar is a continuous procedure, there are three distinct ages when boars should be carefully appraised and some selection and culling decisions made. The first age at which selection decisions are normally made is the initial selection of young boar pigs at four to eight weeks of age. The second age and a more critical selection time is when boars are about six months of age and final decisions are made on herd boars. The third age for selection is on mature boars after they have been proven by progeny tests. Many breeders fail to utilize opportunity for selection at this time to its fullest extent. Obviously, selection at all of these ages is most effective when adequate performance records are available on the boar and his near relatives.

Selecting the Boar Pig

In the initial selection of the young boar pig considerable weight must be given to the relatives (ancestors) in his pedigree. The boar is too young to express much of his potential for growth rate and meat type. Certain unsoundness may not show up until later in life and of course he can never express his potential for sow productivity. Consequently, this is the age at which the performance of relatives should be given considerable weight in selection. Boar pigs should be selected from productive sows that have been evaluated on the basis of all of their litters. The young boars should be sound, healthy, and vigorous pigs with a minimum of 12 nipples. They should show evidence of length and muscling. The meatiness of their sires and dams should be considered. Progeny tests of their sires for rate and efficiency of gain and for carcass merit should be considered for those sires old enough to have such tests. Selection at this age is primarily on pedigree. About twice as many boars should be selected as one expects to use or sell. This will permit additional culling of the boars after performance of the boars and their sibs has been appraised at six months of age.

Selecting the Six Month Old Boar

At about six or seven months of age sound, rapid gaining, meaty boars should be selected whose sibs have made rapid and efficient gains and have yielded desirable, meaty carcasses. Unsound boars should be culled and there should be some discrimination against those boars with sibs exhibiting unsoundness' as hernias, cryptorchidism, and crooked legs. Although most of the selection for dam's productivity should have already been made in the initial selection of the boar pig, there may still be some opportunity to select further for this trait among six month old boars.

Selecting the Proven Sire

At this stage the pedigree information and the individuality of the mature boar are of secondary importance to the progeny test information. If the progeny test is accurate and adequate, it is a true measure of breeding worth. Rate and efficiency of gain, carcass merit, and soundness of the progeny should now be the primary basis for selecting the proven boar for further service. If a boar is proven to be of superior transmitting ability in the desired traits, every effort should be made to extend his use. Proven superior boars are not often found. When one is located, a breeding program should be planned for such a boar that will retain his use for a long period of time.

Practical Methods for Evaluating a Beef Carcass

R. L. Henrickson,
L. E. Walters, and J. J. Guenther

Introduction

The ultimate objective of all beef cattle breeding, feeding, and management endeavors are culminated in the carcass as the marketable end product. In a great measure, the success of any beef production system is determined by the efficiency achieved in producing a quantity of beef that will meet consumer satisfaction. Most of us will agree that during recent decades much progress has been made in the improvement of both the efficiency of production and desirability of end product. Much of this progress has been made through selection practices based on the visual appraisal of breeding stock. In most cases selection has been within certain breeding groups, such as, *families* or *blood-lines.* However, more objective efforts must be forthcoming if further progress is to be made in the identification of breeding stock capable of efficiently producing high quality block beef. Consequently, practical methods for evaluating a carcass are of some concern at this time.

Rate and Efficiency of Production

The rate and efficiency of gain by feeder cattle has been the subject of considerable research in recent years. The influence of ration, as well as inherited ability to "do well" under feed lot conditions, is of importance to both the breeder and feeder. If calves are fed to enable them to express their inherited production ability to a maximum, then differences in efficiency of feed conversion into meat becomes very important. Such factors as birth weight, weaning weight, post weaning feed lot gain, and the efficiency of feed lot gain have their place in a testing program. The producer, regardless of his position in the production line, will have these production data available to help him when confronted with selecting and/or culling decisions. Research has indicated that each of the above factors are influenced greatly by inheritance. Estimates of heritability have been placed at approximately 41 percent for birth weight; 30 for weaning weight; 45 for post weaning feed lot gain and 39 for efficiency of feed lot gain.

Thus, with reliable production data available, the beef cattle breeder can expect to make some progress in herd efficiency by more precisely identifying animals within the herd which have superior carcass traits. Such traits may be measured against a set of production goals.

Production goals have arbitrarily been set at 1.4 pounds of chilled carcass weight per day of age for steers and 1.3 pounds for heifers. It is felt by workers in the field that these values have merit in evaluating efficiency of production, as well as, quantity of production. Many cattle in herds today can accomplish and surpass these minimum goals. The future requirements, of course, must be advanced from time to time as better animals are identified and their genetic potential utilized to the maximum.

Carcass Desirability

In order to properly evaluate the end product (carcass), one must first be reconciled to the fact that it will be necessary to keep a set of records. Such records must by necessity reflect the *breed* and *blood line* to include the sire and dam. These data would then become valuable at the time the herd is culled and replacement selections made. *Sex* of each animal should also be recorded, since it is generally known that the carcass from a male will have less waste fat than one from the females. On the other hand, females are considered to mature more rapidly than males, thus reflecting a carcass which would likely have more outside fat and marbling at a given age. Sex is easily determined in the carcass by observing the udder or cod fat. Further positive identification may be obtained by observing the severed spermatic cord. This is commonly referred to by packing house personnel as the "pizzle". The "pizzle" or severed spermatic cord is located near the rear end of the pelvic bone. (Figures 1 and 2).

The birth date of each animal should be recorded. This would provide a basis for calculating the *age in months*. Accuracy in recording age should be considered important since it must be used in establishing the economics of production.

Cost of producing a pound of carcass meat may be calculated after the *live weight* and carcass weight have been established. These weights by themselves are of little value, but when combined with the age of the animal and the feed cost; it is possible to arrive at some production cost factor. *Cold carcass weight* should be recorded to the nearest one-half pound. Carcass weight by itself is also of little value since it only reflects the total number of pounds of lean, fat, and bone that have been produced. On the average, one may expect a choice carcass to contain approximately 55 percent lean, 32 percent fat, and 13 percent bone. This means that an animal weighing 1000 pounds would yield little more than 330 pounds of lean meat. Some variation in total lean will exist among carcasses and is visually appraised as conformation or carcass thickness. This is why the large retail chains have been selecting some carcasses from the rail in preference to others.

The difference in retail value between carcasses, in extreme cases, can be more than $150. A difference of $50 among carcasses is not unusual. Studies conducted by U.S.D.A. officials have shown that in the higher grading carcasses each one percent increase in the carcass yield of the preferred retail cuts increases the carcass value by approximately $1.25 per hundred weight. This much difference can easily be visually differentiated. A common cut used to recognize these differences in value is the *loin muscle*. Differences are generally determined at the time the carcass is ribbed for shipment.

The *size of loin muscle* is important and does tend to reflect the quantity of lean in the various other portions of the carcass. The *shape of the loin muscle* should also be considered since a plump oval steak is desired. Consequently, a plump oval loin eye is preferred to a long

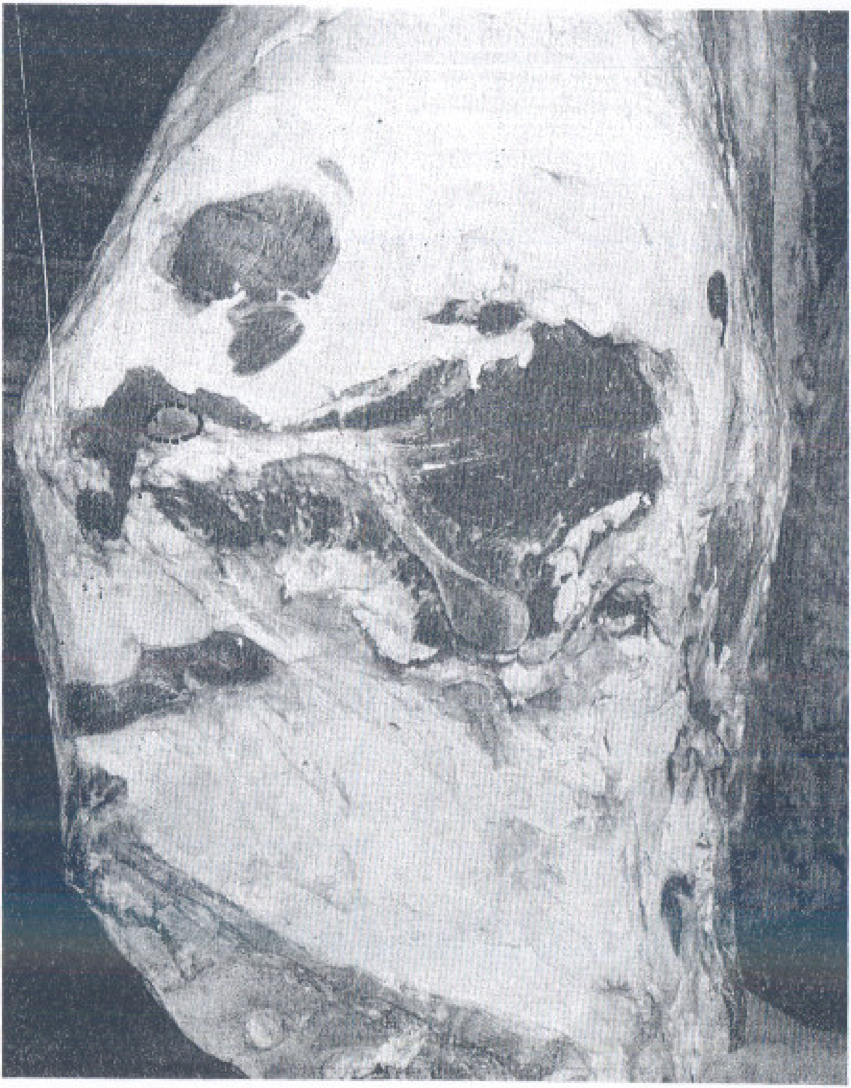


Figure 1.—Characteristics identifying the steer carcass include generally prominent cod fat, the half-closed face of the gracilis muscle, and the spermatic cord at the upper end of the aitch bone.

flat loin eye. The size and shape of the loin muscle may be recorded for future study and measurement by the following methods.

Place a piece of 6 x 9 transparent tracing paper over the ribbed area and trace the outline of the muscle. A number two lead pencil should be used since it will be soft enough to avoid puncturing the

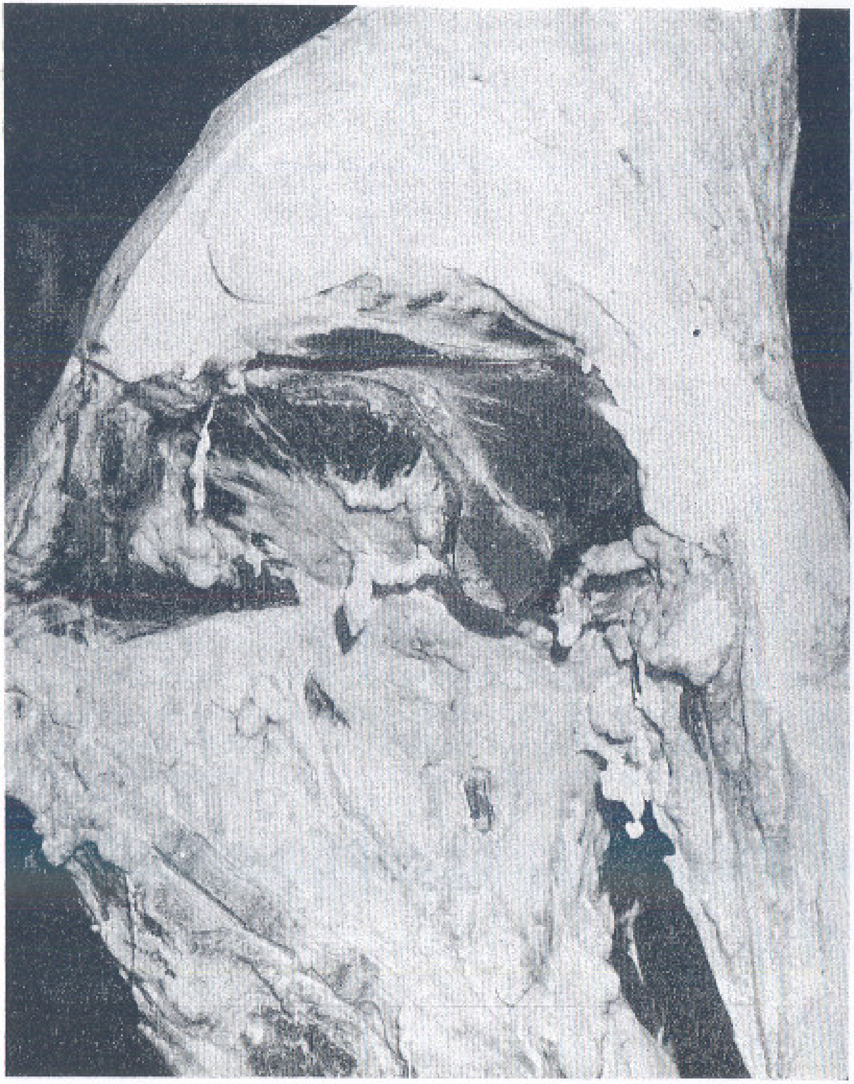


Figure 2.—Identifying heifer carcass characteristics include the presence of the udder and the exposed face of the gracilis muscle above the aitch bone.

tracing paper and will make a line dense enough so that the tracing can be observed. Care should be taken to avoid including adjacent muscles in the loin eye area. An example of the true muscle area may be observed in Figure 3.

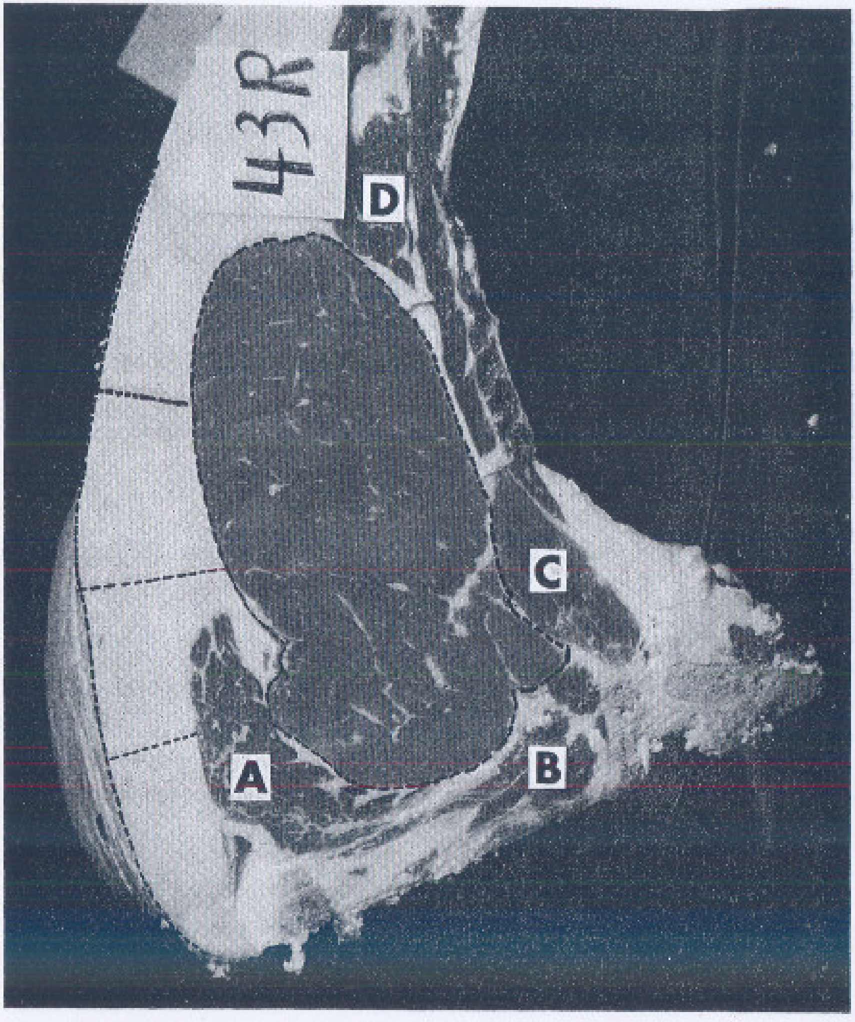


Figure 3.—In some carcasses the loin muscle is cl.arly separated from all surrounding muscles. Other carcasses have some apparent overlapping of muscles. Such adjoining muscle areas should not be included in making loin muscle tracings. The loin muscle in this photograph is enclosed by a dotted line. Fat thickness is determined by taking an average of the thr e measurements shown. Muscle structures labeled as A, B, C, and D should not be included in the loin muscle tracing.

A tracing of the *fat cover* may also be made before the transparent paper is removed from the ribbed area. Thickness of fat over the loin muscle along with the amount of kidney and pelvic fat are good indicators of carcass wastiness. This fat should be held to the very minimum since it is a part of the non-edible portions of the carcass.

The loin muscle area and fat cover may be visually appraised for their approximate quantities of each or they may be measured. If the objective approach is chosen the area may be determined with the aid of a polar planimeter. The planimeter reading will be directly in square inches. The area then should be expressed on a hundred pound basis. Two square inches of loin muscle per 100 pounds of carcass weight would be a good goal for cattle averaging 12 to 15 months old at the time of slaughter. Fat thickness should be determined by taking an average of three separate points over the loin muscle. Make sure the lines are drawn at right angles to the fat surface. One measurement should be at the center of the long axis of the loin muscle and the others one-fourth of the distance from each end. A typical measurement may be observed in Figure 3. The average of the three measurements should be recorded in tenths of an inch of fat thickness. One-tenth of an inch of fat for each 100 pounds of carcass would be adequate. Amounts in excess of this should be basis for discounting a carcass.

A visual appraisal of the muscle should be made for marbling. The quantity may be established by a federal grader or an individual may wish to compare the marbling with a standard set of photographs. Shown in Figure 4 are four degrees of marbling representative of the official United States Standards for grades of carcass beef. The amount of marbling generally desired in the lean ranges from a modest to a moderate amount. This amount of intramuscular fat has been found to provide adequate liquid during cookery and mastication. Since additional marbling has not been shown to improve the tenderness, a *modest* amount is considered sufficient to enhance the lean meat flavor and provide eating pleasure.

Summary

Some improvement in beef type cattle will be made through a recognition of the carcass traits. These traits when combined with the production traits become valuable tools in determining production efficiency and product desirability.

Beef type cattle may be considered to have the following characteristics:

1. Chilled carcass weight/day of age.	Steers 1.4 lbs or more Heifers 1.3 lbs or more
2. Rib eye area/cwt carcass	Two square inches or more
3. Fat cover/cwt carcass (at the 12th rib)	0.1 inches or less
4. Quantity of marbling	Modest to moderate
5. Conformation	Thick and meaty
6. Kidney fat and pelvic fat	Small amount

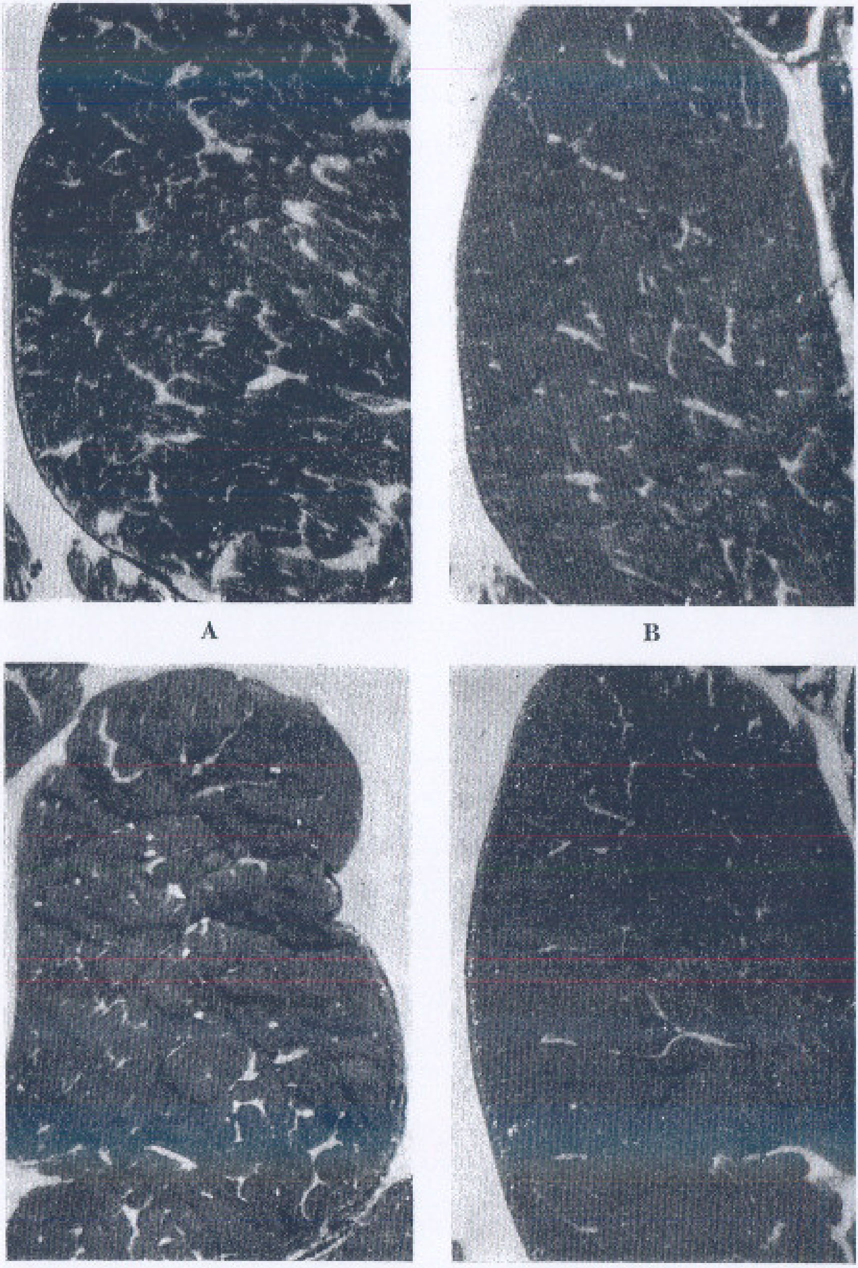


Figure 4. Representative degrees of marbling determined by official United States Standards for grades of carcass beef. Examples shown here include marbling degrees classified as (A) slightly abundant, (B) moderate, (C) modest, and (D) small.

The Influence of Excessive Fatness On the Performance of Beef Females

Robert Totusek, G. L. Holland, Dudley Arnett, and E. W. Jones

Many purebred cattlemen, who often fatten heifers to a high degree while fitting for show and striving for maximum development, feel that excessive body fat adversely affects the subsequent productive value of beef females. Although most commercial cattlemen do not feed heifers and cows above a moderate plane of nutrition, experimental results indicate the possibility that productivity may be impaired by levels of energy intake within limits fed by some cattlemen.

Basic information on the effect of a high degree of body fatness is needed. Such information, obtained by studying extreme differences in energy intake, should aid in the interpretation of results from research in which more "practical" differences in plane of nutrition are studied. The specific objective of this experiment is to determine the influence of excessive body fat on the performance of beef females by inducing a high degree of fatness during the period of growth and development after weaning.

Procedure

Thirteen sets of twin heifers are now on test. Ten of the sets are believed to be identical. One heifer of each set is fed a ration adequate in all nutrients but containing only enough energy to promote gains of one-half to two-thirds pounds per head daily (low level). The second heifer of each set receives a similar ration plus a full feed of corn (high level). Heifers are individually fed in stancheons to facilitate accurate control of feed intake and weight gains of each heifer.

Heifers are bred to calve after 30 months of age. After calving, a ration adequate for maximum lactation is fed to all heifers. Reproductive performance of the heifers is being measured by breeding efficiency, maintenance of pregnancy, ease of calving, and the weight and condition of calves at birth. Milk production is being estimated by the growth rate of the calves, by milking the heifers at regular intervals, and by weighing the calves immediately before and after nursing. Data is also being obtained concerning body measurements, body temperature, certain blood constituents, and gross physiological observations of the reproductive tract.

Results

Eleven sets of twins have attained sufficient age to complete their first lactation. Weight and performance results are shown in Table 1. High level heifers weighed 320 pounds more at first mating, and 507 pounds more at first calving, than low level heifers. These difbody fatness between the two groups of heifers. Most of the sets of twins were maintained on the trial rations at least 12 months before breeding, and in no case was the pre-breeding experimental period less than nine months.

Table 1.—Weight and Performance of Twins Through the First Lactation

Level of Feeding	Low	High
Number	11	11
Average weight (lbs.)		
Beginning of trial	464	460
First mating	679	999
First calving	827	1334
No. services per conception	1.27	1.91
No. cows requiring assistance at calving	1	6[2]
No. calves lost at calving	1	3
No. cows lost	0	2
Birth weight of calves (lbs.)	60	64
Average daily milk production, 112 days (lbs.)[1]	9.2	6.8

[1] Includes data on 10 sets of twins
[2] Includes two Caesarean sections

Little difference in breeding efficiency was noted between low and high level groups. The relatively poor average efficiency of the high level group (1.91 services per conception) was caused entirely by the failure of the first three sets of high level heifers to conceive readily. Observations indicated that the libido of the bull being used at that time was below normal. The bull was replaced and the subsequent breeding efficiency of the next eight sets of heifers was excellent (1.25 and 1.13 services per conception for low and high level heifers, respectively).

More calving difficulty, greater calf losses, and greater cow losses were observed in the high level group than in the low level group. All but one of the low level heifers calved normally without assistance. Six of 11 high level heifers required assistance at calving. Two of the heifers required Caesarean sections, and two others calved by malpresentation.

One calf was lost at birth in the low level group, apparently due to a covering of placental membranes over the mouth and nostrils. Three calf losses were assessed against the high level group. One calf was dead at birth, another died 10 days after birth, and in a third instance the fetus was reabsorbed at approximately the seventh month of gestation. No cows were lost from the low level group during the first lactation. One high level cow died a month after calving as a result of acute mastitis; another was removed from the experiment after 112 days of lactation due to a prolapse and stricture of the rectum which may have been caused by difficult calving.

Low level cows produced an average of 35 percent more milk (9.2 vs. 6.8 pounds per cow daily) than high level cows during the first 112 days of their lactation. Average milk production curves showed that the low level cows reached a peak in production between four and six weeks following parturition while the high level cows failed to similarly increase in production during the same period. The production curves of the two groups were approximately parallel after the first six weeks, although the production of the high level cows was at a lower level.

Differences in milk production within sets of twins were not consistent; three high level cows actually produced more milk than their low level mates. Although the limited number of twins in this experiment prevents definite conclusions, a possible treatment-genotype interaction is suggested by the variable milk production trends among various sets of twins. For example, within the three sets of Angus twins, the high level cows produced drastically less milk than their low level mates (5.7 vs. 11.1, 1.9 vs. 11.5, and 1.1 vs. 11.7 pounds milk per cow daily). It would appear that some cows are more susceptible to impairment of milk production from a high degree of body fatness than others.

Since some heifers and calves were lost from the experiment, only five comparisons can be made wherein both low and high level heifers raised their own calves. Within these five sets the average 210 day weights were 374 and 338 pounds for low and high level groups, respectively. There was a high correlation (.75) between milk production and calf gain on a within twin basis. There was a tendency then for low level cows to produce more milk and raise heavier calves than high level cows.

The twin cows are presently in their second or third lactations. Trends noted in the first lactation have continued. Four of 11 cows have been lost from the high level group, and another has failed to rebreed. All of the low level cows remain on experiment and are apparently in a normal, healthy condition.

Hematocrit, hemoglobin, and plasma protein values of high level cows were significantly ($P<.05$) higher than values of low level cows. Red blood cell and white blood cell values followed the same trend, but differences were not statistically significant. Levels of blood constituents of both low and high level cows were within normal ranges, and actual differences between treatments were probably too small to be of physiological importance. Furthermore, it should be remembered that the high level cows had the higher levels of blood constituents, but performance that was inferior to that of the low level cows.

Rectal temperatures were taken daily during four separate 10 day periods. High level cows had a significantly ($P<.05$) higher average body temperature than low level cows. However, the small difference (102.37° F. compared to 102.21° F.) may not be of physiological importance.

Summary

Eleven sets of twin heifers have completed one lactation on test. Results to date show that a high level of body fatness had little influence on breeding efficiency but slightly increased birth weight of calves, and also resulted in increased calving difficulty, lower milk yields and calf weights, and decreased survival rates of both heifers and calves. Levels of certain blood constituents and the average body temperature of fat heifers were higher than the values of low level heifers.

Relative Value of Bermuda Grass Hay Vs. Prairie Hay For Wintering Beef Calves

A. B. Nelson, R. D. Furr, W. C. Elder, and G. R. Waller

Many pasture improvement plans include establishment of Bermuda grass sod for grazing use or the production of hay. The protein content of the forage may vary considerably with fertilization treatments. Because many cattlemen are concerned with the feeding value of Bermuda grass hay, a preliminary study of its value was started at the Lake Blackwell range area in November, 1960.

Procedure

Eighteen weanling grade Hereford calves were divided into two lots (seven heifers and two steers per lot) on November 16, 1960. Each lot was placed in a small pen (about one acre) and fed hay *ad lib.* Those in Lot 1 were fed prairie hay which had been harvested at the range area. The predominant grasses in this hay were little bluestem, big bluestem, switch, and Indian.

The calves in Lot 2 were fed Bermuda grass hay produced at Stillwater under the direction of the Agronomy Department. This was Midland Bermuda grass grown under conditions of adequate moisture, fertilized with 200 pounds of nitrogen per acre for the season, and cut periodically through the summer.

The chemical composition of the hays is given in Table 1. It was estimated that the total protein furnished by the Bermuda grass hay when consumed at a rate of nine to 10 pounds was more than adequate for maintenance of the calves. The digestibility of the protein in both hays was assumed to be 50 percent. The average daily consumption of Bermuda grass hay was 9.20 pounds per head. Calculations based on a total protein content of 13.1 percent and a protein digestibility of 50 percent indicate an assumed digestible protein intake of 0.66 pounds per head daily. The fact that protein is nearly always the limiting nutrient in prairie hay is borne out when calculating the digestible protein intake from this particular hay. This prairie hay contained an average of only 4.44 percent total protein. With an assumed 50 percent digestibility and the measured 9.26 pounds of hay intake, the digestible protein intake from the hay was 0.21 pound. Supplementing the prairie hay with 1.39 pounds of pelleted 41 percent protein cottonseed meal (32.5 percent digestible protein) furnished an additional 0.45 pound digestible protein. The total from the hay and cottonseed meal was 0.66 pound, the same as from Bermuda grass hay alone. This may be compared to their estimated requirement of about 0.60 pound digestible protein per head daily.

Table 1.—Chemical Composition of Hays Fed to Weanling Calves

	Percent composition as fed								Carotene
	Water	Ash	Protein	Fat	Fiber	N.F.E.	Ca	P	mc/gm
Prairie hay	5.9	6.8	4.4	1.9	32.2	48.8	.42	.07	5.7
Bermuda grass hay	5.5	7.9	13.1	1.9	27.1	44.5	.32	.22	43.4

The total protein intake was considerably greater for Bermuda grass hay alone, 1.21 pounds, as compared to 0.98 pound from the prairie hay and cottonseed meal.

A mineral mixture of two pounds salt and one pound steamed bone meal was available in all lots.

Results and Discussion

A summary of weight gain and feed consumption is given in Table 2.

In the period from November 16 until February 11 (87 days) the calves fed prairie hay and cottonseed meal gained 58 pounds. Those calves fed Bermuda grass hay without a protein supplement gained only seven pounds. It is assumed that the basic deficiency in most grass hays is protein. It has been shown that the protein content of prairie hay from this area is not adequate to maintain weight of weanling calves. The protein content of this unsupplemented Bermuda grass hay should be adequate to support some weight gain. We also assume that both hays should furnish sufficient energy for wintering calves for little or no gain.

Although the calculated digestible protein content of the two rations was nearly equal, either the protein in the Bermuda grass hay was not well utilized or other nutrients were lacking. Therefore, starting on February 16, pelleted cottonseed meal was fed to both groups of calves. For those fed Bermuda grass hay this change resulted in a total protein intake which is considerably higher than that deemed necessary. The gains in the subsequent 27-day period were 19 pounds for prairie hay and 26 pounds for Bermuda grass hay. Calves fed the latter hay had gained more rapidly in this period. Gains of the two groups of calves will be recorded for an additional 40 days.

Table 2.—Relative Value of Bermuda Grass Hay Vs. Prairie Hay for Wintering Beef Calves.

Lot Number Hay Fed[1]	1 Prairie	2 Bermuda Grass
Number of calves per lot	9	9
Average weight per calf (lbs.)		
November 16, 1960	360	362
February 11, 1961	418	369
Nov. - Feb. gain (87 days)	58	7
March 10, 1961	437	395
Feb. - March gain (27 days)	19	26
Average feed consumption per calf (lbs.)		
Cottonseed meal	158	21
Hay[2]	1056	1049

[1] Calves in Lot 1 were fed prairie hay and 1.39 lbs. cottonseed meal pellets for the total 114 days. Those in Lot 2 were fed only Bermuda grass hay until Feb. 16. At this time the Bermuda grass hay was also supplemented with 1.39 lb. of cottonseed meal pellets per head daily.

[2] Total pounds of hay consumed per calf. Average daily consumption was 9.26 and 9.20 lbs. in Lots 1 and 2, respectively.

Summary

Preliminary results have shown that weanling grade Hereford calves fed Bermuda grass hay gained one-eighth of the amount of those fed prairie hay supplemented with cottonseed meal to make the two rations equal in estimated digestible protein content. These data suggest that (1) the protein of the Bermuda grass hay was poorly utilized, (2) the Bermuda grass hay contained some unrecognized inhibitory factor, or (3) the Bermuda grass hay was deficient in some respect.

Stilbestrol for Range Beef Cattle

A. B. Nelson, L. R. Kuhlman, and L. S. Pope

Stilbestrol is being used in many systems of beef cattle production. Its use with fattening cattle is generally accepted as a means of increasing weight gain and feed efficiency. In range beef cattle production the three phases in which stilbestrol is being used are: (1) suckling calves, (2) wintering weanling calves, and (3) summer grazing of yearlings. Summaries of 1960-61 research concerning these three phases are included in this report.

Part 1. Stilbestrol Implants for Fall Calves

Procedure

A total of 89 grade Hereford calves (53 steers and 36 heifers) were divided into lots as shown in Table 1. These calves were born in November and December of 1959 and were from six groups used in a creep-feeding study. Five of these groups were creep-fed and the other group was not creep-fed. One group was creep-fed until weaning; four groups were creep-fed only until green grass was available in the spring. Within each of these treatments, calves of like sex were divided into three lots. One lot served as the control. The second lot was implanted with 6 mg. of stilbestrol, and the third lot was implanted with 12 mg of stilbestrol.

Table 1.—Stilbestrol Implants for Fall Calves

Lot Number Stilbestrol Implant, mg[1]	1 0	2 6	3 12
Steers			
Number of calves	20	16	17
Average weight per calf, lbs.			
Initial 3-19-60	214	228	214
Final 7-25-60	454	473	467
Gain (128 days)	240	245 (5)[2]	253 (13)
Heifers			
Number of calves	12	12	12
Average weight per calf, lbs.			
Initial 3-19-60	216	217	212
Final 7-25-60	440	438	452
Gain (128 days)	224	221 (—3)	240 (16)

[1] Implants furnished by Chas. Pfizer and Co., Terre Haute, Indiana.
[2] Figures in parentheses are increased gain compared to no implant.

The calves were weighed and implanted (Lots 2 and 3) on March 19, 1960. They were left with their dams in native grass pastures at the Lake Blackwell experimental range area until they were weaned on July 25, 128 days after implanting.

Results

The response to stilbestrol implants was nearly equal for both sexes. The 6 mg implant increased steer gains six pounds but reduced heifer gains three pounds. Apparently this level of stilbestrol is too low to consistently affect weight gains.

Although the response was not relatively great, the 12 mg implant resulted in increased gains, an increase of 13 pounds for the steers and 16 pounds for the heifers when compared to no stilbestrol. This is less than the 12 percent average increase obtained in several previous tests.

Part 2. Feed-Lot Performance of Previously-Implanted Calves

Research conducted to date has indicated that the subsequent performance of calves implanted when they are three to five months old is not adversely affected when they are fattened in dry lot or fed wintering rations after weaning. The data reported here are the results of fattening fall calves which were previously used in the study of stilbestrol implants reported in Part 1.

Procedure

From weaning in July until the start of the feed-lot test in October all cattle were treated alike. At weaning they were trucked from the Lake Blackwell range area to Ft. Reno for use in a nutrition study. In the post-weaning period (81 days) from weaning in July (full weight) until the start of the feed-lot test in October (shrunk weight), the steers were allowed to graze native grass and were fed six to eight pounds of a fattening ration containing a moderate amount of roughage. In this period the average gains of the three groups were nearly equal, 61 to 64 pounds. (see Table 2).

Table 2.—Subsequent Feed-Lot Performance of Previously Implanted Fall Calves

Lot Number Previous Stilbestrol Implant, mg	1 0	2 6	3 12
Number of steers per lot	16	13	13
Average weight gain per steer, lbs.			
Implantation on March 19 to weaning on July 25, 1960	241	247	260
Weaning in July to start of feed-lot test on October 10, 1960	64	61	63
133-day feed-lot gain	321	335	342
Total gain	626	643	665

In the subsequent nutrition study, the stilbestrol treatment as suckling calves was considered and each treatment was uniformly alloted to seven different full-fed fattening rations. On October 10, 1960, the initial weight was recorded and all steers were implanted with 24 mg of stilbestrol.

Several steers which were seriously foundered were removed from the experiment.

Results

The 133-day feed-lot gains of the steers are given in Table 2. The steers which were not previously implanted in March gained 321 pounds; those previously implanted with six mg gained 335 pounds, and those previously implanted with 12 mg gained 342 pounds. In this test stilbestrol implants for calves did not have any detrimental effect on subsequent feed-lot gains; in fact, the previously implanted cattle, which had gained more while suckling, also gained more during the feed-lot phase. The total 11-month gain was considerably greater for the previously-implanted steers.

Part 3. Stilbestrol Implants for Wintering Weanling Steer Calves

Procedure

Ninety weanling steer calves used in a nutrition study of the value of urea in protein supplements for wintering range cattle were divided into three groups for stilbestrol treatment. The first group (Lot 1) received no stilbestrol treatment. Those in the second group were implanted with 12 mg of stilbestrol. This group was divided into 2 lots. Lot 2 was implanted with two 6 mg pellets, but one 12 mg pellet was used in Lot 3. The steers in the third group were divided into Lots 4 and 5 and implanted with 24 mg stilbestrol, Lot 4 with four 6 mg pellets and Lot 5 with two 12 mg pellets.

All steers were allowed to graze in the dry native grass pastures and were fed an average of two pounds of protein supplement per head daily. A mineral mixture of two pounds salt and one pound steamed bone meal was available in all pastures.

Results

A summary of the weight gains is given in Table 3.

Implanting 12 mg of stilbestrol increased gains an average of six pounds and 24 mg implants increased gains an additional five pounds. Therefore, 24 mg of stilbestrol increased gains an average of 11 pounds. These results are in agreement with earlier tests which indicate a slight response from stilbestrol when cattle are fed maintenance or low-grain wintering rations.

The response to 12- and 24 mg implants was essentially the same whether administered as 6- or 12 mg pellets.

Table 3.—Stilbestrol Implants for Wintering Weanling Steer Calves

Lot Number	1	2	3	4	5
Stilbestrol Implant, mg	0	12		24	
Pellets, Number and Weight	0	2-6 mg	1-12 mg	4-6 mg	2-12 mg
Number of steers	30	16	14	14[1]	15
Agerage weight per steer, lbs.					
Initial November 4, 1960	395	393	394	386	393
Final March 14, 1961	483	441	444	440	448
Gain (130 days)	43	48	50	54	55

[1] Originally 15 head, but one steer was removed because of urinary calculi.

Part 4. Stilbestrol Implants for Yearling Steers Grazing Grass

Procedure

Seventy-two yearling, grade Hereford steers were divided into two lots on May 31, 1960. Lot 1 served as the control group. Those in Lot 2 were implanted with 12 mg of stilbestrol. All cattle were allowed to graze in the native grass pasture and a mineral mixture of two pounds salt and one pound dicalcium phosphate was available. The final weighing was on September 24.

Results

The average weight data are given in Table 4.

The 12 mg stilbestrol implant increased gains 19 pounds or 11.5 percent in the 116-day period. When this relatively low level of stilbestrol was used there were no noticeable side effects, such as low loins and increased teat length. On the average, this and other tests have indicated that 12 mg implants will increase gains of yearling steers nearly as much as 24 or 36 mg without causing undesirable side effects.

Table 4.—Effect of Stilbestrol Implants on Gains of Yearling Steers Grazing Native Grass

Lot Number Stilbestrol Implant[1]	1 0	2 12 mg
Number of steers per lot	36	36
Average weight per steer (lbs.)		
Initial 5-31-60	524	524
Final 9-24-60	689	708
Gain (116 days)	165	184 (19)[2]

[1] Stimplants furnished by Chas. Pfizer and Co., Inc., Terre Haute, Indiana.
[2] Increased gain compared to Lot 1.

Summary

Stilbestrol implants increased the gains of suckling calves (fall), although the response was less than the average recorded in previous tests. Subsequent feed-lot gain of such stilbestrol-implanted cattle was not decreased. Implants of 12 and 24 mg of stilbestrol slightly increased gains of weanling calves wintered on dry grass. Gains of yearling steers grazing native grass during the summer were increased 11.5 percent by a 12 mg implant without producing any noticeable side effects.

Nutritional Studies With Sows and Litters in Confinement

J. C. Hillier, Marvin Heeney, and J. J. Martin

The successful rearing of pigs in the various confinement or semi-confinement systems in common use is dependent, to a large extent, on the nutritional adequacy of the rations fed. The critical time nutritionally is from breeding through weaning, particularly through farrowing and the nursing period. The development of large, well-grown litters to weaning age is essential to efficient production.

Work reported previously at this station indicated that pigs reared in confinement were somewhat smaller at weaning and had about 1.6 grams less hemoglobin per 100 cc. of blood than those raised on pasture, under good weather conditions. Under adverse weather conditions, fewer pigs were lost from seven to 42 days of age and the pigs were larger when reared in confinement. In general, sows have lost less weight during lactation when kept on pasture than when kept on confinement, even though both groups were self-fed the same ration.

Efforts to improve further both the creep ration for the pigs and the lactation ration for the sows were continued. In a recent test, five pounds of green alfalfa forage was fed to one-half of the sows and their litters from seven to 42 days post farrowing. First litter gilts were farrowed in a central farrowing house and moved with their litters to pens 6 x 30 feet in a concrete floored, open shed when the pigs were about seven days old. Lactation Ration 1 shown in Table 1 was self-fed to

Table 1.—Percentage Composition of Lactation Rations Fed to Sows in Confinement

Ration No. Ingredient	1 Percent	2 Percent
Milo (ground)	76.5	75.0
Soybean Meal (44%)	11.1	11.5
Alfalfa Meal (17%)	10.0	10 0
Dicalcium Phosphate	1.7	2.7
Calcium Carbonate	0 0	0.1
Salt	0.5	0 5
Vitamin Pre-Mix[1]	0.2	0.2
Total	100.0	100.0
Calculated Percentage Composition		
T.D.N.	75 3	74.4
Protein	15.0	15.0
Calcium	0.83	1.2
Phosphorus	0.62	0.84

[1] Pre-Mix supplies the following per pound of mixed ration: Vitamins, D_2 190 I.U.; B_{12} 9.5 mcg.; riboflavin 1.2 mgs; pantothenic acid 5.0 mgs. Minerals, iron 15.0 mgs; copper 2.0 mgs; cobalt 0.88 mg; manganese 18.0 mgs; zinc 75 p.p.m.

all sows and the creep ration shown in Table 2 was available to all pigs from seven to 56 days of age. Water was available to the pigs in their creep at all times. An electrical heat bulb provided some heat in the creep during cold weather.

Table 2.—Percentage Composition of the Creep Ration Fed

Ingredients*	Percentage
Corn (ground)	31.7
Milo (ground)	32.0
Soybean meal (44%)	12.4
Fish meal (60%)	6.8
Buttermilk, Dry	10.0
Sugar (cane)	5.0
Calcium Carbonate	0.5
Dicalcium phosphate	0.5
Salt	0.5
Pre-Mix[1]	0.8
Total	100.0

Calculated Composition of the Total Mixed Ration

		Vitamins per pound	
TDN	78.00%	Vitamin A (USP)	2000.0
Calcium	0.83	Vitamin D (I.U.)	180.0
Phosphorus	0.68	Panto Acid (mgs)	10.06
Protein	19.00	Riboflavin (mgs)	3.29
Lysine	1.09	B_{12} (mcg)	12.6
Isoleucine	1.08		
Threonine	0.73	Antibiotic (mgs/lb)	25.0
Tryptophan	0.23		

[1] Hygromix added at the rate of 5 pounds per ton.

In this trial both groups of sows and pigs performed quite satisfactorily. Average litter weaning weights of 375 and 388 pounds were obtained on the two groups. These differences are not of statistical significance. Neither the 42 day weaning weights or the 56 day weights of the pigs differed significantly due to ration treatment. Sows receiving the alfalfa forage in addition to being self-fed the regular ration consumed 0.7 pounds more ration per day and lost 22 pounds less weight during the period from seven to 42 days post farrowing, than those receiving only the regular lactation ration. This difference in weight lost by the sows is the only difference of importance in the response of the two groups.

In previous tests, a few sows became very stiff during late lactation and required several weeks recovery after weaning. In a recent test the calcium and phosphorus content of the ration was increased to determine if additional amounts of these two elements would be beneficial. Lactation rations 1 and 2 shown in Table 1 were fed. These sows and litters were handled as previously described. The results are summarized in Table 4.

Pigs in this test were troubled with scours at various times and weaned at much lighter weights than has been obtained on previous tests where similar pigs have been handled under similar conditions. Differences in individual pig and litter weaning weights were small and non-significant. Sows receiving the higher level of calcium and phosphorus ate about one pound less feed per day but lost about 11 pounds more weight from seven to 42 days post weaning than those on the ration containing the lower level of calcium and phosphorus. Blood samples were taken from these sows at the time the pigs were weaned on which calcium and phosphorus analyses are being made. This data is not available at this time. However, judging from the performance of the sows and pigs, the additional calcium and phosphorus was not needed.

Table 3.—The Supplemental Feeding of Green Alfalfa Forage to Lactating Sows and Their Pigs in Confinement

Ration:	1 Basal	2 Basal Alfalfa Forage
No. of sows and litters	7	9
No. of pigs	61	83
No. of pigs weaned per litter	8.7	9.2
Average weights		
Per pig—56 days	43.2	42.2
Per pig—42 days	28.9	28.1
Per litter—42 days	251.4	258.5
Per litter—56 days	375.8	388.2
Average weight loss by sows (lbs.)		
Farrowing to 7 days	56.0	57.4
7 to 42 days	66.6	44.3
Total to 42 days	122.6	101.7
Feed Consumption (lbs.)		
Per sow to 42 days	449.4	478.8
Per sow per day	10.7	11.4
Creep ration per litter	222.7	247.5
Creep ration per pig to 56 days	25.6	26.9
Feed Cost[1] ($)		
Per sow—farrowing to 42 days	9.44	10.05
Per pig—creep ration	0.95	1.00
Total feed cost per pig weaned—farrowing to weaning	2.04	2.09
Value of weight lost by sow[2]	14.71	12.20
Feed cost per pig plus credit for weight loss per sow	3.73	3.42

[1] Does not include cost of alfalfa forage.
[2] Calculated at $12.00 per cwt.

Table 4.—Performances of Sows and Pigs Retained in Confinement and Fed Rations Containing Two Levels of Calcium and Phosphorus

Lot No.: Ration Treatments:	1 Basal	2 Basal plus Cal. and Phos.
No. of sows and litters	11	11
Average No. pigs per litter		
7 days of age	9.0	9.1
42 days of age	7.8	8.4
56 days of age	7.8	8.4
Average Pig weights (lbs.)		
42 days	19.9	19.2
56 days	27.3	27.2
Average litter weight (lbs.)		
42 days	155.2	161.3
56 days	212.9	228.5
Average weight loss per sow (lbs.)		
Farrowing to 7 days	42.8	54.5
7 to 42 days	27.6	38.7
Total weight loss of sow	70.4	93.2
Average feed consumption (lbs.)		
Per sow to 42 days	480.9	435.6
Per sow per day	11.4	10.4
Per pig to 56 days	20.2	22.1
Feed cost ($)		
Per sow—farrowing to 42 days	10.10	9.15
Per pig—creep ration only	.75	.82
Total feed cost per pig weaned—farrowing to weaning	2.05	1.91
Value of weight lost by sow[1]	8.95	10.44
Feed Cost per pig plus credit for weight lost by sow	3.13	3.15

[1] Weight cost per sow figured at $12.00 per cwt.

Urea in Protein Supplements for Wintering Steer Calves Grazing Native Grass

A. B. Nelson, L. R. Kuhlman, G. R. Waller and W. D. Campbell

Cattle and sheep may utilize urea as a source of nitrogen (protein) because of the action of microorganisms in parts of the ruminant stomach. Efficient utilization of urea will result only when other nutrients are present in amounts needed by the microorganisms. These other nutrients are usually present in rations of fattening cattle. However, some of these nutrients may be lacking when cattle are wintered on dry native grass supplemented with a urea-containing feed.

Tests conducted at this station in recent years have indicated that urea is apparently not efficiently utilized by cattle wintered on dry range grass when it is added to a mixture of corn and cottonseed meal to produce a pellet containing 40 percent protein, with one-third of the nitrogen furnished by urea. The addition of trace minerals or dehydrated alfalfa meal to these supplements has improved urea utilization.

The results of additional tests of the value of urea are reported here.

Procedure

Ninety grade Hereford steer calves were weighed and divided into six lots of 15 head on November 4, 1960. Some of these calves were produced in herds of the Oklahoma Agricultural Experiment Station but slightly more than one-half were purchased at the Oklahoma City National Stockyards Co. The weanling calves were allowed to graze the dry native grass at the Lake Blackwell range area. In addition, they were fed an average of two pounds per head daily (twice the daily allowance every other day) of the following pelleted protein supplements:

Lot 1. 26 percent protein simple supplement

Lot 2. 40 percent protein supplement containing urea

Lot 3. 40 percent protein supplement

Lot 4. 26 percent protein combination supplement

Lot 5. 40 percent protein combination supplement containing urea

Lot 6. 40 percent protein combination supplement

The 26 percent protein simple supplement was 54.0 percent cottonseed meal (41 percent protein, old process), 44.0 percent ground yellow corn, 0.7 percent ground limestone, and 1.3 percent monosodium phosphate.

The 40 percent protein supplement containing urea was 54.0 percent cottonseed meal, 39.0 percent ground yellow corn, 5.0 percent urea[1], 0.7 percent ground limestone, and 1.3 percent monosodium phosphate. Urea furnished approximately one-third of the nitrogen in this pellet.

The 40 percent protein supplement was 92.0 percent cottonseed meal, 7.5 percent ground yellow corn, and 0.5 percent ground limestone. Corn was added to this pellet to reduce slightly the protein content in order to make it equal to the protein content of the pellets fed in Lot 6.

The 26 percent protein combination supplement was 23.0 percent cottonseed meal, 23.0 percent soybean oil meal, 6.0 percent linseed meal, 5.0 percent dehydrated alfalfa meal, 35.65 percent ground yellow corn, 5.0 percent cane molasses, 0.5 percent dicalcium phosphate, 1.75 percent monosodium phosphate, and 0.1 percent trace minerals. The 40 percent protein combination supplement containing urea was the same as the 26 percent protein supplement except that 5.0 percent urea replaced a like quantity of ground yellow corn.

[1] Urea was furnished by Grand River Chemical Division of [illegible]

The 40 percent protein combination supplement contained several different feed ingredients which are often found in feed supplements offered for sale. The supplement fed in our test was 40.0 percent cottonseed meal, 40.0 percent soybean oil meal, 8.4 percent linseed meal, 5.0 percent dehydrated alfalfa meal, 5.0 percent cane molasses, 1.5 percent monosodium phosphate, and 0.1 percent trace mineral premix.[2] The premix was included as a source of additional manganese, iodine, cobalt, iron, copper, and zinc.

Calcium and phosphorus supplements were added at such rates that the content of these minerals in all pellets was nearly equal. A mixture of two pounds salt and one pound steamed bone meal was available in all lots.

Results

A summary of winter gains is given in Table 1.

Steers fed the low protein simple supplement (Lot 1) gained 34 pounds in the 130-day wintering period. When urea was added to this supplement to increase the protein equivalent to 40 percent (Lot 2) the calves gained 30 pounds. When the 40 percent control supplement (Lot 3, essentially cottonseed meal) was fed the gain was 50 pounds. As was true in many of our previous tests, urea was apparently not efficiently utilized.

Table 1. — Urea in Protein Supplements for Wintering Steer Calves Grazing Native Grass

Lot Number Supplement	1 26-Simple	2 40-Urea	3 40-CSM	4 26-Comb.	5 40-Urea Comb.	6 40-Comb.
Number of steers	15	15	14[1]	15	15	15
Average weight per steer, lbs.						
Initial Nov. 4, 1960	395	394	390	392	393	393
Final Mar. 14, 1961	429	424	440	448	439	470
Gain (130 days)	34	30	50	56	46	77

[1] One steer was removed because of urinary calculi.

The supplements fed in Lots 4, 5, and 6 contained increased quantities of certain nutrients which may effect urea utilization. The feeding of the 26 percent protein combination supplement resulted in a gain of 56 pounds. Adding urea to this feed decreased gain 10 pounds (46 vs. 56 pounds). The gain from the high protein combination pellet without urea was 77 pounds. Again, urea was not efficiently utilized.

In this test it was possible to compare the value of simple vs. combination supplements. It should be noted that in all three comparisons

[2] Mineral mixture furnished by Calcium Carbonate Company, Carthage, Missouri.

(Lots 1 vs. 4, 2 vs. 5, 3 vs. 6) the gains were greater when the combination supplements were fed. In previous tests the results have been variable; however, in this 1960-61 winter season the combination supplements apparently furnished nutrients which resulted in greater gain.

Self-Feeding Lambs on Wheat Pasture

Robert L. Noble, Kenneth Urban, and George Waller, Jr.

During years of adequate rainfall thousands of lambs are fattened on wheat pasture in Oklahoma and adjoining areas. Lambs grazing lush wheat pasture make excellent gains at a much lower cost per unit of gain than can be obtained in the feedlot.

Previous work at the Ft. Reno Station has shown that lush wheat pasture on fertile soil will carry approximately five lambs per acre. In this year's work, in order to increase the carrying capacity per acre, all lambs were self-fed a mixed ration while grazing wheat pasture.

Procedure

Three hundred and nineteen western feeder lambs were used in this study. The lambs were produced in the range area of Southwest Texas. They were sheared at San Angelo prior to shipment. The lambs were shipped by truck and were received at the Ft. Reno Station on October 1. During the month of October the lambs grazed dry-native grass and were fed approximately two pounds of alfalfa hay daily. The lambs were not vaccinated for enterotoxemia. Soluble aureomycin was used in the drinking water the first week. Just prior to starting on pasture (October 31) the lambs were divided into three weight groups, and each weight group was divided into two lots as follows:

Light lambs—62 pounds and below.

Lot 1—Self-fed a ground mixture of 45% milo, 5% molasses and 50% alfalfa hay. (Ration No. 1)

Lot 2—Self-fed a ground mixture of 70% milo, 5% molasses, and 25% alfalfa hay. (Ration No. 2)

Medium weight lambs—63-72 pounds.

Lot 3—Self-fed the same ration as the lambs of Lot 1. (Ration No. 1)

Lot 4—Self-fed the same ration as the lambs of Lot 2.

Heavy weight lambs—72 pounds and above.

Lot 5—Self-fed the same ration as the lambs of Lots 1, 3. (Ration No. 1)

Lot 6—Self-fed the same ration as the lambs of Lots 2, 4. (Ration No. 2)

The lambs were started on wheat pasture November 1. A stocking rate of 10 lambs per acre was used. The heavy lambs were started on self-feeder immediately, the medium weight lambs after 50 days, and the light lambs after 75 days.

The lambs grazed the wheat pasture from about 8 a.m. to 5 p.m. They were penned in dog-proof lots at night. The mixed rations were self-fed at this time. A mixture of three pounds of aurofac 10 and 37 pounds of salt was available to the lambs at all times.

Individual weights following an overnight period without access to feed and water were taken at the beginning and the end of the trial. Intermediate weights without shrinking the lambs were taken at approximately 30-day intervals.

Average weight gains, feed consumed, market data, and financial results are shown in Table 1.

Observations

In each weight group, the ration (Ration No. 1) composed of 45 percent ground milo, 5 percent molasses, and 50 percent ground alfalfa hay was superior to the high energy ration (Ration No. 2) composed of 70 percent ground milo, 5 percent molasses, and 25 percent ground alfalfa hay. The lambs self-fed Ration No. 1 consumed approximately 20 pounds less feed per lamb during the self-feeding period; (162.2, 165.5, and 164.5 pounds per lamb for Lot 1, 3, and 5, respectively as compared to 182.0, 184.5, and 181.0 pounds per lamb for Lot 2, 4, and 6, respectively).

The lambs of lots 1 and 3 also made greater average daily gains than the lambs of lots 2 and 4. There was no difference in the gains of lambs of Lot 5 and 6.

Although growth of the wheat pasture was almost nill during late November, December, and January, sufficient pasture was available during the entire period. After the heavy weight lambs (Lots 5 and 6) were sold on January 10, the other four lots were rotated among the six pastures for greater pasture utilization.

The net return should be considered for the entire group of lambs since we were interested in the overall utilization of the 32 acres of wheat. The net return (considering all cost, except labor) was approximately $300. This was with a margin of less than 50 cents per cwt. considering the difference in selling price and the delivered purchase price.

Table I.—Weight Gains, Rations Fed, and Financial Results Obtained with Fattening Lambs Self-Fed on Wheat Pasture.

Weight Group	Light Lambs (62 pounds & below) Started on self-feeders After 75 Days		Medium Lambs (63-72 pounds) Started on self-feeders After 50 Days		Heavy Lambs (73 pounds & above) Started on self-feeders Immediately	
Lot Number	1[1]	2[2]	3[1]	4[2]	5[1]	6[2]
Acres of Pasture	5	5	5	5	5	7
Number of lambs/lot	50	50	50	50	50	69
Initial weight	55.6	56.6	67.2	65.5	74.6	74.6
Gain in weight prior to self-feeding	26.7	27.4	12.8	12.9	---	---
Feed consumed daily mixed ration	2.63	2.89	3.01	3.84	2.42	2.66
Total feed per lamb	162.2	182.0	165.6	184.5	164.5	181.0
Final weight	106.7	103.8	105.0	102.4	107.3	106.8
Average Daily Gain						
Wheat alone	.36	.37	.26	.26	---	---
During self-feeding period	.39	.31	.47	.44	.48	.48
Financial results						
Date sold	3/21	3/21	2/14	2/14	1/10	1/10
Ave. selling price cwt. ($)	15.5	15.5	16.0	16.0	16.25	16.25
Ave. market weight (lbs.)	100.6	96.8	101.3	97.7	102.7	102.3
Net market value ($)	14.69	14.35	15.63	14.97	16.02	16.07
Initial cost per lamb[3] ($)	8.70	8.86	10.52	10.26	11.68	11.68
Feed cost per lamb ($)						
Mixture[4]	2.69	3.22	2.68	3.27	2.66	3.20
Alfalfa hay[5]	.60	.60	.60	.60	.60	.60
Transportation to market ($)	.25	.25	.25	.25	.25	.25
Profit per lamb ($)	2.45	1.42	1.58	.85	.83	.34

[1] The odd numbered lots (1, 3 & 5) were self-fed a mixture of 45% milo, 5% molasses, and 45% alfalfa hay. (Ration No. 1)

[2] The even numbered lots (2, 4 & 6) were self-fed a mixture of 70% milo, 5% molasses, and 25% alfalfa hay. (Ration No. 2)

[3] $14.00 F.O.B. San Angelo, $15.66 cwt. delivered, includes cost of transportation, shearing, commission, and miscellaneous expenses minus wool returns.

[4] Feed cost: Milo, $1.60 per cwt.; alfalfa hay, $20.00 per ton; molasses, $2.00 per cwt; grinding, $3.00 per ton; mixing, $3.00 per ton. Cost of ration per ton for Lots 1, 3 & 5 = $32.40; for Lots 2, 4 & 6 = $35.40.

[5] The alfalfa hay was fed prior to the start of the experiment.

Sorting lambs into three weight groups and self-feeding a complete ration of wheat pasture appears to offer several advantages:

(1) Unless the heavy lambs are started on feed immediately, they may reach market weight without sufficient finish to top the market.

(2) The stocking rate per acre can be increased considerably.

(3) During snow storms or other inclement weather, the lambs on the self-feeder will continue to gain in weight.

(4) Practically all the lambs will sell at top market price.

Fattening Beef Calves—Supplements to High-Milo and All-Barley Rations, Grinding Vs. Steam Rolling Milo, Implanting with Different Amounts of Stilbestrol

L. S. Pope, Kenneth Urban,

Fred Harper, and George Waller

Fattening beef cattle has become a highly mechanized operation—geared to mass production and automated feeding methods. Two changes during the last decade have been of particular importance to cattle feeders. First, grain has become a cheaper source of energy than roughage when costs of feed, processing, handling, and storage are all considered. Secondly, new methods of feed processing are now available, and these may alter the nutrient value of fattening rations.

In the light of new developments, it is necessary to take another look at fattening rations and the relative value of feeds. Of current interest is the use of "all concentrate" rations, pelleting, steam rolling grains, hormones, and feed additives. Since most of these increase the cost of fattening cattle, they must result in better performance if they are to be justified.

Three feeding tests are now underway to help answer some of these problems. In Experiment 1, steer calves are fed steam-rolled milo or barley, plus supplements, with little or no additional roughage in the ration. The test is designed so that it is possible to compare milo and barley as fattening feeds in rations containing approximately the same fiber level, as well as to test the value of complex supplements and additional minerals vs. an oil meal supplement, with each grain.

In Experiment 2, a comparison is being made of the effect of pelleting a high concentrate (63 percent milo) ration, and the addition of certain minerals to increase the total "ash" in an attempt to improve the ration. In Experiment 3, steer calves are being self-fed complete mixed rations to study the value of fine or coarsely ground milo vs.

steam rolled milo. The rations contain 50 percent of either finely ground, coarsely ground, or steam-rolled milo, with each mixture fed in loose vs. completely pelleted forms. In addition a further comparison is being made of a conventional fattening ration containing 32 percent roughage vs. one with only 8 percent roughage (dehydrated alfalfa meal). Other comparisons include the use of 12 vs. 24 mg. stilbestrol implants for weaner calves starting on feed.

All tests are still in progress, thus the results are not final and may be modified by future developments. However, it is believed that all have progressed far enough to point up certain trends.

Experiment 1.

Milo and Barley Rations with Various Supplements

Sixty-three, choice, Hereford steer calves, averaging 525 pounds, were started on feed October 12 at the Ft. Reno station. These were fall-dropped calves from the Experiment Station herd at Lake Blackwell, and started the test at about 10-11 months of age. Some of the calves had been previously implanted with either 6 or 12 mg. stilbestrol at about 150 days of age, and this was considered in allotment, as well as shrunk weight, feeder grade, and previous treatment. Calves of Lots 1, 2, and 3 were full-fed steam-rolled milo, 1½ to 2 pounds of supplement and 2 pounds of cottonseed hulls, after the calves were on a full-feed of grain. Four lots (4, 5, 6, and 7) were started on steam-rolled barley, plus supplement and no cottonseed hulls, except Lot 7, after the calves had been worked up to a full feed of grain over a seven week period. Lot 7 received the same allowance of hulls (2 pounds per head daily) as the milo-fed lots. Thus a comparison was possible of milo vs. barley at approximately the same fiber level, and also at different fiber levels.

The supplements fed per head daily were:

Lots 1 and 4—1½ pound soybean meal plus 0.1 pound calcium carbonate and approximately 21,000 units of vitamin A.

Lots 2 and 5—2.2 pounds of a special mixture containing 65 percent soybean meal, 25 percent dehydrated alfalfa meal, 10 percent molasses, 2.5 percent calcium carbonate, trace minerals (2 gm. per steer per day) and dry, stabilized vitamin A (21,000 units).

Lots 3 and 6—1½ pound soybean meal, 21,000 units of vitamin A, plus 0.35 pound of a special mineral mix formulated to simulate the major and trace minerals contained in 4 pounds of alfalfa hay.

The steers were fed in dirt pens, without bedding. Each calf received a 24 mg. stilbestrol implant at the base of the ear at the start of the trial, and all calves received 250 mg. aureomycin per head daily, mixed with the protein supplement during a 10-day period early in the trial to help control disease.

All calves were started on 3 pounds of grain per head daily, plus supplement and nearly a full-feed of roughage. The roughage was gradually removed and the grain increased in step-wise fashion over a 50-day period until only 2 pounds of cottonseed hulls per head daily remained in the rations fed Lots 1, 2, 3, and 7; all roughage was removed from the barley rations fed Lots 4, 5, and 6. All cattle had free access to a mineral mixture of two parts salt and one part rock phosphate. The steam-rolled grains were prepared at a commercial mill and stored in 60 day batches.

Considerable scouring and looseness was prevalent in the barley-fed lots when the last few pounds of cottonseed hulls were withdrawn. This became less noticeable as the trial progressed and eventually cleared up. None of the milo cattle appeared to be affected. Several cases of founder occurred among cattle fed either milo or barley.

A summary of the results after 154 days on test are shown in Table 1. Barley-fed cattle outgained milo fed steers by 0.14 pound per head daily, and required 40 pounds less grain and supplement and 79 pounds less roughage per cwt. gain (Lots 1, 2, and 3 vs. Lots 4, 5 and 6). Test weight on the barley was 47 pounds per bushel, and for milo, 58 pounds. Under the current feed prices, steam-rolled barley cost $46 per ton and steam-rolled milo, $39 per ton. The feed cost per cwt.

Table 1.—Milo Vs. Barley Rations with Various Supplements (Nine Steers Per Lot,[1] 154 Days on Test)

Steam-rolled grain	Milo			Barley			
Lot Number and Supplement	1 Basal	2 Special Supplement	3 Basal + Mineral	4 Basal	5 Special Supplement	6 Basal + Mineral	7 Special Supplement + Hulls
Average daily gain, lbs.	2.29	2.45	2.31	2.31	2.55	2.60	2.80
Average daily ration, lbs.							
Milo	14.5	15.3	14.4				
Barley				14.1	14.9	15.1	14.9
Soybean Meal[2]	1.6			1.6			
Special Supplement		2.2			2.2		2.2
Soybean Meal[2] + Mineral			1.8			1.8	
Cottonseed Hulls[3]	2.7	2.7	2.7	.9	.9	.9	2.7
Feed per cwt. gain (lbs.)							
Grain	633	624	623	610	584	581	532
Supplement	70	90	78	69	86	69	79
Cottonseed Hulls	118	110	117	39	35	35	96
Feed cost per cwt. gain ($)[4]	16.59	16.79	17.32	17.25	16.97	17.08	16.28

[1] Two steers foundered badly in Lot 4 and were removed from test. Others slightly foundered but left on test included, one each in Lots 2 and 3, two in Lot 6.

[2] Soybean meal supplement fed Lots 1, 3, 4, and 6 supplied 0.1 lb. $CaCO_3$ and 21,000 units Vitamin A per head daily.

[3] Hulls fed to Lots 4, 5, and 6 only during first seven weeks.

[4] Cost of supplements were $79.14, $72.00, and $95.14 per ton for the soybean basal, special supplement and basal + mineral, respectively.

gain was $16.90 for milo fed lots and $17.10 for barley cattle—almost identical values. Thus, in this type of feeding program, barley was worth about $7 per ton more than milo. Moreover, barley-fed cattle appear to be fatter than those receiving milo. This difference in fatness may appear later in carcass grades when the cattle are slaughtered. This would further improve the relative value of barley as a fattening feed.

The complex supplement containing dehydrated alfalfa meal, molasses, and trace minerals, in addition to the calcium and vitamin A added to all supplements, appeared to improve performance of calves in Lots 2 and 5. This is in contrast to the results of earlier experiments at this station in which no advantage could be shown for complex supplements when milo and sorghum silage were fed with soybean meal in conventional fattening rations. The beneficial effect in this trial may be explained on the basis of a need for certain factors contained in the complex formula where little or no roughage is fed. It is known that roughage supplies added minerals and other factors and in a fattening ration, may be necessary for normal fermentation in the rumen.

A mineral mixture simulating the composition of the minerals in 4 pounds of alfalfa hay was added to the average daily ration fed steers of Lots 3 and 6. In the case of milo and cottonseed hulls, the minerals appeared to be of little benefit (Lot 3). In contrast, the gains of Lot 6 cattle, where barley was fed, appeared to be improved by such an addition. It is possible that (1) the added minerals in the barley rations promoted a more "normal" fermentation in the paunch, thus resulting in certain nutrients needed by the steers, or (2) there may be fundamental differences in the mineral content of milo vs. barley—hence the difference in response. Recent Kansas research points up such a possibility. They were able to show a beneficial response from adding trace minerals to fattening rations containing corn, but not with milo. With the advent of "all concentrate" rations, it appears necessary to study more thoroughly the mineral composition of different grains, and variations within the grain itself.

Calves of Lot 7 fed steam-rolled barley and a special supplement, but with additional cottonseed hulls, showed the best gains and feed efficiency. Cost per cwt. gain was nearly $.82 less for Lot 7 than for the average of Lots 4, 5, and 6—or $.69 less than for Lot 5 getting the same barley and supplement, but without roughage after the first 50 days on test. These results and the better appearance and "bloom" of Lot 7 cattle, together with less scouring, suggest that a small quantity of roughage may be beneficial. Because of better performance, feed costs may actually be less per 100 pounds gain than where all roughage is removed from the ration.

Experiment 2.

Addition of Minerals to Pelleted High-Concentrate Rations

Since grain and protein supplements are so low in mineral or "ash", very concentrated rations may result in certain mineral deficiencies. To further study the value of added minerals in high-concentrate rations, three groups of individually fed steer calves were used in a feeding trial at the Ft. Reno station. Six, Hereford, steer calves in each lot were started on feed in early November. The mixture fed contained 63 percent ground or rolled milo, 9 percent cottonseed meal, 7 percent dehydrated alfalfa meal, 13 percent cottonseed hulls, 7 percent molasses, and 0.9 percent calcium carbonate plus vitamin A supplement.

The calves averaged 450 pounds at the start of the test and were all from one experimental herd, sired by closely related bulls. They were alloted to treatment on the basis of sire, age, feeder grade, and shrunk weight. They were gradually worked up to a full feed of their respective rations over a three-week period. The rations fed were:

Lot 1—Basal ration in meal form.

Lot 2—Basal ration pelleted (5/16-inch cubes).

Lot 3—Pelleted basal ration containing 2.4 percent of a complex mineral mixture simulating alfalfa ash in composition.

All calves had access to salt, but no additional minerals.

Initially, finely ground milo was used in the mixture. This proved quite unpalatable and after 45 days, steam-rolled milo was substituted in its place. This greatly improved the palatability of the ration and performance of the calves.

The results summarized in Table 2 show the characteristic decline in gain when very concentrated rations are pelleted. This has been demonstrated in numerous trials. In this instance, however, feed in-

Table 2.—Performance of Beef Calves Fed High-Concentrate Rations as Influenced by Pelleting and Addition of Minerals

Lot No. and Ration Fed	Average daily gain, lbs.	Average daily Feed Intake, lbs.	Feed per cwt. gain, lbs.
1. Meal	1.77	14.05	794
2. Pellets	1.68	14.74	867
3. Pellets + minerals	1.76	14.17	805

take was not depressed by pelleting, nor was feed efficiency improved. These two characteristics are often noted from pelleting rations containing over 65 percent concentrates.

The addition of 0.33 pound per head daily of a complex mixture fortified with sodium, potassium, calcium, phosphate, sulfate, and trace minerals appeared to improve performance and feed efficiency in Lot 3. These results are somewhat in contrast to those obtained in Experiment 1. The reason for the difference is not clear. Perhaps the nature of the ration (pellets vs. a loose mixture) influenced the results. The trial is still in progress and, as in other studies, further feedlot performance and carcass data will be obtained.

Experiment 3. Effects of Fine, Coarse Ground, and Steam Rolled Milo, High-Milo Rations, and Levels of Stilbestrol Implant

Previous tests have shown that pelleting milo for fattening calves resulted in decreased feed intake and rate of gain as compared to the ground product. Also, in previous tests, steam-rolled milo was less efficiently utilized than the finely ground product. A fundamental problem seemed to involve the best particle size of ground milo, or the best method of preparing milo grain. Since about 75 percent of the total cost of a fattening ration is the cost of the grain, it becomes important to study factors that affect this segment of the ration.

As one phase of Experiment 3, six lots of 10 Hereford steer calves each, averaging 460 pounds per head, were fed identical rations except for the method of preparing the milo. The mixtures contained 50 percent milo, with 9 percent cottonseed meal, 8 percent dehydrated alfalfa meal, 8 percent molasses, 24 percent cottonseed hulls, 1 percent salt, and calcium carbonate, plus sufficient vitamin A to furnish 21,000 units per steer daily. Lots 1 and 2 received finely ground milo, prepared by processing it through 1/8 inch screen hammer mill at 3500 R.P.M. Lots 3

Table 3.—Particle Size of Milo Grain Prepared by Different Methods (Experiment 3)[1]

	Percent Not Passing Through				
Screen Size (inches)	10/64	6/64	1/25	1/40	Remainder
Finely ground	---	---	26.1	36.3	37.2
Coarsely ground	---	4.4	40.6	24.5	29.8
Steam rolled	25.5	50.7	16.2	2.2	6.0

[1] Average of three batches sampled.

and 4 received cracked or coarsely ground milo, processed through a hammer mill without a screen. In the mixtures fed Lots 5 and 6, the milo was steam-rolled. The particle size of the differently processed milo is shown in Table 3. The mixtures self-fed calves in Lots 1, 3, and 5 were in the loose or meal form; while rations fed Lots 2, 4, and 6 were processed into 5/16-inch cubes. The composition of the mixtures fed is shown in Table 4.

Table 4.—Composition of Rations Self-Fed to Fattening Steer Calves in Experiment 3 (Percent)

	Lots 1 through 6	Lot 7
Milo[1]	50	74
Cottonseed meal (solvent)	9	9
Dehydrated alfalfa meal	8	8
Molasses	8	8
Cottonseed hulls	24	--
Calcium carbonate	.5	.5
Salt	.5	.5
Vitamin A premix.[2]	.05	.05

[1] Milo was finely ground for Lots 1 and 2, coarsely ground for Lots 3 and 4, and steam rolled for Lots 5, 6, & 7.
[2] Supplied approximately 21,000 U.S.P. units Vitamin A per steer daily.

Part of the calves used in this test were from the experiment station herd, the remainder were purchased from the L. H. Ham herds at Fitztown and Paoli. Allotment was based on shrunk weight, feeder grade, and source of the cattle. One half of the calves in each lot were implanted at the start of the trial with 12 mg. stilbestrol, the remainder with 24 mg. All calves were drenched with phenothiozine at the start of the trial, and received 250 mg. aureomycin mixed with the ration for 10 days prior to the start of the test to help control disease. The calves were shifted from a preliminary ration of milo, cottonseed meal, and sorghum silage to the mixed rations over a two-week period. All mixtures were self-fed. All calves had access to a mineral mixture of two parts salt and one part rock phosphate.

Calves in an additional group (Lot 7) were started on the same mixture as fed Lot 5, but were gradually shifted over to a mixture containing no cottonseed hulls, and 8 percent dehydrated alfalfa meal as the only roughage over a 6-week period. This change was made with no apparent set-back or digestive disturbance. As in the other lots, the mixture was self-fed and one-half the calves were implanted with 12 mg. stilbestrol, the remainder with 24 mg.

Preparation of milo. The results of this phase of the test are shown in Table 5. As in a previous study, finely ground milo appeared to promote better gains than the coarsely ground product. This difference was reversed when the rations were fed in pelleted form, rather than as meal. Pelleting appeared to improve performance slightly when coarsely ground or steam-rolled milo was fed, but not with finely ground milo. Overall averages showed a gain of 2.36 per head daily for Lots 1 and 2 vs. 2.27 each for Lots 3 and 4, or Lots 5 and 6. Daily feed intake was greatest for Lot 1 calves, although feed per cwt. gain was about 60 pounds less than for either calves fed coarsely ground milo (Lot 3) or for the steam-rolled grain (Lot 5). Differences in feed efficiency between the pelleted rations containing the differently processed grains were not as marked. Finely ground milo rations also proved to be the cheapest in producing 100 pounds gain.

"All concentrate" rations. Calves of Lot 7 were fed a fattening ration containing 74 percent steam-rolled milo and only 8 percent dehydrated alfalfa meal as the roughage. (See Table 6). These calves gained 2.30 pounds per head daily vs. 2.19 pounds for Lot 5 calves which served as controls. They did so on 108 pounds less feed per cwt. gain. The marked decline in feed intake of nearly 1.5 pounds per head daily for Lot 7, as shown in Table 6, is typical of what can be expected from feeding a very concentrated ration. Using current feed prices, the cost of producing 100 pounds gain was 88 cents less for Lot 7 than Lot 5.

Table 5.—Feedlot Performance of Steer Calves Self-Fed Mixtures Containing Fine, Coarsely Ground or Steam Rolled Milo, in Meal or Pelleted Rations (10 Calves Per Lot[1], 138 Days)

Milo preparation	Finely ground		Coarsely ground		Steam rolled	
Lot number and Ration fed as–	1 Meal	2 Pellets	3 Meal	4 Pellets	5 Meal	6 Pellets
Average daily gain, lbs.	2.42	2.29	2.20	2.34	2.19	2.35
Average daily feed intake, lbs.	18.97	17.28	18.60	17.30	18.52	18.06
Feed per cwt. gain, lbs.	784	755	845	739	846	769
Feed cost per cwt. gain, $[2]	16.86	16.98	18.17	16.63	18.60	17.68
Appraised value per cwt., $	23.25	22.90	23.10	23.22	23.30	23.20

[1] Two calves removed from Lot 1 and one from Lot 3 with urinary calculi; one calf removed from data in Lot 4 due to sickness of unknown origin last weigh period. Data on these calves not included. Initial feeder price was $27 per cwt.

[2] Feed costs per cwt. were ($): Lots 1 and 3, 2.15; Lots 2 and 4, 2.25; Lot 5, 2.20, and Lot 6, 2.30.

Table 6.—Comparison of an "All Concentrate" Ration with a Conventional Fattening Ration (10 Calves Per Lot,[1] 138 Days)

	Lot 5 Conventional ration (24% Cottonseed Hulls 8% dehyd. alf. meal)	Lot 7 "All Concentrate" ration (8% dehyd. alf. meal)
Average daily gain, lbs.	2.19	2.30
Average daily feed intake, lbs.	18.52	16.98
Feed per cwt. gain, lbs.	846	738
Feed cost per cwt. gain, $[2]	18.60	17.72
Appraised value per cwt. $	23.30	23.45

[1] One calf removed from Lot 7 with urinary calculi; data on this calf not included. Initial feeder price was $27 per cwt.
[2] Lot 7 mix cost.

Of course, it is misleading to say that Lot 7 calves were fed an "all concentrate" ration. The mixture contained 8 percent dehydrated alfalfa meal which is a roughage—but in meal form. All steers were bedded twice weekly with wheat straw and some was consumed, but these calves had no greater desire for it than those of other lots getting cottonseed hulls in the ration. As in Experiment 1 with "all-barley" rations, considerable scouring and looseness was prevalent in Lot 7 calves—but no cases of founder were observed in this experiment.

Future attempts will be made to improve on this type of ration. Results to date look promising for such a mixture when milo is cheap relative to roughage.

*Effect of 12 vs. 24 mg. implants.** Results of an extensive test on 0 vs. 24 mg. stilbestrol implants conducted on cattle the previous year are shown in Table 7. In this test, implants increased average daily gains by 0.18 pound, or 9 percent. There was virtually no effect on average carcass merit considering any of the measures used.

In Experiment 3, one-half of the calves were implanted with 12 mg., the remainder with 24 mg. Results show an improvement for the 24 mg. level of 0.08 pound per head per day. Judging by previous results, 12 mg. stilbestrol implants appear to give a response about mid-way between 0 and 24 mg. Detailed carcass analyses will also be made upon the completion of this test to determine any effect on the two groups.

Urinary calculi. A marked outbreak of urinary calculi ("water belly") resulting in a blockage of the urinary tract occurred during the

*Stilbestrol implants for this study were supplied by Chas. Pfizer & Co., Terre Haute, Ind.

Table 7.—Stilbestrol Implant Studies with Fattening Steer Calves

	1959-60 Test		1960-61 Test	
	No Implant	24 mg.	12 mg.	24 mg.
No. steers per treatment	26	35	33	32
Average days on test	156	156	138	138
Average daily gain, lbs.	1.93	2.11	2.25	2.33
Final slaughter wt., lbs.	767	793	773	786
Estimated slaughter grade score[1]	6.77	6.54	6.60	6.30
Average yield, (Percent)[2]	62.2	62.3		
Slaughter data:				
Carcass conformation score[1]	5.65	5.50		
Average carcass grade[1]	6.92	7.05		
Average marbling score[3]	8.0	7.9		
Average rib eye area, sq. in.	9.25	9.27		
Average fat thickness (inches)	.84	.81		

[1] Choice = 4, Low Choice = 5, Good + = 6, Good = 7, etc.
[2] Hot carcass weight shrunk 2.5%
[3] Marbling score —8 = modest amount, 9 = slight, etc.

third and fourth months on test. Calves of Lots 1, 3, and 7 were most affected. At the mid-point of the trial, the calcium carbonate was reduced in the mixtures fed all lots. One case of calculi occurred after such a change was made.

The cause of urinary calculi is still obscure. For some reason, the rations fed in this trial appeared to promote considerable difficulty. It is of interest to note that all cases observed were among calves from one experiment station herd. Nearly 25 percent of these calves were affected.

Summary

Three experiments were initiated in the fall of 1960 to study different aspects of fattening rations for steer calves. While all trials are still in progress, and only preliminary results are available, certain trends may be observed.

Calves fed steam-rolled barley without additional roughage tended to outgain those fed steam-rolled milo plus a small amount of cottonseed hulls. In addition, barley-fed calves appear to be fatter. A complex supplement containing dehydrated alfalfa, molasses, minerals, and vitamin A proved superior to soybean meal, fortified calcium and vitamin A, in either milo or barley rations. The addition of more total "ash" or minerals to the ration appeared beneficial where barley was fed, but not with milo. Best overall results have been obtained with steam-rolled barley and a complex supplement—plus a small amount of additional cottonseed hulls.

In pelleted rations containing 63 percent ground or rolled milo, the addition of a complex mineral mix improved gains slightly.

In further experiments, mixed rations containing 50 percent milo in finely ground form proved superior to the same mixtures containing coarsely ground or steam-rolled milo. Less difference between milo preparation was apparent when the rations were pelleted. A ration containing 74 percent steam rolled milo and no roughage other than 8 percent dehydrated alfalfa meal proved superior to one containing only 50 percent steam-rolled milo, with dehydrated alfalfa meal and cottonseed hulls as the roughage. Approximately 13 percent less feed was required per cwt. gain with the "all concentrate" milo ration.

Implanting 8 to 9 month old calves with 24 mg. stilbestrol at the start of the trial improved gains, with no overall effect on carcass quality. Implanting with 12 mg. appeared to give less response than 24 mg. stilbestrol.

A Study of the Ratio of Concentrates to Roughage, Replacing Alfalfa Hay with Peanut Hulls, and Pelleting Vs. a Mixture for Fattening Lambs in Dry-Lot

Robert L. Noble, Kenneth Urban,

Gene Kennedy, and George Waller, Jr.

In recent years the acreage of peanuts in Oklahoma has increased considerably. In a few areas, peanut shelling factories are in operation and peanut hulls are available as a by-product. With the volume of peanut hulls now available, it was felt desirable to test their value in replacing alfalfa hay in a lamb fattening ration.

Also included in this year's work is a study of the ratio of concentrates to roughages, and pelleting versus the same ration fed ground and mixed.

Procedure

One hundred and forty-five western feeder lambs were used in this study. The lambs were produced in the range area of Western New Mexico. They were purchased at Roswell and shipped by truck to the Ft. Reno Station. During the first two weeks, the lambs grazed dry-native grass pasture around the station's headquarters. For the next month the lambs grazed small lots of wheat pasture in the swine area. On

December 30, the lambs were alloted to their dry-lot treatments as follows: (Approximately 18 lambs per lot.)

Lot 1. 45 percent milo, 5 percent molasses, 50 percent alfalfa hay; ground and mixed.

Lot 2. Same as for Lot 1, pelleted.

Lot 3. 40 percent milo, 5 percent molasses, 5 percent cottonseed meal, 25 percent peanut hulls, and 25 percent alfalfa hay; ground and mixed.

Lot 4. Same as for Lot 3, pelleted.

Lot 5. 35 percent milo, 10 percent cottonseed meal, 5 percent molasses, 45 percent peanut hulls, and 5 percent dehydrated alfalfa meal; ground and mixed.

Lot 6. Same as for Lot 5, pelleted.

Lot 7. 60 percent milo, 5 percent molasses, and 35 percent alfalfa hay; ground and mixed.

All rations contained two pounds of Aurofax 10 per ton. A mixture of ⅔ salt and ⅓ steamed bone meal were available to all lambs. The lambs were started on feed gradually and turned loose on the self-feeders after five days.

Individual weights following an overnight period without access to feed and water were taken at the beginning and the end of the trail. Intermediate weights without shrinking the lambs were taken at approximately 30 day intervals. The lambs were weighed off the experiment and shipped to the Oklahoma City market as they reached 100 pounds.

Average weight gains, feed consumed, market data, and financial results are shown in Table 1.

Observations

1. The lambs of all lots made excellent gains during the dry-lot feeding period. The average time required to reach market weight varied less than seven days among the different lots.

2. It would appear that peanut hulls can satisfactorily replace from 50 to 90 percent of the alfalfa hay in a lamb fattening ration, if the peanut ration is nutritionally adequate in other respects.

3. Pelleting increased the average daily gain only with the ration composed of 45 percent milo, 5 percent molasses, and 45 percent alfalfa hay. In the other three comparisons, a slight decrease in gain is noted.

   Pelleting did decrease the amount of feed required per cwt. gain in three comparisons out of four. However, due to the cost

Table 1.—Weight Gains, Rations Fed, and Financial Results Obtained with Fattening Lambs Self-Fed in Dry-Lot.

Treatment	45% Milo 5% Molasses 50% Alf. Hay	Same as 1 Pelleted	40% Milo 5% Molasses 5% C.S.M. 25% Peanut Hulls 25% Alf. Meal	Pelleted Same as 3	35% Milo 10% C.S.M. 5% Molasses 45% Peanut Hulls 5% Dehy. Alf. Meal	Same as 5 Pelleted	60% Milo 5% Molasses 35% Alf. Hay	Same as 7 Pelleted
Lot Number:	1	2	3	4	5	6	7	8
No. of lambs/lot	18	19	18	18	18	17	19	18
Initial weight	72.2	72.7	73.2	72.2	74.9	75.7	72.2	74.2
Av. No. days on feed	53.3	47.9	48.7	51.1	48.9	50.1	54.5	52.9
Final weight	100.5	100.4	101.2	100.4	100.7	101.8	98.8	99.4
Average daily gain	.54	.58	.58	.55	.53	.52	.49	.48
Av. daily feed intake	3.92	4.05	4.35	3.81	3.76	3.91	3.89	3.56
Feed per lamb	206	194	211	195	184	196	212	188
Lbs. feed/lbs. gain	7.11	7.00	7.54	6.90	7.12	7.52	7.98	7.47
Financial Results								
Av. Pur. Price, del.[1]	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75
Av. Selling price	15.88	15.88	15.88	15.88	15.88	15.88	15.88	15.88
Total value/lamb[2]	15.32	15.31	15.44	15.31	15.36	15.53	14.88	15.15
Initial cost/lamb	11.37	11.45	11.52	11.37	11.80	11.92	11.37	11.69
Feed cost/lamb[3]	3.34	3.63	3.20	3.56	2.87	3.54	3.60	3.66
Wheat pasture 1 mo.	.50	.50	.50	.50	.50	.50	.50	.50
Misc. cost[4]	.85	.85	.85	.85	.85	.85	.85	.85
Loss per lamb	.74	1.12	.63	.97	.66	1.28	1.44	1.55

[1] $14.50 F.O.B. Roswell, New Mexico, $15.75 cwt. delivered, includes cost of transportation,, commission, and miscellaneous expenses.
[2] Deducts 4% shrinkage to market.
[3] Cost of ration per ton; for Lot 1., $32.40; Lot 2, $37.45; Lot 3, $30.45; Lot 4, $36.50; Lot 5, $31.25; Lot 6, $36.25; Lot 7, $34.00; and Lot 8, $39.00. Included into this cost; grinding, 15¢ cwt.; mixing, 15¢ cwt.; and pelleting, 25¢ cwt.
[4] Includes 60¢ per lamb for marketing and 25¢ per head for transportation to market.

Feed Prices: Milo, $1.60 per cwt.; alfalfa hay, $20.00 per ton; peanut hulls, $10.00 per ton; cottonseed meal, $65.00 per ton; dehydrated alfalfa meal, $60.00 per ton; molasses, $40.00 per ton.

of pelleting ($5.00 per ton), the lambs fed the pelleted rations lost more money than the lambs fed the mixture.

4. A concentrate to roughage ratio of 50 : 50 (Lot 1 and 2) produced greater gains with less feed per cwt. gain than a ratio of 65 percent concentrate and 35 percent roughage (Lot 7 and 8).

5. All lots of lambs lost from $.63 per head to $1.55 per head. Even with excellent gains and feed efficiency, it is almost impossible to profitably feed lambs in dry-lot without a positive margin of two cents per pound considering selling price over delivered purchase price.

Progeny Testing Beef Bulls for Growth

Doyle Chambers,

Joe B. Armstrong, and Dwight F. Stephens

Growth rate is one of the important economic traits in beef cattle. It is a trait which can be expressed by bulls, steers, and heifers. Under standard conditions on suitable tests, differences in growth rate among individuals have been reported to be highly heritable. In 1955 (Okla. Agr. Exp. Sta. Misc. Pub. 43) data were presented which indicated that different beef bulls, when bred to cows with similar records of productivity, sired calves which differed markedly in ability to gain weight under comparable conditions. In 1956 (Okla. Agr. Exp. Sta. Misc. Pub. 45) it was shown that bull calves which gained the most rapidly on a five month post-weaning growth test were the most efficient in the use of feed. No antagonisms were found between post-weaning rate of gain and pre-weaning growth rate or between growth rate and appraisals of these bulls at the end of the test by experienced livestock judges.

Most of the heritability estimates for growth rate in beef cattle have been based upon differences in growth rate which have been observed between groups of offspring sired by different bulls. These estimates have usually been higher than the few estimates reported based upon data from selection experiments.

Experimental Procedure

In 1956 a cooperative agreement was reached between the Ft. Reno Livestock Experiment Station and the Federal Reformatory located near Ft. Reno which permitted the progeny testing of a number of herd and the others were bulls which had either been purchased by the reformatory or had been produced in that herd. During the years 1956 through 1959, a total of 18 different bulls produced in the experimental herd were bred to 20-25 Angus cows each. Complete gain records were available for each of these bulls and comparable records were obtained from their offspring. It was possible therefore to obtain heritability estimates by relating the growth rate of the progeny to that of their sires. In addition to the 18 groups sired by experimental bulls, data were obtained for 16 additional sire progeny groups, some of these being from repeat matings of some sires.

The measures of growth rate considered in this report were: the adjusted 210 day weights, the average daily gain on a five month post-weaning feed lot test, and the 365 day weights. Because the analyses were to compare the average performance of offspring produced in a single season to the performance of their sires which were also contemporaries, adjustments of the data were made in the following manner. The adjusted 210 day weights of the bulls and of their offspring were obtained as follows: Weaning weight minus birth weight divided by age in days at weaning multiplied by 210 plus birth weight. The 210 day weights of the heifer progeny were adjusted to a steer equivalent by adding the difference between steer and heifer calves to the heifer weights. The progeny which were out of cows less than five years of age were adjusted to a mature equivalent by a similar procedure. The bulls, which were selected for these progeny tests, were with one exception from mature cows and no age-of-dam adjustments were made.

Since the calves in this study were put on post-weaning gain tests on the day they were weaned, average daily gain was obtained by subtracting from the final feed lot weight, the actual weaning weight and dividing by the number of days on feed. The final feed lot weight was obtained after a shrink of about 18 hours. In the first two years the progeny groups contained both steer and heifer calves. The steers gained 0.28 of a pound per day more than their half-sisters and this amount was added to the gain of the heifers to adjust for sex-effect.

The 365 day weight was obtained by adding to the adjusted 210 day weight of each sire the number of pounds equal to 155 multiplied by his own average daily gain on post-weaning test. The 365 day weights for each progeny group was obtained by adding the number of pounds equal to 155 multiplied by average daily gain of the calves on post-weaning test to the adjusted 210 day weight of the entire group of calves by that sire at weaning time.

The 18 different bulls which were progeny tested during this study were selected from a total of 48 produced in this line during the years of 1954 through 1957. Three bulls were dropped in the fall of 1956; the others were dropped during the spring of each year, raised by their dams without creep feed, weaned in early October, and fed for five months immediately following weaning. They were individually self-fed a complete mixed ration which contained the following ingredients: 350 pounds ground whole ear corn, 200 pounds cottonseed hulls, 100 pounds chopped alfalfa hay, 100 pounds whole oats, 100 pounds wheat bran, 100 pounds cottonseed oil meal, and 50 pounds blackstrap molasses. They had access to their feeders overnight and ran in a common lot with access to water during the day.

The progeny produced in the Federal Reformatory herd were dropped in the early spring and had access to a creep feed until weaned at about seven months of age. At weaning time the number of calves to be put on post-weaning gain tests was determined for each sire; they were the calves of proper sex nearest the average calving date. During the first two years calves of both sexes were fed; during the last two years, steers only were fed because some of the better heifer calves were being retained as herd replacements.

The sire progeny groups were self-fed the same ration used in testing their sires. The chief difference was that they were fed in groups and had access to the feeders continuously during the feeding period. They were fed by sex and sire groups for the first two years. The last two years they were fed in two large pens with equal numbers of calves by each sire in each pen.

Results and Discussion

It was mentioned earlier that the 18 bulls which sired calves in this study were selected from 48 which were produced and tested in the same period of time. All of the bulls selected were by a single sire and were from cows which were related because of a common grandsire. They were therefore related and the inbreeding averaged about seven percent for the selected group. The 18 bulls selected for the tests were 37 pounds heavier than the average for the group at 210 days; they gained 0.11 of a pound per day faster on the post-weaning test than the average for all 48 bulls and they were 54 pounds heavier at 365 days of age. Other traits for which selection was practiced included conformation, disposition, and color.

Table 1 gives the average performance records of the 34 sire progeny groups included in this test. The sires with three-digit identification were produced in the experimental herd at Ft. Reno. The differences among sire progeny groups within each year were very striking and economically important. The extreme differences in average 210 day weights were 59, 34, 55, and 73 pounds in the 1957, 1958, 1959, and 1960 calf crops, respectively. The average feeder grades likewise varied among groups from a low of 9.0 (high good) to slightly over 11.0 (average choice). The samples of calves which were on the post-weaning gain tests likewise differed widely in rate of gain. Differences within each year ranged from 0.27 to 0.65 of a pound per day between the extreme sire groups. Some exceptions can be found, but as a rule the sires producing the heavier calves at weaning also produced the faster gaining calves on the post-weaning test. The gross correlation between the average adjusted 210 day weights and the average daily gain on

Table 1.—Average Performance Records of Sire-Progeny Groups by Birth Year of Progeny

Year	Sire	Progeny — 210 Days No.	Progeny — 210 Days Weight (lbs.)	Progeny — 210 Days Grade[1]	Feeding Test No.	Feeding Test Average Daily Gain (lbs.)	365 Day Weight (lbs.)
1957	2	22	462	10.6	6	2.09	786
	5	21	454	9.1	10	2.43	831
	7	20	463	10.5	6	2.31	821
	15	18	444	10.5	6	1.89	737
	17	16	469	11.0	6	2.31	827
	114	23	483	11.2	12	2.23	829
	264	20	503	10.4	14	2.39	873
1958	5	19	481	9.5	5	2.07	802
	6	25	492	10.6	10	2.34	855
	7	20	482	11.2	5	2.21	825
	115	22	501	11.1	10	2.15	834
	155	22	481	10.7	10	2.09	805
	175	21	467	11.2	10	2.08	789
	185	17	467	11.2	8	2.20	808
1959	6	16	488	10.7	5	2.54	882
	21	17	472	10.4	7	2.19	811
	264	22	509	10.1	7	2.58	909
	046	17	460	10.8	6	2.19	799
	066	14	473	9.9	3	2.33	834
	096	22	489	10.2	6	2.51	878
	196	21	512	10.5	7	2.56	909
	406	14	463	10.6	4	2.13	793
	426	19	497	9.6	8	2.56	894
	436	16	515	9.9	6	2.51	904
1960	6	21	485	10.0	5	2.44	863
	21	15	450	9.8	4	1.96	754
	22	15	454	10.6	4	2.36	820
	24	17	478	10.3	5	2.27	830
	264	17	523	10.0	5	2.47	906
	047	18	483	10.4	6	2.51	872
	157	16	501	9.6	7	2.61	906
	187	16	483	9.0	8	2.28	836
	327	18	508	10.2	8	2.38	877
	337	13	466	9.9	8	2.26	816

[1] Grade Code: 9.0 (high good); 10.0 (low choice); 11.0 (average choice)

groups within seasons amounted to 136, 66, 116, and 152 pounds per head in 1957, 1958, 1959, and 1960, respectively. If one applies the appropriate economic data to these differences, he finds that the values of different sires can vary markedly even among closely related individuals which have already been selected for these traits.

Table 2 presents the individual performance records of the 18 sires and the average performance of their offspring for the three measures of growth considered in this study. The high heritability of these traits can be seen by ranking within each season the records of the different sires and their progeny. For example, note that in 1954, sire 264 was heavier and gained more rapidly than sire 114 and that the progeny of sire 264 produced in 1957 were likewise heavier and gained more rapidly. This is generally true but a few notable exceptions occur. In 1955, sire 185 was heavy at 210 days but sired calves which were light at the same age. Note, however, in this case that the average daily gain of the calves was high for this group.

These relationships between the performance of the sires and that of their offspring are given in Figures 1, 2, and 3 for 210 day weights, average daily gain in the feed lot, and 365 day weights, respectively. Each dot represents the average weight or gain for a progeny group sired by a bull whose weight or gain is given along the horizontal axis of the figure. These dots have been plotted without regard to year of test, but the regression line has been computed from an intra-season analysis and represents the average relationship which exists between the measures of growth in the sires and their offspring. The more closely the dots approach the line, the more accurate has been the prediction of the genetic value of a sire from his own performance. Likewise the larger the value of "b" and the steeper the regression line the more highly heritable was the trait.

From these observations one can see that in general the selection of the heavier and faster gaining bulls resulted in increasing the growth rate of their progeny, but there would have been a few disappointments.

Table 2.—Individual Performance Records of Bulls Used in the Progeny Test and the Average Performance of Their Offspring

		Sire Performance				Progeny Performance		
Year	No.	210 Day Weight (lbs.)	Average Daily Gain (lbs.)	365 Day Weight (lbs.)	Year	210 Day Weight (lbs.)	Average Daily Gain (lbs.)	365 Day Weight (lbs.)
1954	114	527	2.69	944	1957	483	2.23	829
	264	574	3.31	1087		503	2.39	873
1955	115	502	2.56	899	1958	501	2.15	834
	155	448	2.53	840		481	2.09	805
	175	481	1.98	788		467	2.08	789
	185	565	2.56	962		467	2.20	808
1956S	046	493	2.36	859	1959	460	2.19	799
	066	504	2.39	874		473	2.33	834
	096	586	2.69	1003		489	2.51	878
	196	575	2.90	1025		512	2.56	909
1956F	406	502	2.44	880	1959	463	2.13	793
	426	485	2.62	891		497	2.56	894
	436	609	2.44	987		515	2.51	904
1957	047	490	2.92	943	1960	483	2.51	872
	157	537	3.21	1035		501	2.61	906
	187	534	2.82	971		483	2.28	836
	327	533	2.76	961		508	2.38	877
	337	499	2.53	891		466	2.26	816

A few bulls with above average records in this group sired offspring below average in this same trait. Likewise a number of cases occurred in which two bulls with quite comparable performance records sired groups of calves which differed to an appreciable extent. This represents the opportunity for gain from progeny testing. In herds with average performance using many sires, the indications of this study were that they have much to gain by selecting the better performing bulls on their own performance. For herds already at a high level of performance for these traits the progeny testing of a number of the higher performing prospects may prove profitable, particularly if that herd is using few sires extensively. This often happens in larger purebred herds. These herds depend for their progress upon the picking of a few sires which are considerably above average in merit and they cannot afford to make the mistake of selecting a bull which breeds below average.

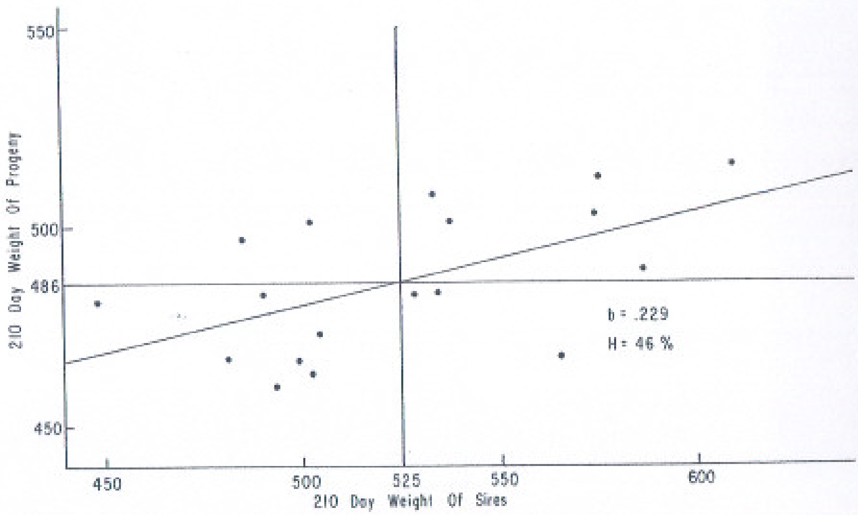


Figure 1. Regression of 210 day weight of progeny on the 210 day weight of sire.

Note in Figure 1 that two bulls, whose weaning weights were below average of those selected, sired calves with above average weaning weights. Seven bulls whose weaning weights were below average sired calves with below average weaning weights. Six bulls which were above average in weight at 210 days sired calves which were likewise above average in weight, while three others which were above average sired calves below average. Only one of the better bulls was particularly out of line with expectation. The heritability for 210 day weight was estimated to be 46 percent from these data. This is somewhat higher than has been reported in most studies, but it could be due to the better control of the environmental factors affecting this trait by the type of analysis used. It could also be due to the fact that the progeny were creep-fed and that both sires and offspring were nursing cows which gave more milk than was provided in other data. The higher plane of nutrition may have permitted a greater expression of genetic factors for growth. It is of course possible that the high estimate is due to random fluctuation due to the small number of sires.

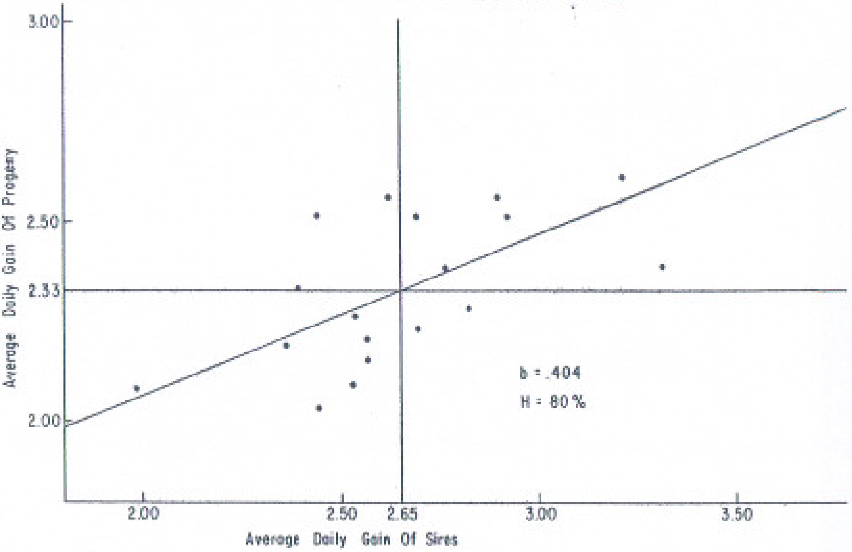


Figure 2. Regression of average daily feed lot gain of progeny on average daily feed lot gain of sire.

Very much the same picture is shown for rate of feed lot gain (Figure 2) and 365 day weight (Figure 3). About the same number of bulls produced calves whose records were in line with sire performance. Heritability for rate of feed lot gain was estimated to be 80 percent which again is somewhat higher than many estimates reported. Again there was reason to expect it to be high in this study since the sires and their progeny were tested on the same kind of ration and the same testing procedures were followed for all groups. The heritability of 365 day weight was estimated to be 54 percent which is in fairly close agreement with most other studies. In view of the limited number of sires (only 18 over a four year period) the standard errors for each of the heritability estimates were large and one could not be confident that the estimates really differ from others published. These were, however, the first to have been reported from data obtained in this manner. The results encourage the use of individual performance tests for the initial selection of sires, but also point out the opportunities for more effective selections following properly designed progeny tests.

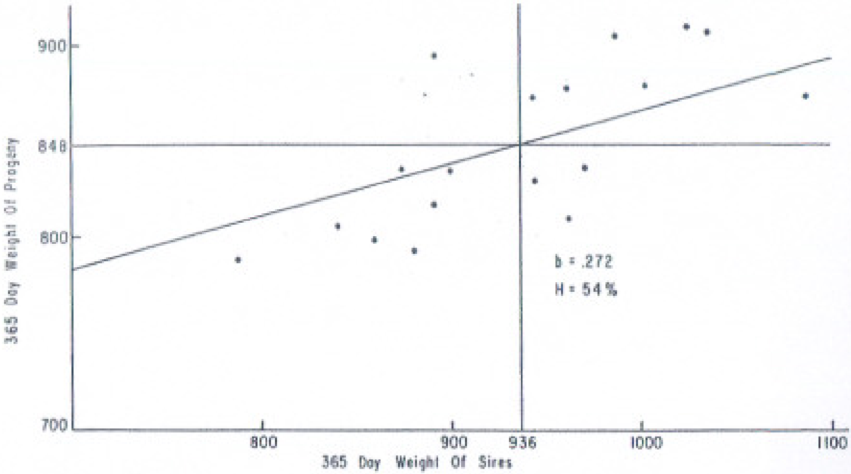


Figure 3. Regression of 365 day weight of progeny on the 365 day weight of sire.

Summary

A study was made of the 210 day weights, average daily gain on post-weaning tests, and 365 day weights for 34 sire progeny groups. The sire progeny groups were composed of 630 calves at weaning time and 236 calves on post-weaning gain tests. Eighteen of the sire progeny groups were the offspring of bulls for which the same traits had been measured under approximately the same conditions. Heritability estimates based upon the intra-season regression of progeny average performance upon sire performance were .46, .80, and .54 for 210 day weight, average daily feed-lot gain, and 365 day weight, respectively.

Feed Prices for 1960-61 Feeders' Day Report

(Note: Feed prices given below are those for the trials conducted during the fall and winter of 1960-61. These feed prices are based on late summer and early fall delivery. For work conducted in the summer of 1960, and reported herein, feed prices are the same as given in the 1960 Feeders' Day Report (Misc. Pub. MP-57). Where two or more years of work are summarized, the feed prices used may be found in MP-57 and the annual report for 1958-59, MP-55).

	PER TON
Alfalfa Hay	$ 20.00
Alfalfa (Dehydrated) Meal	45.00
Alfalfa (Dehydrated) Pellets	47.00
Barley	43.00
Barley (Steam-Rolled)	46.00
Corn	42.00
Cottonseed Hulls	18.00
Cottonseed Meal	66.00
Cottonseed Meal Pellets	68.00
Dicalcium Phosphate	98.00
Ground Limestone	15.00
Milo	32.00
Milo (Steam-Rolled)	35.00
Molasses	40.00
Oats	46.80
Prairie Hay	14.00
Salt	15.00
Salt (Trace Mineral)	45.00
Sorghum Silage	8.00
Soybean Oil Meal	69.00
Steamed Bone Meal	95.00

Cost of Native Grass Pasture
(Per Head)

Cows-year long	25.00
summer	17.50
winter	7.50
Yearlings-year long	18.00
summer	14.00
winter	4.00
Calves-winter	3.50