Table 19

The value of chlortetracycline for steer calves on a wintering, grazing and fattening program.

Lot no.	20	21
Treatment	Control	Chlortetracycline
No. steers per lot	9[1]	10
Initial wt. per steer, lbs.	526	519
Daily gain per steer, lbs.	0.79	0.92
Daily ration per steer, lbs.:		
Sorghum grain	5.0	5.0
Alfalfa hay	4.0	4.0
Prairie hay	8.3	8.4
Salt	.05	.05
Stilbestrol implant, 24 mgs.	Yes	Yes
Chlortetracycline, 70 mgs. per head daily	No	Yes
Feed per cwt. gain, lbs.:		
Sorghum grain	633	543
Alfalfa hay	506	435
Prairie hay	1051	913
Feed cost per cwt. gain[2]	$22.74	$19.59
Phase II—Grazing, May 11 to August 7, 1961—88 days.		
Initial wt. per steer, lbs.	653	666
Daily gain per steer, lbs.	1.36	1.07
Chlortetracycline, 70 mgs. per steer, supplied in the salt	No	Yes
Phase III—Fattening, August 7 to November 9, 1961—94 days.		
Initial wt. per steer, lbs.	773	761
Daily gain per steer, lbs.	3.39	3.27
Daily ration per steer, lbs.:		
Ground corn, self-fed	17.3	17.2
Soybean meal	1.0	1.0
Prairie hay	2.8	2.1
Alfalfa hay	8.2	8.2
Salt	.05	.05
Stilbestrol implant, 24 mgs.	Yes	Yes
Chlortetracycline, 70 mgs. per steer	No	Yes
Feed per cwt. gain, lbs.:		
Corn	510	526
Soybean meal	29	31
Hay	324	315
Feed cost per cwt. gain[2]	$14.81	$15.15
Summary of Phases I, II and III, December 2, 1960, to November 9, 1961—342 days.		
Final wt. per steer, lbs.	1092	1068
Daily gain per steer, all phases	1.65	1.61
Feed cost per cwt. gain[2]	$16.07	$16.45
Dressing %	60.1	61.3
Carcass grades:[3]		
Av. choice	.....	2
Low choice	1	.....
High good	5	2
Av. good	3	5
Av. carcass grade[4]	7.2	7.1
Marbling score[5]	6.8	7.2

1. One steer died during the summer and was omitted from the results.
2. Feed prices may be found on page 2; summer bluestem pasture cost was $15 per steer.
3. Carcass data not obtained on one steer in lot 21.
4. The U.S.D.A. grade, av. choice, was assigned a numerical grade of 5; low choice, 6; high good, 7; av. good, 8.
5. Degree of marbling: a score of 7 indicates small amount; the higher the number, the less marbling.

steers were finished on grain in drylot from August 7 to November 9, 1961. All steers were reimplanted with 24 mgs. of stilbestrol August 7. The steers were self-fed corn after they reached their maximum grain intake. Some difficulty was experienced in getting lot 21 on feed, and one steer in this lot foundered. His performance was average and he remained in the test; this may have affected the performance data of this group.

Observations

Results of this test are reported in Table 19.

The chlortetracycline (aureomycin) increased gains slightly during the winter, but the gains were lower for this lot during the summer, with no difference in fattening or total gain. There was no statistically significant difference in any of the period gains. Other information collected on the two groups did not show any apparent benefit from aureomycin.

Improvement of Beef Cattle Through Breeding Methods (Project 286).

W. H. Smith, J. D. Wheat, H. Spies and H. A. Gottlieb

The purebred Shorthorn cattle breeding program was continued during 1961 according to the breeding program initiated in 1949. Inbreeding of the two lines has been continued. The Wernacre Premier line is in its fourth generation, and the Mercury line will enter its fourth generation of inbreeding during 1962. The inbreeding plan has been basically to continue successive generations of half-sibbing in both lines.

This experimental project was initiated to study the inheritance of production traits in beef cattle, to evaluate the effects of inbreeding in cattle, and to explore the feasibility of using inbred lines of beef cattle for the breeding improvement of their production traits. Many production data have been collected on each of the inbred lines as it has progressed; however, no extensive line crossing has been attempted because of the relatively low level of inbreeding which has prevailed to date and the limited number of breeding animals in the project during its progress.

The management of these experimental cattle includes weighing each cow and calf immediately following parturition. Summer pasture breeding is practiced and the calves are born during the spring and summer each year. The calves are not creep fed during the suckling period. All calves are weaned, weighed, and scored for type when they are approximately six months of age and the standardized weaning age for weaning weight correction is 180 days. Calves are placed on individual feeding trials for record-of-performance tests for 182 days shortly after they are weaned. The final age upon completion of the feeding trial is near 365 days. Body weight gain and feed consumption records are maintained on all individual calves during the feeding period. The calves are scored for type or conformation as yearlings when they are taken off the prescribed feeding test.

The full-feed ration for the bulls consists of 75% cracked corn and 25% chopped alfalfa hay; that for the heifers, 55% cracked corn and 45% chopped alfalfa hay. All calves are fed twice daily by means of individual feeders while the feed test is in progress.

Production data for the 1960 calves are summarized in Table 20. The Wernacre Premier line was established and committed to inbreeding earlier than the Mercury line; hence the Wernacre Premier calves have been somewhat more highly inbred than the Mercury calves during the project's progress. The 1961 calves have not completed their feeding tests at the time of this report, so production data for them are not included. Twenty-six calves of the 1961 calf crop are being individually fed.

No abnormality that definitely can be attributed to inbreeding has occurred in either of the inbred lines. The incidence of still-born calves has been higher in the Mercury line during the last two years than during previous periods. No definite conclusions yet can be made regarding this observation, as one sire and many of the dams involved as parents of

Table 20

Summary of the 1960 Shorthorn calves from indicated inbred lines.

Tattoo no.	Coefficient of inbreeding	Birth weight	Adjusted weaning weight	Weaning score	Initial weight	Final weight	Total gain	Average daily gain	Final score	TDN per cwt. gain
					Mercury Line—Bulls					
025	13	69	344	2+	406	850	445	2.45	2—	379
027	17	60	372	2	370	795	425	2.34	2—	342
029	18	57	370	2—	380	815	435	2.39	2	360
033	18	55	383	2	352	735	383	2.10	3+	377
035	16	70	367	2+	350	731	381	2.09	2+	346
039	20	61	332	2—	300	625	325	1.79	2—	337
041	28	60	364	2	345	775	430	2.36	2—	342
047	18	67	368	2—	300	720	420	2.31	2—	326
051	16	63	405	2	340	730	390	2.14	2	436
053	18	93	406	1—	432	835	403	2.21	2	456
057	10	65	364	1—	377	795	418	2.30	2+	442
061	16	66	366	2+	317	670	353	1.94	2	371
075	7	80	346	1—	313	730	417	2.29	2+	360
031	16	62	317	2—	330	765	435	2.39	2	456
Average	17	66	365	2+	351	755	404	2.22	2	381
					Heifers					
021	19	65	393	2+	370	692	322	1.77	1—	410
023	19	56	350	2	330	642	312	1.71	1	481
043	16	66	370	1—	350	611	261	1.43	1	336
045	16—	57	347	2	285	520	235	1.29	2—	474
059	19	60	397	2—	382	733	351	1.93	1	427
063	16	65	281	2—	242	620	378	2.08	2	400
065	20	70	285	3	267	477	210	1.15	3	562
069	12	72	400	1—	383	732	349	1.92	1	514
077	9	70	372	2+	297	655	392	2.15	2+	322
Average	16	65	355	2	323	631	312	1.71	2+	436
					Wernacre Premier Line—Bulls					
083	34	76	402	3+	275	667	392	2.15	3+	322
					Heifers					
037	30	72	492	3+	380	632	252	1.38	2—	454
055	38	65	485	3+	405	702	297	1.63	2—	515
067	34	67	463	3+	370	620	250	1.37	2—	610
071	24	64	421	2—	334	626	292	1.60	2—	404
Average	32	67	465	3+	372	645	273	1.50	2—	496

still-born calves during the last two years were not afflicted with this difficulty or fault in previous breeding performance.

Data on the weaning weight of all calves in both inbred lines were analyzed during the past year. These data were collected from 1950 through 1960, inclusive, and are summarized according to inbred line and year in Table 21.

All analyses were computed separately on each of the two inbred lines. It was necessary to develop calf-weaning-weight correction factors for age of calf, sex of calf, and age of dam for each inbred line so actual weaning weights could be adjusted for comparisons.

In the Wernacre Premier inbred line, the eight-year-old dams possessed the largest average calf weaning weight, adjusted for age of calf. The following constants were obtained for cow ages 2 through 13 compared with eight-year-olds: 2 = +153; 3 = +72; 4 = +80; 5 = +55; 6 = +53; 7 = +25; 8 = 0; 9 = +33; 10 = +65; 11 = +69; 12 = 59; and 13 = 39. In the Mercury inbred line, the calf weaning weights were adjusted to the nine-year-old dams which had an average calf weaning weight, adjusted for age of calf, of 384 pounds. The following constants were obtained: 2 = +90; 3 = +63; 4 = +40; 5 = +40; 6 = +27; 7 = +15; 8 = +27; 9 = 0; 10 = +42; 11 = +35; and 13 = +16. There were no available records on twelve-year-old dams for this inbred line.

The average weaning weights, adjusted for age of calf and age of dam, for heifer and bull calves were compared on a within-line basis to obtain the correction values for sex of calf. It was determined that 61 pounds and 18 pounds needed to be added to the actual weight of heifer calves to correct them to a bull calf equivalent in the Wernacre Premier and Mercury lines, respectively.

Table 21

Yearly averages for weaning weight, inbreeding of calf and inbreeding of dam.

Year	Number of calves	Average weaning weight* (lbs.)	Average inbreeding of calf (%)	Average inbreeding of dam (%)
		Wernacre Premier Line		
1950	21	496	10.28	0
1951	11	473	11.77	0
1952	14	471	16.28	4.97
1953	9	459	12.89	1.74
1954	6	440	18.63	6.89
1955	9	440	20.73	7.61
1956	8	500	25.61	8.06
1957	5	469	25.23	7.27
1959	9	426	28.36	18.47
1960	6	443	32.34	22.54
Grand averages	....	460	18.03	6.10
		Mercury Line		
1951	14	424	0	0
1952	10	410	0	0
1953	13	400	3.22	0
1954	13	413	7.17	0
1955	18	385	11.66	0
1956	15	426	11.63	0.21
1957	25	416	11.92	2.73
1958	17	374	18.72	8.14
1959	19	363	19.34	7.49
1960	23	361	16.38	7.77
Grand averages	....	395	11.25	3.20

* Adjusted for age of calf, age of dam, and sex of calf. (180 standardized weaning age, mature cow and bull calf equivalent according to specific inbred line-correction factors.)

Analyses of variance indicated that the within-year level of inbreeding of the calves did not affect calf weaning weight significantly in either inbred line. Examination of the yearling summary of the calf weaning weights for both lines portrays a general trend of decreasing weaning weight with increased level of inbreeding of calves. Level of inbreeding of calves is confounded with year effects, so an intricate evaluation of inbreeding is not possible with these data. The analyses of variance indicated that the effect of years on calf weaning weight was highly significant in both inbred lines.

The following within-year simple correlations were calculated for the Wernacre Premier line and Mercury line, respectively; birth weight of calf and average daily gain to weaning, .33 and .34; birth weight and weaning weight (adjusted for age of calf), .51 and .47; actual weaning weight and weaning score, .40 and .57. All of these correlation coefficients are highly significant.

The analyses reported on this purebred Shorthorn cattle breeding project are not conclusive and additional data will be collected as the project progresses. The preliminary findings discussed here indicate the problems involved in evaluating animal production data. None of the corrections used in this study for adjustment of calf weaning weight procedures is recommended for use by cattle breeders at this time.

The growth rate and feed consumption data for the project cattle are undergoing analyses currently. The results of these studies will be reported in the future.

Record of Performance Testing Program for Beef Cattle

Walter Smith and V. E. McAdams

Introduction

Performance in beef cattle includes all traits that contribute to the efficient production of beef with quality appeal to the consumer. The systematic measurement of economically important production traits and the use of such procedures comprise what is known as Record of Performance. The goal of these procedures is to identify the genetically superior individuals within a herd so that maximum genetic improvement can be made through their selection and breeding. Performance should be a guide to beef herd improvement in Kansas.

Principles of Record of Performance

Differences between individual animals are due to two major causes, genetic and environmental. The observed performance of an individual animal for each trait is the result of the heredity that it receives from both parents and the environment in which it is produced.

The inherited differences with regard to the ability of cattle to grow rapidly, mature early, convert feed to meat efficiently, reproduce efficiently, and to produce desirable carcasses provide the basis for selection for improvement through breeding methods.

Record of Performance is useful primarily to provide a basis for comparisons among cattle handled alike within a herd and not for comparing differences between herds. Genetic differences between herds do exist; however, uncontrollable environmental effects eliminate the possibility of an evaluation of these genetic differences in most instances. Minimum standards for level of performance with regard to the various production traits have been advocated in some broad-scale Record of Performance programs. Because of the tremendous variation in environmental conditions and production programs, standards of performance involving comparisons between herds are likely to be erroneous. Performance records are useful for selecting the high producers and for culling undesirable animals. Maintaining production records on cattle produced in a herd helps to identify the best performing individuals and gives information about the breeding value of the sires and dams that

produced them. The performance of all individuals should be measured in order to identify those that are above average in total merit.

The impact of Record of Performance for the entire beef cattle industry will depend mainly on its adoption by purebred breeders in the production of herd sires. Commercial beef breeders can make the most effective use of Record of Performance in the selection of herd bulls on the basis of records from within purebred herds that are on a systematic Record of Performance program. Commercial producers may use production records as a guide to cull cows or bulls and to select replacement heifers.

Attention That Each Trait Should Receive

Beef cattle breeders are concerned with the important problem of determining the emphasis placed on each trait in selection procedures. Generally speaking, the heritability, the relative economic importance, and the genetic association with other traits determine the attention which should be devoted to a given trait in a selection program. The number of traits undergoing selection limits the emphasis which may be placed on a given trait; therefore, the greater the number of traits selected for, the less intensely can selection be practiced for any single trait. Beef cattle production traits vary with regard to their individual heritability and economic value. Traits of high heritability respond more to selection than those of low heritability, and greater attention should be given to traits of higher economic value.

Rate of Improvement from Selection

The factors that determine the rate of breeding improvement as a result of selection are: (1) Heritability, (2) selection differential, (3) genetic association among traits, and (4) generation interval.

Heritability is generally defined as the proportion of the differences measured or observed between animals that is transmitted to their offspring. Theoretically, heritability for a trait may vary from 0 to 100%. Heritability estimates are obtained under carefully controlled environmental conditions, with adjustments being made for known major environmental sources of variation. The heritability value for a given trait may be expected to vary to some limited extent in different herds due to existing genetic variability and the uniformity of the environment. There have been many heritability estimates reported from studies made on data obtained on numerous different research herds. The estimates presented in Table 1 probably represent average expectations for many herds, provided the general environment is similar for all cattle within the herd. These estimates are recommended for reference to Kansas beef cattle breeders pursuing Record of Performance programs.

Table 1

Beef cattle: economically important traits

Trait	Heritability %
Calving interval (reproductive efficiency)	10
Birth weight	40
Weaning weight	30
Cow maternal ability	40
Feedlot gain	45
Pasture gain	30
Efficiency of gain	40
Final feedlot weight	60
Conformation score:	
Weaning	25
Slaughter	40
Carcass traits:	
Carcass grade	30
Rib eye area	70
Tenderness	60
Cancer eye susceptibility	30