Table 1.—Digestibility of Corn-Alfalfa Ration by Wether Lambs. Each Lot Average of Three Lambs.

Lot No.	Experimental treatment	Na:K ratio	Average coefficient of digestibility: Dry matter	Crude protein	Ether extract	Crude fiber	NFE	Ash	Index coefficient
1	$KHCO_3$	1:82	75	70	55	46	87	59	65
2	$NaHCO_3$	1:2	76	72	59	45	88	64	67
3	NaCl	1:2	77	74	63	49	88	64	69
4	Basal	1:45	75	70	59	46	87	60	66

Table 2.—Physiologic Blood Plasma Constituents of Wether Lambs. Each Lot Average of Three Lambs.

Lot No.	Na:K ratio	CO_2 vol. %	NPN mg %	CHON Gms %	Hb Gms %	Ca ++ mg %	P ++++ mg %	Mg ++ mg %	Na + mg %	Cl — mg %
1	1:82	58.3	28.5	6.54	12.0	12.7	6.2	1.83	339	356
2	1:2	54.0	31.9	6.98	13.3	12.7	7.3	1.75	354	372
3	1:2	52.0	31.7	6.45	13.0	12.5	7.4	1.89	354	388
4	1:45	46.7	32.2	6.42	12.4	13.3	6.8	2.05	352	385

In addition to the basal ration, Lot 1 received 32.3 gms of potassium bicarbonate ($KHCO_3$), adjusting the Na:K ratio to 1:82; Lot 2, 30.3 gms of sodium bicarbonate ($NaHCO_3$), adjusting the Na:K ratio to 1:2; Lot 3, salt (NaCl) ad lib (21 gms daily), adjusting the Na:K ratio to 1:2; and Lot 4, basal ration only, the Na:K ratio being 1:45.

After a feeding period of 96 days, three wether lambs from each of the four lots (total of 12 lambs) were placed in metabolism stanchions for 21 days for the mineral balance and digestibility determinations. On the last day of the balance, blood samples were taken and analyzed for carbon dioxide (CO_2 or alkali reserve), non-protein-nitrogen (NPN), protein (CHON), hemoglobin (Hb), and the minerals calcium (Ca++), phosphorus (P++++), magnesium (Mg++), sodium (Na+), potassium (K+), and chloride (Cl-).

On the same day the Na:K ratios in Lots 2 and 4 were changed to 1:82 (formerly 1:2) and 1:2 (formerly 1:45) respectively, for the antagonism study. The antagonism was studied for seven days.

Results

The feed-lot performance was tentatively summarized in the "38th Annual Livestock Feeders' Day." The differences in digestibility are indicated in Table 1, and changes in blood plasma constituents in Table 2.

1. Mineral balance: lambs receiving the basal ration only (Na:K-1:45), and those receiving $KHCO_3$ (Na:K = 1:82), were in negative balance, the daily losses of body sodium being 53 and 22 mg respectively. The quantitative sodium intake was equal in these two lots and the excretion of sodium appears to be a function of the Na:K ratio.
2. Lambs in negative sodium balance retained considerably more potassium than did animals receiving salt or sodium bicarbonate.
3. Excessive sodium excretion leads to potassium retention; and as the dietary sodium: potassium ratio grows progressively wider (from 1:45 to 1:82), sodium excretion increases directly.
4. Sodium; potassium antagonism definitely exists, but it may subsidize to small negative or positive sodium balances after a three-day period.
5. Withholding salt depletes the animal's body sodium through promoting Na:K antagonism, and possibly by not supplying adequate dietary sodium. It also lowers the digestibility of all nutrient components of the feed by 3 to 4 percent. The alkali reserve, or the animal's ability to neutralize nutritional acids, is also reduced.
6. Lambs on the widest Na:K ratio (1:82) performed poorly, showed less digestibility of feed, and showed significantly lower sodium and chloride levels of blood plasma; their bodies were dehydrated by approximately 4 percent.

Project 286: Improvement of Beef Cattle Through Breeding Methods

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The purebred Shorthorn herd maintained at Manhattan is being used as a primary basis for the purebred cattle breeding investigations which started at the Kansas station three years ago. The project is still in its preliminary stages, and the systems of breeding which have been adopted were regulated primarily by the pedigrees of the foundation females in the original college herd.

The project has been designed to facilitate the collection of production data which will be used to devise testing and breeding procedures

useful to cattlemen for the improvement of beef cattle through breeding methods.

In recent years attention has been directed toward research in cattle breeding which has emphasized the selection of breeding animals on the basis of economic factors such as rate of growth or weight for age, economy of gain, and type scores.

The purpose of the Shorthorn project is to study the usefulness of criteria in cattle selection and to determine the practicability of inbreeding to establish two high-producing lines of Shorthorn cattle.

An inbreeding program was initiated in 1949 to establish a line of a Wernacre Premier foundation by breeding the cow herd to College Premier 29th 2368167. Approximately one-half of the females that calved during 1950 were half sisters to College Premier 29th. These calves were placed on feeding trials in the fall of 1950. These trials were completed during the summer of 1951.

The cows in the project are pasture-bred to calve in the spring of each year. The calves are not creep-fed during the suckling period. The 1950 calves were weaned at 196 days of age and placed on feeding trials for a 196-day period following an adjustment period after weaning. Both the weaning age and feeding trial periods were shortened to 182 days in 1951 to facilitate the feeding and breeding management of the project, since data obtained from these shortened periods are believed to be as reliable and useful as those from the original plan. All calves are fed individually, and periodic gains and feed consumption records are recorded. The individual performance data provide part of the information used to select breeding animals in the project. Desirable animals are those which possess rapid gaining ability, good type scores, and efficiency of feed utilization.

The feeding trial data for the 1950 calf crop are summarized in Table 1. The steers consist of the bull calves that were castrated immediately after weaning. The full-feed ration for the bulls and steers consisted of 60 percent cracked corn and 40 percent chopped alfalfa hay, and that for the heifers consisted of 55 percent corn and 45 percent alfalfa hay.

The steers were maintained on a fattening ration following the termination of the regular feeding trials, and were slaughtered in the College meats laboratory during August and September. Detailed carcass data were obtained on these six individuals.

The bull possessing tag number 81 was used during the summer of 1951 to breed the heifers from the same calf crop. These heifers will calve as two-year-olds during the summer of 1952.

Gregg Farms Hoarfrost 2492499, a son of Edellyn Valiant Mercury 2247154, was purchased in 1949 and used as one of the sires in the Shorthorn herd during 1950. A second inbred line of Mercury breeding will be established this year. The 1951 calf crop was sired by College Premier 29th and Gregg Farms Hoarfrost.

The 1951 calf crop was weaned as the calves reached 182 days of age, and placed on feeding trials last fall. A partial summary of these calves is presented in Table 2. The feeding trials are not complete at this time but will terminate after 182 days.

Direct comparisons of data for the calves of the two sire groups are not justifiable because several nongenetic factors cause variation in these groups. The information contained in Tables 1 and 2 illustrates the variation which may be expected in the progeny of single sires.

Table 1.—Summary of the 1950 Shorthorn Calves Representing the Wernacre Premier Inbred Line.

Tag number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Days fed	Initial weight	Final weight	Total gain	Av. daily gain	Final score	Lbs. TDN per 100 lbs. gain
					BULLS						
49	6.25	52.5	440	2	196	480	920	440	2.24	2	523
11	12.50	70.0	445	2+	196	495	975	480	2.45	2	538
13	18.75	74.0	455	2−	196	475	960	485	2.47	3	504
23	3.10	66.0	480	2+	196	490	980	490	2.50	2+	481
81	14.06	76.0	500	2+	196	530	1145	615	3.14	2+	514
61	0.00	90.0	510	3	196	535	1020	485	2.47	3−	516
54	14.06	74.0	440	2−	196	445	930	485	2.47	3	441
	Av. 9.82	71.8	467	2	196	493	990	497	2.53	2−	502
					STEERS						
55	6.25	69.0	425	2	196	455	880	425	2.17	2+	573
90	6.25	70.0	445	2+	196	465	875	410	2.09	2	613
56	12.50	77.0	410	3+	196	425	865	440	2.24	2−	513
87	7.80	65.0	355	2	196	375	825	450	2.30	2	570
53	0.00	74.5	465	2	196	480	865	385	1.96	2+	646
760	6.25	75.0	420	2+	196	425	840	415	2.12	2	538
	Av. 6.50	71.8	420	2	196	438	858	421	2.15	2	575
					HEIFERS						
189	15.60	78.5	440	2	196	475	825	350	1.79	2	663
72	0.00	71.0	475	1	196	475	850	375	1.91	1−	550
4	18.75	60.5	335	3	196	340	690	350	1.79	3	526
58	15.60	57.0	320	3+	196	360	650	290	1.48	3	579
92	15.60	67.5	435	2	196	440	760	320	1.63	2	653
2	12.50	80.0	400	2−	196	420	725	305	1.56	2−	590
39	15.60	77.0	420	2−	196	410	720	310	1.58	2−	575
14	6.25	70.0	380	2	196	425	765	340	1.73	1−	795
	Av. 12.50	70.2	401	2	196	418	748	330	1.68	2	616

Table 2.—Partial Summary of the 1951 Shorthorn Calves Representing the Wernacre Premier and Mercury Inbred Lines.

Tag number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Initial weight	Weight on 4/1/52	Days on trial 4/1/52	Daily gain during trial
			Wernacre Premier Line					
			BULLS					
81	6.25	78.0	470	2—	534	800	128	2.08
120	15.60	80.0	425	2—	454	687	104	2.24
189	14.06	71.0	515	2+	637	1019	128	2.98
Av.	11.90	76.3	470	2	542	835	120	2.43
			STEERS					
39	3.10	66.0	400	3+	533	738	128	1.60
61	18.75	81.0	400	3—	555	800	128	1.92
Av.	11.00	73.5	400	3	544	769	128	1.76
			HEIFERS					
154	0.00	69.0	410	2+	553	770	128	1.70
14	14.10	69.0	405	2—	434	662	128	1.78
72	12.50	74.0	410	2+	485	775	128	2.27
108	6.25	74.0	400	2+	416	604	104	1.80
58	15.60	66.0	358	2—	384	557	104	1.66
105	18.75	74.0	310	3	338	500	104	1.56
Av.	11.20	71.0	382	2—	435	645	116	1.80

Table 2 cont.

Tag number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Initial weight	Weight on 4/1/52	Days on trial 4/1/52	Daily gain during trial
			Mercury Line					
			BULLS					
760	0.00	74.0	445	1—	537	906	128	2.88
49	0.00	58.0	435	1+	Injured Jan. 21, removed from feeding trial			
Av.	0.00	65.0	440	1				
			STEERS					
4	0.00	52.0	380	1—	425	702	128	2.16
92	0.00	67.0	410	2	440	762	128	2.59
Av.	0.00	59.5	395	2+	433	732	128	2.38
			HEIFERS					
13	0.00	60.0	355	2	381	580	128	1.55
23	0.00	54.0	355	2	393	590	128	1.54
2	0.00	71.0	440	1	454	681	128	1.77
87	0.00	58.0	325	2—	329	504	128	1.37
53	0.00	53.0	340	2	375	645	128	2.11
90	0.00	43.0	260	3—	280	480	128	1.56
55	0.00	56.0	400	1—	471	708	128	1.85
56	0.00	59.0	343	1—	367	495	104	1.23
22	0.00	58.0	355	1—	355	530	104	1.68
180	0.00	56.0	300	2	309	520	104	2.03
Av.	0.00	57.0	347	2	371	573	121	1.67