Table 39

Corn, sorghum grain, wheat, rye, and barley in complete pelleted rations vs. a standard nonpelleted ration for self-feeding fattening lambs.

November 16, 1961, to January 21, 1962—65 days.

Lot number	1	2	3	4	5	6
Ration fed	Pelleted: 35% sorghum grain, 65% alfalfa hay	Pelleted: 35% corn, 65% alfalfa hay	Nonpelleted: 45% ground sorghum grain, 55% chopped alfalfa hay	Pelleted: 35% barley, 65% alfalfa hay	Pelleted: 35% wheat, 65% alfalfa hay	Pelleted: 35% rye, 65% alfalfa hay
No. lambs per lot[1]	20	21	18	24	23	23
Initial wt. per lamb, lbs.	65.8	65.2	64.7	65.7	66.5	64.9
Final wt. per lamb, lbs.	101.2	103.3	90.9	104.6	106.6	100.9
Total gain per lamb, lbs.	35.4	38.1	26.2	38.9	40.1	36.0
Av. daily gain per lamb, lbs.	.54	.59	.40	.60	.62	.55
Lbs. feed per lamb daily:						
Complete pelleted ration	3.69	3.87	.....	3.92	4.00	3.77
Chopped alfalfa hay	.18	.17	1.56	.15	.15	.16
Ground sorghum grain	.....	.....	1.30	.....	.....	.....
Total feed per lamb daily	3.87	4.04	2.86	4.07	4.15	3.93
Lbs. feed per cwt. gain	712.3	690.8	711.5	683.8	672.1	709.8
Feed cost per cwt. gain	$11.01	$11.13	$9.83	$11.25	$14.03	$10.86
Av. % yield[2]	49.5	48.1	49.0	48.3	48.5	49.3
Av. U.S.D.A. carcass grade[3]	9.5	9.6	8.7	9.7	9.3	9.4

1. Four lambs in lot 1; 3 from lot 2; 6 from lot 3; and 1 from each of lots 5 and 6 died from overeating.
2. Based on hot dressed carcass weight and individual lamb weight at Manhattan just prior to shipment.
3. Based on prime, 14; choice, 11; good, 8; utility, 5; and cull, 2.

of feeding lambs is less difficult. Lambs will consume more pounds of feed per day; therefore, gains are higher than when a loose ration is fed, but the cost of gains is higher because of the processing cost.

Fifteen lambs died from overeating during the test—6 in lot 3; 4 in lot 1; 3 in lot 2; 1 each in lots 5 and 6, and 0 in lot 4. The lambs were not vaccinated for overeating when put on feed. There was about 4% U.S.D.A. carcass grade variation among lots and 1.4 percent variation in yield among lots.

Heritabilities, Genetic, and Phenotypic Correlations Between Carcass and Live Animal Traits in Sheep (Project 847).

Myron Hillmann, Carl Menzies, John D. Wheat, D. L. Mackintosh and F. A. Merkel

This is a contributing project to the North-Central-50 Regional Sheep Breeding Project. The Kansas State Project was initiated to determine relationships between various carcass measurements and live animal traits, to estimate heritability of these traits, and to determine how findings may be applied to selection and breeding of meat-type lambs.

Experimental Procedure

In 1959-60, 10 Hampshire rams were bred to 100 yearling Western ewes. The ewes were divided into 10 equal lots and one ram was randomly assigned to each lot. One ram was sterile, so his ewes were randomly assigned to the other nine lots. The nine rams sired 77 lambs.

In 1960-61, 10 different Hampshire rams were used on the same ewes and 99 lambs resulted from these matings. Experimental rams were used from June 1 to August 15, each year, and then clean-up rams were turned with the ewes, hence the relatively small experimental lamb crop.

The ewes were on a bromegrass pasture during the spring and summer months and were on rye pasture from the last week in September until they lambed. Three weeks before lambing, each ewe received ½ pound of grain daily. After the ewes lambed, they were put into a drylot and fed sorghum silage free choice, and approximately 1.5 pounds of alfalfa hay and 1 pound of grain per head daily.

As soon as the lambs would eat it, they were started on a pelleted creep ration, and remained on it until they were slaughtered. All lambs were slaughtered when their unshorn feedlot weights were from 95 to 100 pounds. They were shorn and held off feed approximately 12 hours before slaughter.

In August, when the rams were taken from the ewes, each was subjectively scored for certain conformation traits by a five-man committee. At that time each ram was weighed and in 1960-61 the rams were probed for fat and muscle depth over the second lumbar vertebra. The probe depth for each ram was corrected for weight (by regression).

Five scores (among those taken for each ram), weight, and loin depth probe were used in correlating ram scores with each other and with some production and carcass traits in the lambs. Before they were slaughtered, the born lambs were subjected to 13 objective measurements to the nearest tenth of an inch. Birth weight, average daily gain, and market age were corrected for type of birth, sex, and type of rearing.

These 176 lambs also were used in a lamb carcass quality study (Project 580) conducted by meats researchers at Kansas State University. From this study subjective carcass scores, carcass measurements and weights of cuts were obtained. The rack was physically separated and the lean, fat and bone were weighed to the nearest gram. Loin eye area and back fat thickness were measured from tracings.

Procedure followed in handling ewes and rams the past two years is outlined in Kansas Circulars 378 and 388.

Results and Discussion

There were only a few significant correlations between ram scores and lamb traits. The depth of loin probe had the highest relationship with lamb traits. It was negatively correlated with lamb's market age (—.60);

as depth of loin probe increased the lamb reached market weight sooner. Loin probe was positively correlated with loin eye area (.39), length of right forecannon (.68), and weight of loin (.53). Length of leg of ram was highly correlated with depth of heart (.63), circumference of right forecannon (.57), depth of loin eye (.50), and width of loin eye (.48). Muscling score was negatively correlated with birth weight (−.50).

Most of the ram scores or traits were significantly correlated with each other. The highest correlation was ram weight with depth of loin probe (.99). This relationship indicates that heavier rams have deeper longissimus dorsi muscles. Muscling score was highly correlated with general type score (.87).

Table 40 gives the correlation, for both years, between production and carcass traits in lambs.

Market age was negatively correlated with birth weight. The heavier lambs at birth gained far more rapidly and reached market weight sooner. Birth weight was negatively correlated with carcass grade, feathering, and marbling. These relationships indicate that larger lambs at birth gained faster, reached market weight sooner, therefore, they were younger and didn't have the quality carcass that a more mature lamb does.

Objective measurements taken on the live lambs were correlated with carcass traits. Data from each of the two years were analyzed separately.

Table 40

Correlations between production and carcass traits in lambs.

	Birth weight		Av. daily gain		Market age	
	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.
Market age	−.44[1]	−.62[2]	−.92[2]	−.91[2]		
Av. daily gain	.38[2]	.53[2]				
Carcass grade	−.24[2]	−.15[1]	−.49[2]	.00	.47[2]	.14
Feathering	−.09	−.12	−.38[2]	0.06	.38[2]	.18
Marbling	−.22[2]	−.19[1]	−.36[2]	.01	.33[2]	.04
Firmness	−.19[1]	.19[1]	−.38[2]	.28[2]	.37[2]	−.27[2]
Grams of lean in rack	.20[2]	.21[2]	−.03	.33[2]	.06	−.38[2]
Grams of bone in rack	.36[2]	.34[2]	.22[2]	.35[2]	−.20[2]	−.39[2]
Loin eye depth	....	.05	....	.27[2]	....	−.33[2]

1. $P < .05$.
2. $P < .01$.

Circumference of right forecannon was the most highly correlated trait with gram of bone in the rack (.36) (.40). Length of right forecannon, length of body and length of rump were positively correlated with gram of bone in rack, which is a good indicator of the total bone in carcass.

Length of rump was significantly correlated with the weight of leg (.39) (.60). Also, circumference of right forecannon and circumference of right hind leg were positively correlated with weight of leg. The relationship of these measurements with weight of leg could be used in selecting lambs with high cut-out value, because weight of leg makes up approximately 30 percent of the total carcass weight.

Length of rump was also significantly correlated with grams of lean in the rack (.23) (.16), which is also one of the best indicators of total lean in the carcass.

Width of second lumbar vertebra was significantly correlated with carcass traits that are associated with the fat in the carcass. These traits are weight of rack, back fat thickness, grams of fat in rack, and weight of loin.

Feathering was positively correlated with marbling and with carcass grade. Marbling was also positively correlated with carcass grade, grams of fat in the rack and percentage of fat in the longissimus dorsi. The percentage of fat in longissimus dorsi was negatively correlated with birth weight, positively correlated with market age, negatively correlated with average daily gain. These significant relationships indicate that a

lamb with a heavy birth weight, that had a fast daily gain, will reach market weight sooner and will have less fat in longissimus dorsi and, therefore, have less marbling.

Carcass grade correlated with weight of leg more than with any of the other wholesale cuts. Weight of shoulder was significantly correlated with weight of leg (.46) (.57), also with weight of rack, weight of loin, and grams of fat in the rack.

Heritability estimates based on paternal half-sib correlation were made on all lamb measurements and traits (Table 41).

Sire effects were significant ($P < .01$) in the following lamb traits: weight of loin, marbling, feathering, average daily gain, market age, birth weight, length of rump, and length of right forecannon.

The sire difference in rib eye area was significant ($P < .05$).

Table 42 gives the results on the 10 yearling Hampshires and their lambs.

Table 41

Heritability estimates based on paternal half-sib correlations.

Weight of loin	.46	Grams of lean in rack	.16
Marbling	.39	Grams of bone in rack	.10
Feathering	.57	Firmness of carcass	.14
Av. daily gain	.54	Market age	.53
Birth weight	.60	Backfat thickness	.21
Rib eye area	.39	Length of body	.09
Length of rump	.50	Length of right forecannon ..	.51
Weight of shoulder	.08	Weight of breast	.02

Table 42
1960-61 data on ten yearling Hampshire rams and their lambs.

Ram number	1	2	3	4	5	6	7	8	9	10
Ram type score[1]	80	78.8	71.6	92.1	78.8	82.3	86.8	86.8	78.3	60.0
Wt. of ram, lbs., 9-2-60	198	161	163	270	189	229	224	222	170	147
Ram probe fat depth at 2nd lumbar, in.	.30	.40	.40	.35	.30	.40	.30	.20	.30	.20
Ram probe loin eye depth at 2nd lumbar, in.	1.75	1.60	1.40	2.15	1.60	1.50	1.90	2.10	1.70	1.20
Ram loin eye depth corrected[2]	1.7	1.5	1.5	2.2	1.6	1.9	1.8	1.9	1.5	1.4
Total number of lambs	12	11	13	10	10	8	7	12	11	10
Number twin lambs	6	4	6	4	2	2	2	6	4	2
Av. birth wt., lbs.[3]	10.8	9.2	9.0	10.7	9.9	10.6	10.4	9.6	10.0	8.9
Av. daily gain, lbs.[3]	.78	.67	.68	.69	.66	.77	.72	.68	.67	.65
Av. age at slaughter	126	135	129	128	133	119	121	130	132	136
Av. rib eye area, 12th rib, sq. in.	2.3	2.2	2.3	2.3	2.4	2.6	2.4	2.5	2.2	2.4
Av. fat thickness, 12 rib, in.	.37	.34	.30	.39	.34	.30	.29	.33	.30	.32
Av. marbling score[4]	5.9	6.1	5.8	5.2	5.0	5.4	5.8	5.4	6.1	5.6
Av. USDA carcass grade[5]	14.2	14.4	14.4	14.2	14.1	13.8	13.8	14.1	14.4	14.4

1. Average general type score, with perfect score, equals 100.
2. Ram loin depth probe corrected for weight (by regression).
3. Not corrected for sex or type of birth.
4. Higher score means more marbling.
5. Carcasses graded by USDA graders: Prime, 14; choice, 11; good, 8; etc.

Meat

The Relation of Feathering and Overflow Fat of Lamb Carcasses to the Grade of the Lamb, Degree of Marbling, and Market Value of the Lamb (Project 580).

D. L. Mackintosh, R. A. Merkel and C. S. Menzies

This project was undertaken the spring of 1960 to attempt to determine the relationship, if any, of internal fats, overflow, and feathering to the degree of marbling in the longissimus dorsi muscle, the grade of the carcass, and the relationship of marbling to the palatability of the meat. Eighty-eight lambs were slaughtered in 1960; 120 in 1961; and about 80 will be slaughtered this spring.

The Hampshire rams crossed on western ewes produced highly acceptable lambs weighing 95 pounds in 82 to 178 days in 1960 (average 136 days), and from 96 to 147 days (average 121 days) in 1961. All lambs graded average choice or prime, with a fair range in marbling. Lambs by Suffolk rams and out of the same ewes are being studied this year.

Correlation coefficients for both 1960 and 1961 data show a highly significant relationship between feathering, fat streaking in the flank, estimated marbling, actual marbling, overflow fat, and thickness of fat. Feathering also was significantly correlated with most other factors, both years; overflow fat was highly correlated with grade, yield, marbling, and kidney and pelvic fat, but not with other 1960 data. Marbling and percentage of fat in the longissimus dorsi were highly related to all palatability factors in 1960, but much less so in 1961. In general, external indices of quality used in grading lamb are highly satisfactory with "A" (young) maturity lambs.

The Relation of Packaging Material to the Keeping Quality of Frozen Pork (Project 424).

D. L. Mackintosh, R. A. Merkel, J. L. Hall, Dorothy L. Harrison and L. Anderson

Fresh pork sausage is used by an increasing number of families with home storage units. Several years of research here indicate that with salt, pepper and sage added before sausage is stored, its maximum storage life is 6 to 9 months at 0° F., and then only when tested packaging materials are used (Polyethylene, Pliofilm, Cellophane, or Aluminum Foil). Poor packaging materials reduce storage life of sausage to as little as 30 days. Addition of antioxidants to the sausage increased the storage life from about 6 to 9 months in our tests. Antioxidants have little influence when used with poor wrapping materials. High peroxide values in test sausage early in the storage period have been common the last two years. The processing equipment has been modified, and a study is now under way to try to determine why the high peroxide values occur.

The Effect of Level of Dietary Iron on Pork Muscle Characteristics.

F. A. Merkel, D. L. Mackintosh, J. L. Hall, Dorothy L. Harrison, Mercedes Hunsaker, D. G. Topel and D. H. Kropf

Increasing undesirable muscle characteristics in pork carcasses make any method to alter or improve pork muscle quality desirable. Effects of various levels of dietary iron and copper (or NaCl) on pork muscle were investigated in this experiment.

Procedure

Barrows and gilts (28 of each), averaging 43 pounds, were randomly divided into 7 lots to receive treatments indicated in Table 43. The con-