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-

Table 43
The effect of level of dietary iron on pork muscle characteristics (lot averages).*

Lot no.	1	2	3	4	5	6	7
Ration	Control[1]	Control +0.4 gm. EDTA per lb.	Low iron	Control +260 mgs. Fe +28.2 mgs. Cu per lb.	Control +560 mgs. Fe +53.2 mgs. Cu per lb.	No salt group[2]	Control + salt[3]
Initial wt., lbs.	48.6	49.0	46.1	37.1	37.9	40.4	37.5
Final wt., lbs.	205.0	210.4	209.8	207.6	201.0	205.2	209.8
Av. daily gain, lbs.	1.46	1.41	1.55	1.42	1.32	1.30	1.36
Feed per lb. gain, lbs.	3.83	3.27	2.86	3.19	3.07	3.18	3.15
Muscle characteristics:[4]							
Expressible water, %	42[a]	39[b]	38[b]	41[a]	42[a]	43[a]	45[c]
pH, 24 hours	5.53[a,7]	5.48[b]	5.54[a,7]	5.51[a,7]	5.56[a,7]	5.55[a,7]	5.58[7]
Ether extract, %	2.69[b]	2.93[b,7]	2.99[b,7]	2.98[b,7]	3.88[7]	3.98[7]	3.19[b,7]
Total moisture, %	73.90[a]	73.84[a]	73.90[a]	73.76[a]	73.11[b]	73.10[b]	73.72[a]
Myoglobin, mgs./gm.	0.93[b]	0.90[b]	0.60[c]	1.00[a,8]	1.07[a,8]	1.11[a,8]	1.17[a]
Color intensity[5]	4.93[a,7]	4.97[7]	5.34[b]	4.82[a,7]	4.75[a,7]	4.81[a,7]	4.65[a]

* All values with same superscript are not significantly different at 5% level of probability.
1. Includes 40 mgs. Fe and 6.8 mgs. Cu per lb. ration.
2. Received no added salt in ration.
3. Control ration until 180 lbs. live weight, then 10% NaCl in ration until reaching slaughter weight.
4. Average value from 10 locations on 5 different muscles.
5. Munsell value. Higher number indicates **lighter** color.
6, 7, 8. See first footnote, introduced by asterisk (*).

trol ration was essentially a sorghum grain-protein supplement ration. The EDTA added to lot 2 ration may tie up iron in a pig's system and thus affect muscle characteristics. Rations fed to the low-iron lot contained about half the recommended dietary allowance for iron. Iron and copper were added to some rations to determine if that would increase myoglobin, the muscle pigment, or change color intensity of pork muscle.

Rations were pelleted and fed free choice to pigs in concrete-floored feeding pens. Water was softened so essentially no iron was available from it. Animals were individually taken off feed at 205 to 210 pounds and slaughtered after holding for 24 hours. After chilling for 24 hours at 30-34° F., standard cutting procedures were used.

Muscle samples were removed as follows:

A. **Longissimus dorsi** (loin eye muscle)
   1. Anterior sample—opposite 3rd rib to 10th rib.
   2. Center—10th rib to 1st lumbar vertebra.
   3. Posterior—lumbar section.

B. **Psoas major** (tenderloin)

C. **Rectus femoris** (a ham muscle)
   1. Ventral
   2. Dorsal

D. **Biceps femoris** (a ham muscle)
   1. Ventral
   2. Dorsal

E. **Semimembranosus** (a ham muscle)
   1. Ventral
   2. Dorsal

Expressible water, 24 hr. pH, ether extract (fat), total water, myoglobin (muscle pigment), and red color intensity were determined for these samples.

Results

The greatest average daily gain and best feed efficiency were achieved in the group of pigs receiving lower than the required iron level. Slowest gains were observed in the lots where NaCl consumption was altered and in groups receiving the high level of added iron and copper.

Percentages of expressible water and of total water in pork muscle were not altered by any treatment used. Pigs receiving the high level of salt after reaching 180 pounds (lot 7) had a higher average 24-hour muscle pH than those receiving the agent that may tie up iron (lot 2). Muscle samples from pigs of lots 5 and 6 had higher intramuscular fat content than those from lot 1. A lighter average muscle color and less muscle pigment were noted in pigs receiving the low dietary level of iron and copper. This is explained by insufficient iron being available for the animal to synthesize myoglobin. The highest myoglobin concentration and the most intense muscle color were noted in pigs receiving the 10% salt ration before being slaughtered, possibly as a result of stress caused by this abnormal treatment. It appears that certain muscle characteristics can be altered by some of the treatments used in this study.