THE EFFECT OF BREED AND SEX-CLASS ON FAT DEPOSITION ACROSS THE FIVE USDA YIELD GRADES

A Thesis

by

MISTI DEON MENZIES

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 1994

Major Subject: Animal Science

THE EFFECT OF BREED AND SEX-CLASS ON FAT DEPOSITION ACROSS THE FIVE USDA YIELD GRADES

A Thesis

by

MISTI DEON MENZIES

Submitted to Texas A&M University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Approved as to style and content by:

Jeffrey W. Savell
(Chair of Committee)

John D. Williams
(Member)

Chris L. Skaggs
(Member)

Bryan Johnson
(Head of Department)

William L. Mies
(Member)

Major Subject: Animal Science

December 1994

ABSTRACT

The Effect of Breed and Sex-Class on Fat Deposition Across the Five USDA Yield Grades. (December 1994)

Misti Deon Menzies, B.S., Texas A&M University

Chair of Advisory Committee: Dr. J. W. Savell

Feeder lambs (n = 90) were selected to represent the five USDA yield grades (YG). Ewes and wethers (n=15 for each group) were selected from Suffolk, F_1 (Suffolk X Commercial Rambouillet first cross), and Commercial Rambouillet. Lambs were sorted randomly into one of five YG treatments and placed on a finishing diet. A three-member team of trained livestock evaluators estimated fat thickness in the live lambs. Lambs were slaughtered according to appropriate humane slaughter methods at staggered intervals when evaluators determined that the lambs had reached their assigned endpoint.

All carcasses were evaluated for USDA quality and yield grade at 48 hours postmortem. Carcasses were fabricated into a rough leg, loin, rack, shoulder, neck, breasts, shanks, plates, and flanks. The rough subprimals were then split into right and left sides and all right side subprimals were physically dissected into dissectable lean, bone, and fat (subcutaneous, seam, and internal). Dissectable tissues were weighed for each subprimal. Analysis of variance of the means revealed that breed was significant for virtually all subprimals. Sex class was significant for most bone weights and percentages. Mean analysis of percentage total, subcutaneous, seam, and internal fat and percentage lean and

bone reveals the high variability between breeds and sex classes within the five yield grades.

Regression equations were developed to predict compositional development of percentage lean, bone, and fat (total, subcutaneous, seam fat, and internal) given actual fat thickness. These equations revealed that Suffolk lambs had lower percentages of total and subcutaneous fat than Commercial Rambouillet and F_1 lambs, respectively. Commercial Rambouillet lambs were lower for percentage seam fat than Suffolk and F_1 lambs, respectively. Carcasses from ewes were slightly higher than their wether counterparts for total, subcutaneous, and internal fat, and percentage lean. Wether carcasses had more seam fat and bone than ewe carcasses. Across the five yield grades, breed and sex-class impact the ultimate composition of lambs.

ACKNOWLEDGMENTS

I would like to thank my father, Dr. Frank Craddock, Mr. Allen Turner, Dr. John Edwards, Dr. Jim Bassett and all of the livestockmen I grew up listening to, for instilling in me the ability to learn with my eyes and ears, and for teaching me about life and livestock. You are the foundation that my education has been built upon. Thank you for your special support through the years.

I would like to thank my committee members, Dr. Jeff W. Savell, Dr. Bill L. Mies, Dr. John D. Williams, and Dr. Chris L. Skaggs. Dr. Williams, you made statistical analysis much easier and I enjoyed our conversations about white-tailed deer. Thank you to Dr. Skaggs for keeping me on the right track, but I really am leaving.

Carl Hyde, Tryan Fields, Greg Schuman, and Troy Ruffin deserve special thanks for their help in locating lambs with the correct bloodlines for this study. Thanks to Kenny Smarr for taking time to make the long haul to Rocksprings to pick up sheep with Kristina and me.

Special thanks to Tim Akers, Chris Boleman, and Kyla Goodson for their dedicated help in the cutting room and to Carol Lorenzen for helping me with the analysis of the data.

Thanks to Ray Riley, H. R. Taylor, and the guys at the Rosenthal Center. Without your support this project would never have gotten started.

I appreciate the support of past and present graduate students and secretaries in the Animal Science department who helped smooth the path for me. Thank you for taking some of your own precious time to help dissect lambs.

My gratitude is extended to Miss Kristina Fritz for her understanding, dedication, and hard work. I would not have completed this project without your support. Good luck with "Phase II".

Finally, and most importantly, I would like to thank my parents, Duery and LaWanda Menzies, and my brother, Dusty, for their constant love. Thank you for giving me such a remarkable family.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF FIGURES

INTRODUCTION

Consumer demands are forcing all segments of the red meat industry to decrease fat in products. However, in the last 20 years, the average fat thickness for lamb at the 12th/13th rib has increased from 4.8 mm to 7.4 mm, and the average USDA yield grade is now approximately 4. Over 39% of the lamb carcasses in a national carcass survey were yield grade 4 or 5 (Tatum *et al.*, 1989). Individuals interviewed across industry segments listed overfinished lambs as the number one marketing/merchandising problem (Williams, 1991).

Comprehension of fat partitioning and deposition in sheep will become increasingly important. The yield grade equation can accurately predict the cutability of a carcass, only when highly correlated factors are used in the equation. A complete understanding of the effects of breed, sex, frame size, and management will be needed for an accurate prediction of cutability. Knowledge of deposition sites and growth rates of fat will affect the development of breeding schemes and feeding methods for the lamb industry.

Carpenter (1966), Smith *et al.* (1969), Smith and Carpenter (1973), Johnson (1975), and Garrett *et al.* (1990) have found that lamb carcass fatness has the greatest influence on the yield of closely trimmed retail products. Fat partitioning and distribution are critical because fat accounts for most of the variation in lamb cutability. Therefore, objectives for this study were to determine:

1.) The influence of sex-class and breed on fat deposition, partitioning and yield grade.

2.) The relationship between the growth of subcutaneous fat and other fat depots and the effect these deposits have on yield grade.

Literature cited according to the style of the Journal of Animal Science.

LITERATURE REVIEW

Breed Effect. Breed or breed-type has been shown to have a distinct effect on the composition of the carcass (Hammond, 1932; Kempster, 1981; Savell and Cross, 1991). Hammond (1932) observed that in animals five months of age the early maturing breeds have a higher percentage of fat in the carcass than late maturing breeds. Generally, maternal breeds of sheep are thought to develop higher degrees of fat than sire breeds, which were developed to be leaner and heavier muscled (Berg and Walters, 1983; Boggs and Merkel, 1993). Research has suggested that the more prolific, heavy milking maternal breeds require a higher degree of internal fat to support lactation, maintenance of the ewe, and to serve as an energy reserve (Wood *et al.*, 1980). Hohenboken (1977) studied progeny from Suffolk and Columbia range ewes bred to North Country Cheviot, Dorset, Finnsheep, or Romney rams and found that breed of sire had little effect on USDA Yield Grade, but the breed of dam did. The lambs from Suffolk dams typically had less external and internal fat and received lower numerical yield grades than lambs from Columbia dams. Crouse *et al.* (1981) studied Suffolk and Rambouillet-sired lambs and found that external fat did not differ between the breeds on a weight-constant basis, but that kidney and pelvic fat was higher in the Rambouillet lambs than the Suffolk lambs (4.4% versus 3.6%). Lirette *et al.* (1984) found that the Suffolk breed results in thicker dorsal fat deposits, while the Finnish-Landrace breed develops more kidney fat. Dickerson *et al.* (1972) and Bidner *et al.* (1978) both report results favoring Suffolk and Hampshire breeds for carcass traits.

Sex-Class Effects. The influence of sex-class is relatively strong. The two main sex-classes marketed in the US are wethers and ewes. Hammond (1932) noted that at five months of age ewe lambs had a higher percentage of kidney noted that at five months of age ewe lambs had a higher percentage of kidney and pelvic fat than did ram or wether lambs. Tatum *et al.* (1989) found carcasses produced by ewes were fatter and had less desirable yield grades than carcasses produced by wethers. Oliver *et al.* (1967) showed that the hindsaddles from ewes were heavier than those from wethers due to significantly higher kidney fat content. Data indicate that males can be fed to heavier weights without excessive fat deposition, but, when under the same management system, ewes become excessively fat at lower weights (Shelton and Carpenter, 1972).

Effects of Castration. According to Hammond (1932), wethers have greater fat development than rams, which have more bone and muscle. Butterfield (1988) continues the comparison stating that wethers tend to concentrate fat in subcutaneous depots while rams concentrate fat intermuscularly; however, the proportion of total fat found in the body in not different in rams and wethers. However, intact males also have been found to possess undesirable odors and flavors, lower quality grades, lower meat tenderness and undesirable color and, are therefore seldom used for meat production (Berg and Walters, 1983).

Fat Deposition and Partitioning. Smith (1988) noted that adipose tissue increases in weight and in proportion to body weight as an animal grows. Growth of adipose tissue normally occurs when energy intake exceeds the requirements for body maintenance and growth of lean tissue. The increase in adipose tissue mass associated with its growth is due mainly to the deposition of triglycerides into the cytosol of adipocyte cells. When energy requirements exceed energy intake, triglycerides are broken down to provide supplemental energy, and the adipose tissue decreases. In this method, adipose tissue functions as a reserve for energy storage.

Fourie *et al.* (1970) reported that rate of growth of the carcass components differs from the rate of growth of the whole carcass, with fat being deposited at a substantially faster rate, while muscle grows at a slower rate, and bone considerably slower. Fat growth starts out relatively slowly and increases geometrically as the animal enters a fattening stage (Berg and Walters, 1983). We know that fat tends to be deposited from the distal ends and converges in the abdominal region (Hammond, 1932). Kempster (1981) reported the relative pattern of fat development in sheep indicating that kidney knob and channel fat had a high growth rate and intermuscular fat had a slower rate of growth. In this particular experiment, the subcutaneous fat growth rate was higher than that found for kidney knob and channel fat. Of the three fat depots, subcutaneous fat grows the fastest. Reports on the relative growth rate for kidney fat have been variable. Belk *et al.* (1993) reported that with kidney pelvic fat (KP) excluded, subcutaneous fat was the earliest-maturing, slowest-growing depot, intermuscular fat was the latest-maturing, fastest-growing depot, and that intramuscular fat was intermediate ($P < .05$). When compared to carcass weight, kidney fat grew faster and the growth rate accelerated as body weight increased. When KP was removed from consideration in the allometric analysis of rack component growth, increasingly larger proportions of trimmable fat could be credited to intermuscular fat as the lambs grew. This finding accentuates the importance of intermuscular fat growth, which is hard to remove from retail cuts. The regulation of this fat depot will become increasingly important with the removal of KP estimates from the USDA Yield Grades standards (USDA, 1992).

Berg and Butterfield (1976) suggested that localized pressure may influence fat partitioning and distribution. Pressure may be imparted by the body cavity, area under the skin, and muscle groups. Therefore, areas that impose less pressure will fill with fat more quickly, increasing resistance until deposition moves to alternative areas. This may explain why increased intermuscular fat deposits are seen in the forequarter as compared to the hind quarter where muscle groups are more compact and cause more resistance. Fat deposition would continue through out the body, filling areas of lowered resistance until the overall smooth, deep, and wide appearance of extremely fat animals is developed. This theory seems more compatible with fat distribution than with fat partitioning to specific areas.

Butler-Hogg (1984) suggested that the maturity pattern for kidney fat has a biphasic distribution with an initial low growth impetus and is followed by a period of high growth impetus. Smith *et al.* (1987) also demonstrated a biphasic distribution for subcutaneous adipose tissue in very young lambs. Smith justifies this phenomenon by evidence that cell numbers reach a plateau early in life. Hypertrophy continues until a critical size is reached. At this point, a signal is generated to recruit new fat cells. Biphasic distributions have been very difficult to demonstrate and have not been recognized in mature sheep.

MATERIALS AND METHODS

Animals. Commercial Rambouillet sheep are the basis of the sheep industry in Texas. The Rambouillet was introduced to the United States as a large, durable breed which could survive drought and rugged range conditions often found in the Western United States (Briggs, 1958). The Commercial Rambouillet was developed from purebred Rambouillet sheep and a mixture of many other Finewool breeds for use in both wool and lamb production. The Suffolk was developed mainly for use as a meat producing breed. The Suffolk is the largest framed breed in the United States and produces superior, high cutability carcasses. However, the Suffolk produces a medium-wool fleece that is often contaminated with black fiber and the Suffolk is not well-adapted to range conditions (SID, 1988). Producers in the Edwards Plateau of Texas often cross Suffolk sires with Commercial Rambouillet dams to produce Finewool first cross market lambs which have the rapid growth and leanness of the Suffolk while maintaining the adaptability and fine fleece of the Rambouillet ewe (SID, 1988). Therefore, this study used Commercial Rambouillet, Suffolk, and Finewool first cross lambs to characterize the current market lamb supply in Texas.

The study design called for lambs of similar genotype in each of three breeds. This was essential so that the individual animals used were as similar as possible. Because of the necessary number of replications, this study required 15 wethers and 15 ewes from each of the three breeds. The Suffolk lambs were purchased from two producers who use the same genetic base to produce Suffolk market lambs. The Commercial Rambouillet and F_1 lambs were purchased from one producer who uses the identified Suffolk line in his crossbreeding program. Ninety feeder lambs (27.2-31.7 kg) were bought and transported to the Texas A&M Sheep Center. Upon arrival, each lamb was randomly assigned to one of five treatment groups (n=18). The treatment groups were devised to simulate the fat thickness ranges designated by the USDA (1992) Yield Grade equation. Table 1 shows the planned and actual distributions of lambs within each breed, sex, and yield grade. The total number of Suffolk lambs found in the actual distribution differs from the planned due to the deaths of two lambs, one yield grade 5 wether and one yield grade one ewe.

Diets and Feeding Regime. All lambs were given an initial shot (1 cc) for enterotoxemia and were drenched for stomach worms using Ivomectin® sheep drench according to label directions. During the feeding period all lambs were housed in a pen approximately 30 x 60 m. Lambs were fed a starter diet of 34.6% milo, 10% cottonseed meal, 23.75% peanut hulls, 20% wheat middlings, 2.5% premix, .4% ammonium chloride, 1.65% calcium carbonate, .5% salt, .05% vitamins ADE mix, .25% dynamate, .05% ruminant trace minerals, 1.25% masonex, and 5.0% molasses. After a backgrounding program (starter diet) for two weeks, the lambs were weighed and evaluated for frame size and fat thickness. They then were introduced to a finishing diet of 47% milo, 7.5% cottonseed hulls, 13.75% peanut hulls, 20% wheat middlings, 2.5% premix, .4% ammonium chloride, 1.75% calcium carbonate, 1.75% salt, .05% vitamin ADE mix, .25% dynamate, .05% ruminate trace minerals, 1.25% masonex, and .05% molasses until slaughter. Lambs were allowed to consume their diets on an *ad libitum* basis and received a constant supply of fresh water.

According to Edwards *et al.* (1989), the best predictor of market lamb composition is still a subjective estimate of fatness by an experienced livestock

Table 1: Number of lambs within breeds, sexes, and USDA yield grades (N=88)

	Wethers					Ewes					
	USDA yield grade groups					USDA yield grade groups					
Breed	YG 1	YG 2	YG 3	YG 4	YG 5	YG 1	YG 2	YG 3	YG 4	YG 5	Total
Planned Distribution											
Commercial Rambouillet	3	3	3	3	3	3	3	3	3	3	30
F_1 cross	3	3	3	3	3	3	3	3	3	3	30
Suffolk	3	3	3	3	3	3	3	3	3	3	30
Actual Distribution											
Commercial Rambouillet	1	5	3	4	2	1	4	4	4	2	30
F_1 cross	2	7	1	4	1	3	6	2	3	1	30
Suffolk	3	3	3	3	2	1	5	3	4	1	28

evaluator. Therefore, the lambs were periodically evaluated and visually appraised by a team of three experienced livestock evaluators. The livestock evaluators individually evaluated each lamb and compared estimates of fatness before making a collective decision. Lambs were slaughtered at staggered intervals, when the evaluators determined that the lamb had reached its assigned fat thickness. Before slaughter, shoulder height, heart girth, body length, and forearm circumference was measured on each lamb.

All lambs were slaughtered at the Rosenthal Meat Science and Technology Center on the Texas A&M University campus following all appropriate humane slaughter methods as set forth by the Humane Methods of Slaughter Act. Mechanical stunning (concussion type) was used to immobilize the animals before exsanguination. Kidney and pelvic fat (KP) was not removed on the kill floor, and was left intact until fabrication.

Carcasses. All carcasses were evaluated for USDA quality and yield grade characteristics by trained carcass evaluators at 48 h postmortem. Trained evaluators ribbed each carcass at the 12th - 13th rib interface and took the following measurements, ribeye area, fat thickness opposite the ribeye, body wall thickness (5.08 cm from the edge of the M. longissimus), loin edge thickness (15.24 cm from the edge of the M. longissimus) and flank fat thickness (20.32 cm from the edge of the M. longissimus).

Additional measurements such as fat in the shoulder pocket (2.54 cm dorsal to the ball of the shoulder joint), fat over the dock region (over the 1st and 2nd sacral vertebra), and neck fat (opposite the atlas vertebra) were determined. Leg, loin, and shoulder circumferences were collected.

Fabrication Method. Carcasses were fabricated into a rough leg, rough loin, rough rack, rough shoulder, neck, right and left breasts, right and left plates, right and left shanks, and right and left flanks. The kidney and pelvic fat (KP) was removed from the rough leg and rough loin following breaking. KP was removed from the leg and loin to represent no more than approximately 1% KP remaining in the carcass.

To begin fabrication, the foresaddle was removed from the hindsaddle between the 12th and 13th ribs, following the natural curvature of the ribs. The shanks, breasts, and plates were removed from the foresaddle in a straight cut perpendicular to the skin surface from a point 1.27 cm dorsal to the bony spot on the humerus following a line parallel to the vertebral column to a point 7.26 cm from the distal edge of the M. longissimus. The neck was removed from the foresaddle in straight cut perpendicular to the skin surface and the vertebral column, leaving no more than 2.54 cm of neck on the primal shoulder. The rack was removed from the shoulder by making a cut originating between the 5th and 6th ribs.

Fabrication of the hindsaddle was accomplished by removing the rough leg from the loin by making a straight cut perpendicular to the backline between the second and third sacral vertebra. The right and left flanks were then be removed from the leg following the natural seam and from the loin in a straight cut 7.62 cm from the distal edge of the M. longissimus.

The rough leg, rough loin, rough rack, rough shoulder and the neck were then split longitudinally through the vertebral column to form right and left sides. The right side of each carcass was then dissected into knife-separable components to determine physical composition. The left side was fabricated into retail cuts for use in an associated study.

Statistical Analysis. Data were subjected to analysis of variance procedures. All statistical analysis were performed using the Statistical Analysis

System (1991). A completely randomized design in a 3 (breed) X 2 (sex-class) factorial arrangement was used. All categories of breed and sex and all combinations of these were used.

Regression analysis was utilized to predict carcass composition for each breed and sex-class given actual fat thickness at the 12th/13th rib as the independent variable. Linear regression analysis was used to develop regression equations based on percentage total fat, percentage subcutaneous fat, percentage seam fat, percentage internal fat, percentage lean, and percentage bone given actual fat thickness at the 12th/13th rib. Residual standard deviations (RSD) were generated for each regression equation.

RESULTS AND DISCUSSION

Major Wholesale Cut Comparisons. Means and standard deviations are reported by major cuts as a proportion of the entire carcass for each breed and sex in Tables 2 through 4. The main effects of breed, sex, and yield grade have been analyzed by analysis of variance using the general linear model. Results of this analysis are reported in Table 5 indicate that there is a highly significant difference ($P < .001$) between breeds and yield grades when the main effects were used in the model and the leg was analyzed by weight. But, when the leg was analyzed by percentage of the carcass, yield grade was the only factor which was significant ($P < .001$). In the loin, when analyzed by percentage of the carcass weight, sex and yield grade effects were significant ($P < .01$ and $P < .001$, respectively). The rack showed significant effects only when analyzed by kg of weight; breed was highly significant at $P < .001$ and yield grade was highly significant at $P < .001$. When analyzed by weight, the shoulder was significant ($P < .001$) for breed and yield grade; when analyzed by percentage of the carcass only the yield grade effect was significant ($P < .01$). Analysis of the total weight of the four main cuts revealed a significant difference for the breed effect ($P < .001$) and for the yield grade effect ($P < .001$). Analysis of the percentage of the side weight found in the four major cuts showed that only yield grade was significant ($P < .001$). Table 6 reports the ANOVA for total loin weight, the interactions for breed X sex and yield grade X breed were both significant ($P < .01$ and $P < .01$, respectively) and were therefore used in the model. Upon further analysis, the yield grade X breed interaction was highly significant ($P < .001$).

Table 2: Means and standard deviations for individual weights and percentages of the side weight segmented by major cuts for USDA yield grade and sex in Suffolk lambs

USDA yield grade	n	Leg kg	Leg %	Loin kg	Loin %	Rack kg	Rack %	Shoulder kg	Shoulder %	Total kg	Total %
Wethers											
1	3	4.30	34.00	1.15	9.10	1.04	8.34	3.06	24.39	9.56	75.83
		(.58)	(.50)	(.18)	(.43)	(.07)	(1.11)	(.23)	(2.21)		
2	3	4.60	31.69	1.47	10.13	1.35	9.18	3.29	22.67	10.71	73.66
		(.72)	(.52)	(.22)	(.55)	(.37)	(1.31)	(.60)	(1.26)		
3	3	5.57	32.04	1.77	10.17	1.55	8.69	3.47	19.85	12.36	70.74
		(.87)	(2.51)	(.27)	(.62)	(.52)	(1.39)	(.73)	(1.90)		
4	3	6.97	31.69	2.22	10.07	1.70	7.72	3.56	16.47	14.45	65.96
		(.72)	(.98)	(.27)	(.38)	(.27)	(.52)	(.42)	(3.78)		
5	2	6.04	30.54	2.02	10.20	1.91	9.67	4.03	20.42	13.99	70.84
		(.37)	(.91)	(.07)	(.03)	(.09)	(.14)	(.43)	(2.79)		
Average		5.46	32.10	1.70	9.92	1.48	8.65	3.44	20.78		
		(1.18)	(1.60)	(.44)	(.60)	(.40)	(1.11)	(.53)	(3.56)		
Ewes											
1	1	3.57	35.89	1.04	10.49	.81	8.16	2.12	21.30	7.54	75.83
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	4.68	33.59	1.48	10.69	1.32	9.53	2.80	20.22	10.27	74.03
		(.81)	(1.57)	(.14)	(.69)	(.29)	(1.62)	(.43)	(1.70)		
3	3	5.97	32.09	1.87	10.02	1.64	8.93	3.86	20.82	13.35	71.85
		(1.23)	(.88)	(.48)	(.60)	(.21)	(1.02)	(.75)	(1.75)		
4	4	6.05	31.84	2.07	10.82	1.74	9.27	3.91	20.57	13.78	72.50
		(.45)	(.95)	(.35)	(1.00)	(.20)	(1.89)	(.28)	(1.17)		
5	1	5.43	31.47	2.13	12.36	1.51	8.75	3.63	21.03	12.70	73.61
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		5.32	32.78	1.75	10.69	1.49	9.18	3.35	20.58		
		(1.07)	(1.61)	(.43)	(.87)	(.34)	(1.40)	(.74)	(1.34)		

Table 3: Means and standard deviations for individual weights and percentages of the side weight segmented by major cuts for USDA yield grade and sex in F_1[a] lambs

USDA yield grade	n	Leg kg	Leg %	Loin kg	Loin %	Rack kg	Rack %	Shoulder kg	Shoulder %	Total kg	Total %
Wethers											
1	2	4.32	34.25	1.24	9.68	1.30	10.31	2.86	22.51	9.77	76.75
		(.62)	(1.40)	(.16)	(.30)	(.27)	(3.19)	(.12)	(1.38)		
2	7	4.47	32.92	1.36	10.01	1.19	8.83	2.95	21.81	9.97	73.56
		(.73)	(1.07)	(.26)	(.52)	(.16)	(1.09)	(.51)	(2.48)		
3	1	4.42	32.88	1.38	10.30	1.25	9.32	3.07	22.82	10.12	75.32
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	5.32	31.45	1.87	11.04	1.66	9.81	3.26	19.27	12.10	71.57
		(.42)	(.99)	(.15)	(.57)	(.12)	(.64)	(.61)	(3.24)		
5	1	5.86	31.63	2.12	11.43	1.64	8.84	3.27	17.63	12.88	69.52
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		4.77	32.62	1.53	10.35	1.36	9.32	3.05	21.01		
		(.74)	(1.32)	(.34)	(.73)	(.26)	(1.29)	(.47)	(2.75)		
Ewes											
1	3	3.62	32.60	1.26	11.31	.94	8.42	2.20	20.00	8.02	72.33
		(.66)	(.44)	(.28)	(.74)	(.19)	(.33)	(.35)	(2.94)		
2	6	4.43	33.57	1.36	10.30	1.26	9.51	2.64	20.08	9.68	73.45
		(.44)	(1.18)	(.17)	(.47)	(.28)	(1.47)	(.20)	(1.75)		
3	2	4.98	33.87	1.44	9.85	1.37	9.40	2.73	18.49	10.52	71.61
		(1.31)	(.07)	(.32)	(.44)	(.31)	(.39)	(.81)	(.61)		
4	3	5.54	33.01	1.89	11.27	1.69	10.10	2.93	17.44	12.05	71.82
		(.34)	(1.02)	(.11)	(.18)	(.12)	(.39)	(.37)	(1.62)		
5	1	6.45	29.36	2.27	10.32	1.99	9.04	4.50	20.46	15.20	69.19
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		4.70	33.02	1.52	10.64	1.35	9.36	2.74	19.35		
		(.97)	(1.38)	(.35)	(.71)	(.37)	(1.07)	(.63)	(2.00)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 4: Means and standard deviations for individual weights and percentages of the side weight segmented by major cuts for USDA yield grade and sex in Commercial Rambouillet lambs

USDA yield grade	n	Leg		Loin		Rack		Shoulder		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%
Wethers											
1	1	4.59	34.27	1.23	9.19	1.15	8.58	2.44	18.20	9.40	70.24
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	4.11	34.10	1.12	9.26	1.19	9.83	2.42	20.04	8.84	73.23
		(.23)	(1.94)	(.20)	(1.02)	(.22)	(1.30)	(.26)	(2.11)		
3	3	4.21	32.33	1.31	10.07	1.23	9.49	2.75	21.07	9.50	72.96
		(.23)	(.60)	(.11)	(.66)	(.09)	(1.23)	(.31)	(1.41)		
4	4	4.98	30.90	1.72	10.67	1.53	9.52	3.56	22.19	11.79	73.28
		(.53)	(1.52)	(.28)	(1.30)	(.19)	(1.32)	(.13)	(1.85)		
5	2	5.72	30.28	1.96	10.38	1.80	9.51	3.82	20.17	13.30	70.34
		(.03)	(.47)	(.17)	(1.10)	(.02)	(.08)	(.31)	(1.22)		
Average		4.61	32.39	1.44	9.94	1.37	9.55	2.98	20.72		
		(.65)	(2.05)	(.37)	(1.09)	(.27)	(1.08)	(.62)	(1.92)		
Ewes											
1	1	3.53	34.95	.98	9.74	.96	9.47	2.44	24.09	7.91	78.24
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	3.46	34.09	1.00	9.80	.95	9.35	2.12	20.81	7.53	74.04
		(.47)	(.57)	(.19)	(.49)	(.11)	(.73)	(.41)	(1.42)		
3	4	3.95	32.83	1.24	10.26	1.12	9.40	2.49	20.81	8.81	73.31
		(.40)	(1.79)	(.20)	(.78)	(.12)	(1.48)	(.25)	(2.27)		
4	4	4.59	31.13	1.56	10.71	1.33	8.97	3.13	20.89	10.60	71.70
		(.65)	(1.27)	(.12)	(1.74)	(.25)	(.79)	(.76)	(1.59)		
5	2	4.93	29.42	1.88	11.18	1.90	11.52	3.47	20.53	12.17	72.64
		(.77)	(.28)	(.32)	(.29)	(.06)	(2.06)	(.90)	(2.34)		
Average		4.09	32.40	1.33	10.34	1.22	9.56	2.69	21.01		
		(.73)	(2.04)	(.36)	(1.04)	(.34)	(1.30)	(.69)	(1.79)		

Table 5: ANOVA for Suffolk, F_1[a], and Commercial Rambouillet major cut analysis

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Leg (kg):			
Breed	2	9.52	23.35	.0001	Error
Sex	1	1.31	3.22	.0765	Error
Yield grade	1	34.05	83.51	.0001	Error
Residual error	83	.41			
Total	87	.98			
		Percentage leg:			
Breed	2	.17	.10	.9031	Error
Sex	1	2.83	1.73	.1917	Error
Yield grade	1	101.47	62.19	.0001	Error
Residual error	83	1.63			
Total	87	2.79			
		Percentage loin:			
Breed	2	1.83	2.99	.0556	Error
Sex	1	5.06	8.26	.0051	Error
Yield grade	1	11.15	18.22	.0001	Error
Residual error	83	.61			
Total	87	.79			
		Rack (kg):			
Breed	2	.41	8.23	.0005	Error
Sex	1	.06	1.25	.2671	Error
Yield grade	1	5.17	105.25	.0001	Error
Residual error	83	.05			
Total	87	.11			
		Percentage rack:			
Breed	2	2.96	2.04	.1366	Error
Sex	1	.74	.51	.4780	Error
Yield grade	1	1.82	1.26	.2656	Error
Residual error	83	1.45			
Total	87	1.48			

Table 5: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Shoulder (kg):			
Breed	2	2.97	13.58	.0001	Error
Sex	1	1.17	5.34	.0233	Error
Yield grade	1	13.55	61.96	.0001	Error
Residual error	83	.22			
Total	87	.44			
		Percentage shoulder:			
Breed	2	7.13	1.40	.2522	Error
Sex	1	6.21	1.22	.2726	Error
Yield grade	1	40.32	7.92	.0061	Error
Residual error	83	5.09			
Total	87	5.48			
		Total (kg):			
Breed	2	41.86	24.62	.0001	Error
Sex	1	6.82	4.01	.0485	Error
Yield grade	1	213.96	125.87	.0001	Error
Residual error	83	1.70			
Total	87	4.95			
		Total percentage:			
Breed	2	5.59	.84	.4342	Error
Sex	1	5.28	.80	.3750	Error
Yield grade	1	137.67	20.75	.0001	Error
Residual error	83	6.64			
Total	87	8.05			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 6: ANOVA for Suffolk, F1[a], and Commercial Rambouillet l major cut analysis

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Loin (kg):			
Breed (sex)	5	.08	1.67	.1525	Error
Yield grade (breed)	3	2.70	54.50	.0001	Error
Residual error	79	.05			
Total	87	.16			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Tukey's mean separation was used to distinguish differences between breeds and sexes. The Suffolk lambs were higher (P < .05) than either the F_1 and the Rambouillet for leg weight, shoulder weight, and total weight of major cuts. The Suffolk lambs also differed (P < .05) from the Rambouillet lambs for loin weight. Wethers were higher (P < .05) in percentage loin than the ewes.

Tables 7 through 24 report the means and standard deviations for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat and ANOVA analysis from the leg, loin, rack, and shoulder.

Tables 10 and 11 report the results of analysis of variance for the leg. ANOVA revealed that when weight of lean was analyzed, breed and sex were both highly significant (P < .001). When percentage lean in the leg was analyzed, sex was highly significant (P < .001) and yield grade was significant (P < .05). Analysis of bone weight and percentage bone in the leg, revealed that breed, sex, and yield grade were all highly significant (P < .001). Percentage subcutaneous fat in the leg was highly significant (P < .001) for sex effects and was significant (P < .05) for breed effect. Seam fat weight was highly significant (P < .001) for sex and breed was significant at P < .05 when analyzed by percentage seam fat, sex was significant at P < .001. Total weight of the leg was highly significant (P < .001) for breed and sex effects. Table 11 reports analysis of the weight of subcutaneous fat in the leg, and revealed that breed and yield grade X sex effects were both highly significant (P < .001).

Analysis of variance is reported for the loin in Tables 15 and 16. Lean weight was highly significant (P < .001) for breed and yield grade effects and percentage lean was highly significant (P < .001) for yield grade effects. Bone

Table 7: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the leg for USDA yield grade, and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	2.69	62.69	.97	22.69	.41	9.23	.12	2.77	.08	1.81	4.27	99.20
		(.29)	(1.79)	(.09)	(.95)	(.17)	(2.60)	(.05)	(.80)	(.05)	(1.23)		
2	3	2.57	56.43	.99	21.51	.65	14.12	.23	4.99	.11	2.20	4.56	99.24
		(.22)	(5.43)	(.20)	(.94)	(.16)	(1.37)	(.06)	(.53)	(.13)	(2.49)		
3	3	3.11	55.86	1.14	20.58	.90	16.01	.27	4.85	.10	1.91	5.53	99.21
		(.52)	(.66)	(.16)	(.89)	(.19)	(1.84)	(.07)	(.98)	(.04)	(.73)		
4	3	3.87	55.62	1.42	20.41	1.14	16.22	.42	5.97	.10	1.41	6.94	99.64
		(.31)	(1.60)	(.11)	(1.31)	(.21)	(1.40)	(.15)	(1.52)	(.07)	(1.09)		
5	2	3.37	55.69	1.24	20.50	1.01	16.84	.32	5.28	.06	1.10	6.00	99.40
		(.46)	(4.28)	(.03)	(.76)	(.04)	(1.60)	(.01)	(.53)	(.09)	(1.55)		
Average		3.10	57.37	1.15	21.18	.81	14.32	.27	4.74	.09	1.73		
		(.59)	(3.91)	(.21)	(1.24)	(.31)	(3.29)	(.13)	(1.40)	(.07)	(1.33)		
Ewes													
1	1	2.37	66.45	.81	22.74	.25	7.12	.07	1.91	.05	1.40	3.56	99.62
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	2.73	58.39	.96	20.78	.59	12.58	.23	4.83	.13	2.70	4.64	99.27
		(.48)	(.38)	(.08)	(1.96)	(.14)	(1.17)	(.07)	(.98)	(.05)	(.91)		
3	3	3.35	55.87	1.06	17.81	1.02	17.15	.33	5.61	.16	2.63	5.92	99.08
		(.78)	(3.44)	(.21)	(.86)	(.18)	(1.75)	(.09)	(1.14)	(.07)	(1.00)		
4	4	3.30	54.52	1.06	17.61	1.17	19.33	.35	5.71	.13	2.11	6.01	99.28
		(.30)	(1.12)	(.06)	(.99)	(.07)	(.50)	(.07)	(1.05)	(.04)	(.61)		
5	1	2.63	48.37	1.26	23.22	.87	15.96	.33	6.02	.31	5.68	5.39	99.25
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		2.99	56.60	1.02	19.55	.84	15.34	.28	5.13	.14	2.64		
		(.56)	(4.19)	(.14)	(2.41)	(.32)	(3.84)	(.10)	(1.34)	(.07)	(1.19)		

Table 8: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the leg for USDA yield grade and sex for F_1[a] crossbred lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	2	2.44	56.10	1.00	22.82	.51	11.62	.27	5.96	.14	3.11	4.36	99.61
		(.13)	(4.90)	(.22)	(1.81)	(.13)	(1.28)	(.10)	(1.42)	(.02)	(.00)		
2	7	2.51	56.50	.92	20.62	.68	15.30	.21	4.45	.11	2.31	4.43	99.19
		(.36)	(3.52)	(.14)	(1.24)	(.18)	(3.19)	(.09)	(1.44)	(.06)	(1.37)		
3	1	2.66	60.27	.92	20.74	.62	14.07	.13	2.98	.07	1.54	4.40	99.59
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	2.71	51.00	1.04	19.51	1.05	19.69	.35	6.60	.12	2.19	5.27	98.99
		(.23)	(3.06)	(.09)	(1.33)	(.20)	(2.45)	(.08)	(1.45)	(.03)	(.66)		
5	1	3.06	52.24	1.02	17.41	1.31	22.37	.33	5.65	.10	1.63	5.82	99.30
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		2.60	54.95	.97	20.41	.80	16.37	.26	5.21	.11	2.29		
		(.31)	(4.17)	(.13)	(1.74)	(.29)	(3.95)	(.11)	(1.67)	(.05)	(1.04)		
Ewes													
1	3	2.20	60.78	.75	21.01	.39	10.48	.21	5.85	.04	1.21	3.60	99.34
		(.39)	(.88)	(.09)	(2.06)	(.18)	(2.78)	(.04)	(.54)	(.04)	(1.27)		
2	6	2.53	57.18	.88	19.18	.66	14.81	.19	4.19	.14	3.16	4.39	99.14
		(.28)	(3.16)	(.08)	(.86)	(.13)	(2.47)	(.09)	(1.64)	(.06)	(1.52)		
3	2	2.80	56.47	.86	17.27	.91	17.97	.25	4.96	.13	2.73	4.95	99.41
		(.66)	(1.60)	(.21)	(.41)	(.38)	(2.95)	(.08)	(.37)	(.03)	(1.36)		
4	3	3.05	55.06	.90	16.33	1.09	19.70	.31	5.54	.14	2.60	5.49	99.24
		(.18)	(.58)	(.05)	(.17)	(.11)	(1.21)	(.08)	(1.43)	(.02)	(.48)		
5	1	3.27	50.77	1.08	16.74	1.45	22.50	.42	6.47	.20	3.02	6.42	99.51
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		2.65	56.95	.87	18.81	.78	15.85	.24	5.05	.12	2.59		
		(.45)	(3.26)	(.11)	(2.08)	(.34)	(4.21)	(.09)	(1.40)	(.06)	(1.34)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 9: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the leg for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	1	2.82	61.52	1.07	23.34	.32	6.92	.18	3.96	.16	3.56	4.55	99.31
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	2.27	55.21	.95	23.24	.59	14.38	.17	4.09	.10	2.35	4.08	99.27
		(.21)	(2.37)	(.08)	(1.73)	(.08)	(2.40)	(.03)	(.78)	(.05)	(1.22)		
3	3	2.63	56.06	.90	21.29	.66	15.59	.19	4.59	.08	1.88	4.19	99.42
		(.07)	(1.74)	(.10)	(1.32)	(.19)	(4.03)	(.08)	(2.18)	(.07)	(1.63)		
4	4	2.51	50.44	.97	19.43	1.01	20.27	.32	6.50	.13	2.57	4.94	99.21
		(.30)	(1.09)	(.12)	(1.43)	(.13)	(.81)	(.02)	(1.01)	(.06)	(1.00)		
5	2	3.01	52.58	1.12	19.57	.81	14.08	.64	11.23	.12	2.05	5.70	99.52
		(.17)	(3.26)	(.01)	(.11)	(.44)	(7.54)	(.38)	(6.62)	(.15)	(2.57)		
Average		2.49	54.18	.98	21.35	.73	15.66	.28	5.78	.11	2.36		
		(.32)	(3.52)	(.11)	(2.15)	(.26)	(4.54)	(.19)	(3.19)	(.07)	(1.29)		
Ewes													
1	1	2.02	57.25	.86	24.39	.42	11.81	.10	2.70	.11	3.08	3.51	99.23
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	2.06	59.37	.74	21.21	.44	12.89	.12	3.56	.08	2.22	3.44	99.24
		(.29)	(2.41)	(.13)	(1.36)	(.05)	(2.48)	(.05)	(1.43)	(.06)	(1.18)		
3	4	2.26	57.19	.79	19.97	.60	15.25	.15	3.91	.12	2.99	3.92	99.31
		(.28)	(2.20)	(.07)	(1.17)	(.02)	(1.22)	(.04)	(.98)	(.04)	(.77)		
4	4	2.62	57.41	.81	17.76	.79	17.02	.22	4.65	.11	2.47	4.56	99.31
		(.24)	(4.14)	(.10)	(.47)	(.23)	(2.88)	(.10)	(1.63)	(.03)	(.61)		
5	2	2.59	52.53	.96	19.53	1.01	20.65	.27	5.36	.07	1.45	4.90	99.51
		(.39)	(.23)	(.17)	(.39)	(.03)	(2.72)	(.14)	(2.02)	(.03)	(.29)		
Average		2.33	57.21	.81	19.95	.65	15.58	.18	4.13	.10	2.45		
		(.35)	(3.23)	(.12)	(2.00)	(.23)	(3.36)	(.09)	(1.43)	(.04)	(.88)		

Table 10: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the leg for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Lean (kg):			
Breed	2	3.35	25.62	.0001	Error
Sex	1	5.07	38.72	.0001	Error
Yield grade	1	.11	.87	.3530	Error
Residual error	83	.13			
Total	87	.25			
		Percentage lean:			
Breed	2	18.34	2.08	.1311	Error
Sex	1	463.58	52.63	.0001	Error
Yield grade	1	47.81	5.43	.0222	Error
Residual error	83	8.81			
Total	87	14.59			
		Bone (kg);			
Breed	2	.32	21.28	.0001	Error
Sex	1	.39	26.15	.0001	Error
Yield grade	1	.38	25.09	.0001	Error
Residual error	83	.01			
Total	87	.03			
		Percentage bone:			
Breed	2	18.41	8.45	.0005	Error
Sex	1	137.82	63.23	.0001	Error
Yield grade	1	52.52	24.09	.0001	Error
Residual error	83	2.18			
Total	87	4.46			

Table 10: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Percentage subcutaneous fat:			
Breed	2	31.88	4.50	.0139	Error
Sex	1	668.04	94.31	.0001	Error
Yield grade	1	.34	.05	.8270	Error
Residual error	83	7.08			
Total	87	14.72			
		Seam fat (kg):			
Breed	2	.03	3.26	.0434	Error
Sex	1	.49	48.98	.0001	Error
Yield grade	1	.03	2.88	.0934	Error
Residual error	83	.01			
Total	87	.02			
		Percentage seam fat:			
Breed	2	2.27	.79	.4563	Error
Sex	1	65.20	22.80	.0001	Error
Yield grade	1	5.36	1.87	.1747	Error
Residual error	83	2.86			
Total	87	3.55			
		Internal fat (kg):			
Breed	2	.00	.55	.5763	Error
Sex	1	.01	2.52	.1162	Error
Yield grade	1	.01	1.66	.2007	Error
Residual error	83	.00			
Total	87	.00			

Table 10: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Percentage internal fat:			
Breed	2	.54	.38	.6858	Error
Sex	1	.23	.16	.6907	Error
Yield grade	1	3.97	2.79	.0985	Error
Residual error	83	1.42			
Total	87	1.42			
		Total (kg):			
Breed	2	9.37	23.29	.0001	Error
Sex	1	33.73	83.85	.0001	Error
Yield grade	1	1.30	3.24	.0756	Error
Residual error	83	.40			
Total	87	.97			
		Total percentage:			
Breed	2	.03	.29	.7493	Error
Sex	1	.03	.26	.6113	Error
Yield grade	1	.01	.04	.8354	Error
Residual error	83	.12			
Total	87	.11			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]*Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X* sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 11: ANOVA for dissectable subcutaneous fat from the leg for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Subcutaneous fat (kg):			
Breed	2	.34	10.81	.0001	Error
Yield grade (sex)	2	2.29	73.68	.0001	Error
Residual error	83	.03			
Total	87	.09			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 12: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the loin for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	.62	53.69	.24	21.60	.21	18.41	.05	4.05	.02	2.24	1.15	100.00
		(.15)	(5.55)	(.03)	(5.09)	(.05)	(4.35)	(.05)	(3.84)	(.03)	(2.80)		
2	3	.72	49.01	.25	16.87	.30	20.80	.17	11.78	.02	1.55	1.47	100.01
		(.09)	(2.53)	(.10)	(5.14)	(.03)	(.92)	(.07)	(4.65)	(.03)	(1.53)		
3	3	.85	48.37	.25	14.35	.46	25.41	.17	9.69	.04	2.37	1.77	100.18
		(.09)	(4.05)	(.06)	(3.16)	(.12)	(3.28)	(.06)	(2.25)	(.01)	(.73)		
4	3	1.02	46.12	.36	16.29	.54	24.49	.18	7.86	.12	5.40	2.22	100.15
		(.06)	(3.04)	(.09)	(2.54)	(.07)	(2.29)	(.15)	(6.35)	(.14)	(6.06)		
5	2	.88	43.81	.27	13.60	.58	28.55	.24	12.12	.04	2.04	2.02	100.12
		(.03)	(2.90)	(.02)	(.66)	(.04)	(1.27)	(.04)	(1.50)	(.01)	(.70)		
Average		.81	48.51	.28	16.75	.41	23.17	.16	8.88	.05	2.77		
		(.17)	(4.62)	(.08)	(4.35)	(.15)	(4.26)	(.10)	(4.70)	(.07)	(3.08)		
Ewes													
1	1	.63	60.43	.20	19.13	.15	14.35	.07	6.52	.00	.00	1.05	100.43
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.78	53.39	.21	13.87	.32	21.78	.13	8.48	.03	2.37	1.47	99.88
		(.09)	(5.99)	(.06)	(3.58)	(.03)	(1.86)	(.05)	(2.75)	(.04)	(3.08)		
3	3	.91	48.44	.24	12.53	.49	26.61	.20	10.28	.04	2.15	1.87	100.01
		(.23)	(1.88)	(.10)	(2.98)	(.08)	(5.44)	(.08)	(1.65)	(.03)	(1.24)		
4	4	.95	46.14	.27	12.67	.61	29.31	.21	9.97	.04	1.79	2.07	99.88
		(.13)	(2.65)	(.09)	(2.94)	(.10)	(.64)	(.05)	(1.89)	(.01)	(.41)		
5	1	.73	34.47	.41	19.36	.70	32.77	.11	5.11	.18	8.30	2.13	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.84	49.41	.24	14.01	.45	25.22	.16	8.91	.05	2.41		
		(.16)	(7.02)	(.09)	(3.55)	(.17)	(5.42)	(.07)	(2.44)	(.05)	(2.54)		

Table 13: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the loin for USDA yield grade and sex for F_1[a] lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	2	.68	55.76	.22	17.83	.21	17.19	.08	6.50	.04	2.75	1.24	100.03
		(.03)	(5.30)	(.06)	(2.31)	(.04)	(.84)	(.00)	(1.12)	(.04)	(2.75)		
2	7	.67	49.16	.22	16.40	.32	23.01	.10	7.27	.05	4.10	1.36	99.93
		(.12)	(2.84)	(.07)	(4.18)	(.09)	(4.35)	(.06)	(4.48)	(.04)	(3.31)		
3	1	.76	55.08	.20	14.75	.26	18.69	.16	11.80	.00	.00	1.39	100.33
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.76	40.97	.28	15.33	.56	30.04	.22	11.44	.04	2.16	1.86	99.93
		(.10)	(4.84)	(.08)	(4.16)	(.06)	(1.98)	(.06)	(2.13)	(.01)	(.64)		
5	1	.82	38.76	.31	14.52	.76	35.97	.20	9.42	.03	1.50	2.12	100.21
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.71	47.56	.24	16.07	.39	24.69	.14	8.72	.04	2.95		
		(.10)	(6.59)	(.07)	(3.54)	(.18)	(6.19)	(.07)	(3.77)	(.03)	(2.63)		
Ewes													
1	3	.66	52.64	.20	15.26	.28	21.38	.06	4.94	.08	5.64	1.26	99.86
		(.09)	(4.29)	(.07)	(2.84)	(.11)	(3.89)	(.05)	(5.02)	(.05)	(3.10)		
2	6	.66	48.84	.20	14.51	.33	24.75	.13	9.58	.03	2.38	1.36	100.06
		(.09)	(4.53)	(.05)	(2.24)	(.04)	(3.15)	(.05)	(2.75)	(.03)	(1.95)		
3	2	.66	45.65	.17	12.50	.42	29.00	.14	9.55	.04	3.34	1.44	100.05
		(.15)	(.18)	(.01)	(3.42)	(.15)	(4.07)	(.06)	(1.90)	(.04)	(3.19)		
4	3	.83	43.93	.20	10.70	.60	31.94	.23	12.11	.03	1.41	1.89	100.09
		(.07)	(1.15)	(.02)	(.77)	(.05)	(1.09)	(.05)	(3.14)	(.02)	(.73)		
5	1	.91	40.20	.34	15.00	.71	31.20	.27	12.00	.04	1.80	2.27	100.20
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.71	47.62	.21	13.66	.41	26.51	.15	9.32	.04	2.93		
		(.12)	(4.86)	(.05)	(2.63)	(.16)	(4.77)	(.08)	(3.78)	(.03)	(2.42)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 14: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the loin for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade		Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	1	.66	53.87	.27	22.14	.20	16.24	.06	4.80	.03	2.58	1.22	99.63
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.54	48.93	.19	16.10	.27	23.53	.10	9.29	.03	2.29	1.13	100.13
		(.07)	(5.01)	(.08)	(3.64)	(.09)	(4.59)	(.02)	(3.12)	(.03)	(1.78)		
3	3	.62	47.94	.18	13.66	.34	25.33	.14	11.20	.03	1.88	1.31	100.00
		(.07)	(7.78)	(.07)	(4.79)	(.09)	(5.00)	(.05)	(4.57)	(.02)	(1.64)		
4	4	.68	39.83	.23	13.61	.57	33.11	.09	5.57	.15	7.86	1.72	99.98
		(.12)	(4.31)	(.04)	(2.11)	(.12)	(4.79)	(.10)	(5.88)	(.12)	(5.99)		
5	2	.85	43.73	.24	12.28	.55	27.85	.25	12.60	.07	3.66	1.96	100.12
		(.03)	(5.03)	(.07)	(2.39)	(.12)	(3.85)	(.03)	(.40)	(.03)	(1.78)		
Average		.65	45.94	.21	14.84	.40	26.53	.12	8.82	.06	3.90		
		(.12)	(6.44)	(.06)	(3.80)	(.17)	(6.27)	(.07)	(4.55)	(.08)	(3.95)		
Ewes													
1	1	.45	45.62	.15	15.21	.25	25.35	.04	3.69	.10	10.14	.98	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.51	51.01	.15	14.43	.23	23.04	.08	8.18	.03	3.47	1.00	100.12
		(.11)	(1.61)	(.05)	(2.70)	(.06)	(4.61)	(.02)	(2.52)	(.01)	(.93)		
3	4	.59	47.35	.18	14.37	.35	28.08	.07	5.42	.06	4.78	1.24	100.00
		(.10)	(1.05)	(.03)	(2.36)	(.07)	(2.98)	(.04)	(2.65)	(.03)	(2.59)		
4	4	.69	44.59	.17	11.02	.46	29.55	.16	10.44	.07	4.41	1.56	100.01
		(.05)	(3.19)	(.03)	(2.08)	(.09)	(4.94)	(.10)	(5.71)	(.08)	(5.38)		
5	2	.79	41.84	.27	14.53	.60	32.71	.20	9.87	.02	1.06	1.88	100.00
		(.21)	(4.23)	(.02)	(1.65)	(.06)	(9.07)	(.15)	(6.16)	(.01)	(.33)		
Average		.61	46.74	.18	13.57	.37	27.56	.11	7.97	.05	4.19		
		(.14)	(3.80)	(.05)	(2.54)	(.14)	(5.36)	(.08)	(4.24)	(.05)	(3.47)		

Table 15: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the loin for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Lean (kg):			
Breed	2	.33	28.61	.0001	Error
Sex	1	.00	.01	.9386	Error
Yield grade	1	.60	52.19	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage lean:			
Breed	2	44.22	2.68	.0746	Error
Sex	1	7.35	.45	.5065	Error
Yield grade	1	1271.66	77.04	.0001	Error
Residual error	83	16.51			
Total	87	31.59			
		Bone (kg):			
Breed	2	.04	9.87	.0001	Error
Sex	1	.03	7.03	.0096	Error
Yield grade	1	.06	17.17	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage bone:			
Breed	2	7.66	.75	.4741	Error
Sex	1	99.55	9.78	.0024	Error
Yield grade	1	138.75	13.63	.0004	Error
Residual error	83	10.18			
Total	87	12.68			

Table 15: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.05	7.92	.0007	Error
Sex	1	.00	.69	.4078	Error
Yield grade	1	1.65	253.34	.0001	Error
Residual error	83	.01			
Total	87	.03			
		Percentage subcutaneous fat:			
Breed	2	48.98	3.53	.0338	Error
Sex	1	57.99	4.18	.0441	Error
Yield grade	1	1277.43	92.05	.0001	Error
Residual error	83	13.88			
Total	87	29.94			
		Seam fat (kg):			
Breed	2	.02	5.37	.0064	Error
Sex	1	.00	.00	.9453	Error
Yield grade	1	.19	47.52	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage seam fat:			
Breed	2	9.99	.71	.4949	Error
Sex	1	.14	.01	.9217	Error
Yield grade	1	145.09	10.30	.0019	Error
Residual error	83	14.08			
Total	87	15.18			

Table 15: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Internal fat (kg):			
Breed	2	.00	.41	.6662	Error
Sex	1	.00	.37	.5464	Error
Yield grade	1	.01	2.99	.0878	Error
Residual error	83	.00			
Total	87	.00			
		Percentage internal fat:			
Breed	2	16.86	1.81	.1706	Error
Sex	1	.01	.00	.9718	Error
Yield grade	1	.03	.00	.9533	Error
Residual error	83	9.33			
Total	87	9.29			
		Total percentage:			
Breed	2	.00	.04	.9598	Error
Sex	1	.02	.40	.5267	Error
Yield grade	1	.03	.67	.4153	Error
Residual error	83	.04			
Total	87	.04			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 16: ANOVA for total dissectable weight (kg) from the loin for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Total (kg):			
Yield grade (breed)	3	2.71	54.79	.0001	Error
Breed (sex)	5	.08	1.66	.1536	Error
Residual error	79	.05			
Total	87	.16			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

weight was highly significant (P < .001) for breed and yield grade and was significant (P < .01) for sex effect. Percentage bone was highly significant (P < .001) for yield grade effect and was significant (P < .01) for sex effect. When analyzed for subcutaneous fat weight, breed and yield grade effects were both highly significant (P < .001). When analyzed by percentage subcutaneous fat, yield grade was highly significant (P < .001) and breed and sex effects were significant at P < .01. In the loin, when seam fat was analyzed by weight, yield grade was highly significant (P < .001) and breed was significant at P < .01. Percentage seam fat was significant (P < .01) for yield grade. Table 16 reports ANOVA for total weight of the loin, yield X breed was highly significant (P < .001) when used in the model.

Table 20 reports the results of analysis of variance for the rack. Breed was highly significant (P <.001) for lean weight and for total weight of the rack, and was significant (P < 01) for percentage lean and bone weight. Also, breed was significant (P < .05) for subcutaneous fat. Sex was significant (P < .01) for percentage bone and (P < .05) for bone weight and percentage subcutaneous fat. Yield grade had a highly significant (P < .001) effect on all compositional tissues for weight and as a percentage of the rack, expect for internal fat weight and percentage as well as total percentage. Yield grade was significant (P < .05) for bone weight.

In the shoulder, breed had a highly significant (P < .001) effect on the model for lean weight and total weight and was significant (P < .01) for percentage lean, bone weight, and seam fat weight. Sex was significant (P < .01) for bone weight and was significant (P < .05) for percentage bone and total weight. Yield grade was significant (P < .05) for percentage bone, and highly

Table 17: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the rack for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	.50	47.59	.26	25.49	.19	18.06	.07	7.15	.01	1.01	1.04	99.30
		(.02)	(1.32)	(.02)	(3.28)	(.10)	(8.19)	(.05)	(4.84)	(.00)	(.19)		
2	3	.52	38.59	.30	22.84	.28	21.14	.22	15.78	.01	.88	1.34	99.23
		(.13)	(1.48)	(.08)	(3.38)	(.06)	(3.05)	(.10)	(4.01)	(.01)	(.89)		
3	3	.57	36.73	.31	21.17	.35	22.40	.28	17.36	.02	1.46	1.54	99.12
		(.18)	(1.62)	(.06)	(4.22)	(.14)	(2.10)	(.13)	(2.90)	(.01)	(.31)		
4	3	.68	40.07	.30	17.72	.39	23.16	.30	16.30	.03	1.77	1.70	99.63
		(.08)	(4.31)	(.04)	(.61)	(.07)	(4.94)	(.15)	(5.71)	(.01)	(.59)		
5	2	.63	33.04	.33	17.37	.56	29.31	.35	18.24	.02	1.33	1.90	99.29
		(.07)	(2.36)	(.03)	(2.13)	(.02)	(.49)	(.04)	(1.19)	(.02)	(.90)		
Average		.57	39.64	.30	21.17	.34	22.35	.24	14.86	.02	1.29		
		(.12)	(5.28)	(.05)	(4.06)	(.14)	(5.33)	(.13)	(5.53)	(.01)	(.61)		
Ewes													
1	1	.43	53.07	.22	27.37	.10	12.29	.05	6.70	.00	.56	.81	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.55	41.99	.27	20.52	.27	21.01	.20	14.70	.02	1.24	1.31	99.45
		(.10)	(3.01)	(.08)	(1.23)	(.02)	(3.53)	(.10)	(3.93)	(.01)	(.50)		
3	3	.62	37.50	.30	18.25	.37	22.73	.32	18.97	.03	1.77	1.63	99.22
		(.14)	(6.23)	(.02)	(1.13)	(.05)	(4.27)	(.10)	(4.30)	(.01)	(.47)		
4	4	.63	36.35	.31	17.48	.53	29.56	.24	14.15	.03	1.61	1.73	99.14
		(.04)	(2.78)	(.08)	(2.90)	(.19)	(7.03)	(.11)	(7.30)	(.01)	(.76)		
5	1	.44	28.83	.24	15.62	.53	35.14	.30	19.82	.00	.30	1.51	99.70
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.57	39.27	.28	19.30	.37	24.21	.23	15.25	.02	1.34		
		(.11)	(6.31)	(.06)	(3.24)	(.17)	(7.17)	(.11)	(5.55)	(.01)	(.67)		

Table 18 : Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the rack for USDA yield grade and sex for F_1[a] lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	2	.61	46.66	.29	22.28	.21	15.90	.17	13.98	.01	.61	1.29	99.44
		(.18)	(4.29)	(.08)	(1.25)	(.05)	(.37)	(.04)	(6.41)	(.01)	(.86)		
2	7	.45	37.67	.26	21.90	.25	21.62	.20	16.38	.03	2.11	1.18	99.69
		(.08)	(4.54)	(.04)	(1.16)	(.06)	(4.73)	(.03)	(1.21)	(.01)	(.47)		
3	1	.58	46.01	.22	17.75	.19	15.22	.23	18.48	.03	2.17	1.25	99.64
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.53	31.79	.31	18.56	.45	26.93	.33	20.05	.03	1.78	1.64	99.12
		(.04)	(1.36)	(.07)	(4.05)	(.05)	(2.63)	(.07)	(3.79)	(.00)	(.16)		
5	1	.53	32.41	.27	16.34	.59	36.29	.23	14.13	.00	.00	1.62	99.17
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.50	37.51	.28	20.42	.32	22.82	.23	17.03	.02	1.69		
		(.10)	(6.24)	(.05)	(2.91)	(.13)	(6.37)	(.08)	(3.40)	(.01)	(.80)		
Ewes													
1	3	.31	33.68	.22	23.90	.22	23.46	.16	16.06	.02	2.18	.93	99.28
		(.06)	(2.75)	(.02)	(3.00)	(.04)	(1.83)	(.08)	(6.10)	(.01)	(.91)		
2	6	.47	37.25	.26	20.44	.29	23.26	.21	16.53	.02	1.76	1.25	99.22
		(.11)	(1.32)	(.08)	(2.96)	(.04)	(3.26)	(.06)	(2.74)	(.02)	(.85)		
3	2	.50	36.70	.27	19.76	.30	21.77	.27	19.54	.01	1.07	1.36	98.84
		(.06)	(3.56)	(.09)	(1.87)	(.11)	(3.06)	(.05)	(.64)	(.01)	(.71)		
4	3	.56	33.11	.25	14.93	.55	32.43	.29	17.33	.03	1.50	1.68	99.30
		(.07)	(1.93)	(.04)	(3.42)	(.06)	(1.99)	(.02)	(.86)	(.01)	(.45)		
5	1	.61	30.59	.30	15.30	.63	31.74	.38	18.95	.06	2.97	1.98	99.54
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.47	35.19	.26	19.60	.35	25.50	.23	17.16	.02	1.78		
		(.12)	(2.86)	(.06)	(4.07)	(.15)	(4.86)	(.08)	(3.10)	(.02)	(.81)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 19: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the rack for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	1	.49	42.29	.25	22.13	.20	17.39	.17	15.02	.03	2.77	1.14	99.60
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.47	39.37	.30	24.65	.23	19.65	.17	14.85	.01	.68	1.18	99.20
		(.12)	(3.34)	(.10)	(4.08)	(.02)	(3.21)	(.02)	(2.65)	(.01)	(.79)		
3	3	.46	37.57	.23	18.83	.30	24.28	.21	17.06	.02	1.55	1.22	99.30
		(.05)	(1.38)	(.07)	(4.32)	(.05)	(3.89)	(.00)	(1.66)	(.02)	(1.61)		
4	4	.47	30.93	.26	17.32	.46	29.98	.29	19.02	.04	2.31	1.52	99.55
		(.09)	(3.09)	(.06)	(3.20)	(.07)	(1.90)	(.05)	(3.38)	(.02)	(1.46)		
5	2	.60	33.32	.27	15.12	.52	29.11	.35	19.55	.04	2.27	1.79	99.37
		(.08)	(5.05)	(.04)	(1.95)	(.07)	(3.74)	(.00)	(.42)	(.00)	(.03)		
Average		.49	36.15	.27	20.09	.34	24.44	.23	17.04	.02	1.64		
		(.09)	(4.81)	(.07)	(4.86)	(.13)	(5.52)	(.07)	(2.98)	(.02)	(1.27)		
Ewes													
1	1	.34	36.02	.20	20.85	.26	27.49	.14	14.69	.00	.00	.95	99.05
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.37	39.72	.18	19.34	.23	24.16	.10	10.98	.05	5.11	.94	99.31
		(.06)	(6.47)	(.02)	(1.30)	(.05)	(4.58)	(.04)	(4.78)	(.07)	(5.87)		
3	4	.43	38.50	.22	19.28	.27	23.51	.18	16.24	.02	1.92	1.12	99.45
		(.01)	(3.95)	(.03)	(1.37)	(.04)	(1.80)	(.05)	(2.87)	(.00)	(.35)		
4	4	.47	35.48	.20	15.34	.36	26.76	.27	19.84	.02	1.55	1.31	98.98
		(.06)	(3.17)	(.02)	(1.81)	(.08)	(2.93)	(.12)	(5.92)	(.01)	(.50)		
5	2	.65	34.01	.34	17.69	.57	30.14	.31	16.31	.03	1.66	1.90	99.64
		(.11)	(4.64)	(.05)	(3.26)	(.04)	(1.23)	(.04)	(2.71)	(.01)	(.28)		
Average		.45	37.25	.22	18.14	.32	25.70	.20	15.68	.03	2.51		
		(.10)	(4.55)	(.06)	(2.41)	(.12)	(3.54)	(.10)	(5.11)	(.04)	(3.21)		

Table 20: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the rack for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Lean (kg):			
Breed	2	.09	10.46	.0001	Error
Sex	1	.02	1.70	.1956	Error
Yield grade	1	.20	21.81	.0001	Error
Residual error	83	.01			
Total	87	.01			
		Percentage lean:			
Breed	2	106.75	6.35	.0027	Error
Sex	1	6.22	.37	.5447	Error
Yield grade	1	800.33	47.62	.0001	Error
Residual error	83	16.81			
Total	87	27.21			
		Bone (kg):			
Breed	2	.02	5.31	.0067	Error
Sex	1	.02	6.25	.0144	Error
Yield grade	1	.01	4.31	.0410	Error
Residual error	83	.00			
Total	87	.00			
		Percentage bone:			
Breed	2	5.74	.83	.4411	Error
Sex	1	52.19	7.52	.0075	Error
Yield grade	1	544.12	78.39	.0001	Error
Residual error	83	6.94			
Total	87	13.71			

Table 20: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.02	3.72	.0284	Error
Sex	1	.00	.74	.3907	Error
Yield grade	1	1.14	190.74	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage subcutaneous fat:			
Breed	2	23.16	1.39	.2552	Error
Sex	1	82.02	4.92	.0293	Error
Yield grade	1	1161.78	69.65	.0001	Error
Residual error	83	16.68			
Total	87	30.74			
		Seam fat (kg):			
Breed	2	.01	2.73	.0711	Error
Sex	1	.00	.77	.3832	Error
Yield grade	1	.35	66.53	.0001	Error
Residual error	83	.01			
Total	87	.01			
		Percentage seam fat:			
Breed	2	45.32	2.91	.0600	Error
Sex	1	1.95	.13	.7242	Error
Yield grade	1	305.94	19.66	.0001	Error
Residual error	83	15.56			
Total	87	19.09			

Table 20: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Internal fat (kg):			
Breed	2	.00	.62	.5392	Error
Sex	1	.00	.54	.4649	Error
Yield grade	1	.00	3.64	.0598	Error
Residual error	83	.00			
Total	87	.00			
		Percentage internal fat:			
Breed	2	4.22	1.76	.1784	Error
Sex	1	2.64	1.10	.2971	Error
Yield grade	1	.01	.01	.9401	Error
Residual error	83	2.40			
Total	87	2.41			
		Total (kg):			
Breed	2	.40	8.33	.0005	Error
Sex	1	.06	1.30	.2569	Error
Yield grade	1	5.09	105.81	.0001	Error
Residual error	83	.05			
Total	87	.11			
		Total percentage:			
Breed	2	..00	.01	.9920	Error
Sex	1	.19	.90	.3445	Error
Yield grade	1	.02	.12	.7312	Error
Residual error	83	.21			
Total	87	.20			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 21: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shoulder for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	1.71	55.88	.65	21.25	.18	6.03	.43	13.95	.04	1.446	3.02	98.57
		(.09)	(1.21)	(.04)	(.88)	(.04)	(1.14)	(.07)	(1.56)	(.02)	(.62)		
2	3	1.62	49.64	.67	20.03	.38	11.17	.54	16.50	.04	1.30	3.25	98.64
		(.22)	(4.08)	(.22)	(3.87)	(.15)	(2.56)	(.05)	(1.85)	(.03)	(.89)		
3	3	1.61	46.34	.73	20.80	.38	11.47	.59	16.61	.08	2.33	3.39	97.55
		(.37)	(1.12)	(.18)	(.87)	(.11)	(5.26)	(.22)	(3.93)	(.05)	(.89)		
4	3	1.82	51.30	.66	18.13	.42	12.18	.56	15.76	.03	.74	3.49	98.10
		(.16)	(2.83)	(.27)	(5.29)	(.17)	(5.88)	(.08)	(1.12)	(.01)	(.30)		
5	2	1.93	48.17	.76	18.79	.49	12.22	.71	17.33	.05	1.18	3.93	97.68
		(.12)	(2.16)	(.10)	(.56)	(.03)	(2.01)	(.22)	(3.66)	(.01)	(.11)		
Average		1.73	50.42	.69	19.87	.36	10.50	.55	15.94	.05	1.42		
		(.22)	(4.05)	(.16)	(2.90)	(.14)	(4.14)	(.14)	(2.43)	(.03)	(.79)		
Ewes													
1	1	1.19	56.10	.49	23.13	.15	7.07	.27	12.85	.00	.21	2.10	99.36
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	1.55	55.56	.48	17.40	.19	6.73	.47	16.73	.05	1.68	2.74	98.09
		(.23)	(3.80)	(.08)	(3.09)	(.06)	(1.22)	(.12)	(2.50)	(.05)	(1.71)		
3	3	1.94	50.04	.69	17.97	.37	9.54	.76	19.79	.02	.70	3.78	98.04
		(.43)	(3.06)	(.15)	(2.98)	(.10)	(2.36)	(.16)	(3.43)	(.02)	(.62)		
4	4	1.91	48.91	.71	18.05	.43	10.98	.76	19.48	.06	1.44	3.86	98.86
		(.12)	(1.85)	(.05)	(.51)	(.14)	(2.61)	(.03)	(1.35)	(.01)	(.20)		
5	1	1.61	44.50	.63	17.37	.49	13.63	.73	20.25	.07	2.00	3.55	97.75
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		1.71	51.73	.60	18.12	.32	9.06	.62	18.14	.04	1.32		
		(.32)	(4.57)	(.13)	(2.56)	(.15)	(2.84)	(.19)	(2.93)	(.03)	(1.12)		

Table 22: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shoulder for USDA yield grade and sex for F_1[a] lambs

USDA yield		Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
grade	n	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	2	1.45	50.56	.61	21.19	.23	8.18	.50	17.53	.04	1.40	2.83	98.95
		(.08)	(4.96)	(.10)	(2.51)	(.02)	(.89)	(.11)	(3.10)	(.03)	(1.06)		
2	7	1.46	49.62	.58	19.58	.29	9.69	.51	17.45	.06	2.13	2.90	98.46
		(.24)	(3.80)	(.14)	(2.28)	(.13)	(3.60)	(.10)	(2.38)	(.03)	(1.07)		
3	1	1.64	53.55	.63	20.41	.24	7.84	.45	14.79	.04	1.33	3.00	97.93
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	1.42	43.53	.67	20.71	.41	12.82	.65	19.47	.04	1.20	3.13	97.74
		(.29)	(3.34)	(.10)	(1.68)	(.10)	(3.52)	(.23)	(3.38)	(.03)	(.78)		
5	1	1.59	48.75	.66	20.28	.43	13.06	.50	15.28	.05	1.67	3.23	99.03
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		1.47	48.34	.62	20.20	.32	10.42	.54	17.68	.05	1.70		
		(.22)	(4.53)	(.11)	(1.92)	(.12)	(3.45)	(.15)	(2.74)	(.03)	(.94)		
Ewes													
1	3	1.17	52.74	.40	18.46	.19	8.65	.38	17.21	.02	1.11	2.17	98.18
		(.22)	(2.25)	(.04)	(1.49)	(.03)	(1.76)	(.10)	(2.10)	(.00)	(.15)		
2	6	1.30	49.22	.50	18.69	.26	9.75	.47	17.33	.05	2.03	2.57	97.62
		(.13)	(2.23)	(.09)	(2.69)	(.12)	(4.42)	(.10)	(4.22)	(.03)	(1.08)		
3	2	1.26	45.72	.51	19.70	.49	17.19	.39	14.35	.03	1.26	2.69	98.22
		(.44)	(2.56)	(.01)	(6.30)	(.31)	(6.19)	(.12)	(.10)	(.02)	(1.19)		
4	3	1.44	49.17	.46	15.56	.36	12.36	.56	19.14	.03	1.19	2.86	97.43
		(.21)	(1.38)	(.12)	(2.50)	(.03)	(1.18)	(.04)	(1.25)	(.03)	(.96)		
5	1	2.02	44.90	.83	18.47	.49	10.90	.92	20.38	.15	3.33	4.40	97.98
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		1.34	49.16	.49	18.14	.31	11.12	.49	17.72	.05	1.66		
		(.28)	(3.00)	(.12)	(2.93)	(.16)	(4.25)	(.16)	(3.14)	(.04)	(1.02)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 23: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shoulder for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	1	1.32	54.19	.59	24.39	.13	5.40	.31	12.66	.01	.37	2.36	97.02
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	1.25	51.70	.49	20.37	.23	9.56	.38	15.71	.02	.79	2.37	98.14
		(.15)	(1.70)	(.06)	(1.77)	(.06)	(3.66)	(.10)	(3.27)	(.01)	(.25)		
3	3	1.35	49.36	.53	19.13	.40	14.29	.38	14.15	.05	1.99	2.72	98.93
		(.13)	(1.00)	(.09)	(1.28)	(.17)	(4.97)	(.10)	(4.78)	(.02)	(.64)		
4	4	1.51	42.52	.68	18.96	.50	13.97	.72	20.39	.08	2.24	3.49	98.09
		(.09)	(1.69)	(.10)	(2.58)	(.12)	(3.26)	(.20)	(5.87)	(.07)	(1.95)		
5	2	1.78	46.82	.69	18.16	.44	11.46	.80	20.93	.03	.86	3.75	98.23
		(.04)	(2.81)	(.08)	(.54)	(.21)	(4.44)	(.00)	(1.79)	(.03)	(.69)		
Average		1.42	48.30	.58	19.72	.36	11.66	.52	17.14	.04	1.40		
		(.21)	(4.34)	(.11)	(2.21)	(.17)	(4.30)	(.22)	(4.80)	(.04)	(1.20)		
Ewes													
1	1	1.17	48.23	.52	21.42	.27	10.99	.38	15.46	.06	2.42	2.40	98.51
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	1.12	52.56	.40	18.71	.23	11.23	.29	13.82	.06	2.33	2.09	98.65
		(.23)	(3.26)	(.11)	(3.65)	(.12)	(6.68)	(.11)	(5.15)	(.06)	(2.15)		
3	4	1.22	48.82	.51	20.59	.26	10.38	.39	15.76	.05	2.08	2.44	97.62
		(.15)	2.40()	(.06)	(1.89)	(.12)	(4.47)	(.12)	(4.80)	(.05)	(1.88)		
4	4	1.47	47.70	.62	19.58	.39	12.08	.55	17.38	.07	2.02	3.09	98.77
		(.24)	(4.77)	(.20)	(2.13)	(.19)	(4.12)	(.25)	(5.33)	(.06)	(1.70)		
5	2	1.56	44.98	.65	18.52	.42	12.42	.73	21.01	.04	1.08	3.40	98.01
		(.42)	(.38)	(.22)	(1.49)	(.03)	(2.38)	(.21)	(.48)	(.00)	(.28)		
Average		1.30	48.97	.53	19.60	.31	11.37	.45	16.35	.06	2.02		
		(.27)	(3.86)	(.16)	(2.38)	(.14)	(4.30)	(.21)	(4.70)	(.05)	(1.59)		

Table 24: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shoulder for Suffolk, F1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Lean (kg):			
Breed	2	1.14	23.13	.0001	Error
Sex	1	.16	3.33	.0715	Error
Yield grade	1	1.29	26.35	.0001	Error
Residual error	83	.05			
Total	87	.09			
		Percentage lean:			
Breed	2	63.03	5.96	.0038	Error
Sex	1	18.75	1.77	.1876	Error
Yield grade	1	489.76	46.12	.0001	Error
Residual error	83	10.62			
Total	87	17.22			
		Bone (kg):			
Breed	2	.08	5.19	.0075	Error
Sex	1	.17	11.23	.0012	Error
Yield grade	1	.30	20.36	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage bone:			
Breed	2	5.47	.91	.4058	Error
Sex	1	37.30	6.20	.0148	Error
Yield grade	1	29.81	4.95	.0288	Error
	83	6.02			
Total	87	6.59			

Table 24: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.00	.32	.7288	Error
Sex	1	.02	1.81	.1824	Error
Yield grade	1	.69	51.11	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage subcutaneous fat:			
Breed	2	19.26	1.49	.2307	Error
Sex	1	2.21	.17	.6799	Error
Yield grade	1	209.11	16.21	.0001	Error
Residual error	83	12.90			
Total	87	15.24			
		Seam fat (kg):			
Breed	2	.11	5.07	.0084	Error
Sex	1	.01	.54	.4656	Error
Yield grade	1	1.05	50.19	.0001	Error
Residual error	83	.02			
Total	87	.03			
		Percentage seam fat:			
Breed	2	16.75	1.47	.2368	Error
Sex	1	4.41	.39	.5360	Error
Yield grade	1	150.31	13.15	.0005	Error
Residual error	83	11.43			
Total	87	12.84			

Table 24: Continued

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Internal fat (kg):			
Breed	2	.00	.10	.9012	Error
Sex	1	.00	.01	.9273	Error
Yield grade	1	.00	2.24	.1386	Error
Residual error	83	.00			
Total	87	.00			
		Percentage internal fat:			
Breed	2	1.03	.78	.4628	Error
Sex	1	.62	.47	.4962	Error
Yield grade	1	.00	.00	.9642	Error
Residual error	83	1.32			
Total	87	1.29			
		Total (kg):			
Breed	2	2.85	13.55	.0001	Error
Sex	1	1.14	5.43	.0222	Error
Yield grade	1	12.90	61.24	.0001	Error
Residual error	83	.21			
Total	87	.42			
		Total percentage:			
Breed	2	.50	.67	.5158	Error
Sex	1	.14	.19	.6620	Error
Yield grade	1	.85	1.14	.2881	Error
Residual error	83	.74			
Total	87	.73			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

significant (P < .001) for all other categories, but had no significant effect on internal fat weight or percentage and for total percentage of the shoulder.

According to Tukey's mean separation, Suffolk lambs were higher (P < .05) than F_1 and Rambouillet lambs for lean weight, bone weight, and total weight in the leg. In the loin, Suffolks were higher (P < .05) than F_1 for lean weight and higher than the Rambouillets for lean weight, bone weight and total weight. For the rack, Suffolks were higher (P < .05) than the F_1 for lean weight and were higher than the Rambouillet lean weight and bone weight. Suffolks were higher (P < .05) than both other breeds for lean weight, bone weight, and total weight in the shoulder. Wethers were higher (P < .05) than ewes for bone weight and percentage bone in the leg, loin, and the shoulder and wethers were higher (P < .05) than ewes for bone weight in the rack. Hammond (1932) and Butterfield (1988) stated that wethers had more bone than ewes.

Mean and standard deviation tables for each major cut also depict general trends across the yield grades. In each of the major wholesale cuts, lean weight generally increases across the yield grades but percentage lean decreases. Subcutaneous fat and seam fat both generally increase as yield grade increases. Seam fat was the highest in the rack and the shoulder for all breeds. Internal fat was variable in all major cuts and yield grades.

Minor Wholesale Cut Comparison. Means and standard deviations are given in Tables 25 through 27 by breed and sex for the minor wholesale cuts. Table 28 reports the results of analysis of variance using breed, sex, and yield grade as the main effects in the general linear model. The minor cuts weight (kg) and percentage of the cut, were both analyzed by analysis of variance. Breed, sex, and yield grade were used as the main effects in the general linear model. The results showed that breed was highly significant (P < .001) for breast weight,

Table 25: Means and standard deviations for individual weights and percentages of the side weight segmented by minor cuts for USDA yield grade and sex in Suffolk lambs

USDA yield grade	n	Neck kg	Neck %	Breast kg	Breast %	Shank kg	Shank %	Plate kg	Plate %	Flank kg	Flank %	Total kg	Total %
Wethers													
1	3	.38	2.98	.58	4.51	.81	6.34	.79	6.20	.52	4.14	3.07	24.17
		(.08)	(.26)	(.16)	(.78)	(.21)	(.88)	(.28)	(2.11)	(.10)	(.91)		
2	3	.41	2.85	.73	5.01	.84	5.80	1.09	7.70	.72	4.97	3.80	26.34
		(.06)	(.26)	(.12)	(.41)	(.12)	(.42)	(.04)	(1.51)	(.20)	(1.00)		
3	3	.57	3.21	.98	5.57	1.24	7.05	1.49	8.28	.91	5.14	5.18	29.26
		(.13)	(.19)	(.28)	(1.08)	(.27)	(.66)	(.54)	(1.66)	(.27)	(.69)		
4	3	.70	3.19	1.39	6.19	2.05	9.19	2.20	9.96	1.21	5.50	7.56	34.04
		(.07)	(.07)	(.52)	(1.66)	(.59)	(1.68)	(.45)	(1.15)	(.19)	(.37)		
5	2	.74	3.71	.90	4.54	1.25	6.33	1.85	9.38	1.03	5.20	5.77	29.16
		(.25)	(1.17)	(.06)	(.15)	(.16)	(.62)	(.08)	(.12)	(.04)	(.34)		
Average		.55	3.15	.91	5.21	1.24	6.99	1.46	8.22	.87	4.98		
		(.18)	(.46)	(.39)	(1.08)	(.55)	(1.51)	(.61)	(1.89)	(.30)	(.79)		
Ewes													
1	1	.37	3.74	.41	4.10	.62	6.20	.62	6.20	.39	3.92	2.40	24.17
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.42	2.98	.61	4.35	.98	7.17	.98	7.05	.61	4.41	3.60	25.97
		(.13)	(.58)	(.15)	(.69)	(.20)	(1.80)	(.14)	(.35)	(.10)	(.42)		
3	3	.54	2.96	.92	5.02	1.28	6.84	1.65	8.71	.87	4.61	5.26	28.15
		(.04)	(.63)	(.11)	(.66)	(.35)	(1.21)	(.56)	(1.21)	(.28)	(.54)		
4	4	.53	2.77	.94	4.94	1.23	6.41	1.56	8.10	1.01	5.27	5.26	27.50
		(.1)	(.59)	(.06)	(.43)	(.26)	(.91)	(.38)	(1.45)	(.16)	(.53)		
5	1	.45	2.60	.98	5.65	.93	5.42	1.33	7.73	.86	4.99	4.55	26.39
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.47	2.94	.78	4.074	1.09	6.69	1.29	7.69	.78	4.71		
		(.11)	(.56)	(.22)	(.66)	(.29)	(1.29)	(.46)	(1.17)	(.25)	(.59)		

Table 26: Means and standard deviations for individual weights and percentages of the side weight segmented by minor cuts for USDA yield grade and sex in F_1[a] lambs

USDA yield grade	n	Neck kg	Neck %	Breast kg	Breast %	Shank kg	Shank %	Plate kg	Plate %	Flank kg	Flank %	Total kg	Total %
Wethers													
1	2	.36	2.86	.57	4.46	.74	5.74	.80	6.14	.51	4.05	2.98	23.25
		(.08)	(.94)	(.06)	(.02)	(.30)	(1.78)	(.38)	(2.34)	(.01)	(.34)		
2	7	.38	2.78	.70	5.08	.91	6.67	1.06	7.70	.58	4.21	3.63	26.44
		(.11)	(.39)	(.21)	(.99)	(.22)	(.75)	(.26)	(.84)	(.16)	(.61)		
3	1	.51	3.81	.56	4.15	.88	6.52	.86	6.38	.51	3.81	3.32	24.68
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.57	3.37	.92	5.47	1.13	6.72	1.34	7.98	.83	4.89	4.79	28.43
		(.12)	(.65)	(.12)	(.75)	(.23)	(1.71)	(.15)	(1.19)	(.14)	(.65)		
5	1	.59	3.21	.96	5.17	1.23	6.66	1.73	9.33	1.13	6.12	5.65	30.48
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.45	3.04	.75	5.05	.97	6.55	1.13	7.59	.67	4.47		
		(.14)	(.58)	(.21)	(.84)	(.25)	(1.10)	(.32)	(1.29)	(.22)	(.77)		
Ewes													
1	3	.25	2.34	.65	5.76	.83	7.47	.83	7.50	.51	4.62	3.07	27.67
		(.02)	(.54)	(.25)	(1.39)	(.24)	(1.29)	(.10)	(.85)	(.07)	(.76)		
2	6	.42	3.17	.68	5.10	.86	6.59	.98	7.39	.56	4.22	3.50	26.55
		(.07)	(.46)	(.11)	(.69)	(.13)	(1.05)	(.12)	(.32)	(.11)	(.56)		
3	2	.56	3.74	.85	5.76	.98	6.78	1.15	7.76	.64	4.35	4.18	28.39
		(.19)	(.30)	(.25)	(.16)	(.10)	(1.09)	(.41)	(.72)	(.20)	(.20)		
4	3	.51	3.07	.92	5.48	1.09	6.46	1.35	8.06	.86	5.12	4.73	28.18
		(.08)	(.51)	(.17)	(.98)	(.15)	(.50)	(.07)	(.46)	(.09)	(.21)		
5	1	.58	2.62	1.37	6.26	1.37	6.26	2.08	9.46	1.37	6.22	6.77	30.81
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.43	3.02	.79	5.51	.95	6.74	1.12	7.73	.67	4.63		
		(.13)	(.60)	(.24)	(.83)	(.20)	(.95)	(.35)	(.71)	(.25)	(.72)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 27: Means and standard deviations for individual weights and percentages of the side weight segmented by minor cuts for USDA yield grade and sex in Commercial Rambouillet lambs

USDA yield grade	n	Neck kg	Neck %	Breast kg	Breast %	Shank kg	Shank %	Plate kg	Plate %	Flank kg	Flank %	Total kg	Total %
Wethers													
1	1	.49	3.66	.90	6.71	1.23	9.19	.99	7.39	.38	2.81	3.98	29.76
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.42	3.45	.62	5.13	.80	6.65	.84	6.88	.57	4.66	3.25	26.77
		(.14)	(1.04)	(.11)	(.64)	(.04)	(.94)	(.30)	(1.94)	(.24)	(1.49)		
3	3	.40	3.02	.62	4.80	.88	6.78	1.02	7.84	.60	4.60	3.52	27.04
		(.12)	(.79)	(.14)	(1.12)	(.06)	(.77)	(.14)	(.64)	(.09)	(.43)		
4	4	.50	3.10	.80	4.99	.93	5.76	1.32	8.20	.75	4.67	4.31	26.72
		(.10)	(.61)	(.06)	(.36)	(.17)	(.78)	(.21)	(.80)	(.12)	(.58)		
5	2	.59	3.09	.91	4.83	1.29	6.80	1.86	9.86	.96	5.09	5.61	29.66
		(.17)	(.82)	(.13)	(.59)	(.05)	(.14)	(.15)	(1.01)	(.00)	(.11)		
Average		.46	3.24	.73	5.09	.94	6.63	1.15	7.85	.67	4.58		
		(.13)	(.76)	(.15)	(.75)	(.20)	(1.08)	(.40)	(1.52)	(.21)	(1.00)		
Ewes													
1	1	.30	3.01	.44	4.31	.57	5.65	.49	4.85	.40	3.95	2.20	21.76
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.34	3.32	.50	4.96	.68	6.68	.68	6.69	.44	4.31	2.64	25.96
		(.07)	(.37)	(.04)	(.42)	(.12)	(.68)	(.14)	(1.27)	(.09)	(.42)		
3	4	.37	3.11	.63	5.08	.81	6.61	.94	7.72	.50	4.17	3.25	26.69
		(.05)	(.71)	(.26)	(1.50)	(.28)	(1.51)	(.23)	(.87)	(.08)	(.19)		
4	4	.43	2.91	.72	4.86	.93	6.25	1.39	9.20	.75	5.08	4.22	28.30
		(.08)	(.43)	(.14)	(.79)	(.22)	(.40)	(.41)	(1.48)	(.20)	(1.12)		
5	2	.56	3.37	.83	5.05	.90	5.35	1.43	8.53	.85	5.05	4.57	27.36
		(.02)	(.36)	(.12)	(1.45)	(.20)	(.38)	(.28)	(.43)	(.15)	(.17)		
Average		.40	3.14	.63	4.93	.80	6.30	1.03	7.76	.59	4.55		
		(.10)	(.47)	(.19)	(.92)	(.22)	(.93)	(.42)	(1.61)	(.20)	(.72)		

Table 28: ANOVA for Suffolk, F_1[a], and Commercial Rambouillet minor cut analysis

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Neck (kg):			
Breed	2	.06	5.98	.0037	Error
Sex	1	.06	5.65	.0197	Error
Yield grade	1	.57	53.90	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage Neck:			
Breed	2	.17	.52	.5940	Error
Sex	1	.25	.76	.3868	Error
Yield grade	1	.14	.42	.5180	Error
Residual error	83	.33			
Total	87	.33			
		Breast (kg):			
Breed	2	.30	7.79	.0008	Error
Sex	1	.08	2.11	.1503	Error
Yield grade	1	1.76	45.93	.0001	Error
Residual error	83	.04			
Total	87	.06			
		Percentage Breast:			
Breed	2	1.01	1.34	.2663	Error
Sex	1	.05	.07	.7954	Error
Yield grade	1	1.22	1.62	.2062	Error
Residual error	83	.75			
Total	87	.75			
		Shank (kg):			
Breed	2	.71	10.28	.0001	Error
Sex	1	.22	3.14	.0801	Error
Yield grade	1	2.06	29.79	.0001	Error
Residual error	83	.07			
Total	87	.11			

Table 28: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Percentage Shank:			
Breed	2	.94	.71	.4966	Error
Sex	1	.43	.32	.5729	Error
Yield grade	1	.54	.41	.5240	Error
Residual error	83	1.33			
Total	87	1.30			
		Plate (kg):			
Breed	2	.82	9.61	.0002	Error
Sex	1	.23	2.65	.1073	Error
Yield grade	1	8.57	99.91	.0001	Error
Residual error	83	.09			
Total	87	.20			
		Percentage Plate:			
Breed	2	.62	.47	.6283	Error
Sex	1	.51	.38	.5379	Error
Yield grade	1	54.59	40.98	.0001	Error
Residual error	83	1.33			
Total	87	1.92			
		Flank (kg):			
Breed	2	.37	15.11	.0001	Error
Sex	1	.06	2.36	.1282	Error
Yield grade	1	2.70	109.49	.0001	Error
Residual error	83	.02			
Total	87	.06			
		Percentage Flank:			
Breed	2	.84	1.88	.1585	Error
Sex	1	.04	.09	.7596	Error
Yield grade	1	12.99	29.14	.0001	Error
Residual error	83	.45			
Total	87	.59			

Table 28: Continued

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Total (kg):			
Breed	2	9.82	13.58	.0001	Error
Sex	1	2.93	4.05	.0473	Error
Yield grade	1	65.34	90.39	.0001	Error
Residual error	83	.73			
Total	87	1.66			
		Total Percentage:			
Breed	2	5.59	.84	.4342	Error
Sex	1	5.28	.80	.3750	Error
Yield grade	1	137.67	20.75	.0001	Error
Residual error	83	6.64			
Total	87	8.05			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

breed was highly significant ($P < .001$) for breast weight, shank weight, plate weight, flank weight, and total weight and breed was significant ($P <.01$) for neck weight. Sex effect was significant ($P < .05$) for neck weight. Yield grade was highly significant ($P < .001$) for neck weight, breast weight, shank weight, plate weight and percentage plate, flank weight and percentage flank, as well as total weight and total percentage.

Tukey's mean separation was used to determine significant differences between breeds and sexes. Suffolk lambs were higher ($P < .05$) than both the F_1 lambs for the shank, and flank weights, and the Suffolks were higher than the Rambouillet lambs for the breast, plate, shank, flank and total weights. There were no significant differences between wethers and ewes for the minor cuts.

Tables 29 through 48 report the means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat. Analysis of variance for the neck, breast, shank, plate, and flank were also reported by weight (kg) and percentage of tissue components for each minor wholesale cut. Table 32 reports the analysis of the neck by ANOVA, breed was found to have a highly significant ($P < .001$) effect on the model for bone weight, and was significant ($P < .01$) for total weight. Sex was significant ($P < .05$) for total weight. Yield grade was highly significant ($P < .001$) for lean weight, bone weight, subcutaneous fat weight, seam fat weight, and total weight. Yield grade was also significant ($P < .01$) for percentage subcutaneous fat and percentage seam fat and was significant ($P < .05$) for percentage lean.

Table 36 addresses analysis of variance in the breast. Breed was highly significant ($P < .001$) for total weight and was significant ($P < .01$) for lean weight, bone weight, seam fat weight and at $P < .05$ for percentage subcutaneous fat. Sex had an influence ($P < .05$) on bone weight. Yield grade was highly

Table 29: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the neck for USDA yield grade and sex for Suffolk lambs

USDA yield grade		Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	3	.17	43.06	.12	30.72	.06	17.51	.03	8.40	.00	.00	.38	99.68
		(.06)	(8.67)	(.03)	(4.03)	(.02)	(8.27)	(.02)	(4.62)	(.00)	(.00)		
2	3	.18	42.84	.13	31.17	.07	16.72	.04	8.64	.00	.00	.41	99.37
		(.01)	(3.50)	(.01)	(4.50)	(.02)	(1.27)	(.03)	(6.42)	(.00)	(.00)		
3	3	.24	40.92	.18	32.54	.09	15.94	.06	9.76	.00	.00	.56	99.17
		(.10)	(8.64)	(.02)	(9.20)	(.02)	(3.10)	(.02)	(1.04)	(.00)	(.00)		
4	3	.30	43.38	.19	27.24	.10	14.44	.11	14.95	.00	.00	.70	100.00
		(.04)	(4.30)	(.05)	(8.08)	(.01)	(.47)	(.04)	(4.73)	(.00)	(.00)		
5	2	.28	37.69	.22	31.55	.12	16.55	.10	12.98	.00	.00	.73	98.76
		(.12)	(2.71)	(.01)	(11.72)	(.04)	(.40)	(.08)	(6.85)	(.00)	(.00)		
Average		.23	41.85	.16	30.58	.09	16.21	.06	10.80	.00	.00		
		(.08)	(5.68)	(.05)	(6.55)	(.03)	(3.68)	(.05)	(4.92)	(.00)	(.00)		
Ewes													
1	1	.19	50.00	.11	29.27	.04	10.98	.04	9.76	.00	.00	.37	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.17	40.56	.14	35.32	.07	15.89	.03	7.05	.00	.00	.42	98.82
		(.05)	(5.58)	(.03)	(5.87)	(.04)	(4.59)	(.03)	(4.30)	(.00)	(.00)		
3	3	.24	44.80	.16	30.51	.07	12.99	.06	11.10	.00	.00	.53	99.41
		(.05)	(7.69)	(.01)	(.71)	(.02)	(4.33)	(.02)	(4.06)	(.00)	(.00)		
4	4	.23	43.06	.14	26.87	.09	17.86	.06	11.29	.00	.00	.52	99.09
		(.07)	(3.80)	(.05)	(5.43)	(.03)	(7.05)	(.01)	(1.09)	(.00)	(.00)		
5	1	.13	29.29	.19	42.42	.09	19.19	.04	9.09	.00	.00	.45	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.20	42.05	.15	31.95	.07	15.72	.05	9.47	.00	.00		
		(.06)	(6.50)	(.03)	(6.27)	(.03)	(5.16)	(.02)	(3.52)	(.00)	(.00)		

Table 30: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the neck for USDA yield grade and sex for F1[a] lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	2	.17	43.96	.12	32.86	.07	20.16	.01	3.03	.00	.00	.36	100.00
		(.11)	(19.31)	(.01)	(4.96)	(.02)	(10.06)	(.01)	(4.29)	(.00)	(.00)		
2	7	.16	43.16	.12	30.34	.06	15.56	.04	10.80	.00	.00	.38	99.85
		(.05)	(6.88)	(.03)	(2.38)	(.02)	(4.08)	(.02)	(3.93)	(.00)	(.00)		
3	1	.27	52.21	.15	29.20	.06	11.50	.03	5.31	.00	.00	.50	98.23
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.22	39.94	.17	28.42	.12	21.36	.05	9.77	.00	.00	.57	99.49
		(.06)	(9.30)	(.06)	(5.56)	(.03)	(3.56)	(.01)	(2.67)	(.00)	(.00)		
5	1	.20	33.59	.22	37.40	.14	22.90	.02	3.05	.00	.00	.58	96.95
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.19	42.37	.14	30.56	.08	17.94	.04	8.60	.00	.00		
		(.06)	(8.96)	(.05)	(4.05)	(.04)	(5.36)	(.02)	(4.43)	(.00)	(.00)		
Ewes													
1	3	.10	38.00	.08	33.76	.04	16.17	.03	10.92	.00	.00	.25	98.85
		(.02)	(6.03)	(.00)	(3.84)	(.01)	(2.71)	(.01)	(3.64)	(.00)	(.00)		
2	6	.19	46.59	.12	28.35	.06	13.02	.05	11.46	.00	.00	.42	99.42
		(.04)	(4.22)	(.02)	(2.44)	(.03)	(4.13)	(.02)	(4.11)	(.00)	(.00)		
3	2	.21	37.03	.17	31.02	.10	18.47	.07	13.15	.00	.00	.55	99.67
		(.07)	(.67)	(.03)	(4.79)	(.04)	(1.79)	(.04)	(1.87)	(.00)	(.00)		
4	3	.22	42.69	.12	23.74	.11	20.67	.07	12.89	.00	.00	.51	100.00
		(.03)	(1.17)	(.01)	(4.76)	(.03)	(4.03)	(.03)	(4.16)	(.00)	(.00)		
5	1	.21	36.22	.19	32.28	.10	18.11	.07	12.60	.00	.00	.57	99.21
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.18	42.13	.12	29.13	.07	16.25	.05	11.94	.00	.00		
		(.06)	(5.50)	(.03)	(4.63)	(.04)	(4.39)	(.03)	(3.38)	(.00)	(.00)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 31: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the neck for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	1	.24	48.15	.18	37.04	.04	8.33	.03	5.56	.00	.00	.49	99.07
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.21	46.93	.12	29.76	.05	13.37	.04	8.96	.00	.00	.42	99.02
		(.10)	(9.95)	(.03)	(4.96)	(.03)	(5.19)	(.01)	(3.15)	(.00)	(.00)		
3	3	.15	38.32	.12	30.40	.09	22.16	.04	8.39	.00	.00	.39	99.27
		(.04)	(2.72)	(.02)	(3.05)	(.04)	(2.87)	(.03)	(3.68)	(.00)	(.00)		
4	4	.21	41.71	.11	22.55	.11	22.58	.06	12.30	.00	.00	.49	99.14
		(.06)	(6.36)	(.02)	(1.83)	(.02)	(6.43)	(.04)	(5.41)	(.00)	(.00)		
5	2	.25	42.65	.15	26.34	.08	11.45	.09	15.67	.02	3.40	.58	99.51
		(.05)	(2.84)	(.01)	(5.31)	(.11)	(14.82)	(.02)	(1.18)	(.02)	(4.81)		
Average		.20	43.33	.13	27.99	.08	16.99	.05	10.40	.00	.45		
		(.07)	(7.15)	(.03)	(5.31)	(.04)	(7.91)	(.03)	(4.41)	(.01)	(1.75)		
Ewes													
1	1	.14	44.78	.10	32.84	.05	16.42	.02	5.97	.00	.00	.30	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.16	46.53	.11	30.87	.05	13.78	.03	8.41	.00	.00	.34	99.60
		(.04)	(3.25)	(.03)	(1.72)	(.02)	(4.91)	(.01)	(3.17)	(.00)	(.00)		
3	3	.15	40.50	.11	31.58	.06	16.56	.04	11.35	.00	.00	.36	100.00
		(.02)	(2.04)	(.02)	(1.95)	(.02)	(2.24)	(.01)	(1.27)	(.00)	(.00)		
4	4	.19	44.01	.12	29.08	.08	17.66	.04	8.70	.00	.00	.43	99.45
		(.03)	(4.49)	(.02)	(3.69)	(.03)	(4.02)	(.01)	(1.34)	(.00)	(.00)		
5	2	.22	38.83	.14	24.57	.13	23.24	.07	12.55	.00	.00	.56	99.19
		(.02)	(1.88)	(.04)	(6.46)	(.04)	(8.37)	(.00)	(.07)	(.00)	(.00)		
Average		.17	43.29	.12	29.75	.07	17.03	.04	9.54	.00	.00		
		(.04)	(4.05)	(.03)	(3.71)	(.04)	(4.98)	(.02)	(2.59)	(.00)	(.00)		

Table 32: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the neck for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Lean (kg):			
Breed	2	.01	2.35	.1021	Error
Sex	1	.01	3.42	.0681	Error
Yield grade	1	.05	16.48	.0001	Error
Residual error	83	.00			
Total	87	.00			
		Percentage lean:			
Breed	2	27.22	.69	.5022	Error
Sex	1	.02	.00	.9824	Error
Yield grade	1	230.59	5.88	.0175	Error
Residual error	83	32.21			
Total	87	39.94			
		Bone (kg):			
Breed	2	.01	9.74	.0002	Error
Sex	1	.03	3.43	.0675	Error
Yield grade	1	.03	27.86	.0001	Error
Residual error	83	.00			
Total	87	.00			
		Percentage bone:			
Breed	2	37.52	1.51	.2273	Error
Sex	1	6.30	.25	.6177	Error
Yield grade	1	157.99	6.30	.0141	Error
Residual error	83	25.09			
Total	87	26.50			

Table 32: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.00	1.48	.2332	Error
Sex	1	.00	2.58	.1122	Error
Yield grade	1	.04	47.62	.0001	Error
Residual error	83	.00			
Total	87	.00			
		Percentage subcutaneous fat:			
Breed	2	16.07	.60	.5527	Error
Sex	1	11.67	.43	.5120	Error
Yield grade	1	196.71	7.31	.0083	Error
Residual error	83	26.91			
Total	87	28.02			
		Seam fat (kg):			
Breed	2	.00	2.18	.1196	Error
Sex	1	.00	.83	.3641	Error
Yield grade	1	.02	32.37	.0001	Error
Residual error	83	.00			
Total	87	.00			
		Percentage seam fat:			
Breed	2	4.77	.32	.7271	Error
Sex	1	4.06	.27	.6034	Error
Yield grade	1	144.37	9.68	.0026	Error
Residual error	83	14.92			
Total	87	15.78			
		Internal fat (kg):			
Breed	2	.00	.70	.4974	Error
Sex	1	.00	.95	.3321	Error
Yield grade	1	.00	2.52	.1164	Error
Residual error	83	.00			
Total	87	.00			

Table 32: Continued

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Percentage internal fat:			
Breed	2	.37	.70	.4974	Error
Sex	1	.50	.95	.3321	Error
Yield grade	1	1.31	2.52	.1164	Error
Residual error	83	.52			
Total	87	.52			
		Total (kg):			
Breed	2	.06	5.73	.0047	Error
Sex	1	.06	5.36	.0231	Error
Yield grade	1	.56	52.82	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Total percentage:			
Breed	2	.12	.14	.8685	Error
Sex	1	.01	.08	.7715	Error
Yield grade	1	.32	.39	.5339	Error
Residual error	83	.82			
Total	87	.78			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

significant for lean weight, percentage bone, subcutaneous fat weight, seam fat weight, and total weight of the breast. Yield grade also was significant (P < .01) for percentage seam fat and total percentage.

When analyzing the shank, (Table 40), breed was found to be highly significant (P < .001) for lean weight, bone weight, seam fat weight, and total weight. Breed was also significant (P < .05) for percentage lean, percentage bone subcutaneous fat, and percentage seam fat in the shank. Sex was highly significant (P < .001) for bone weight and was significant (P < .01) for percentage bone and (P < .05) for percentage lean. Yield grade was highly significant (P < .001) for lean weight, bone weight, subcutaneous fat weight and percentage, seam fat weight, and total weight. Yield grade was also significant at (P < .01) for percentage bone.

In Table 44, analysis of the plate reveals that breed was highly significant (P < .001) for lean weight, bone weight, and total weight. Breed also was significant (P < .05) for subcutaneous fat weight and seam fat weight. Sex was significant at (P < .05) for bone weight. Yield grade was highly significant (P < .001) for lean weight and percentage, bone weight and percentage, subcutaneous fat weight, seam fat weight and percentage, and total weight. Yield grade was significant (P < .01) for percentage subcutaneous fat and for internal fat weight.

Table 48 reports results from analysis of variance for the flank. Breed was highly significant (P <. 001) for lean weight and total kg. Breed was significant (P < .01) for subcutaneous fat weight and internal fat weight, and (P < .05) for percentage lean and seam fat weight. Sex was significant for any of the compositional tissues. Yield grade was significant (P < .001) for lean weight, subcutaneous fat weight, seam fat weight, and total weight, as well as being

Table 33: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the breast for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	.22	38.55	.12	20.61	.09	16.77	.13	22.11	.01	1.40	.57	99.44
		(.08)	(3.41)	(.02)	(2.19)	(.01)	(2.64)	(.04)	(3.34)	(.02)	(2.42)		
2	3	.23	31.90	.14	18.71	.16	20.78	.18	26.40	.01	1.00	.72	98.79
		(.03)	(6.25)	(.04)	(2.20)	(.10)	(9.80)	(.04)	(9.14)	(.01)	(.97)		
3	3	.33	33.16	.14	14.18	.20	20.86	.25	24.62	.05	5.89	.96	98.72
		(.12)	(6.68)	(.05)	(4.12)	(.05)	(7.37)	(.15)	(12.15)	(.06)	(8.45)		
4	3	.55	39.28	.19	14.27	.22	16.84	.36	25.50	.06	3.42	1.38	99.30
		(.22)	(6.14)	(.05)	(1.93)	(.07)	(5.87)	(.23)	(8.95)	(.07)	(3.14)		
5	2	.28	31.48	.13	14.34	.19	20.97	.27	30.48	.02	2.48	.90	99.76
		(.04)	(2.62)	(.02)	(1.58)	(.01)	(.28)	(.03)	(5.53)	(.01)	(1.27)		
Average		.33	35.12	.14	16.57	.17	19.12	.24	25.49	.03	2.86		
		(.16)	(5.74)	(.04)	(3.60)	(.07)	(5.82)	(.14)	(7.67)	(.04)	(4.14)		
Ewes													
1	1	.14	34.44	.09	22.22	.05	13.33	.07	16.67	.01	2.22	.36	88.89
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.23	37.90	.11	18.20	.09	13.72	.16	27.25	.01	1.74	.60	98.81
		(.07)	(5.63)	(.03)	(3.47)	(.04)	(3.44)	(.02)	(4.98)	(.01)	(1.24)		
3	3	.35	37.60	.10	11.14	.16	18.16	.28	30.16	.02	2.64	.92	99.69
		(.11)	(8.43)	(.01)	(1.96)	(.06)	(9.64)	(.08)	(5.69)	(.02)	(2.22)		
4	4	.36	38.62	.13	13.55	.16	16.96	.27	29.06	.01	1.20	.93	99.39
		(.05)	(4.67)	(.02)	(2.69)	(.03)	(3.51)	(.05)	(3.86)	(.01)	(1.47)		
5	1	.28	28.84	.14	14.42	.30	31.16	.24	24.65	.00	.00	.97	99.07
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.29	37.15	.11	15.38	.14	16.82	.22	27.45	.01	1.69		
		(.10)	(5.70)	(.02)	(4.23)	(.07)	(6.45)	(.08)	(5.30)	(.01)	(1.50)		

Table 34 : Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the breast for USDA yield grade and sex for F1[a] lambs

USDA yield grade	n	Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	2	.20	34.10	.11	19.66	.10	18.37	.16	27.01	.00	.43	.57	99.57
		(.04)	(3.11)	(.00)	(2.67)	(.04)	(8.16)	(.07)	(8.94)	(.00)	(.61)		
2	7	.25	35.03	.12	17.71	.11	16.28	.20	27.14	.02	2.63	.69	98.80
		(.08)	(3.57)	(.04)	(2.93)	(.05)	(6.79)	(.08)	(4.70)	(.01)	(2.38)		
3	1	.26	46.34	.08	13.82	.11	20.33	.10	18.70	.00	.00	.55	99.19
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.28	30.74	.12	13.32	.24	26.31	.24	25.74	.02	2.54	.91	98.65
		(.04)	(6.25)	(.04)	(3.95)	(.02)	(1.74)	(.10)	(8.12)	(.02)	(2.10)		
5	1	.32	33.65	.10	10.90	.22	23.22	.30	31.75	.00	.47	.96	100.0
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.25	34.42	.12	16.09	.15	19.97	.20	26.49	.01	2.00		
		(.07)	(5.36)	(.04)	(3.89)	(.07)	(6.68)	(.09)	(6.00)	(.01)	(2.12)		
Ewes													
1	3	.22	32.94	.10	16.72	.13	22.58	.16	23.18	.03	3.30	.64	98.72
		(.09)	(2.30)	(.02)	(2.74)	(.07)	(13.07)	(.14)	(13.11)	(.04)	(3.49)		
2	6	.23	34.33	.11	16.00	.17	24.08	.15	21.49	.02	3.37	.68	99.27
		(.04)	(5.65)	(.02)	(3.69)	(.10)	(12.46)	(.08)	(9.83)	(.01)	(2.07)		
3	2	.29	35.28	.10	12.12	.23	24.3	.21	26.41	.01	1.11	.85	99.56
		(.05)	(4.21)	(.04)	(1.01)	(.20)	(15.85)	(.04)	(12.95)	(.00)	(.32)		
4	3	.28	30.40	.11	12.36	.20	21.78	.29	30.93	.03	4.03	.91	99.49
		(.04)	(3.83)	(.02)	(.62)	(.04)	(1.52)	(.10)	(6.15)	(.02)	(3.70)		
5	1	.37	26.73	.12	8.58	.33	23.76	.52	37.95	.03	2.31	1.37	99.34
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.26	32.89	.11	14.40	.19	23.37	.21	25.47	.02	3.12		
		(.06)	(4.61)	(.02)	(3.52)	(.10)	(9.96)	(.13)	(10.10)	(.02)	(2.46)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 35 : Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the breast for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	1	.34	37.88	.17	18.69	.11	12.63	.24	26.26	.01	1.52	.87	96.97
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.22	35.92	.12	18.53	.13	21.00	.14	22.73	.01	1.02	.62	99.20
		(.04)	(3.52)	(.04)	(3.89)	(.04)	(6.07)	(.04)	(6.48)	(.01)	(.79)		
3	3	.22	34.85	.09	14.70	.11	17.38	.18	29.00	.02	3.11	.62	99.04
		(.07)	(4.15)	(.01)	(3.08)	(.01)	(2.69)	(.05)	(2.72)	(.01)	(1.77)		
4	4	.25	30.99	.10	12.78	.19	24.19	.24	29.56	.01	1.64	.79	99.16
		(.04)	(4.51)	(.02)	(3.77)	(.04)	(5.23)	(.06)	(6.51)	(.01)	(1.41)		
5	2	.31	33.69	.09	9.77	.25	26.79	.24	26.84	.02	2.46	.91	99.55
		(.05)	(.77)	(.03)	(2.10)	(.13)	(10.53)	(.10)	(14.39)	(.01)	(.35)		
Average		.25	34.23	.11	15.07	.16	21.34	.19	26.59	.01	1.83		
		(.06)	(3.94)	(.03)	(4.45)	(.07)	(6.38)	(.07)	(6.78)	(.01)	(1.31)		
Ewes													
1	1	.14	31.25	.08	18.75	.21	48.96	.00	.00	.00	.00	.43	98.96
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.17	33.45	.11	21.91	.12	23.18	.10	19.41	.00	.67	.49	98.63
		(.03)	(4.47)	(.03)	(5.09)	(.03)	(6.21)	(.00)	(2.11)	(.00)	(.82)		
3	4	.23	35.09	.08	13.64	.13	22.57	.16	25.43	.01	1.97	.62	98.70
		(.12)	(5.88)	(.03)	(3.36)	(.04)	(8.73)	(.08)	(4.96)	(.01)	(1.23)		
4	4	.25	35.53	.10	13.09	.18	24.41	.17	24.00	.02	2.32	.71	99.35
		(.03)	(2.95)	(.03)	(2.21)	(.09)	(9.59)	(.08)	(10.62)	(.02)	(2.11)		
5	2	.25	31.12	.11	13.20	.23	27.06	.23	28.32	.0	.30	.83	100.0
		(.01)	(6.01)	(.04)	(3.14)	(.13)	(12.39)	(.04)	(9.10)	(.00)	(.43)		
Average		.22	33.99	.10	15.98	.16	25.58	.14	22.13	.01	1.36		
		(.07)	(4.36)	(.03)	(5.04)	(.07)	(9.96)	(.08)	(9.11)	(.01)	(1.49)		

Table 36: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the breast for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Lean (kg):			
Breed	2	.05	7.28	.0012	Error
Sex	1	.01	1.41	.2389	Error
Yield grade	1	.14	20.42	.0001	Error
Residual error	83	.01			
Total	87	.01			
		Percentage lean:			
Breed	2	54.71	2.26	.1107	Error
Sex	1	.03	.00	.9700	Error
Yield grade	1	73.07	3.02	.0860	Error
Residual error	83	24.02			
Total	87	25.08			
		Bone (kg):			
Breed	2	.01	5.04	.0086	Error
Sex	1	.01	5.80	.0183	Error
Yield grade	1	.00	.45	.5054	Error
Residual error	83	.00			
Total	87	.00			
		Percentage bone:			
Breed	2	18.16	1.79	.1726	Error
Sex	1	9.17	.91	.3440	Error
Yield grade	1	606.90	59.97	.0001	Error
Residual error	83	10.12			
Total	87	16.83			

Table 36: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.01	1.82	.1680	Error
Sex	1	.00	.01	.9217	Error
Yield grade	1	.15	37.90	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage subcutaneous fat:			
Breed	2	217.34	3.61	.0313	Error
Sex	1	77.28	1.29	.2602	Error
Yield grade	1	145.94	2.43	.1231	Error
Residual error	83	60.14			
Total	87	65.12			
		Seam fat (kg):			
Breed	2	.04	5.77	.0045	Error
Sex	1	.01	1.26	.2656	Error
Yield grade	1	.26	36.21	.0001	Error
Residual error	83	.01			
Total	87	.01			
		Percentage seam fat:			
Breed	2	65.28	1.21	.3035	Error
Sex	1	34.11	.63	.4289	Error
Yield grade	1	537.61	9.96	.0022	Error
Residual error	83	53.97			
Total	87	58.88			
		Internal fat (kg):			
Breed	2	.00	2.00	.1425	Error
Sex	1	.00	.42	.5172	Error
Yield grade	1	.00	2.82	.0967	Error
Residual error	83	.00			
Total	87	.00			

Table 36: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Percentage internal fat:			
Breed	2	8.05	1.41	.2499	Error
Sex	1	.49	.09	.7693	Error
Yield grade	1	2.24	.39	.5330	Error
Residual error	83	5.70			
Total	87	5.64			
		Total (kg):			
Breed	2	.29	7.85	.0008	Error
Sex	1	.08	2.07	.1543	Error
Yield grade	1	1.79	47.74	.0001	Error
Residual error	83	.04			
Total	87	.06			
Total percentage:		----------------------	R^2 = .095	----------------------	
Breed	2	1.06	.63	.5338	Error
Sex	1	.35	.21	.6474	Error
Yield grade	1	12.81	7.65	.0070	Error
Residual error	83	1.67			
Total	87	1.76			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 37: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shank for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Total kg	Total %
Wethers											
1	3	.38	46.18	.33	40.86	.08	9.25	.03	3.21	.80	99.49
		(.12)	(3.09)	(.05)	(3.80)	(.02)	(.60)	(.02)	(2.83)		
2	3	.38	45.77	.33	39.04	.08	9.64	.05	4.84	.83	99.30
		(.06)	(3.31)	(.04)	(4.78)	(.01)	(2.77)	(.06)	(5.76)		
3	3	.58	46.82	.39	32.45	.15	12.11	.10	7.99	1.23	99.37
		(.14)	(2.80)	(.05)	(3.48)	(.03)	(2.52)	(.06)	(3.21)		
4	3	1.04	50.12	.56	28.08	.28	13.18	.17	8.37	2.05	99.75
		(.35)	(4.16)	(.12)	(5.37)	(.12)	(2.25)	(.05)	(1.89)		
5	2	.57	45.17	.45	35.83	.16	12.55	.07	5.55	1.24	99.10
		(.13)	(4.72)	(.03)	(2.28)	(.01)	(.84)	(.01)	(1.74)		
Average		.59	46.93	.41	35.21	.15	11.26	.08	6.02		
		(.30)	(3.46)	(.11)	(6.06)	(.09)	(2.42)	(.07)	(3.61)		
Ewes											
1	1	.32	52.21	.22	35.29	.04	6.62	.03	5.15	.61	99.26
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.50	50.86	.29	30.44	.12	11.62	.06	6.26	.97	99.18
		(.14)	(4.45)	(.04)	(6.69)	(.05)	(2.44)	(.03)	(1.64)		
3	3	.63	48.58	.39	30.75	.15	12.56	.09	6.90	1.26	98.79
		(.23)	(5.66)	(.10)	(.76)	(.02)	(6.02)	(.04)	(1.58)		
4	4	.59	47.01	.38	31.62	.17	13.63	.09	7.14	1.22	99.40
		(.17)	(4.31)	(.03)	(5.40)	(.05)	(2.58)	(.04)	(2.04)		
5	1	.44	46.60	.33	35.44	.15	15.53	.01	1.46	.93	99.03
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.54	49.06	.33	31.55	.13	12.32	.07	6.23		
		(.17)	(4.37)	(.07)	(4.84)	(.05)	(3.60)	(.04)	(2.09)		

Table 38: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shank for USDA yield grade and sex for F1[a] lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Total kg	Total %
Wethers											
1	2	.36	47.24	.28	39.38	.06	8.35	.04	4.79	.74	99.76
		(.20)	(7.58)	(.04)	(10.79)	(.03)	(.93)	(.03)	(1.94)		
2	7	.43	46.19	.31	34.09	.12	12.94	.06	6.45	.91	99.67
		(.13)	(5.22)	(.06)	(2.95)	(.04)	(3.58)	(.02)	(1.81)		
3	1	.48	54.92	.28	32.12	.04	4.15	.08	8.81	.88	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.53	46.67	.36	32.23	.14	12.39	.09	7.68	1.11	98.97
		(.15)	(3.99)	(.06)	(2.77)	(.02)	(2.95)	(.04)	(2.56)		
5	1	.58	47.06	.41	33.46	.15	12.50	.08	6.25	1.22	99.26
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.46	47.10	.32	34.12	.11	11.57	.07	6.70		
		(.14)	(4.90)	(.06)	(4.36)	(.04)	(3.75)	(.03)	(2.06)		
Ewes											
1	3	.40	47.04	.26	32.74	.09	11.09	.07	8.06	.82	98.93
		(.15)	(5.63)	(.02)	(6.47)	(.04)	(1.67)	(.02)	(.94)		
2	6	.42	48.94	.28	33.21	.11	11.92	.05	5.61	.86	99.69
		(.06)	(2.07)	(.02)	(4.23)	(.04)	(2.78)	(.03)	(3.29)		
3	2	.50	51.27	.31	31.57	.08	7.78	.07	7.48	.96	98.09
		(.01)	(6.38)	(.09)	(5.56)	(.03)	(2.47)	(.00)	(.79)		
4	3	.54	50.03	.31	28.51	.16	14.58	.06	5.73	1.08	98.86
		(.08)	(2.06)	(.03)	(2.33)	(.04)	(1.96)	(.01)	(.42)		
5	1	.64	46.20	.43	31.35	.24	17.49	.06	4.62	1.37	99.67
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.47	48.91	.30	31.83	.12	12.11	.06	6.31		
		(.10)	(3.45)	(.05)	(4.33)	(.05)	(3.23)	(.02)	(2.32)		

[a] Finewool first cross lambs of Suffolk sires and Commercial Rambouillet dams.

Table 39: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shank for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Total kg	Total %
Wethers											
1	1	.64	52.40	.42	34.62	.10	7.75	.05	4.43	1.22	98.89
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.37	46.35	.30	28.07	.08	10.13	.04	4.78	.79	99.33
		(.03)	(2.66)	(.02)	(3.25)	(.02)	(2.57)	(.01)	(.99)		
3	3	.41	46.13	.32	36.09	.09	10.64	.06	6.81	.88	99.66
		(.05)	(2.94)	(.07)	(8.62)	(.02)	(1.93)	(.04)	(4.10)		
4	4	.41	43.23	.34	37.50	.12	12.63	.06	6.19	.93	99.55
		(.12)	(6.49)	(.02)	(6.69)	(.04)	(3.22)	(.02)	(2.63)		
5	2	.58	45.16	.41	31.91	.21	16.58	.08	5.98	1.28	99.64
		(.02)	(.42)	(.02)	(.39)	(.01)	(.20)	(.01)	(.74)		
Average		.43	45.72	.34	36.45	.11	11.60	.05	5.70		
		(.11)	(4.18)	(.05)	(5.27)	(.05)	(3.25)	(.02)	(2.22)		
Ewes											
1	1	.25	43.65	.24	41.27	.09	15.08	.00	.00	.57	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.33	47.63	.24	36.05	.08	11.14	.03	4.03	.67	98.85
		(.07)	(4.07)	(.04)	(3.63)	(.02)	(1.54)	(.02)	(3.74)		
3	3	.46	49.57	.28	31.67	.12	12.92	.05	5.52	.91	99.68
		(.17)	(4.97)	(.07)	(5.02)	(.04)	(.75)	(.02)	(2.85)		
4	4	.43	47.37	.31	33.32	.13	13.62	.05	4.98	.93	99.29
		(.06)	(5.47)	(.07)	(3.33)	(.08)	(5.29)	(.02)	(1.26)		
5	2	.42	46.68	.30	33.78	.14	15.14	.04	4.41	.90	100.00
		(.06)	(3.02)	(.06)	(.22)	(.05)	(2.05)	(.02)	(1.18)		
Average		.39	47.55	.28	34.38	.11	13.08	.04	4.38		
		(.11)	(4.18)	(.06)	(4.01)	(.05)	(3.10)	(.02)	(2.62)		

Table 40: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the shank for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	*P*	Error term
		Lean (kg):			
Breed	2	.19	8.16	.0006	Error
Sex	1	.02	.78	.3811	Error
Yield grade	1	.42	18.20	.0001	Error
Residual error	83	.02			
Total	87	.03			
		Percentage lean:			
Breed	2	15.50	.93	.4004	Error
Sex	1	80.34	4.80	.0313	Error
Yield grade	1	7.22	.43	.5131	Error
Residual error	83	16.74			
Total	87	17.22			
		Bone (kg):			
Breed	2	.04	10.66	.0001	Error
Sex	1	.06	16.76	.0001	Error
Yield grade	1	.12	35.14	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage bone:			
Breed	2	72.04	3.43	.0371	Error
Sex	1	153.57	7.31	.0083	Error
Yield grade	1	197.08	9.38	.0030	Error
Residual error	83	21.00			
Total	87	25.01			

Table 40: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.01	3.56	.0330	Error
Sex	1	.00	.03	.8571	Error
Yield grade	1	.09	40.13	.0001	Error
Residual error	83	.00			
Total	87	.00			
		Percentage subcutaneous fat:			
Breed	2	1.14	.13	.8753	Error
Sex	1	22.58	2.63	.1085	Error
Yield grade	1	160.00	18.66	.0001	Error
Residual error	83	8.58			
Total	87	10.24			
		Seam fat (kg):			
Breed	2	.01	7.47	.0010	Error
Sex	1	.00	2.70	.1042	Error
Yield grade	1	.02	13.16	.0005	Error
Residual error	83	.00			
Total	87	.00			
		Percentage seam fat:			
Breed	2	20.01	3.21	.0457	Error
Sex	1	5.59	.89	.3469	Error
Yield grade	1	16.18	2.59	.1113	Error
Residual error	83	6.24			
Total	87	6.51			

Table 40: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Total (kg):			
Breed	2	.64	9.45	.0002	Error
Sex	1	.19	2.84	.0956	Error
Yield grade	1	2.03	29.97	.0001	Error
Residual error	83	.07			
Total	87	.10			
		Total percentage:			
Breed	2	.15	.44	.6447	Error
Sex	1	1.08	3.12	.0811	Error
Yield grade	1	.00	.01	.9266	Error
Residual error	83	.35			
Total	87	.34			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Table 41: Means and standard deviations segmented by lean, bone, subcutaneous fat, seam fat, and internal fat from the plate for USDA yield grade and sex for Suffolk lambs

USDA yield		Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
grade	n	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	3	.34	44.93	.17	20.74	.19	22.78	.08	10.10	.00	.47	.78	99.03
		(.11)	(12.48)	(.07)	(2.60)	(.10)	(6.29)	(.05)	(3.57)	(.01)	(.82)		
2	3	.42	38.10	.21	19.29	.28	25.31	.18	16.35	.00	.00	1.08	99.05
		(.14)	(11.37)	(.03)	(3.34)	(.01)	(1.69)	(.07)	(7.47)	(.00)	(.00)		
3	3	.47	31.64	.26	18.00	.40	26.68	.33	21.43	.02	1.40	1.47	99.15
		(.18)	(1.39)	(.08)	(2.91)	(.18)	(5.11)	(.16)	(5.83)	(.01)	(1.31)		
4	3	.83	37.65	.36	16.56	.48	22.29	.49	21.50	.02	.97	2.18	98.97
		(.16)	(.91)	(.04)	(3.08)	(.07)	(3.40)	(.26)	(6.73)	(.01)	(.55)		
5	2	.60	32.40	.31	16.59	.51	27.61	.37	19.91	.05	2.99	1.84	99.50
		(.05)	(1.54)	(.06)	(2.40)	(.04)	(3.45)	(.05)	(2.08)	(.04)	(2.21)		
Average		.53	37.27	.26	18.35	.36	24.75	.28	17.71	.02	1.04		
		(.22)	(8.31)	(.09)	(2.95)	(.15)	(4.21)	(.20)	(6.64)	(.02)	(1.31)		
Ewes													
1	1	.33	53.68	.12	19.85	.13	21.32	.03	5.15	.00	.00	.62	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.38	39.36	.18	18.52	.21	20.93	.18	18.66	.02	2.04	.97	99.51
		(.07)	(4.52)	(.05)	(4.40)	(.07)	(5.09)	(.05)	(6.10)	(.01)	(.94)		
3	3	.62	36.19	.28	16.80	.39	24.76	.32	20.20	.01	1.03	1.63	98.98
		(.32)	(9.74)	(.11)	(3.59)	(.11)	(7.08)	(.08)	(4.51)	(.02)	(1.45)		
4	4	.54	34.42	.24	15.38	.39	25.69	.33	21.11	.04	2.47	1.55	99.07
		(.17)	(4.28)	(.11)	(4.41)	(.07)	(3.61)	(.09)	(1.60)	(.04)	(2.10)		
5	1	.39	29.59	.20	14.97	.38	28.23	.31	23.13	.04	3.06	1.32	98.98
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.48	37.60	.22	17.09	.31	23.66	.25	19.04	.02	1.88		
		(.19)	(7.39)	(.09)	(3.88)	(.12)	(5.01)	(.11)	(5.74)	(.02)	(1.51)		

Table 42: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the plate for USDA yield grade and sex for F_1[a] lambs

USDA yield grade	n	Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	2	.36	47.78	.15	17.26	.12	14.07	.15	18.12	.02	1.70	.79	98.93
		(.09)	(11.00)	(.12)	(6.28)	(.07)	(1.77)	(.08)	(1.45)	(.02)	(1.20)		
2	7	.38	36.63	.19	17.80	.24	22.81	.22	19.66	.02	2.17	1.05	99.07
		(.10)	(5.35)	(.05)	(3.68)	(.04)	(3.15)	(.10)	(5.13)	(.02)	(2.05)		
3	1	.37	42.86	.18	21.16	.15	16.93	.15	17.99	.00	.00	.85	98.94
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.41	29.94	.25	18.86	.40	29.30	.26	20.21	.01	.65	1.33	98.96
		(.12)	(5.58)	(.03)	(2.44)	(.14)	(9.26)	(.11)	(9.17)	(.01)	(.88)		
5	1	.60	34.65	.28	16.27	.48	27.82	.36	20.73	.00	.00	1.72	99.48
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.40	36.62	.20	18.13	.27	23.32	.23	19.56	.02	1.42		
		(.10)	(7.82)	(.06)	(3.33)	(.13)	(7.06)	(.10)	(5.49)	(.02)	(1.68)		
Ewes													
1	3	.32	39.25	.16	19.32	.19	22.77	.13	15.76	.02	1.95	.82	99.05
		(.04)	(3.48)	(.01)	(3.55)	(.04)	(1.74)	(.06)	(4.88)	(.01)	(1.71)		
2	6	.35	35.76	.18	18.97	.26	27.06	.16	16.21	.01	1.30	.97	99.30
		(.11)	(7.79)	(.04)	(6.11)	(.08)	(8.13)	(.06)	(4.94)	(.02)	(1.77)		
3	2	.42	35.94	.18	15.35	.28	24.62	.24	20.59	.02	2.25	1.14	98.74
		(.16)	(1.21)	(.10)	(3.20)	(.08)	(1.46)	(.09)	(.24)	(.02)	(2.74)		
4	3	.43	31.76	.21	15.29	.37	27.86	.32	23.55	.01	.54	1.34	99.00
		(.04)	(1.24)	(.03)	(1.50)	(.07)	(6.29)	(.06)	(3.49)	(.01)	(.94)		
5	1	.60	29.04	.18	8.52	.61	29.48	.53	25.55	.14	6.55	2.06	99.13
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.39	35.23	.18	17.12	.30	26.20	.22	18.79	.02	1.76		
		(.11)	(5.72)	(.04)	(5.01)	(.12)	(5.86)	(.12)	(5.22)	(.03)	(2.07)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 43: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the plate for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean		Bone		Subcutaneous fat		Seam fat		Internal fat		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Wethers													
1	1	.47	47.71	.22	22.02	.18	18.35	.09	9.17	.03	2.75	.99	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.32	40.46	.16	20.11	.24	24.58	.09	12.70	.01	1.20	.83	99.06
		(.06)	(9.95)	(.04)	(2.98)	(.25)	(15.29)	(.03)	(6.70)	(.02)	(2.35)		
3	3	.34	33.51	.16	15.95	.27	25.85	.19	18.83	.05	5.20	1.02	99.35
		(.05)	(.44)	(.01)	(3.26)	(.07)	(3.39)	(.04)	(3.01)	(.03)	(2.94)		
4	4	.41	31.31	.17	13.22	.41	31.51	.27	19.98	.04	3.03	1.31	99.05
		(.05)	(4.61)	(.02)	(2.10)	(.04)	(2.64)	(.12)	(5.66)	(.05)	(3.03)		
5	2	.67	36.08	.29	15.52	.48	25.99	.39	20.86	.02	.95	1.85	99.40
		(.10)	(2.42)	(.06)	(1.84)	(.04)	(4.17)	(.02)	(.83)	(.01)	(.61)		
Average		.41	36.53	.19	16.96	.32	26.46	.20	16.72	.03	2.56		
		(.13)	(7.58)	(.05)	(3.89)	(.17)	(9.19)	(.12)	(6.11)	(.03)	(2.72)		
Ewes													
1	1	.17	35.19	.14	27.78	.10	19.44	.08	16.67	.00	.00	.49	99.07
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.27	39.01	.11	17.02	.16	24.14	.11	17.32	.01	1.54	.67	99.03
		(.10)	(7.83)	(.02)	(2.13)	(.04)	(4.90)	(.02)	(3.42)	(.01)	(2.35)		
3	4	.33	33.78	.19	19.66	.22	24.45	.14	16.26	.05	5.17	.93	99.31
		(.13)	(6.14)	(.09)	(4.44)	(.03)	(6.57)	(.03)	(6.17)	(.05)	(5.29)		
4	4	.46	34.63	.20	14.74	.30	22.02	.38	25.51	.03	2.04	1.37	98.94
		(.06)	(7.76)	(.06)	(1.72)	(.11)	(5.47)	(.24)	(11.00)	(.02)	(1.61)		
5	2	.49	33.73	.19	13.01	.42	30.65	.30	20.49	.03	1.94	1.43	99.82
		(.16)	(4.55)	(.08)	(2.81)	(.07)	(10.73)	(.09)	(2.46)	(.02)	(1.18)		
Average		.36	35.49	.17	17.30	.24	24.21	.22	19.60	.03	2.59		
		(.14)	(6.38)	(.07)	(4.51)	(.11)	(6.16)	(.17)	(7.24)	(.03)	(3.27)		

Table 44: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the plate for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Lean (kg):			
Breed	2	.13	8.27	.0005	Error
Sex	1	.03	1.80	.1829	Error
Yield grade	1	.55	33.94	.0001	Error
Residual error	83	.02			
Total	87	.02			
		Percentage lean:			
Breed	2	39.46	.98	.3799	Error
Sex	1	11.47	.28	.5950	Error
Yield grade	1	965.36	23.96	.0001	Error
Residual error	83	40.30			
Total	87	50.15			
		Bone (kg):			
Breed	2	.03	8.71	.0004	Error
Sex	1	.01	4.31	.0410	Error
Yield grade	1	.09	27.02	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage bone:			
Breed	2	2.02	.16	.8518	Error
Sex	1	8.69	.69	.4081	Error
Yield grade	1	280.77	22.32	.0001	Error
Residual error	83	12.58			
Total	87	15.40			

Table 44: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.03	3.77	.0272	Error
Sex	1	.03	3.04	.0849	Error
Yield grade	1	.83	91.82	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage subcutaneous fat:			
Breed	2	8.56	.22	.8006	Error
Sex	1	.37	.01	.9224	Error
Yield grade	1	369.88	9.63	.0026	Error
Residual error	83	38.40			
Total	87	41.11			
		Seam fat (kg):			
Breed	2	.04	4.10	.0200	Error
Sex	1	.00	.08	.7722	Error
Yield grade	1	.76	71.16	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage seam fat:			
Breed	2	36.38	1.25	.2915	Error
Sex	1	28.72	.99	.3231	Error
Yield grade	1	698.35	24.02	.0001	Error
Residual error	83	29.07			
Total	87	36.29			

Table 44: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Internal fat (kg):			
Breed	2	.00	.75	.4735	Error
Sex	1	.00	.49	.4867	Error
Yield grade	1	.01	8.09	.0056	Error
Residual error	83	.00			
Total	87	.00			
		Percentage internal fat:			
Breed	2	9.71	2.00	.1418	Error
Sex	1	3.45	.71	.4016	Error
Yield grade	1	4.33	.89	.3476	Error
Residual error	83	4.86			
Total	87	4.98			
		Total (kg):			
Breed	2	.81	9.65	.0002	Error
Sex	1	.22	2.65	.1076	Error
Yield grade	1	8.43	100.78	.0001	Error
Residual error	83	.08			
Total	87	.19			
		Total percentage:			
Breed	2	.16	.49	.6122	Error
Sex	1	.08	.23	.6319	Error
Yield grade	1	.01	.02	.8804	Error
Residual error	83	.33			
Total	87	.32			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

significant ($P < .01$) for bone weight, percentage seam fat, and percentage internal fat.

Tukey's mean separation was used to distinguish differences between the sexes and breeds. In the neck, Suffolks had a higher ($P < .05$) bone weight than the F_1 and Rambouillet lambs. No differences were seen between the sexes for the neck. Suffolks had higher ($P < .05$) lean, bone, and total weights and higher percentage subcutaneous fat than the Rambouillet lambs in the breast. Wethers had higher ($P < .05$) bone weights in the breast than did ewes.

Suffolks had higher ($P < .05$) bone and total weights for the shank than the F_1 lambs and were higher than the Rambouillets for lean weight, bone weight, total weight, and seam fat weight. In the shank, ewes were higher ($P < .05$) than wethers for percentage lean, but wethers were higher than ewes for bone weight and percentage bone. This concurs with Hammond (1932) who stated that at five months, the ewe has a higher proportion of meat and a lower proportion of bone than the wether.

For the plate, Suffolks were higher ($P < .05$) in lean and bone weights than the F_1 and were higher ($P < .05$) than the Rambouillets for lean weight, bone weight and total weight. No differences were seen between the sexes in the plate. Suffolks had higher lean and total weights than F_1 and Rambouillets in the flank (Table 48) and were higher than the Rambouillets for percentage lean, subcutaneous fat weight, internal fat weight and percentage internal fat. There were no significant differences between the sexes for the flank.

Tables 29 through 38 also depict general trends in the development of compositional tissues. Subcutaneous fat and seam generally increased as the yield grade increased. Percentage seam fat was high in the breast, plate, and the flank.

Table 45: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the flank for USDA yield grade and sex for Suffolk lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	3	.22	42.82	.02	2.94	.16	28.54	.06	11.84	.06	12.6	.52	99.10
		(.04)	(.89)	(.02)	(2.92)	(.11)	(15.75)	(.01)	(4.18)	(.05)	(12.78)		
2	3	.25	35.98	.02	2.59	.31	41.01	.13	18.71	.01	1.33	.72	99.62
		(.07)	(11.64)	(.01)	(1.80)	(.15)	(11.18)	(.03)	(2.41)	(.02)	(2.31)		
3	3	.30	33.33	.05	5.38	.37	40.52	.12	14.07	.05	6.42	.91	99.71
		(.09)	(.69)	(.03)	(2.18)	(.15)	(6.24)	(.02)	(3.71)	(.04)	(4.47)		
4	3	.48	39.57	.03	2.73	.28	22.67	.39	32.64	.03	1.88	1.21	99.50
		(.10)	(5.88)	(.02)	(1.91)	(.18)	(12.35)	(.13)	(10.76)	(.04)	(3.25)		
5	2	.42	40.53	.03	3.12	.45	43.64	.08	7.52	.05	4.96	1.03	99.77
		(.07)	(7.95)	(.02)	(1.98)	(.06)	(4.12)	(.01)	(.88)	(.07)	(7.01)		
Average		.33	38.30	.03	3.37	.30	34.68	.16	17.63	.04	5.55		
		(.12)	(6.63)	(.02)	(2.15)	(.15)	(12.63)	(.14)	(10.11)	(.04)	(7.39)		
Ewes													
1	1	.15	39.53	.00	.00	.15	39.53	.01	2.33	.07	18.60	.39	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.25	41.80	.02	2.74	.17	26.73	.11	17.80	.06	9.76	.61	98.83
		(.03)	(2.72)	(.01)	(2.00)	(.10)	(15.52)	(.05)	(6.46)	(.06)	(10.34)		
3	3	.33	37.59	.02	2.53	.29	33.87	.17	20.62	.05	4.38	.86	98.99
		(.14)	(12.25)	(.02)	(1.80)	(.20)	(24.62)	(.09)	(13.35)	(.08)	(6.45)		
4	4	.38	38.04	.03	3.14	.36	35.84	.21	20.36	.02	2.01	1.00	99.39
		(.08)	(4.17)	(.01)	(1.84)	(.07)	(5.87)	(.10)	(8.24)	(.03)	(3.76)		
5	1	.28	32.11	.05	5.79	.43	50.00	.07	8.42	.02	2.63	.85	98.95
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.30	38.97	.02	2.83	.27	33.44	.14	17.36	.04	6.51		
		(.10)	(6.07)	(.02)	(1.96)	(.14)	(14.78)	(.09)	(9.20)	(.05)	(8.15)		

Table 46: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the flank for USDA yield grade and sex for F1[a] lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	2	.23	44.46	.02	3.92	.13	26.05	.09	16.75	.05	8.81	.51	100.00
		(.02)	(3.53)	(.02)	(4.29)	(.03)	(6.09)	(.01)	(1.56)	(.00)	(.16)		
2	7	.21	36.49	.03	4.53	.19	31.39	.09	14.91	.07	12.26	.58	99.58
		(.05)	(5.14)	(.03)	(3.59)	(.12)	(16.85)	(.05)	(10.14)	(.04)	(7.81)		
3	1	.20	39.82	.00	.00	.29	57.52	.01	2.65	.00	.00	.51	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
4	4	.26	31.95	.03	4.09	.29	35.27	.20	23.52	.04	4.77	.83	99.60
		(.05)	(9.10)	(.02)	(2.19)	(.03)	(5.49)	(.13)	(10.16)	(.05)	(5.51)		
5	1	.48	42.00	.04	3.60	.26	23.20	.32	28.00	.03	2.40	1.12	99.20
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.24	36.93	.03	3.97	.22	32.91	.13	17.51	.05	8.33		
		(.08)	(6.90)	(.02)	(3.03)	(.10)	(13.79)	(.10)	(10.19)	(.04)	(7.18)		
Ewes													
1	3	.18	35.16	.01	3.03	.14	27.14	.03	7.18	.14	26.95	.50	99.45
		(.02)	(6.40)	(.02)	(3.91)	(.07)	(11.90)	(.03)	(6.29)	(.03)	(3.03)		
2	6	.20	36.67	.02	2.65	.20	33.74	.06	11.87	.07	14.40	.55	99.33
		(.04)	(4.89)	(.02)	(4.26)	(.14)	(18.40)	(.02)	(5.57)	(.08)	(15.00)		
3	2	.21	32.08	.02	3.05	.27	43.69	.10	14.49	.04	6.69	.64	100.00
		(.08)	(2.05)	(.03)	(3.04)	(.04)	(7.01)	(.07)	(6.48)	(.02)	(4.55)		
4	3	.29	33.83	.01	1.35	.37	43.08	.15	17.82	.02	2.86	.85	98.94
		(.02)	(1.27)	(.01)	(.91)	(.06)	(5.56)	(.09)	(9.96)	(.03)	(3.81)		
5	1	.44	31.89	.01	.66	.51	37.21	.34	24.92	.07	4.98	1.36	99.67
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
Average		.23	34.87	.01	2.39	.25	35.84	.10	13.34	.07	12.95		
		(.08)	(4.28)	(.02)	(3.17)	(.14)	(13.69)	(.09)	(7.55)	(.06)	(12.65)		

[a] Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

Table 47: Means and standard deviations segmented by dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the flank for USDA yield grade and sex for Commercial Rambouillet lambs

USDA yield grade	n	Lean kg	Lean %	Bone kg	Bone %	Subcutaneous fat kg	Subcutaneous fat %	Seam fat kg	Seam fat %	Internal fat kg	Internal fat %	Total kg	Total %
Wethers													
1	1	.14	37.35	.02	6.02	.11	30.12	.06	15.66	.04	10.84	.38	100.00
		(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	5	.21	38.51	.01	1.44	.15	25.59	.10	15.74	.10	17.77	.57	99.05
		(.05)	(9.85)	(.01)	(1.50)	(.10)	(15.17)	(.08)	(5.80)	(.06)	(8.45)		
3	3	.20	33.44	.03	4.45	.23	37.45	.08	11.88	.07	12.02	.60	99.24
		(.00)	(5.20)	(.01)	(1.74)	(.10)	(10.05)	(.05)	(6.81)	(.05)	(9.86)		
4	4	.24	32.17	.02	2.20	.34	45.02	.10	12.75	.05	7.04	.75	99.20
		(.07)	(8.54)	(.01)	(.64)	(.09)	(10.17)	(.05)	(5.50)	(.04)	(4.81)		
5	2	.36	37.26	.03	3.54	.10	10.38	.27	28.07	.20	20.28	.96	99.53
		(.01)	(1.33)	(.00)	(.33)	(.06)	(6.67)	(.12)	(12.34)	(.04)	(4.67)		
Average		.23	35.56	.02	2.83	.21	31.42	.11	15.81	.09	13.63		
		(.07)	(7.44)	(.01)	(1.83)	(.12)	(15.55)	(.09)	(7.81)	(.07)	(8.17)		
Ewes													
1	1	.12	30.68	.004	1.14	.26	64.77	.01	2.27	.00	.00	.394	98.86
		(--)	(--).	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)		
2	4	.15	32.55	.02	5.63	.18	43.15	.05	10.34	.04	7.52	.44	99.20
		(.05)	(5.99)	(.01)	(2.31)	(.03)	(13.08)	(.02)	(4.31)	(.06)	(11.23)		
3	4	.17	34.00	.02	4.79	.11	23.05	.09	16.78	.11	21.12	.50	99.74
		(.05)	(4.12)	(.02)	(4.22)	(.02)	(5.94)	(.02)	(2.76)	(.04)	(5.07)		
4	4	.24	32.08	.02	3.34	.21	29.48	.14	17.12	.14	17.98	.75	100.00
		(.07)	(3.23)	(.01)	(1.79)	(.07)	(11.54)	(.14)	(13.35)	(.05)	(2.87)		
5	2	.27	31.53	.04	5.20	.29	37.85	.15	16.46	.08	8.71	.85	99.76
		(.13)	(9.02)	(.00)	(1.32)	(.23)	(34.10)	(.19)	(18.94)	(.07)	(7.12)		
Average		.19	32.55	.03	4.44	.19	34.88	.09	14.14	.09	13.59		
		(.08)	(4.52)	(.01)	(2.72)	(.09)	(16.99)	(.10)	(9.43)	(.06)	(9.31)		

Table 48: ANOVA for dissectable lean, bone, subcutaneous fat, seam fat, and internal fat from the flank for Suffolk, F_1[a], and Commercial Rambouillet lambs

Model/ source of variation[b]	df	MS	F	P	Error term
		Lean (kg):			
Breed	2	.09	21.40	.0001	Error
Sex	1	.01	3.11	.0814	Error
Yield grade	1	.29	66.84	.0001	Error
Residual error	83	.00			
Total	87	.01			
		Percentage lean:			
Breed	2	143.92	4.03	.0214	Error
Sex	1	50.59	1.42	.2374	Error
Yield grade	1	123.30	3.45	.0667	Error
Residual error	83	35.72			
Total	87	39.59			
		Bone (kg):			
Breed	2	.00	.74	.4824	Error
Sex	1	.00	1.44	.2340	Error
Yield grade	1	.00	8.49	.0046	Error
Residual error	83	.00			
Total	87	.00			
		Percentage bone:			
Breed	2	2.35	.34	.7114	Error
Sex	1	.57	.08	.7745	Error
Yield grade	1	.06	.01	.9239	Error
Residual error	83	6.86			
Total	87	6.61			

Table 48: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Subcutaneous fat (kg):			
Breed	2	.07	5.79	.0044	Error
Sex	1	.00	.06	.8034	Error
Yield grade	1	.33	26.96	.0001	Error
Residual error	83	.01			
Total	87	.02			
		Percentage subcutaneous fat:			
Breed	2	19.48	.09	.9126	Error
Sex	1	70.28	.33	.5669	Error
Yield grade	1	73.94	.35	.5570	Error
Residual error	83	212.62			
Total	87	204.78			
		Seam fat (kg):			
Breed	2	.02	3.24	.0441	Error
Sex	1	.01	1.65	.2022	Error
Yield grade	1	.25	33.42	.0001	Error
Residual error	83	.01			
Total	87	.01			
		Percentage seam fat:			
Breed	2	66.12	.90	.4101	Error
Sex	1	94.74	1.29	.2592	Error
Yield grade	1	746.54	10.17	.0020	Error
Residual error	83	73.39			
Total	87	80.88			
		Internal fat (kg):			
Breed	2	.02	5.50	.0057	Error
Sex	1	.00	.33	.5647	Error
Yield grade	1	.00	.11	.7367	Error
Residual error	83	.00			
Total	87	.00			

Table 48: Continued

Model/ source of variation[b]	df	MS	F	P	Error term
		Percentage internal fat:			
Breed	2	465.04	6.25	.0030	Error
Sex	1	76.78	1.03	.3126	Error
Yield grade	1	599.21	8.06	.0057	Error
Residual error	83	74.38			
Total	87	88.40			
		Total (kg):			
Breed	2	.37	15.09	.0001	Error
Sex	1	.06	2.43	.1230	Error
Yield grade	1	2.69	110.66	.0001	Error
Residual error	83	.02			
Total	87	.06			
		Total percentage:			
Breed	2	.32	1.05	.3533	Error
Sex	1	.21	.68	.4128	Error
Yield grade	1	.35	1.15	.2872	Error
Residual error	83	.30			
Total	87	.30			

[a]Finewool first cross offspring of Suffolk sires and Commercial Rambouillet dams.

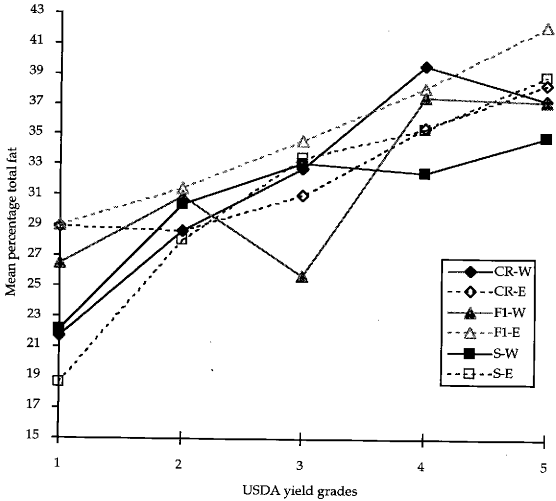
[b]Initially, the breed X sex, yield grade X breed, yield grade X sex, yield grade X breed X sex effects were also partitioned. However, upon analysis, these terms were shown to be highly insignificant and were therefore pooled with the appropriate error term.

Mean Analysis of Tissue Composition. Means for percentages of compositional tissues were generated by yield grades using the general linear model with breed, sex, and the breed X sex interaction. These means were then utilized to develop charts to report the development of the compositional tissues across the yield grades.

Figure 1 reports the mean analysis for percentage total fat in the carcass for Suffolks, F1s, and Commercial Rambouillet sheep. The percentage total fat generally increases as you move across the five yield grades. This observance is consistent with information presented by Judge *et al.* (1989). The only significant difference ($P < .05$) seen was for breed effect for yield grade one carcasses. However, Figure 1 does reveal the high variability in percentage fat both across the yield grades and within each individual yield grade.

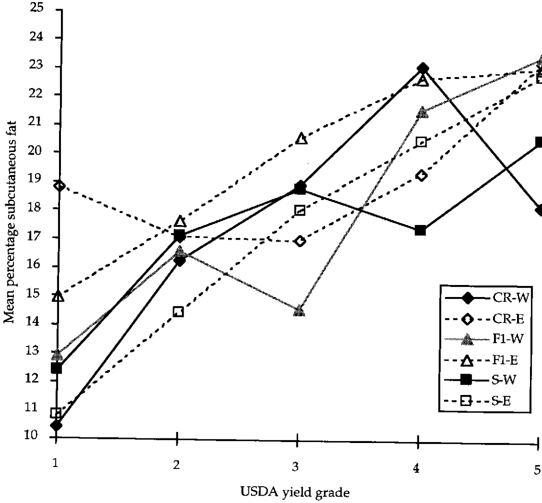
Mean analysis for percentage subcutaneous fat is reported in Figure 2. Results show that there are significant differences ($P < .01$) for breed, sex, and breed X sex effects within yield grade one. For yield grade four carcasses, significant differences are again seen, $P < .05$ for breed effect and $P < .01$ for breed X sex effect. Subcutaneous fat was highly variable within and across the yield grades. The highest variability was seen in yield grade one and yield grade four carcasses.

Percentage seam fat analysis is revealed in Figure 3. Results showed that there was a highly significant difference ($P < .01$) for breed effect in yield grade two carcasses. Seam fat generally started out low and gradually increased across the yield grades. Figure 3 also depicts the variability between carcasses within the same yield grade.



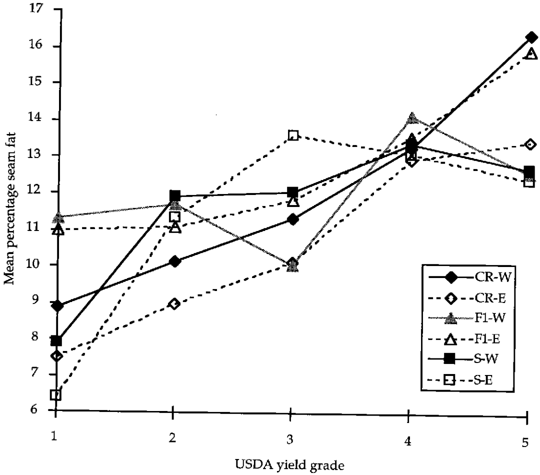
[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 1: Analysis for mean percentage total fat by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 2: Analysis for mean percentage subcutaneous fat by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

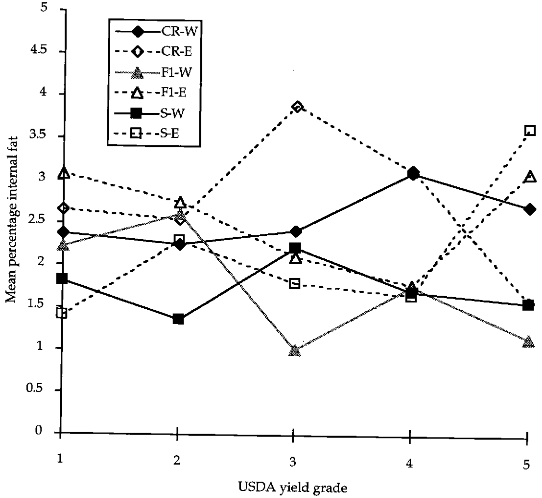
Figure 3: Analysis for mean percentage seam fat by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

Figure 4 reports percentage internal fat analysis. Yield grade one carcasses were significantly different ($P < .05$) for breed effect and yield grade four carcasses were highly significant ($P < .001$) for breed effect. Internal fat tends to highly variable across all yield grades and percentage internal fat remains basically stable across all five yield grades.

Figure 5 reveals the mean analysis for percentage lean found in Suffolk, F_1, and Commercial Rambouillet lambs. Breed was significant ($P < .05$) for yield grade one carcasses. Percentage lean decreases as the yield grades increase. This coincides with the statement by Judge *et al.* (1989) that muscle mass increases during growth but its proportion of carcass weight decreases.

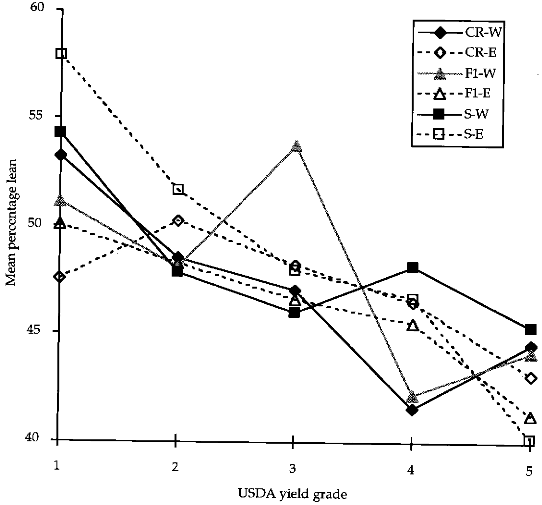
Percentage bone means are depicted in Figure 6. Significant differences were seen in yield grade two carcasses for breed effect ($P <.05$) and for sex effect ($P < .01$). Yield grade four carcasses were significant for sex ($P < .01$) and yield grade five carcasses were significant for breed ($P < .05$). Generally the ewes lambs tended to be lower in percentage bone than the wether lambs. As the yield grades increased, the percentage bone decreased, which concurs with Judge *et al.* (1989).

Regression Equation Analysis. Regression equations were used to predict compositional development of tissues. Table 49 contains the equation used to predict percentage total fat found in a carcass given actual fat thickness. The equation used was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent total fat, μ is 20.29, s_i is the effect of breed, p_j is the effect of sex, q_k is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. This equation explained 68% of the variation in the prediction of percentage total fat. Data for percentage total fat (Table 49)



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 4: Analysis of mean percentage internal fat by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 5: Analysis of mean percentage lean by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

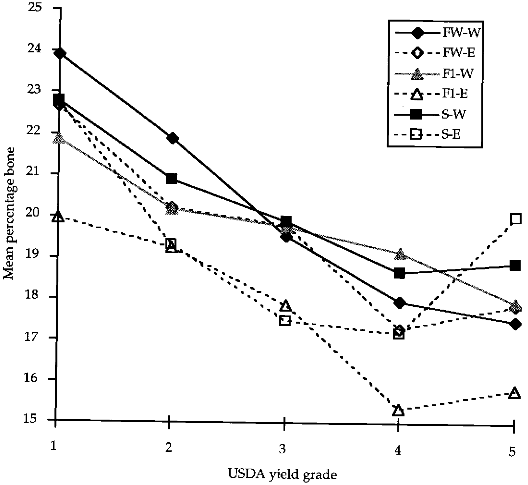


Figure 6: Analysis of mean percentage bone by USDA yield grade for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

Table 49: Regression equation for estimated percentage total fat for Suffolk, F1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

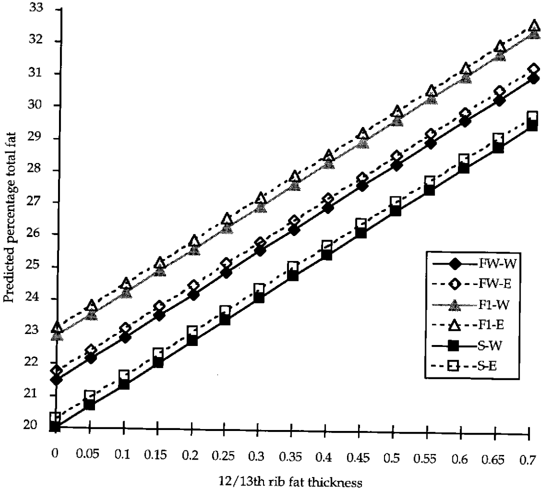
Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F1	2.86***
Rambouillet	1.47*
Sex (p_j)	
Wethers	-.28
Ewes	0
Actual fat thickness[c] ($q_{k(x)}$)	13.71***

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 20.29 + s_i + p_j + q_{k(x)} + e_{i,j,k} \sim N(\emptyset, \sigma^2)$ $R^2 = .68$ RMSE = 3.04
[c]Fat thickness measured at the 12th/13th rib.
*P<.1, **P<.05, ***P<.001

indicates that actual fat thickness was significant ($P < .001$) and had the most influence on the equation. Data indicate that the F_1 is 2.86 percentage points ($P < .001$) above the Suffolks and the Commercial Rambouillets are 1.47 percentage points ($P < .1$) above the Suffolks for percentage total fat. Figure 7 depicts these differences between the breeds and sexes.

The equation used to predict percentage subcutaneous fat (Table 50) was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent subcutaneous fat, μ is 10.45, s_i is the effect of breed, p_j is the effect of sex, q_k is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. The equation explained 55% of the variation found in subcutaneous fat. This indicates that subcutaneous fat thickness varies dramatically over the lamb carcass. Data in Table 50 show that again fat thickness was significant ($P < .001$) and had the greatest effect on the equation. In addition, the F_1 was 1.75 percentage points ($P < .05$) above the Suffolk for subcutaneous fat. These differences can be seen in Figure 8.

The equation used to predict percentage seam fat (Table 51) was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent seam fat, μ is 7.54, s_i is the effect of breed, p_j is the effect of sex, $q_k(x)$ is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. This equation explains 46% of the variation in seam fat. Table 51 data shows that actual fat thickness at the 12th rib was significant ($P < .001$) and had the greatest impact on the equation. None of the other variables had a significant effect on the equation. Figure 9 depicts the change in seam fat across increasing fat thicknesses.



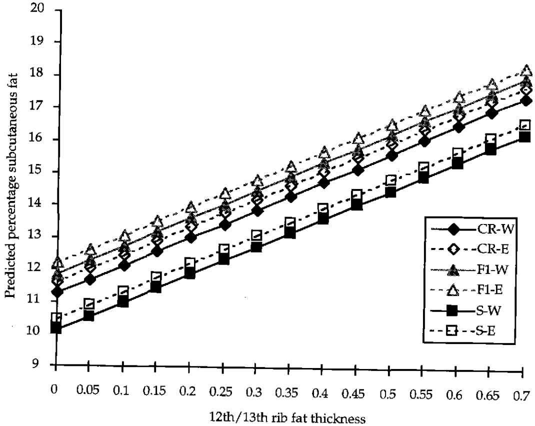
[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 7: Estimated percentage total fat given actual fat thickness at the 12/13th rib for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

Table 50: Regression equation for estimated percentage subcutaneous fat for Suffolk, F1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F1	1.75**
Rambouillet	1.14
Sex (p_j)	
Wethers	-.34
Ewes	0
Actual fat thickness[c] ($q_k(x)$)	8.82***

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 10.45 + s_i + p_j + q_k(x) + e_{i,j,k} \sim N(\emptyset, \sigma^2)$ $R^2 = .55$ RMSE = 2.61
[c]Fat thickness measured at the 12th/13th rib.
*P<.1, **P<.05, ***P<.001



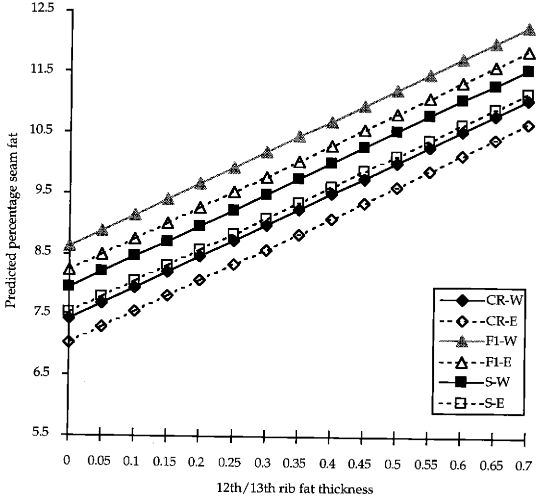
[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 8: Estimated percentage subcutaneous fat given actual fat thickness at the 12/13th rib in Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

Table 51: Regression equation for estimated percentage seam fat for Suffolk, F1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F1	.69
Rambouillet	-.51
Sex (p_j)	
Wethers	.40
Ewes	0
Actual fat thickness[c] ($q_k(x)$)	5.20***

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 7.54 + s_i + p_j + q_k(x) + e_{i,j,k} \sim N(\emptyset, \sigma^2)$ $R^2 = .46$ RMSE = 1.80
[c]Fat thickness measured at the 12th/13th rib.
*P<.1, **P<.05, ***P<.001



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 9: Estimated percentage seam fat given actual fat thickness at the 12/13th rib for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

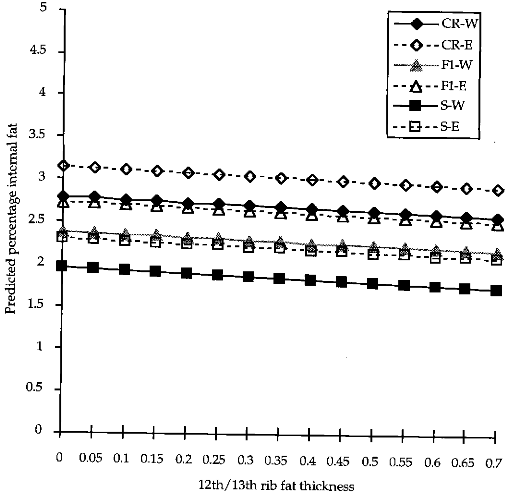
The equation used to predict percentage internal fat (Table 52) was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent internal fat, μ is 2.30, s_i is the effect of breed, p_j is the effect of sex, $q_k(x)$ is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. This equation accounts for 18% of the variation in internal fat. This indicates that internal fat is extremely variable and difficult to predict. Data in Table 52 and Figure 10 shows that breed was significant for F_1 ($P < .1$) which was .43 percentage points above the Suffolks and Rambouillet ($P < .001$) which was .84 percentage points above the Suffolks. This supports (Berg and Walters, 1983; Boggs and Merkel, 1993; Wood *et al.*, 1980) the theory that maternal breeds of sheep develop higher percentage of internal fat than sire breeds. Crouse *et al.*, (1981) also stated that Rambouillet-sired lambs had higher percentages of internal fat than Suffolk-sired lambs. Sex was also significant in the wethers at ($P < .1$) which were .35 percentage points below the ewes. Hammond (1932) states that ewes tends to be slightly higher in kidney fat than wethers.

The equation used to predict percentage lean (Table 53) was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent lean, μ is 56.37, s_i is the effect of breed, p_j is the effect of sex, $q_k(x)$ is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. The equation explains 54% of the variation in percentage lean found in the carcass. Actual fat thickness has the greatest influence and is significant at $P < .001$. Also, breed played an important role, with F_1 2.20 percentage points ($P < .01$) below the Suffolks for lean and Rambouillet 1.65 percentage points ($P < .05$) below the Suffolks for lean. These differences can be seen in Figure 11. Hammond (1932)

Table 52: Regression equation for estimated percentage internal fat for Suffolk, F1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F1	.43*
Rambouillet	.84***
Sex (p_j)	
Wethers	-.35*
Ewes	0
Actual fat thickness[c] ($q_k(x)$)	-.30

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 2.30 + s_i + p_j + q_k(x) + e_{i,j,k} \sim N(\varnothing, \sigma^2)$ $R^2 = .18$ RMSE = .84
[c]Fat thickness measured at the 12th/13th rib.
*P<.1, **P<.05, ***P<.001



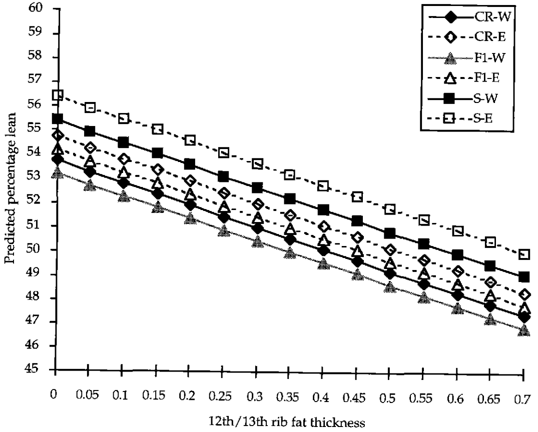
[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 10: Estimated percentage internal fat given actual fat thickness at the 12/13th rib for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

Table 53: Regression equation for estimated percentage lean for Suffolk, F1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F1	-2.20**
Rambouillet	-1.65*
Sex (p_j)	
Wethers	-.99
Ewes	0
Actual fat thickness[c] ($q_k(x)$)	-9.04***

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 56.37 + s_i + p_j + q_k(x) + e_{i,j,k} \sim N(\varnothing, \sigma^2)$ $R^2 = .54$ RMSE = 2.77
[c]Fat thickness measured at the 12th/13th rib.
*P<.05, **P<.01, ***P<.001



aFinewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 11: Estimated percentage lean given actual fat thickness at the 12/13th rib for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

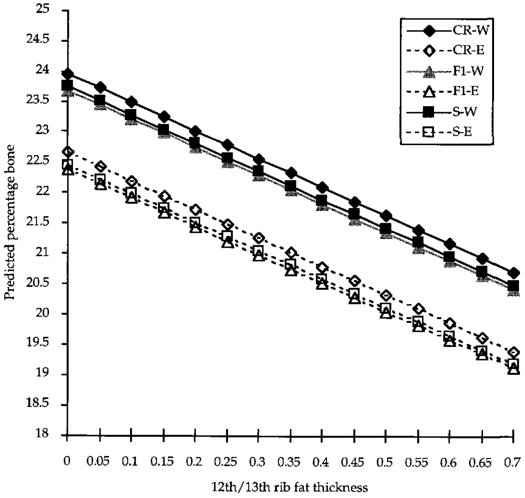
stated that at five months of age the ewe had a higher percentage meat and a lower percentage bone than wethers.

The equation used to predict percentage bone (Table 54) was $y = \mu + s_i + p_j + q_k(x) + e_{ijk}$ where y is the predicted percent bone, μ is 22.44, s_i is the effect of breed, p_j is the effect of sex, $q_k(x)$ is the regression coefficient, x is the actual fat thickness at the 12/13th rib, and e_{ijk} is the error term which was assumed to be approximately normally distributed with mean 0 and variance σ^2. This equation accounts for 63% of the variation in percentage bone. Data included in Table 54 indicate that actual fat thickness and sex play important roles in determining percent bone in the equation. Fat thickness and sex have a significant effect ($P < .001$ and $P < .001$, respectively). Figure 12 shows the wethers were 1.30 percentage points above the ewes. Breed also was significant in the F_1 ($P < .05$), which was .69 percentage points below the Suffolks.

Table 54: Regression equation for estimated percentage bone for Suffolk, F_1[a], and Commercial Rambouillet lambs given actual fat thickness at the 12/13th rib

Variable	Percentage fat[b]
Breed (s_i)	
Suffolk	0
F_1	-.69**
Rambouillet	.21
Sex (p_j)	
Wethers	1.30***
Ewes	0
Actual fat thickness ($q_k(x)$)[c]	-4.64***

[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.
[b]$y = 22.44 + s_i + p_j + q_k(x) + e_{i,j,k} \sim N(\emptyset, \sigma^2)$ $R^2 = .63$ RMSE = 1.27
[c]Fat thickness measured at the 12th/13th rib.
*P<.1, **P<.05, ***P<.001



[a]Finewool first cross offspring of Suffolk sires and Rambouillet dams.

Figure 12: Estimated percentage bone given actual fat thickness at the 12/13th rib for Suffolk, F1[a], and Commercial Rambouillet wethers and ewes

CONCLUSION

Currently the USDA yield grade equation uses only one measurement to predict percent cutability, adjusted 12th rib fat thickness. Results from this study show that fat develops differently in various areas of the body. This study also reveals differences between breeds and sexes in fat development.

Mean analysis of variance of the subprimals revealed that there were significant differences between breeds for lean and bone for virtually all subprimals. Sex was significant for bone in most subprimals. Mean analysis depicts the variation in percentage lean, bone, and fat (subcutaneous, internal, and seam) within the current yield grades. This indicates that the current cutability prediction system does not accurately predict cutability for all breeds and sexes. Yield grading can accurately predict percent cutability only when highly correlated factors are utilized in the equation.

Regression equations to predict percentage fat, lean , and bone revealed that the Suffolks had the least total fat and subcutaneous fat followed by the Commercial Rambouillet and then the F_1 lambs. The Commercial Rambouillet lambs had the least seam fat followed by the Suffolks and then the F_1. However, the Suffolks had the least internal fat and the Commercial Rambouillet lambs had the most internal fat. This supports the theory (Berg and Walters, 1983; Boggs and Merkel, 1993; Wood *et al.*, 1980) that maternal breeds of sheep develop higher percentage of internal fat than sire breeds. Crouse *et al.*, (1981) also stated that Rambouillet-sired lambs had higher percentages of internal fat than Suffolk-sired lambs. Ewe lamb carcasses were slightly higher than wether carcasses for total fat, subcutaneous fat, and internal fat. This is supported by Tatum *et al.*, (1989) which stated that carcasses from ewe lambs had more external and internal fat than carcasses from wether lambs. The cross-bred lambs seemed to be fatter than their parent breeds for all fat depots with the exception of internal fat.

The Suffolk ewes followed by the Suffolk wethers had the highest percentages of lean. The Suffolks were followed by the Commercial Rambouillet and F_1 ewes and then the Commercial Rambouillet and F_1 wethers for percentage lean. Wether carcasses had more bone than their female counterparts.

IMPLICATIONS

Today the consumer dictates demand for red meat products, and the consumer wants a lean, uniform, convenient product. Overfat lamb carcasses and uniformity are still major problems haunting the lamb industry. The production of leaner slaughter lambs may provide an opportunity to improve lamb merchandising. This must be accomplished for the lamb industry to keep stride with competitive meat products.

My purpose for this study was to discover the way in which fat is being deposited in breeds of sheep that play an important role in the Texas lamb industry. Some of the results of this study vary from what has historically been considered fattening patterns in Rambouillet and Rambouillet cross-bred lambs. I also wanted to document the variability seen between carcasses within the same yield grades. Variation in the current yield grading system can be explained to some extent by the variation in the backgrounding methods used in the lamb industry. Currently, carcasses from lambs fattened on grass and lambs fattened on high concentrated diets in feedlots are marketed together. These different feeding systems affect fat deposition and thus, affect the final yield grade and cutability of the carcass (Tatum *et al.*, 1989; Crouse *et al.*, 1981). However, this study documents variation seen in lambs with similar backgrounding.

Research indicates the need to use multiple measurements to accurately indicate fatness in lamb carcasses. An associated study will look at the correlation between various carcass measurements and retail cutability. Due to the breed and sex effects on cutability that were seen in this study, the need to develop separate prediction equations for different breeds and sexes to accurately predict cutability will be addressed by the associated study.

However, the need to develop a new system to predict percent cutability may not be the only change needed in the lamb industry to reduce fat. There is a tendency in the industry to feed small-framed, early-maturing lambs to higher levels of fat in order to increase carcass weight and improve dressing percent. The dressing percent marketing system allows the industry to pass excessive, unwanted fat down the chain to the consumer. Pricing based on dressing percentage and live weight rewards increases in fat rather than compensating producers for superior cutability carcasses. This system of pricing discriminates against large frame, late-maturing lambs which are capable of producing lean, heavy carcasses. This indicates that the marketing system used today does not accurately segment carcasses if the ultimate endpoint is the production of closely-trimmed retail cuts. Pressure from consumers and retailers may force the lamb industry to adopt a new system where cutability is a high priority.

LITERATURE CITED

Belk, K. E., J. W. Savell, S. K. Davis, J. F. Taylor, J. E. Womack, and S. B. Smith. 1993. Tissue-specific activity of pentose cycle oxidative enzymes during feeder lamb development. J. Anim. Sci. 71:1795.

Berg, R. T., and R. M. Butterfield. 1976. New Concepts of Cattle Growth. Sydney University Press.

Berg, R. T., and L. E. Walters. 1983. The meat animal: Changes and challenges. J. Anim. Sci. 57:133.

Bidner, T. D., P. E. Humes, R. Boulware, and P. E. Schilling. 1978 Characterization of ram and ewe breeds. II. Growth and carcass traits. J. Anim. Sci. 47:114.

Boggs, D. L. and R. A. Merkel. 1993. Live animal carcass evaluation and selection manual (4th Ed.). Kendall/Hunt, Dubque, IA.

Briggs, H. M. 1958. Modern Breeds of Livestock (Revised Ed.). The Macmillan Company, New York.

Butler-Hogg, B. W. 1984. The growth of Clun and Southdown sheep: body composition and the partitioning of fat. Anim. Prod. 39:405.

Butterfield, R. M. 1988. New Concepts of Sheep Growth. Griffin Press Limited, Netley, South Australia.

Carpenter, Z. L. 1966. What is consumer-preferred lamb? J. Anim. Sci. 25:1232.

Crouse, J. D., J. R. Busboom, R. A. Field, and C. L. Ferrell. 1981. The effects of breed, diet, sex, location and slaughter weight on lamb growth, carcass composition and meat flavor. J. Anim. Sci. 53:376.

Dickerson, G. E., H. A. Glimp, H. J. Tuma, and K. E. Gregory. 1972 Genetic resources for efficient meat production in sheep. Growth and carcass characteristics of ram lambs of seven breeds. J. Anim. Sci. 34:940.

Edwards, J. W., R. C. Cannell, R. P. Garrett, J. W. Savell, H. R. Cross, and M. T. Longnecker. 1989. Using ultrasound, linear measurements and live fat thickness estimates to determine the carcass composition of market lambs. J. Anim. Sci. 67:3322.

Fourie, P. D., A. H. Kirton, and K. E. Jury. 1970. Growth and development of sheep. II. New Zealand J. Agr. Sci. 13:753.

Garrett, R. P. 1988. Role of yield grade and carcass weight on the cutability of lamb carcasses at multiple trim levels and fabrication styles. M. S. Thesis, Texas A&M University, College Station.

Garrett, R. P., J. W. Savell, S. G. May, H. K. Johnson, and H. R. Cross. 1990. Role of yield grade and carcass weight on the composition of lamb carcasses. J. Anim. Sci. 68:1299.

Hammond, J. 1932. Growth and the Development of Mutton Qualities in the Sheep (2nd Ed.). Oliver and Boyd, Edinburgh, Scotland.

Hohenboken, W. 1977. Genetic and environmental effects on postweaning growth and carcass merit of crossbred lambs. J. Anim. Sci. 61:98.

Johnson, H. K. 1975. What's the opportunity with lamb? Lamb Marketing Seminars: An update on marketing systems. American Sheep Producers Council, Inc., Englewood, CO. p. 65.

Judge, M. D., E. D. Aberle, J. C. Forrest, H. B. Hedrick, R. A. Merkel. 1989. Principles of Meat Science (2nd Ed.). Kendell/Hunt Publishing Company, Dubuque, IA.

Kempster, A. J. 1981. Fat partition and distribution in the carcasses of cattle, sheep, and pigs. A review. Meat Sci. 5:83.

Lirette, A., J. R. Seoane, F. Minvielle, and D. Froehlich. 1984. Effects of breed and castration on conformation, classification, tissue distribution, composition and quality of lamb carcasses. J. Anim. Sci. 58:1343.

Oliver, W. M., Z. L. Carpenter, G. T. King, and J. M. Shelton. 1967. Qualitative and quantitative characteristics of ram, wether and ewe lamb carcasses. J. Anim. Sci. 26:307.

SAS. 1991. SAS User's Guide: Statistics (4th Ed.). SAS Institute, Inc., Cary, NC.

Savell, J. W., and H. R. Cross. 1991. Reassessment of significant factors influencing carcase composition. In: R. A. Lawrie (Ed.) Developments in Meat Science - 5. p. 1. Elsevier Applied Science. London and New York.

Shelton, M., and Z. L. Carpenter. 1972. Influence of sex, Stilbestrol treatment and slaughter weight on performance and carcass traits of slaughter lambs. J. Anim. Sci. 34:203.

SID. 1988. Sheep Production Handbook. American Sheep Industry Association, Englewood, CO.

Smith, G. C., Z. L. Carpenter, and G. T. King. 1969. Ovine carcass cutability. J. Anim. Sci. 29:272.

Smith, G. C., and Z. L. Carpenter. 1973. Estimations of lamb carcass cutability within narrow ranges of weight and fat thickness. J. Anim. Sci. 36:432.

Smith, S. B., T. J. Jenkins, and R. L. Prior. 1987. Carcass composition and adipose tissue metabolism in growing sheep. J. Anim. Sci. 65:1525.

Smith, S. B. 1988. Adipose tissue growth in livestock species. Proc. Int. Cong. Meat Science and Technology 34. p. 23.

Tatum, J. D., J. W. Savell, H. R. Cross, and J. G. Butler. 1989. A national survey of lamb cutability traits. SID Res. J. 5(1):23.

USDA. 1992. Official United States standards for grades of lamb, yearling mutton, and mutton carcasses. USDA-AMS, Washington, DC.

Williams, G. W. (Ed.). 1991. Assessment of Marketing Strategies to Enhance Returns to Lamb Producers. In: Texas Agricultural Market Research Center Report. TARMC Lamb Study Team, TARMC Commodity Market Research Report No. CM-1-91, TX.

Wood, J. D., H. J. H. MacFie, R. W. Pomeroy, and D. J. Twinn. 1980. Carcass composition in four sheep breeds, the importance of type of breed and stage of maturity. Anim. Prod. 30:135.

APPENDICES

APPENDIX A

LAMB CUTABILITY PROJECT

CARCASS DATA WORKSHEET

Animal Number:______ Date of Measurements:____

WEIGHTS

Hot Carcass Weight:_____ Cold Carcass Weight:_____

REA: _______________
R. REA:_____ L. REA:___

Leg Score:_______ QG:______

FAT THICKNESS PREDICTORS

PROBES: (Unribbed/Ribbed)

12th Rib Fat Thickness: __________
Shoulder Pocket: __________
Loin Edge (3" lateral): __________
Flank: __________
Body Wall Thickness (2" lateral):_______

Breast Fat: __________
Neck Fat: __________
Sirloin: __________
Dock Fat: __________

CIRCUMFERENCE MEASUREMENTS

Leg Conformation:______
Leg Width:___________

Shoulder Circumference:_______
Loin Circumference:__________

APPENDIX B

CARCASS DISSECTION SHEET-LAMB

Animal # ______

Cold Side Wt.______

Foresaddle Wt._
Hindsaddle Wt.______

Rough Shoulder___
Rough Rack ______
Rough Loin ______
Rough Leg ______
Neck ______
Breasts ______
Shanks ______

Plates

______

Flanks ______
Kidney Knob ______
Kidneys ______

TOTAL ______
Addition % ______

NECK--

RIGHT WT ______

Lean Tissue ______
External Fat ______
Seam Fat ______
Internal Fat ______
Bone ______
H. C. Tissue ______

TOTAL ______
Addition % ______

LEFT WT. ______

Lean Tissue ______
External Fat ______
Seam Fat ______
Internal Fat ______
Bone ______
H. C. Tissue ______

TOTAL ______
Addition % ______

BREAST--

RIGHT WT ______

Lean Tissue ______
External Fat ______
Seam Fat ______
Internal Fat ______
Bone ______
H. C. Tissue ______

TOTAL ______
Addition % ______

LEFT WT. ______

Lean Tissue ______
External Fat ______
Seam Fat ______
Internal Fat ______
Bone ______
H. C. Tissue ______

TOTAL ______
Addition % ______

______

Left side cuts were used in an additional study which will be discussed at a later date.

SHANKS--

RIGHT WT	________	**LEFT** WT.	________
Lean Tissue	________	Lean Tissue	________
External Fat	________	External Fat	________
Seam Fat	________	Seam Fat	________
Internal Fat	________	Internal Fat	________
Bone	________	Bone	________
H. C. Tissue	________	H. C. Tissue	________
TOTAL	________	TOTAL	________
Addition %	________	Addition %	________

PLATES--

RIGHT WT	________	**LEFT** WT.	________
Lean Tissue	________	Lean Tissue	________
External Fat	________	External Fat	________
Seam Fat	________	Seam Fat	________
Internal Fat	________	Internal Fat	________
Bone	________	Bone	________
H. C. Tissue	________	H. C. Tissue	________
TOTAL	________	TOTAL	________
Addition %	________	Addition %	________

FLANKS--

RIGHT WT	________	**LEFT** WT.	________
Lean Tissue	________	Lean Tissue	________
External Fat	________	External Fat	________
Seam Fat	________	Seam Fat	________
Internal Fat	________	Internal Fat	________
Bone	________	Bone	________
H. C. Tissue	________	H. C. Tissue	________
TOTAL	________	TOTAL	________
Addition %	________	Addition %	________

SHOULDERS--

RIGHT WT	________	**LEFT** WT.	________
Lean Trim	________	Rolled Shoulder	________
External Fat	________	Lean Trim	________
Seam Fat	________	External Fat	________
Internal Fat	________	Seam Fat	________
Bone	________	Internal Fat	________
H. C. Tissue	________	Bone	________
		H.C. Tissue	________
TOTAL	________	TOTAL	________
Addition %	________	Addition %	________

RACKS--

RIGHT WT	________	**LEFT** WT.	________
Lean Trim	________	Rough chops__	
External Fat	________	1/8" chops	________
Seam Fat	________	Lean Trim	________
Internal Fat	________	External Fat	________
Bone	________	Seam Fat	________
H. C. Tissue	________	Internal Fat	________
TOTAL	________	Bone	________
Addition %	________	H.C. Tissue	________
		TOTAL	________
		Addition %	________

LOINS--

RIGHT WT	________	**LEFT** WT.	________
Lean Trim	________	Rough chops__	
External Fat	________	1/8" chops	________
Seam Fat	________	Lean Trim	________
Internal Fat	________	External Fat	________
Bone	________	Seam Fat	________
H. C. Tissue	________	Internal Fat	________
TOTAL	________	Bone	________
Addition %	________	H.C. Tissue	________
		TOTAL	________
		Addition %	________

LEGS–

RIGHT WT	______
Lean Trim	______
External Fat	______
Seam Fat	______
Internal Fat	______
Bone	______
H. C. Tissue	______
TOTAL	______
Addition %	______

LEFT WT.	______
Short Cut Leg	______
Lean Trim	______
External Fat	______
Seam Fat	______
Internal Fat	______
Bone	______
H.C. Tissue	______
Rough Sirloin chops___	
1/8" Sirloin chops	______
BLess Sirloin chops ___	
Lean Trim	______
External Fat	______
Seam Fat	______
Internal Fat	______
Bone	______
H.C. Tissue	______
Total	______
Additional %	______
TOTAL(not Italicized)__	
Addition %	______

VITA

Misti Deon Menzies was born February 20, 1970 in Fredericksburg, Texas to Max Duery and LaWanda Menzies, Jr. The author graduated from Fredericksburg High School in 1988. Following high school, Misti attended Texas A&M University in College Station, Texas where she received her B. S. degree in Animal Science in August of 1992. The author is currently completing her M. S. degree at Texas A&M University and will graduate in December 1994. While at Texas A&M, Misti was actively involved in the Saddle and Sirloin club and was a member of the Intercollegiate Meats Judging (1990) and Livestock Judging (1991) Teams. The author may be reached through the Meat Science Section, Animal Science Department, Texas A&M University, College Station, TX 77843-2471.