

**Table 4. The Effect of Protein Supplements on Ammonia Concentrations in Rumen Fluid**

	Diet		SE <sup>1</sup>
	Ration 1	Ration 2	
36 hour fasting (mg./100 ml.)	5.2	7.0	0.30
Non fasting (mg./100 ml.)	4.0	16.0	1.8

<sup>1</sup> Standard error of treatment means.

studies that a ratio of 55 parts of carbohydrate is needed for optimum protein synthesis when urea is the sole source of dietary nitrogen. As feed grade urea contains about 45 percent nitrogen, these results would indicate that a ratio of about 25 parts of NFE to one part of urea is needed for optimum urea utilization. More importantly, the NFE of weathered range forage is slowly hydrolyzed, thus it is doubtful if the NFE contained in these feeds is of much value for furnishing the carbon fragments needed for protein synthesis in the rumen. If this is true, all of the required NFE for protein synthesis must be included in the urea-containing supplement. This, of course, would place the upper level of urea in most range supplements to around two percent.

These results of the present experiments offer a possible explanation as to why Nelson and coworkers of this station never obtained good urea utilization when urea-containing supplements were fed to range cows.

## The Association Between Sex and Certain Lamb Carcass Characteristics

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### Story in Brief

Differences in economically important live animal and carcass characteristics were observed between sexes in lambs. Ram lambs grew faster, reached slaughter weight at an earlier age, had higher daily gains throughout life and produced more muscle and bone in a shorter period of time than wether and ewe lambs. Ewe lambs grew slower, thus re-

quiring more time to reach market weight, and produced carcasses that were fattest of the sexes—with wethers intermediate with respect to these characteristics. Carcass quality grade scores were highest for ewe carcasses as were palatability scores for tenderness, flavor and meat juice. Differences in growth and carcass composition were observed to be greater among sexes than were the differences in quality and palatability of prepared cuts of the carcasses.

## Introduction

Consumer preference for lamb with high ratios of lean to fat and of lean to bone has been well established. During recent years, researchers have dealt with the problem of producing heavier muscled lamb carcasses through selection and management techniques. Earlier studies with cattle have demonstrated that the uncastrated male has a greater potential for muscle production with minimal fat than the castrated male or the female.

This study was undertaken to investigate the differences among sexes in lambs for (1) growth, (2) carcass composition (lean, fat and bone) and (3) carcass quality and palatability.

## Materials and Methods

Equal numbers of ram, wether and ewe lambs out of Dorset X Rambouillet or Western ewes and sired by mutton breed rams, were slaughtered in each of two years. The lambs were fall born and reared on wheat pasture. Lambs were weaned at approximately 70 days of age at which time the ewes were removed, and the lambs remained on wheat pasture with access to creep feed. From this point in time, the lambs were weighed regularly until they reached a slaughter "full" weight of one-hundred pounds. Slaughter occurred after 18-hour shrink at which time carcass component measurements and appraisals were made following accepted procedures.

## Results and Discussion

### Growth

Data presented in Table 1 summarize the influence of sex on certain estimates of growth and carcass measurements.

Ram lambs were observed to grow faster by all measures of growth. This difference has been observed in other species also. They were heavier at 70 days and had higher average daily gains to slaughter weight

Table 1. Mean Comparisons for Growth and Slaughter Measurements

Measurement	Mean		
	Ram	Wether	Ewe
70-day weight (lbs.)	56.4	52.7	52.1
ADG to 70-days (lbs.)	0.7	0.6	0.6
ADG 70-days to slaughter (lbs.)	0.7	0.6	0.6
Age at slaughter (days)	137.3	154.9	160.0
Slaughter weight (lbs.)	92.3	91.7	90.3
Chilled carcass weight (lbs.)	48.7	50.8	50.7
Carcass weight per day of age (lbs.)	0.4	0.3	0.3
Dressing percent	53.5	56.2	56.9
Carcass quality grade	Ave. Ch.	Hi. Ch.	Low Pr.

than wethers and ewes. There were only small differences in growth rate between wethers and ewes. The somewhat lower dressing percentage of the ram lambs is believed to be due to smaller deposits of fat than was the case with wether and ewe lamb carcasses. Also, some of the ram lambs had heavy horns. Carcass quality differences were observed as shown in Table 1. The fatter ewe carcasses had more feathering, fat streaking in primary and secondary flank and firmer flanks than wethers and rams. Rams had lower quality scores because they exhibited less feathering and fat streaking and were softer.

### Carcass Lean

The rate and efficiency with which meat animals produce muscle is becoming more important since the consumer is placing more emphasis on the matter of proportion of lean in retail cuts at the self-service counter. Lamb carcass lean differences by sex are presented in Table 2.

Table 2. Mean Comparisons of Lean Measurements

Measurement	Mean		
	Ram	Wether	Ewe
Total lean weight (lbs.) <sup>1</sup>	26.8	25.7	25.3
Percent carcass lean <sup>2</sup>	55.1	50.7	49.8
Percent lean of slaughter wt. <sup>2</sup>	29.0	28.0	27.9
Percent trimmed major wholesale cuts <sup>3</sup>	35.6	35.9	35.9
Loin eye area (sq. in.)	2.3	2.2	2.2
Left trimmed leg weight (lbs.)	5.6	5.5	5.4
Percent left trimmed leg weight <sup>2</sup>	11.5	10.7	10.6

<sup>1</sup> Lbs. of lean per lamb.

<sup>2</sup> Calculated as a percentage of carcass weight.

<sup>3</sup> Calculated as a percentage of slaughter weight.

Rams weighed slightly more at slaughter than wethers and ewes, and the total lean in the ram carcasses was found to be higher than for wether and ewe carcasses. When lean was expressed as a percent of slaughter weight, the rams yielded one percent more lean than the wethers and ewes. When lean was expressed as percent of carcass weight, rams were found to have 55.1 percent lean as compared to 50.7 and 49.8 percent respectively for wether and ewe carcasses. This apparent advantage however, is somewhat unrealistic because it does not take into consideration the lower dressing percentage for rams. The presence of larger amounts of intermuscular fat, plainly visible in the wholesale cuts of ewe and wether carcasses is thought to be responsible for the higher dressing percentages in these sexes as well as for the higher percent of trimmed major wholesale cuts in ewe and wether carcasses.

### Carcass Fat

While fat is essential to lamb carcass quality and to certain of the palatability characteristics, the search for animals with superior muscling must consider the carcass component variable known from earlier work to have the greatest magnitude—namely FAT. Mean measurements for carcass fat by sexes are presented in Table 3.

In terms of fat trim from the 4 major cuts and total carcass fat as determined by ether extract procedures, ram carcasses had significantly less fat than wethers and wethers significantly less fat than ewes. Similar rank order is observed in such carcass fat estimates as percent kidney knob, average fat thickness at the 12th rib, thickest fat at 12th rib, percent fat trim from the loin and loin fat trim expressed as percent of carcass weight.

Table 3. Mean Comparisons of Fat Measurements

Measurement	Mean		
	Ram	Wether	Ewe
Fat trim from four major cuts (lbs.)	5.4	6.8	7.3
Total carcass fat weight (lbs.)	13.1	16.9	17.8
Percent carcass fat	26.9	33.3	35.2
Percent kidney knob	2.9	4.0	4.7
Ave. fat 12th rib (in.)	0.2	0.2	0.3
Thickest fat 12th rib (in.)	0.5	0.7	0.8
Percent left loin fat trim (of carcass)	1.7	2.1	2.3
Percent left loin fat trim (of left loin)	21.2	25.1	26.4

## Carcass Bone

Bone represents the remaining major carcass constituent. Because of the association of growth characteristics with size and proportionate development of the parts of the animal, certain estimates and measures of bone content in the carcass were observed. Mean comparisons of certain of these are presented in Table 4.

Percent carcass bone was found to be significantly different for each of the three sexes. Bone in the leg, expressed as weight or percent of carcass weight was also found to be significantly different for each of the sexes. It should be noted that rams have more bone by all measurements. It should be further noted that excessive bone is just as objectionable in the carcass as excessive fat.

## Palatability

Tenderness, flavor and meat juiciness scores were obtained from a taste panel for one-inch thick cooked rib chops from each carcass. For season II of the study, differences in the 3 mentioned palatability characteristics between sexes were small and non-significant. Rank order for mean values of the panel scores for tenderness was ewe, wether and ram; for flavor—ram, ewe and wether and for meat juice, the differences were small and inconclusive. Warner-Bratzler shear force values for tenderness were determined. From these results, it appears that ewe carcasses were more tender than wethers and wether carcasses more tender than rams (taste panel results are in agreement).

Table 4. Mean Comparisons for Bone Measurements

Measurement	Mean		
	Ram	Wether	Ewe
Total bone weight (lbs.)	8.77	8.14	7.62
Percent carcass bone	18.03	16.03	15.10
Left leg bone weight (lbs.)	1.14	1.02	0.95
Percent left leg bone weight (carcass basis)	2.34	2.01	1.87