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Acknowledgment

This publication summarizes part of a regional study on the carcass weight and grade method of marketing which was conducted by the North Central Livestock Marketing Research Committee in cooperation with the Bureau of Agricultural Economics and the Bureau of Animal Industry, USDA.

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The Effect on Carcass Yield and Grade of Holding Lambs in Packers' Yards

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Most of our present-day livestock is sold on the basis of live weight and grade. An alternative method of selling is to base prices on the carcass weight and grade of the animals. This latter method is used in several foreign countries and, to a limited extent, on an optional basis in this country. The carcass weight and grade method has the important advantage that prices are based more nearly on the wholesale value of the carcass than when the live weight method of selling is used.

Several important technical factors need to be studied before the present system of marketing is likely to be changed. Among the more important of these factors are tissue shrinkage and reductions in carcass grade (1) when livestock is shipped from the point of sale to the packing plant and (2) when livestock is held over in the packer's yards for one or more days before slaughter.

If payments are made to farmers on the basis of carcass weight and grade, changes in carcass yield and grade between the time of delivery and the time of slaughter may influence the returns received by farmers. This is of particular importance if livestock is bought at one market and then shipped to a packing plant located at a distant point. Similarly, packers often hold livestock in their yards for one or more days before slaughter. If equitable settlements are to be made to farmers, the extent of such changes in yield and grade needs to be determined, and a method of adjusting payments to farmers should be developed.

Previous Work

A study by Knute Bjorka, Bureau of Agricultural Economics, was concerned with weight losses of hogs in transit to packing plants.[2] This study was based on packing plant records covering approximately six million hogs. This study is of interest because of the method used.

The present study is a part of a regional project of research on the merits of the carcass weight and grade method of marketing livestock. Another phase of this research was studied in "Marketing Lambs—Comparison of Liveweight Method and Carcass Weight and Grade Method."[3]

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[2]Knute Bjorka, *Shrinkage and Dressing Yields of Hogs*, Bureau of Agricultural Economics, United States Department of Agriculture, Technical Bulletin No. 621 Washington, D. C., 1938.

[3]Bulletin No. 416, South Dakota State College Agricultural Experiment Station, Brookings, 1952.

Purpose and Method of Study

This study was made during the period August to December 1950, and was concerned with the problem of tissue shrinkage[4] and grade reductions when lambs are held over in the packer's yards for one or two days. Its purpose was to determine whether a significant decline in carcass yield and grade would occur in lambs held over in the packer's yards for one and two days. Seventeen lots of 54 lambs each, totaling 918 lambs, were examined to determine whether such a significant decline did occur. One sublot of 18 was killed on each of three consecutive days.

The experiment was designed to obtain uniformity of sublots for each day's kill from individual lots. The important factor was to divide each lot into three sublots of 18 each which would be of approximately the same meat type quality. It was assumed that differences in carcass yield and grade exceeding those caused by chance variation could be attributed to holdover in the packer's yards, if the sublots selected for each day's kill were uniform. To obtain these uniform sublots, each lot of 54 lambs was divided by live grade into three groups of 18. One group contained the 18 highest grading lambs; the second group, the 18 medium lambs; and the third contained the 18 low grading lambs of each lot. Six of the top, six of the medium and six of the low grade lambs were included in each day's kill.

It would have been desirable to have had a direct measure of the variation between lots. This could have been achieved by having two lots of 54 killed each week of the experiment. However, the experiment had to be run so as to cause a minimum of interference with the working routine of the packing plant. Under these conditions there was not sufficient pen space available to permit this, nor did the time permit the necessary sorting of the lambs.

Each lot of 54 was obtained on a "gate run" basis from shipments which had arrived that day. However, some days no lambs were received at the packing plant. It was therefore necessary to include five lots which came from shipments which had arrived one day before the weights were taken. All lambs were identified by ear tags, and individual live weights were taken. After slaughter the carcasses were weighed[5] and graded.

The carcass grading was done by the Federal grader assigned to the plant. Each carcass grade was divided into three subgrades and was coded numerically from 1 for *utility minus*[6] to 13 for *prime*. Carcass grades used in this study were in accordance with the official United States Department of Agriculture "Standards for Grades of Lamb, Yearling Mutton and Mutton Carcasses" which existed prior to the amendment of the standards in April, 1951.

[4]As measured by yield.

[5]On warm carcass basis minus 3 percent shrinkage.

[6]Only one lamb graded cull, and it was given the numerical value 1, corresponding to utility minus.

The live lambs were graded by a representative of the South Dakota Experiment Station. The object of this grading was to obtain uniformity in the sublots of 18 lambs for each day's kill.

Origin of Lambs

Seven lots of lambs were from the western range country and had been in transit from four to six days before arrival at the packing plant. Eight lots were native lambs[7] coming from a distance of less than 70 miles. The remaining two lots came from a feed lot operated by the packer in the immediate neighborhood of the plant. The previous origin of these lambs was unknown.

Conditions at the Yards

In the packer's yards the lambs were fed free choice a ration which consisted of native hay, ground alfalfa hay mixed with molasses, and water. This was the usual ration fed at the holding yards.

It should be added that if the lambs are held for three or four days it has been the practice of this plant to feed some grain, preferably oats, with the hay and molasses. In general, it is not the policy of the plant to hold lambs more than two days.

Analysis of Data

Analysis of variance was the statistical measure used in analyzing the data. The data were analyzed by three groups: Western, native, and lambs from packer's yards according to origin.

Each of the 17 lots consisted of 54 lambs. For degrees of freedom relative to each group and analysis of variance, see Tables 1, 3 and 5.

Analysis of Yield Data

Western Lambs

In the 17 lots of western lambs no significant difference was found in yield between days (Table 1). No consistent pattern could be found in the yield between days in this group. The average yield for all western lambs was 51.1 percent for the first, 51.8 percent for the second, and 51.7 percent for the third day (Table 2).

Table 1. Analysis of Variance of Yield—Western Lambs

	Degrees of Freedom	Mean Square
Total	377	
Days	2	15.6
Grades	2	34.1*
Days x grades	4	9.2
Lots	6	273.4†
Days x lots	12	34.0†
Grades x lots	12	11.7
Days x grades x lots	24	33.9†
Error	315	7.5

*Significant
†Highly significant

Table 2. Average Lot Yield of Western Lambs —Lots 1, 2, 3, 4, 5, 6 and 7

Lot	Day 1	Day 2	Day 3
	Percent	Percent	Percent
1	52.7	52.8	53.3
2	48.8	48.8	48.8
3	51.3	49.3	48.2
4	51.8	56.6	54.2
5	52.6	52.8	55.8
6	49.0	49.3	49.9
7	53.3	52.7	51.5
Mean	51.1	51.8	51.7

[7]Native lambs were mainly black face and black face crosses.

There was a significant difference in yields according to live grades. The lambs grading top in the live grading had higher yields than those grading medium or low in the live grading. This is in accordance with the belief that better quality lambs yield higher than lower quality lambs.

Interaction between the day slaughtered and live grades was not significant. This indicates that there was no difference in tissue shrinkage between lambs in the higher grades and those in the lower grades.

A highly significant interaction existed between days and lots. This means that there was a considerable variation in tissue shrinkage among lots due to length of holdover. In fact, some lots gained from the first to the third day and others declined. Differences in the handling methods before and during shipment may have influenced the condition of the lambs when they arrived at the packing plant.

Native Lambs

A highly significant difference in yields was found between days for native lambs (Table 3). All lots declined in yield from the first to the third day (Table 4).

As was the case with the western lambs, there was a highly significant difference in yield according to live grades. The lambs grading high in the live grading had higher yields than those grading low.

Interaction between days and grades was highly significant. In this group the higher quality lambs had less tissue shrinkage than the lower quality lambs.

Interaction between days and lots was not significant, indicating little variation between lots due to the influence of holdover.

Lambs from Packer's Yards

No significant differences were found in the two lots in this group (Tables 5 and 6).

Analysis of Carcass Grade

Western Lambs

The western lambs showed a significant difference in carcass grade between each day's kill (Table 7). For all western lambs the coded mean carcass grade was 7.4 the first day and 7.0 the second and third day (Table 8). There was a highly significant difference in carcass grade between the various live grades. This indicates that the live grading of western lambs did group them in such a manner that the lambs which were in the top live grade had the highest carcass grades.

Native Lambs

In native lambs there was a significant difference in carcass grade between each day's kill (Table 9). The coded mean carcass grade for all native lambs declined from 7.1 the first day to 6.8 the second and 6.5 the third day (Table 10). As in the western lambs there was a highly significant difference in carcass grade between the various live grades.

Table 3. Analysis of Variance of Yield—Native Lambs

	Degrees of Freedom	Mean Square
Total	431	
Days	2	61.1†
Grades	2	193.9†
Days x grades	4	74.7†
Lots	7	78.9†
Days x lots	14	4.6
Grades x Lots	14	12.2
Days x grades x lots	28	4.1
Error	360	11.2

*Significant
†Highly significant

Table 4. Average Lot Yield of Native Lambs—Lots 9, 11, 12, 13, 14, 15, 16 and 17

Lot	1	Day 2	3
	Percent	Percent	Percent
9	51.4	51.3	50.6
11	49.8	48.8	46.9
12	52.9	51.5	51.3
13	49.4	48.9	49.0
14	50.3	50.3	48.4
15	51.6	50.7	49.9
16	50.0	48.1	48.9
17	50.6	50.6	49.9
Mean	50.8	50.0	49.5

Table 5. Analysis of Variance of Yield—Lambs from Packer's Yards

	Degrees of Freedom	Mean Square
Total	107	
Days	2	10.9
Grades	2	0.1
Days x grades	4	12.1
Lots	1	115.3†
Days x lots	2	12.3
Grades x lots	2	2.0
Days x grades x lots	4	18.7
Error	90	10.1

*Significant
†Highly significant

Table 6. Average Lot Yield of Lambs from Packer's Feedlot—Lots 8 and 10

Lot	1	Day 2	3
	Percent	Percent	Percent
Lot 8	48.9	49.3	48.7
Lot 10	51.4	51.3	50.6
Mean	50.4	50.2	49.4

Table 7. Analysis of Variance of Grades—Western Lambs

	Degrees of Freedom	Mean Square
Total	377	
Days	2	7.3*
Grades	2	78.0†
Days x grades	4	0.6
Lots	6	6.6†
Days x lots	12	2.0
Grades x lots	12	4.9*
Days x grades x lots	24	0.5
Errors	315	2.3

*Significant †Highly significant

Table 8. Average Lot Carcass Grade of Western Lambs

Lot	1	Day 2	3
1	8.0	7.0	7.3
2	6.6	7.1	6.8
3	8.2	7.3	7.3
4	7.8	7.6	6.8
5	7.7	6.7	7.3
6	7.2	6.9	7.3
7	6.5	6.3	6.2
Mean	7.4	7.0	7.0

Table 9. Analysis of Variance of Grades—Native Lambs

	Degrees of Freedom	Mean Square
Total	431	
Days	2	10.4*
Grades	2	132.4†
Days x grade	4	2.8
Lots	7	11.4†
Days x lots	14	4.6*
Grades x lots	14	6.7†
Days x grades x lots	28	2.4
Error	360	2.6

*Significant †Highly significant

Table 10. Average Lot Carcass Grade of Native Lambs—Lots 9, 11, 12, 13, 14, 15, 16 and 17

Lot	1	Day 2	3
9	6.9	6.7	6.8
11	7.2	6.3	5.4
12	8.1	7.2	6.8
13	6.6	6.8	7.1
14	6.7	6.4	6.2
15	7.2	6.7	5.8
16	6.9	6.6	5.9
17	7.0	7.4	8.2
Mean	7.1	6.8	6.5

Lambs from Packer's Yards

No significant decline in carcass grade was found in this group of lambs. There was a direct relationship between live grade group and corresponding carcass grade, indicating again that the live grading did differentiate between lambs according to their final carcass grade (Tables 11 and 12).

Table 11. Analysis of Variance of Grades—Lambs from Packer's Yards

	Degrees of Freedom	Mean Square
Total	107	
Days	2	0.3
Grades	2	9.4†
Days x grades	4	1.1
Lots	1	29.0†
Days x lots	2	4.0
Grades x lots	2	0.8
Days x grades x lots	4	1.9
Error	90	1.6

*Significant
†Highly significant

Table 12. Average Lot Carcass Grade of Lambs from Packer's Yards

Lot	Day 1	2	3
8	6.8	6.8	6.2
10	7.6	7.2	8.0
Mean	7.2	7.0	7.1

Economic Implications

One of the main arguments for the carcass weight and grade method of marketing meat animals, such as lambs, hogs and cattle, is that it would give more equitable returns to producers, since their payments would be based on the actual rather than the estimated value of the carcass. This argument would not be entirely true if there was a significant decline in yield and grade of the animals when they are held over in the packer's yards for one or more days before slaughter as is often done in the packing plants. Under these conditions, producers whose animals were held over in the packer's yards would need to be compensated for the loss in carcass weight or carcass grade of the animals involved.

It was found in this study that there was no significant decline in yields for lambs from the western range when they were held over for one or two days. However, there was a great variation in this respect among lots. Some lots actually had increased yields whereas others had reduced yield on the third day. This variation may have been caused by differences in condition of the lambs when they arrived at the packing plant.

In native lambs, a highly significant decline in yield was found. A consistent pattern was found in all of these lots. This would indicate that for native lambs an adjustment in payments to producers for tissue shrinkage during holdover in packer's yards would be desirable if the carcass weight and grade method is to be used.

No significant difference between lambs killed the first, second, and third day was found in lambs from the packer's yards. In other words, the differences in yields which were observed between the sublots of lambs killed each day could easily have occurred even if all these lambs had been killed the same day.

A significant decline in carcass grade was indicated in western and

native lambs, but no decline in grade was found in lambs from the packer's yards. In this study each carcass grade was divided into three subgrades, and the decline did not exceed one-third of a full grade on the average for any group.

In evaluating the carcass weight and grade method, the problem is whether a decline in yield and grade during holdover in the packer's yards would reduce accuracy in pricing; and if so, whether an adjustment in payments to producers can be made. In western lambs there would be some variation in tissue shrinkage among lots, but for all western lambs the findings of the study indicated that the decline was not significant. Because of the variation among lots, an adjustment for decline in yield would be difficult to make.

For native lambs, adjustments for tissue shrinkage during such holdovers would make payments to producers more equitable, and the study indicates that such an adjustment should be made.

The grade differences were only of minor importance and might not necessitate adjustments in payments to producers.