EARLY WEANING AND OTHER METHODS OF INTENSIVE LAMB PRODUCTION

by

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INTRODUCTION

In recent years the productivity of grassland has increased very greatly due to the more widespread use of fertilizers and improved strains of grasses and legumes. These have tended to increase the amount of forage available early in the season much more than during the latter half. This type of pasture system is very suitable for sheep, since the high quality pasture present early in the season can be utilized for lamb production, and after the lambs are sold very much less forage is needed to carry the dry ewes through the summer months. This increase has not been fully used by sheep; intensification has been mainly confined to set stocking at moderately high levels. One method of more intensive pasture use is rotational grazing; this has given very varied results in both research and practice. It has been shown to be more efficient than continuous grazing at high stocking levels, but most of its success appears to be due to increased production per acre rather than per animal.

At higher stocking levels there is greater contamination of the sward with dung and urine, and it is more difficult to maintain a supply of palatable and nutritious herbage. There is also an increased risk of worm infestation and other diseases. Since the pasture requirements of the lamb from birth to weaning vary greatly from those of the ewe, some modifications of rotational grazing, such as creep grazing, have been suggested in order to be able to differentiate somewhat between them. With creep grazing the lamb is able to graze selectively ahead of the ewes. The ewes also complete sward defoliation,

are at a lower level of nutrition, and ingest and may destroy much of the infective larva. Milk is most important during the early stages of the lamb's life. At this point the effect of creep grazing on the pasture is negligible, and so during this period plenty of herbage is available for the ewes. As grass becomes more important to the lamb, the amount that is available to the ewe gets automatically smaller. Rotational creep grazing both forwards and sideways has been tried experimentally and commercially. The results seem to show that under conditions of intensive management it is more efficient and productive than ordinary rotational grazing.

Workers in New Zealand found that the correlation between the milk yield of ewes and weight gains in the live weight of lambs was lowest between seven and twelve weeks of age. At this stage in the lactation the milk supply is very much decreased and the lambs then get most of their sustenance from pasture. They suggested that lambs might be able to grow well without the long periods of lactation that are common in farming practice. The gross efficiency of milk production decreases as lactation continues; there is a further loss of efficiency from the double conversion of grass to milk by the ewes and milk to meat by the lambs. It was suggested that weaning the lambs at around two months of age would be possible, and the lambs might grow as well if not better than lambs weaned at the more conventional time of four months. Other advantages of early weaning were increased efficiency in the use of the pasture, greater flexibility in stock management, and better parasite control.

Australian workers showed that the possible advantages of early weaning can only be obtained if the lambs are given access to pasture which allows them to maintain their protein requirements. Since the pasture intake of the lamb is limited and it tends to graze very selectively anyway, it may not be able to eat enough when grazing mature herbage.

Until recently little research has been done in the United States on intensive stocking of ewes and lambs on pasture. At the Virginia Agricultural Experiment Station from 1955-1959, intensive production of spring lambs from pasture was investigated. Comparisons were made between native bluegrass and orchard grass ladino clover pasture and between continuous and rotational grazing on bluegrass pasture. As a replacement for this project it was decided to investigate the effect of early weaning under conditions in Virginia and to compare this with various other methods of intensive lamb production. The data collected in the first two years of this experiment are used in this study.

LITERATURE REVIEW

McMeekan (1960) stated that there are several basic factors which affect the efficiency of conversion of pasture to animal products. These are the amount, quality, and seasonality of the crop, and the proportion of the crop which is actually harvested by the animal. These are affected by grazing management, some components of which can be controlled by man, such as the grazing method, the stocking rate, the kind of stock used, and the severity and frequency of defoliation. In practice grazing management attempts to maximise yields of animal products from grassland without damaging the pasture. It was believed that continuous grazing was harmful to both the animal and the pasture yield, and grazing methods which gave the pasture a resting period were suggested, as it was thought that this should maximise both plant and animal yields. McMeekan compared set stocking with rotational grazing in 15 separate studies. Rotational grazing was slightly advantageous in two cases, continuous grazing slightly superior in two cases, while the remaining studies showed no difference between the two methods. He suggested that there should be an investigation as to the failure of rotational grazing when contrasted with set stocking under experimental conditions, when in practice, rotational grazing was widely accepted in the intensively used grassland areas of the world.

Lambourne (1956) compared rotational and continuous grazing for fat lamb production at three different stocking levels--low, medium, and high. He found that at low and medium stocking rates, the rotational system was inferior in terms of lamb growth rate, but that it was

superior at the high rate. There was no significant difference at any of the levels in the ewe's wool production or in the live weight gain. The results supported previously reported work that rotational methods increase the amount of feed available and give substantial increases in output per acre, mainly by an increase in carrying capacity, rather than increased animal production. He suggested that there is probably little value in using rotational grazing in the spring and early summer unless stock numbers are increased in order to graze the extra feed, or else it is conserved.

Carter, et al. (1960) reported on the intensive production of spring lambs from pasture in Virginia. They found that lambs grazed continuously on bluegrass pastures had the highest average daily gains and somewhat higher carcass grades than lambs grazed rotationally on either bluegrass or orchard grass ladino clover pasture. The rotationally grazed pastures had a higher carrying capacity than those grazed continuously. These results are in agreement with previously reported work.

Blaser, et al. (1960) stated that the output of the grazing animal, in the absence of nutritional and pathological disorders, depends on many factors which affect the quality and quantity of the ingested herbage. Grazing management is a method of achieving a compromise between output per animal and output per acre. At low stocking rates the animal has a high degree of selectivity, but output per acre is low; at higher stocking rates the output per animal is lower, but there is a higher output per acre.

According to Spedding, nematodes parasitic in the alimentary tract may affect the live weight gain, the dry matter intake, and the apparent digestibility of that intake, even though the sheep may show no symptoms of worm infestation.

In farm practice there are two methods of preventing excessive worm infestation. These may be used separately or together, either a therapeutic measure or by grazing management. The ewe is much more resistant to attack than the young lamb. Spedding suggested that parasitism is much more likely to be serious when there is a high stocking rate of young animals to old. This situation arises when there is a high lambing percentage. Twin animals are also more likely to be attacked than singles; they tend to grow more slowly, since they receive less milk and are present on the farm for a longer period of time. A method of grazing management which would allow the young animal clean pasture to graze upon, eliminate competition from the ewe, and give a greater degree of selectivity should be advantageous. This should result in increased production per animal as well as per acre, rather than just increased production per acre as has been reported by most workers when comparing rotational and continuous grazing.

Two modifications of rotational grazing were suggested by Davies and Spedding (1956), by Dickson (1959), and by Spedding and Large (1959). These were sideways creep grazing and forward creep grazing. Both of these methods have the advantage that they allow differentiation between the treatment of the ewe and the lamb. The young animal is able to graze selectively ahead of the ewe and is probably on a higher plane of nutrition.

Spedding and Large (1959) compared sideways creep grazing with a rotational method for lamb production from pasture, using a stocking rate of seven ewes and twelve lambs to the acre from birth until the lambs were sent to slaughter. With sideways creep grazing they got higher live weight gains per acre in both years of the study. The biggest difference in favor of sideways creep grazing was in the quality of the carcasses produced, and worm infestation was also much lower.

Harrison, et al. (1948) also compared continuous and rotational grazing and found little difference between the two methods on total acre production, but the lambs on the continuous grazing were somewhat heavier. Judging by its appearance only, the rotationally grazed pasture looked very much better.

Dickson (1960) compared forward creep grazing with rotational grazing. He got higher live weight gains, a reduced worm burden, and a very much higher percentage of fat lambs, with creep grazing. He concluded that by this method he was able to get a high output per acre without sacrificing quality. When these two methods of creep grazing are compared, the sideways method has the advantage that the area which is kept for the lambs is never infected by the ewes, whereas in the forward method both ewes and lambs cover the same area.

It would seem that the next logical step would be the separation of ewes and lambs in order to be able to differentiate between them completely. If the lambs were weaned early in the grazing season and then grazed separately, the pasture should have less parasites and the lambs could be completely selective in their grazing.

The first reports of early weaning come from South Africa. Bosman and Bonsma (1944) reported that lambs weaned at 8 weeks and grazed on high quality cereal pastures grew as fast and has as high carcass grades as those run with their mothers, with a saving of 23% in feed.

It is important to know at what age or weight a lamb can be weaned successfully without a serious setback. An investigation of the milk yield of the ewe in relation to the growth rate of the lamb should prove helpful in answering this.

Wallace (1948) reported on the growth of lambs before and after birth in relation to nutrition. He reported that the milk yield reached a maximum during the second and third week of lactation and fell steadily after this. About 30% of the total milk yield for a 16-week period (which is about the conventional weaning time) is produced in the first month, 30% in the second month, 21% in the third month, and 11% in the fourth month. He concluded that the milk which the lamb receives during the first month to six weeks of its life, is of the greatest importance to its subsequent growth. He found a correlation of 0.90 between the weight increase of the lamb at a month of age and the milk consumed in that period.

Burris and Baugus (1955) also found that milk production was highest during the first four weeks of the lactation and that it then decreased at a varying rate throughout the remainder of the period. They also found that the average daily gain of the lambs was very highly correlated with the milk consumption during the first four weeks and that the correlation decreased rapidly as the lamb got older. They found that

daily gain from 12 to 16 weeks was not significantly correlated with milk consumption during the previous periods.

Barnicoat, et al. (1956) in New Zealand reported that under fat lamb farming conditions the milk intake was of most importance until the lamb was between six and eight weeks old. However, the total milk consumed during the first 12 weeks of lactation is of importance for live weight gain. They found the correlations between the rate of live weight gain and the amount of milk consumed in the first 12 weeks of the lamb's life. Between birth and three weeks of age they found that it was irregular; it was highest between four and six weeks of age. They concluded that this was due to the fact that at this stage the lambs were able to use all the milk that was produced and that milk secretion was at its highest during this period. The correlation was lowest between seven and ten weeks of age because the lambs then normally got most of their nourishment from grass.

Coombe, et al. (1960) in Australia also reported on the correlations between milk yield and lamb growth, using two methods to determine the milk yield of the ewe. From birth to four weeks the correlation was 0.71, from four to seven weeks of age 0.58, and from seven to ten weeks 0.31.

In general, it seems that milk is of most importance to the lamb until it is six weeks of age; after this the correlation between the milk yield of the ewe and the growth of the lamb falls steadily.

Clarke (1954) in New Zealand concluded from previously reported work that where feed was limited, the value of the milk received by the lamb after the age of two months might be offset by the increased

competition between the ewe and the lamb for the available feed. This might happen even in a good season where animal requirements were increasing at a time when pasture production was beginning to fall off. He found that the gross efficiency of meat production was 30% when grass was converted directly to meat; where there was a double conversion from grass to milk and then milk to meat, the efficiency dropped to 9%. He thought that early weaned lambs might grow as well, if not better, than lambs weaned at the more conventional age of four months. He weaned lambs at an average age and weight of 12 weeks and 49.5 pounds, running the experiment for three years. He concluded that the growth pattern of early weaned and late weaned animals was essentially the same, and that the small differences between them were probably due to the stage of maturity of the herbage.

Baird and Sell (1959) reported on the early weaning of lambs grazed on winter temporary pasture in Georgia. They weaned lambs at 60 pounds and left a control group with their dams until they weighed 90 pounds. They found that those lambs weaned at the lighter weight grew as well as those left with their dams until they reached market weight. The slaughter grades of the early weaned group were higher. Creep feeding had no effect on the rate of gain of either group, but it improved the slaughter grade of the lambs left with their dams. There was a saving of 35% in ewe grazing, thus more high quality pasture was available for the lambs. In a second study where the lambs were weaned at 45 and 60 pounds and a control group was again left with their dams until they reached 90 pounds, they found no statistically significant

differences between average daily gain or slaughter grade in any of the groups, and early weaning did not stimulate creep consumption. They concluded that the lambs could be weaned at a relatively early age and still continue to grow well, provided that high quality forage was available.

Brown and Spedding (1959) in England weaned lambs between 15 and 20 days of age. They reported that the weaned lambs survived and later recovered from the setback, but they believed that their performance was affected by parasites. It would seem that this is too early an age at which to wean.

Wardrop, et al. (1960) in Australia reported on two early weaning experiments that were carried out under very different pasture conditions. They weaned lambs at 7, 10, 13, and 18 weeks of age; all animals were slaughtered at 19 weeks. They found no significant difference in lamb live weights at any age, nor in carcass or wool production. In the second trial, where the pasture was much more mature, one group of lambs was weaned at nine weeks of age while the second group was left with their dams until 18 weeks of age. The late weaned group had higher average daily gains, slaughter grades, and dressing percentage. They concluded that it was possible to wean lambs early, provided that they were given access to high quality pasture.

Hinds, et al. (1960) in Illinois found that lambs not grazed with their dams showed no evidence of stomach worms either subclinically or in their faecal samples. They found that lambs given access to a creep ration from birth to market could be successfully weaned at a relatively

early age. Lambs weaned at eight to nine weeks and kept in the drylot or fed on pasture performed as well as lambs left with their dams. A later study showed that lambs weaned at six weeks performed as well as those weaned at nine weeks. Average daily gain for the whole period was 0.476 and 0.486 pounds respectively. In the first study they found that when twins were weaned, or not grazed with their dams, they performed as well or better than comparable single lambs. In the second study where lambs were weaned at six or nine weeks of age, twins did not do as well as single lambs that were weaned at the same age.

The next logical step would be the comparison of lambs weaned on pasture with those weaned and placed in a drylot on a concentrated ration.

Noland, et al. (1961) compared the effect of weaning lambs and feeding them in the drylot, with creep feeding the nursing lambs on pasture. Both groups were fed the same high energy pelleted ration and had access to this ration before the trial began. Lambs that were weaned and fed in the drylot gained 13 pounds during the 27-day trial, whereas the creep fed group only gained five pounds. They concluded that early weaning might be advantageous under certain production conditions.

Brothers and Whiteman (1961) in the winter of 1958-1959 weaned at a minimum weight of 50 pounds, using either twins or singles. They could show very little difference between weaned and unweaned groups in average daily gain. Lambs that were weaned at 12 or 13 weeks and fed in the drylot made slightly faster gains than unweaned lambs. In the

winter of 1959-1960, singles were weaned at 56 days of age; here average daily gain was significantly reduced by weaning, but there appeared to be no subsequent effect on the lamb's grade. In both years of the trial the pasture supply became limited in January, when the lambs were being weaned. They conclude that single lambs on good pasture and creep may be weaned when they reach a minimum weight of 50 pounds and are at least 70 days old, without influencing their subsequent gain or market grade.

In conclusion, it seems that early weaned lambs generally perform as well as, and perhaps better than, those left with their dams, provided that they are not weaned too early and that an adequate supply of high quality forage is available.

EXPERIMENTAL PROCEDURE

A. Objectives

The general objective of the experiment was to investigate various methods of intensive lamb production.

The specific objectives were:

1. To compare the early weaning of lambs onto ladino clover, permanent bluegrass, or a drylot, with the conventional method of running ewes and lambs together during the grazing season.

2. To compare ewes and nonweaned lambs grazed separately with grazing ewes and lambs together on pasture.

B. Location

The experiment was conducted in two locations, the main station at Blacksburg and the Southwest station at Glade Spring. Both stations are fairly similar in soils, climate, elevation and pastures. At Blacksburg 5 one-acre plots of permanent bluegrass and white clover, 5 one-acre plots of seeded ladino clover, and an area of 7-1/2 acres of permanent bluegrass were used. At the Southwest station 4 one-acre plots of permanent bluegrass, 4 one-acre plots of seeded ladino clover (in 1960 only), and an additional area of 4-1/2 acres of permanent bluegrass were used. The permanent pastures were mainly bluegrass and white clover with some orchard grass, timothy and red clover and had not been ploughed for at least 50 years. The lots were limed and fertilized according to soil tests so that lack of nutrients would not be a limiting factor for the optimum growth of the forage. All of the pastures were provided with shade and water.

C. Animals

The 457 lambs used as tester animals in the experiment were produced from the grade flocks at both stations. The ewes in these flocks were mainly grade Hampshire, or Hampshire x Rambouillet, or Hampshire x Suffolk crossbreds, but there were some North Country Cheviots and some North Country Cheviot crossbreds. Hampshire, Dorset, Suffolk, North Country Cheviot, and Southdown rams were used, the majority being Hampshire.

Most of the lambs were born in January and February; the remainder were born in early March. They were allowed to run with their mothers with access to a grain mixture in a creep from birth until the experimental treatments were started in mid-April. Both ewes and lambs were given access to small grain pastures when these were available.

Assignments to treatments were made at random from groups of similar age, sex, breeding, weight, and age of dam.

D. Experimental Treatments

The lambs, or lambs and ewes, were placed on the various treatments each year at the time that it was thought that the experimental pastures were ready for grazing, colloquially known as turning out time. This was April 22nd and 26th in 1960 and 1961 respectively at Blacksburg and about a week earlier at Glade Spring, April 15th and 19th. The following treatments were used at both stations.

1. Blacksburg

Treatments 1, 2, and 3 were repeated in 1960 and 1961, but treatment 4 was only tried in 1961.

In treatment 1, ewes and lambs were grazed together on a 7-1/2 acre area of permanent bluegrass pasture. No supplemental grain was fed to the ewes or lambs. The stocking rate was three ewes and four lambs per acre. This was the control for the other treatments.

In treatment 2, weaned lambs were grazed rotationally on the 5 one-acre plots of permanent bluegrass. Shelled corn was fed at the rate of one pound per head per day. The initial stocking rate was seven lambs per acre.

In treatment 3, lambs weaned at the beginning of the grazing season were grazed rotationally on the 5 one-acre plots of ladino clover. Supplemental feeding, management, and stocking rate were the same as for treatment 2.

In treatment 4, in 1961 only, 40 lambs were weaned at the same time as those on treatments 2 and 3, viz. April 26th, and placed on full feed in a drylot. The lambs were divided into four equal groups making up two treatments, each with a replicate. They were self-fed two pelleted rations, one containing 65 per cent roughage and the other 35 per cent. A small amount of high quality alfalfa hay was fed in addition to the pellets. The composition of the two pelleted rations used at both Blacksburg and Glade Spring is shown on page 20.

2. Glade Spring

Treatments 1 and 2 following were in effect in both 1960 and 1961, but treatments 4 and 5 were in effect in 1961 only and treatment 3 in 1960 only.

In treatment 1, ewes and lambs were grazed together on a 4-1/2 acre plot of permanent bluegrass pasture. This was the control for the other treatments. The initial stocking rate was four ewes and six lambs per acre.

In treatment 2, lambs were grazed separately from the ewes from about 4 p.m. to 8 a.m. in rotation on the 4 one-acre plots of permanent bluegrass. The ewes and lambs were together in a barn from 8 a.m. to 4 p.m. No supplemental grain was fed. The initial stocking rate was seven lambs per acre.

In treatment 3, in 1960 only, lambs were grazed separately from the ewes on the 4 one-acre plots of ladino clover, with supplemental feeding, management, and stocking rate as above.

In treatment 4, in 1961 only, weaned lambs were placed in a drylot, in two groups on the same high and low roughage pelleted rations that were used at Blacksburg.

In treatment 5, in 1961, the lambs were placed on the same high and low roughage pelleted ration in a drylot as in the treatment above, but were with their mothers from 8 a.m. until 4 p.m.

The composition of the pelleted rations at both stations was:

	High Roughage	Low Roughage
Alfalfa meal	65.0	35.0
Ground shelled corn	24.4	48.6
Soybean meal	5.0	10.0
Molasses	5.0	5.0
Monosodium phosphate	0.5	
Defluorinated phosphate		0.7
Ground limestone		0.6
Vitamin D premix	0.1	0.1

E. Grazing Management

The lambs that were grazed rotationally on either permanent bluegrass or ladino clover were moved to a fresh lot every four to seven days. The pastures were generally clipped immediately after the lambs were moved in order to control weeds and to prevent uneaten forage from becoming too stemmy. In 1961, when there was a surplus of forage, some lots were taken out of the experiment.

The continuously grazed pastures were also clipped periodically, mainly to control weeds but also to trim off any surplus forage.

F. Parasite Control

Immediately before the experiment was begun each year (i.e. when the lambs were weaned), they were drenched with a phenothiazine, copper sulphate and nicotine sulphate mixture in order to control internal parasites in the alimentary tract. During the experiment all animals had access to a 1:9 phenothiazine, salt mixture.

G. Marketing

The lambs were marketed when they weighed between 85 and 100 pounds, in three groups, in late May, mid-June, and mid-July. The experiment was closed in mid-July, and any animals that were not ready for market then were kept for feeder lambs. Some females were kept as replacements for the grade flocks.

H. Observations

Each lamb was weighed at the beginning of the experiment, at 14-day intervals, and at the time of marketing or at the end of the experiment. Carcass weights were obtained immediately after slaughter and before

chilling for each lamb slaughtered. Dressing percentage was calculated on the basis of the unchilled carcass weight and the final home weight.

A live slaughter grade was obtained on each lamb either immediately before it was marketed or at the end of the test. The basis of the grading was the official standards of the Division of Markets of the Virginia Department of Agriculture. The lambs were graded by a committee of three or more, working independently, and the grades were averaged for each lamb. At least one member of the committee was an official grader of the Virginia Division of Markets. All the carcasses were graded after a 24-hour chill by the official U.S.D.A. grader at the packing plant.

Rainfall and maximum and minimum temperatures were recorded at Blacksburg. See Appendix A.

ANALYSIS OF THE DATA

Each lamb was classified according to the breed of sire, breed of dam, age of dam, type of birth and rearing, and its sex. Each of these classifications was considered as an environmental effect which was fixed (i.e. not random) in the statistical sense. It was known from reports in the literature that these fixed environmental effects might result in significant differences in the traits that were to be investigated, among lambs that were otherwise treated identically. The lambs were assigned randomly to the various treatments, but this resulted in unequal and disproportionate numbers of lambs in the various treatments; i.e. it was nonorthogonal. Therefore, it was necessary to adjust the data for differences due to the fixed environmental effects before any valid comparisons could be made between the treatments.

The least squares method of analysis for multiple classification with disproportionate numbers was used to obtain estimates of the magnitude and significance of the fixed environmental effects on the traits studied. Each observation was assumed to be a linear combination of an effect common to all lambs, plus the effect due to breed of sire, breed of dam, age of dam, type of birth and rearing of the lamb, sex of the lamb, plus the effect peculiar to each lamb. It was assumed that the fixed effects were not correlated and that the random errors had an expectation of zero. The mathematical model assumed was:

$$Y_{ijklm} = \mu + p_i + m_j + a_k + t_l + s_m + e_{ijklm}$$

Where: Y_{ijklm} is an observation on an individual lamb

And where: i = 1-5, j = 1-5, k = 1-4, l = 1-3, m = 1-2

μ is the general mean for all lambs

p is the effect due to breed of sire

m is the effect due to breed of dam

a is the effect due to age of dam

t is the effect due to type of birth and rearing

s is the effect due to sex

e is the effect peculiar to each lamb.

The breeds of sire (p) and breeds and crosses of dam (m) were given above. The ewes were grouped with respect to age as yearlings, two-year-olds, three to seven years old, and eight years or older. Lambs were classified as singles, as twins or triplets reared as singles, and as twins. The sexes were ewes or wethers.

In this method of multiple regression, one variable from each classification is deleted and this becomes the base from which the remaining variables of the respective classifications are expressed as deviations. In each classification the variable with the largest number of observations was deleted from the original matrix. The equations that were deleted were: Hampshire for both breed of sire and breed of dam, three to seven year old dams, and twin and wether lambs; therefore, these became the base to which all the lambs were adjusted. A copy of the two original matrices may be found in Appendix B and Appendix C.

Two multiple regressions were run, one using data on 457 lambs for average daily gain and slaughter grade and the second using data on 311 lambs for carcass grade and dressing percentage. The latter information

was not available on all lambs, since some were kept for flock replacements or were not ready for market when the experiment was completed.

In order to simplify the computations, the "Raleigh Method" as developed by personnel of the Statistical Laboratory at North Carolina State College, Raleigh, North Carolina, was used in making the analysis on the IBM 650 electronic computer at the Virginia Polytechnic Institute, Blacksburg, Virginia.

A number of analyses of variance were run with the adjusted data in order to discover if there were any differences between treatments, and if these existed, to find out whether they were significant or not. The calculations were all made on a Marchant automatic desk calculator.

ADJUSTMENT OF THE DATA

Estimates of the effects of breed of sire, breed of dam, age of dam, type of birth and rearing, and sex on the traits studied are shown in Tables 1 and 2. The standard errors for each estimate are also shown. When the sign on these estimates is reversed, they can be used as factors for adjusting the data.

A. Average Daily Gain

The computed estimates for differences due to the breed of sire varied widely; Southdown and Dorset sires were significantly different ($P < .01$) from Hampshire sires. For breed of dam the range was not as wide, but both Hampshire x Rambouillet and Suffolk x Rambouillet were significantly different ($P < .01$) from the base value. In the age of dam classification only the eight years old and older group was significantly different from the base value. Lambs reared as singles were significantly different ($P < .05$) from those reared as twins. Ewes were significantly different ($P < .01$) from wethers. The computed estimates were found to be in general agreement with those reported by Kincaid and Carter (1953), Carter, et al. (1957) and (1958), and Givens (1958).

B. Slaughter Grade

The constants computed for differences due to breed of sire were fairly similar and were all highly significant ($P < .01$). For breed of dam the range was wider, but only two breeds, Hampshire x Rambouillet and Border Leicester x North Country Cheviot, were significantly different at the five per cent and one per cent levels respectively from

Table 1

Regression Coefficients and Standard Deviations for Average Daily Gain and Slaughter Grade

Classification	No. of Lambs	Average Daily Gain b value	Average Daily Gain S.E.	Slaughter Grade b value	Slaughter Grade S.E.
Breed of Sire					
Hampshire	161	.000		.000	
Southdown	32	-.115**	±.027	-1.04**	±.36
Dorset	111	-.064**	±.017	-0.72**	±.23
Suffolk	87	.035	±.019	-0.67**	±.25
North Country Cheviot	66	-.006	±.019	-0.93**	±.25
Breed of Dam					
Hampshire	221	.000		0.00	
Hampshire x Rambouillet	94	.084**	±.017	-0.57*	±.23
Suffolk x Rambouillet	97	.076**	±.019	-0.19	±.25
North Country Cheviot	19	.056	±.034	-0.12	±.44
Border Leicester x N.C.C.	26	-.002	±.031	-1.56**	±.41
Age of Dam					
Yearling	25	-.044	±.032	-1.75**	±.42
2 Years Old	100	-.031	±.021	-0.74**	±.28
3-7 Years Old	299	.000		0.00	
8 Years and Older	33	-.104**	±.026	-1.07**	±.34
Type of Birth and Rearing					
Single Born and Reared	121	.030*	±.015	1.36**	±.19
Twin or Triplet Reared as Single	32	-.040	±.024	0.29	±.32
Twin Born and Reared	304	.000		0.00	
Sex					
Wether	227	.000		0.00	
Ewe	230	-.045**	±.012	0.38*	±.16
Mean	457	.543		12.833	

** Significant at the one per cent level ($P < .01$)
* Significant at the five per cent level ($P < .05$)

Hampshire ewes. For age of dam, all the computed differences were significantly different from the three to seven year old ewes ($P < .01$). Those lambs reared as singles were significantly different at the one per cent level from those reared as twins. A ewe lamb was significantly different at the five per cent level from a wether lamb. The computed estimates were found to be in general agreement with those reported in the literature.

C. Carcass Grade

The constants computed for differences due to the breed of sire varied considerably; that for the Southdown was significantly different at the five per cent level, while that for the Suffolk was significant ($P < .01$) from the base value. The estimates for the effect of breed of dam varied largely, only those for Suffolk x Rambouillet and Border Leicester x North Country Cheviot being significantly different ($P < .05$) from the base value. None of the computed differences for the effect of age of dam were significantly different from the base value. For type of birth and rearing, singles were significantly different at the one per cent level. Ewe lambs were significantly different ($P < .01$) from wether lambs. The values were in general agreement with those reported in the literature.

D. Yield

The constants computed for differences for the breed of sire again varied considerably. The Southdown and Suffolk sires were significantly different from the Hampshire rams at the five per cent level. For breed of dam, Hampshire x Rambouillet were significantly different ($P < .01$),

Table 2

Regression Coefficients and Standard Deviations for Carcass Grade and Dressing Percentage

Classification	No. of Lambs	Carcass Grade b value	Carcass Grade S.E.	Dressing Percentage b value	Dressing Percentage S.E.
Breed of Sire					
Hampshire	134	0.00		0.00	
Southdown	13	0.81*	±0.37	1.77*	±0.72
Dorset	46	0.23	±0.22	0.23	±0.43
Suffolk	68	-0.62**	±0.21	-0.96*	±0.40
North Country Cheviot	50	0.04	±0.21	0.18	±0.41
Breed of Dam					
Hampshire	138	0.00		0.00	
Hampshire x Rambouillet	85	-0.23	±0.19	-1.39**	±0.37
Suffolk x Rambouillet	73	-0.48*	±0.21	-1.04*	±0.41
North Country Cheviot	11	-0.10	±0.45	-0.28	±0.89
Border Leicester x N.C.C.	4	-1.53*	±0.68	-0.15	±1.32
Age of Dam					
Yearling	9	0.49	±0.45	-0.86	±0.88
2 Years Old	41	0.01	±0.28	-0.56	±0.55
3-7 Years Old	238	0.00		0.00	
8 Years and Older	23	0.19	±0.30	-0.79	±0.57
Type of Birth and Rearing					
Single Born and Reared	93	0.73**	±0.17	1.87**	±0.32
Twin or Triplet Reared as Single	22	0.40	±0.28	0.95	±0.54
Twin Born and Reared	196	0.00		0.00	
Sex					
Wether	178	0.00		0.00	
Ewe	133	0.51**	±0.14	0.34	±0.28
Mean	311	12.9		49.5	

** Significant at the one per cent level ($P < .01$)

* Significant at the five per cent level ($P < .05$)

while Suffolk x Rambouillet was significant ($P < .05$) from the base value. None of the computed estimates were different from the base value for the age of dam classification. Here again, for the type of birth and rearing, the estimates were significantly different at the one per cent level from the base value for singles. There was no difference between sexes for dressing percentage. These figures were also in general agreement with those in the literature.

Since so many of the constants were significant, all the computed differences were included in adjusting the data. This bypassed the question of choice of a level of significance of a constant, before using it to adjust the data.

RESULTS AND DISCUSSION

Both adjusted and unadjusted means are shown for all results. The unadjusted data probably give the best evaluation of the treatments from a practical standpoint. However, the adjusted data probably give the best comparison of the effects of the different treatments. In the discussion of results, only adjusted means were used.

The results for Blacksburg, 1960-1961, for the first three treatments are shown in Table 3 for average daily gain and slaughter grade. On a within year basis in 1960, the lambs on the ladino clover had significantly higher average daily gains than the other treatments; the slaughter grade was also higher for this group, but the difference was not significant. In 1961 on a within year basis the control group had the higher average daily gain and slaughter grade, but the difference was not significant.

The results for Blacksburg, 1960-1961, for treatments 1, 2, and 3 are shown in Table 4 for carcass grade and dressing percentage. As with the other two traits, on a within year basis in 1960 the ladino clover group had the highest carcass grade and dressing percentage, but the difference between it and the other treatment was not significant. In 1961 there was no difference between the treatments.

The analysis of variance for adjusted average daily gain and slaughter grade for the first three treatments at Blacksburg, 1960-1961, is shown in Table 5, and for adjusted carcass grade and dressing percentage in Table 6. In the analysis of variance for the first two traits on a two-way classification, the mean squares for years and

Table 3

Adjusted and Unadjusted Means for Average Daily Gain and Slaughter Grade
Blacksburg, 1960-1961

Treatment	No. of Lambs		Average Daily Gain				Slaughter Grade			
			1960		1961		1960		1961	
	1960	1961	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Control	33	32	.48	.44	.55	.50	12.9	12.6	13.5	13.3
Weaned, bluegrass	36	33	.51	.48	.49	.44	13.4	12.9	12.4	12.1
Weaned, ladino clover	39	32	.57	.55	.49	.42	14.0	13.9	13.0	12.4

Table 4

Adjusted and Unadjusted Means for Carcass Grade and Yield
Blacksburg, 1960-1961

Treatment	No. of Lambs		Carcass Grade				Yield			
			1960		1961		1960		1961	
	1960	1961	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Control	22	16	12.3	12.7	12.7	13.2	49.4	49.8	50.2	51.1
Weaned, bluegrass	29	16	12.6	13.0	12.6	13.2	49.1	49.3	50.5	51.2
Weaned, ladino clover	36	16	13.1	13.6	12.5	12.8	50.6	50.7	50.6	51.0

Table 5

Analysis of Variance for
Adjusted Average Daily Gain and Slaughter Grade
Blacksburg, 1960-1961

Source of Variation	df.	Mean Squares	
		A.D.G.	Sl. Gr.
Years	1	.006	7.2
Treatments	2	.016	8.6
Years x treatments	2	.098**	12.9**
Error	186	.009	2.2
Total	191		

** Significant at P < .01

Table 6

Analysis of Variance for
Adjusted Carcass Grade and Yield
Blacksburg, 1960-1961

Source of Variation	df.	Mean Squares	
		Car. Gr.	Yield
Years	1	.85	13.47
Treatments	2	3.11	15.27
Years x treatments	2	72.97**	255.18**
Error	129	.03	.10
Total	134		

** Significant at P < .01

treatments were not significant, but there was a highly significant interaction between years and treatments for both traits. This reversal in results is believed to be due mainly to the differences in rainfall between the two years. The year 1960 was a normal season with a fairly evenly distributed rainfall and was very suitable for lamb production. Perhaps the elimination of competition from the ewes for forage was also favorable, since both early weaned groups performed better than the control. Though there is no data to support this, it is believed that parasites were more of a problem in 1960 than in 1961; thus, by removing the ewes from the pastures, the biggest source of contamination was eliminated. The year 1961 was a fairly wet season, particularly in June, and there was a surplus of forage on the pastures. In fact, the forage became rather too coarse and stemmy for the early weaned lambs, and they also appeared to be wet much of the time.

The analysis of variance for carcass grade and yield was very similar to that for average daily gain and slaughter grade; the mean squares for treatments and years were not significant, but there was a highly significant interaction between years and treatments. This interaction is thought to be due to the reasons previously mentioned.

The adjusted means for the first three treatments at Glade Spring for 1960-1961 for all four traits are shown in Tables 7 and 8. On a within year basis in 1960 the lambs that were grazed separately from their dams on ladino clover had the highest mean for each of the four traits, but the difference was not significant. This treatment appeared very promising, but the area had to be reseeded and was not available

Table 7

Adjusted and Unadjusted Means for Average Daily Gain and Slaughter Grade
Glade Spring, 1960-1961

Treatment	No. of Lambs		Average Daily Gain				Slaughter Grade			
			1960		1961		1960		1961	
	1960	1961	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Control	26	28	.54	.61	.53	.51	13.2	13.0	12.5	11.5
Separate on bluegrass	28	31	.59	.66	.51	.49	12.8	12.5	12.2	11.1
Separate on ladino clover	28		.68	.74			14.0	13.7		

Table 8

Adjusted and Unadjusted Means for Carcass Grade and Yield
Glade Spring, 1960-1961

Treatment	No. of Lambs		Carcass Grade				Yield			
			1960		1961		1960		1961	
	1960	1961	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Control	22	14	12.2	12.2	12.0	12.2	49.2	48.3	48.2	47.7
Separate on bluegrass	23	14	12.3	12.1	11.4	11.1	48.3	47.4	47.0	46.1
Separate on ladino clover	28		13.0	12.9			49.9	49.0		

in the following year. On a within year basis in 1961 there was no difference between treatments for average daily gain and slaughter grade; for carcass grade and yield the control group had higher means, but the difference was not significant. The analysis of variance on a two-way classification for these traits, excluding the ladino clover group, showed a highly significant years x treatments interaction for all four traits. This is thought to be due to the same reasons as at Blacksburg.

The high and low roughage pelleted rations which were used in the drylot treatments at both stations were compared. The adjusted and unadjusted means are shown in Table 9 for both stations. Feed records were kept at Blacksburg only. There was a significant difference between the two stations for most of the traits. The reason for this is not known, since the management practices were the same. At Blacksburg there was no significant difference between the two rations for any of the traits or for feed consumption. The means for the low roughage ration were somewhat higher. The average daily gain for both rations was very high. At Glade Spring, lambs on the high roughage ration had lower slaughter grades, carcass grades, and yield than the low roughage ration, but the average daily gain was higher for the high roughage treatment. This method would seem to have possibilities for intensive lamb production in the future. The choice of the particular ration would depend on the cost of the ingredients; in our case the low roughage ration was the cheaper of the two. The drawback to this type of production would be the cost.

Table 9

Adjusted and Unadjusted Means for Average Daily Gain, Slaughter Grade, Yield and Carcass Grade for Drylot Treatments Blacksburg and Glade Spring, 1961

Trait	Blacksburg				Glade Spring			
	High Roughage		Low Roughage		High Roughage		Low Roughage	
	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Average daily gain	.65	.61	.72	.68	.60	.55	.55	.54
Slaughter grade	14.6	14.2	14.8	14.6	12.6	11.7	13.8	11.5
Carcass grade	12.8	13.3	12.9	13.8	11.4	11.6	13.0	12.8
Yield	49.2	49.5	50.3	51.4	48.2	47.4	49.6	48.9
Daily feed consumption	3.0		3.0					
Daily hay consumption	0.7		0.8					
No. of lambs	25		25		15		15	

The adjusted and unadjusted means for the treatments at Blacksburg in 1961 are shown in Table 10. The low roughage group was significantly different at the 5 per cent level from all the treatments on pasture for average daily gain. For slaughter grade there was less difference between the treatments; only the early weaned group on bluegrass was significantly lower at the 5 per cent level than the two drylot treatments. The other two traits, carcass grade and yield, show no significant difference between any of the treatments. It would appear that the drylot treatments are advantageous when compared with the pasture treatments; the average daily gain and slaughter grades are higher, and although the means for the other two traits are not significantly different from those of the rest of the treatments, they are higher.

The means for the four traits for the treatments at Glade Spring in 1961 are shown in Table 11. The adjusted means for the drylot treatment where the lambs were not weaned were higher than those for any other treatment. The only mean that was significantly different from the other treatments was the control group, for yield; this was significantly lower at the 5 per cent level than the drylot groups. Even though there is no significant difference between the treatments, it would seem that there is an advantage in feeding the lambs a pelleted ration and allowing them access to their dams. When the drylot groups were compared separately, the unweaned group was significantly better than the weaned group.

Table 10

Adjusted and Unadjusted Means for Average Daily Gain, Slaughter Grade, Yield and Carcass Grade - Blacksburg, 1961

Treatment	No. of Lambs		A.D.G.		Sl.Gr.		Car.Gr.		Yield	
	A.D.G., Sl.Gr.	Car.Gr., Yield	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Weaned, bluegrass	33	16	.49	.44	12.4	12.1	12.6	13.2	50.5	51.2
Weaned, ladino clover	32	16	.49	.42	13.0	12.4	12.5	12.8	50.7	51.0
Control	32	16	.55	.50	13.5	13.3	12.6	13.2	50.2	50.1
Weaned, high roughage	25	22	.65	.62	14.6	14.2	12.8	13.2	49.2	49.5
Weaned, low roughage	25	24	.72	.68	14.8	14.6	12.9	13.8	50.3	51.4

Table 11

Adjusted and Unadjusted Means for Average Daily Gain, Slaughter Grade, Yield and Carcass Grade - Glade Spring, 1961

Treatment	No. of Lambs		A.D.G.		Sl.Gr.		Car.Gr.		Yield	
	A.D.G., Sl.Gr.	Car.Gr., Yield	Adj.	Un.	Adj.	Un.	Adj.	Un.	Adj.	Un.
Control	28	14	.53	.51	12.5	11.5	11.4	12.2	46.9	47.7
Separate on bluegrass	31	14	.51	.49	12.2	11.1	12.0	11.1	48.2	46.1
Weaned, drylot	31	14	.57	.54	13.2	11.6	12.4	12.2	49.1	48.1
Not weaned, drylot	30	15	.59	.57	14.3	12.7	13.3	12.8	51.6	50.6

Grade Code: 9-11 is Good, 12-14 is Choice

CONCLUSIONS

From the results of this study the following conclusions are drawn by the author:

1. That differences in average daily gain, slaughter grade, carcass grade, and yield due to the effects of breed of sire, breed of dam, age of dam, sex, and type of birth and rearing are quite large; therefore, these and similar data should be adjusted for these effects before analysis.

2. That early weaning onto a high or low roughage pelleted ration with the lambs in a drylot has definite possibilities for intensive fat lamb production, though cost might be a limiting factor.

3. That early weaning onto pasture can be advantageous under certain conditions, but that there is no disadvantage of any significance to the four traits that were studied, in any year, when compared with the other pasture treatments. If the other advantages of the method, such as greater flexibility in flock management, more intensive use of available high quality pasture, and the possibility of decreased infection by parasites are considered, this method offers definite management prospects for the future.

4. That separate grazing for ewes and lambs is also a possible technique for the future in much the same way as early weaning onto pasture, but it does not have the flexibility of stock management that the latter method has.

SUMMARY

Early weaning onto pasture, separate grazing for ewes and lambs on pasture, and weaned and nonweaned lambs in a drylot were compared with a control group of ewes and lambs grazed together at Blacksburg and Glade Spring in 1960 and 1961.

Data were available on 457 lambs for average daily gain and slaughter grade and on 311 lambs for carcass grade and yield. The data were adjusted for the effects of breed of sire, breed of dam, age of dam, sex, and type of birth and rearing.

On a within year basis, comparing the pasture treatments in 1960 at Blacksburg, the early weaned group on the ladino clover had the highest means for the four traits studied; in 1961 the control group had the highest means for average daily gain and slaughter grade. There was a highly significant interaction between years and treatments, in a two-way classification, in the analysis of variance for these groups.

At Glade Spring, comparing the pasture treatments on a within year basis in 1960, the lambs grazed separately from their dams on ladino clover had higher means for all four traits. In 1961 there was no difference between the two treatments. Here again there was a highly significant years x treatments interaction in the analysis of variance.

There was no significant difference between the high and the low roughage ration at either station.

The weaned lambs on the low roughage ration at Blacksburg performed significantly better at the 5 per cent level than the pasture groups for

average daily gain, and the means were higher for the other three traits, though not significantly so.

At Glade Spring, the drylot lambs that were not weaned had a significantly higher mean at the 5 per cent level for yield over the control group, and the means were higher for the other three traits.

In a separate comparison of the two drylot treatments at Glade Spring, the unweaned group was significantly better than the weaned group.

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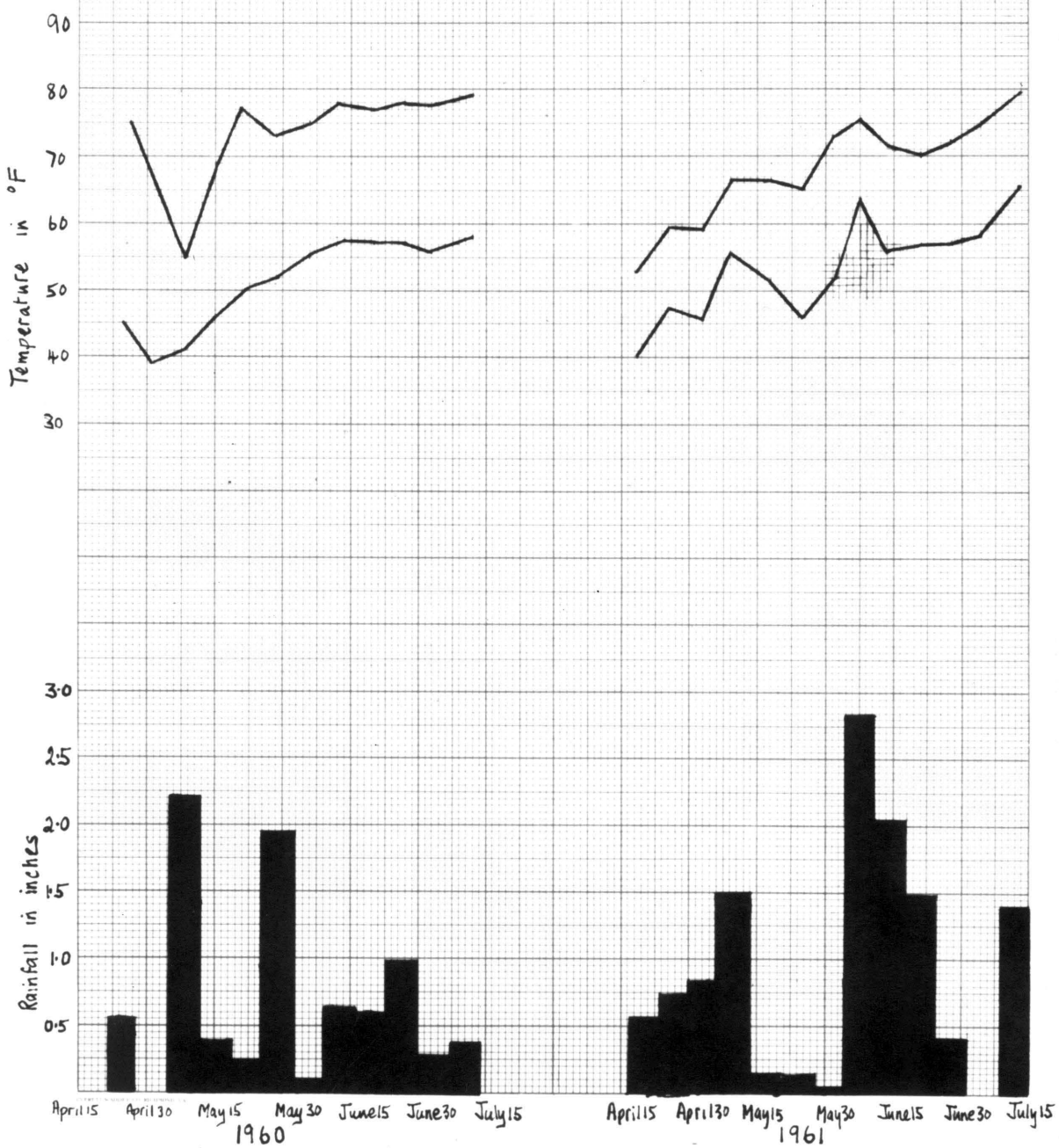
APPENDIX A

RAINFALL, MAXIMUM AND MINIMUM TEMPERATURES DURING PERIOD OF EXPERIMENT, BLACKSBURG 1960 AND 1961.



APPENDIX B

Original Matrix for Carcass Grade and Yield Used for Fitting Constants

		Total	p_1	p_2	p_3	p_4	p_5	m_1	m_2	m_3	m_4	m_5	a_1	a_2	a_3	a_4	t_1	t_2	t_3	s_1	s_2	Carcass Grade	Yield
	Total	311	134*	13	46	68	50	138*	85	73	11	4	9	41	238*	23	93	22	196*	178*	133	3995.4	15400.3
Breed of Sire																							
Hampshire	p_1		134	0	0	0	0	57	44	32	1	0	5	8	111	10	35	9	90	74	60	1728.6	6631.0
Southdown	p_2			13	0	0	0	13	0	0	0	0	3	0	10	0	5	1	7	9	4	182.0	677.0
Dorset	p_3				46	0	0	28	6	8	0	4	0	7	37	2	14	1	31	30	16	598.5	2302.7
Suffolk	p_4					68	0	11	23	24	10	0	1	24	43	0	23	4	41	35	33	833.9	3292.4
North Country Cheviot	p_5						50	29	12	9	0	0	0	2	37	11	16	7	27	30	20	652.4	2497.2
Breed of Dam																							
Hampshire	m_1							138	0	0	0	0	9	21	108	0	47	8	83	77	61	1824.9	6967.6
Hampshire x Rambouillet	m_2								85	0	0	0	0	4	72	9	21	6	58	48	37	1078.3	4128.4
Suffolk x Rambouillet	m_3									73	0	0	0	1	58	14	20	7	46	44	29	908.2	3568.4
North Country Cheviot	m_4										11	0	0	11	0	0	2	1	8	8	3	135.0	532.7
Border Leicester x N.C.C.	m_5											4	0	4	0	0	3	0	1	1	3	49.0	203.2
Age of Dam																							
Yearling	a_1												9	0	0	0	8	1	0	9	0	126.0	459.0
2 Years Old	a_2													41	0	0	22	3	16	20	21	523.8	2031.2
3-7 Years Old	a_3														238	0	54	14	170	133	105	3047.2	11788.8
8 Years and Older	a_4															23	9	4	10	16	7	298.4	1121.3
Type of Birth and Rearing																							
Single	t_1																93	0	0	57	36	1239.8	4715.6
Twin or Triplet Reared as Single	t_2																	22	0	16	6	284.7	1092.3
Twin	t_3																		196	105	91	2470.9	9592.4
Sex																							
Wether	s_1																			178	0	2260.2	8800.8
Ewe	s_2																				133	1735.2	6599.5
	ss Carcass Grade																					51877.32	
	ss Yield																						764756.89

* Variable which was deleted

APPENDIX C

Matrix for Average Daily Gain and Slaughter Grade Used for Fitting Constants

		Total	p_1	p_2	p_3	p_4	p_5	m_1	m_2	m_3	m_4	m_5	a_1	a_2	a_3	a_4	t_1	t_2	t_3	s_1	s_2	A.D.G.	Sl. Grade
Total		457	161*	32	111	87	66	221*	94	97	19	26	25	100	299*	33	121	32	304*	227*	230	248.145	5865.5
Breed of Sire																							
Hampshire	p_1		161	0	0	0	0	76	46	38	1	0	8	10	130	13	44	12	105	82	79	92.137	2175.1
Southdown	p_2			32	0	0	0	28	2	1	1	0	14	0	17	1	17	2	13	20	12	13.693	395.4
Dorset	p_3				111	0	0	55	9	18	5	24	0	49	57	5	18	2	91	50	61	53.005	1363.3
Suffolk	p_4					87	0	22	24	27	12	2	3	37	47	0	25	4	58	45	42	53.902	1099.2
North Country Cheviot	p_5						66	40	13	13	0	0	0	4	48	14	17	12	37	30	36	35.408	832.5
Breed of Dam																							
Hampshire	m_1							221	0	0	0	0	24	50	147	0	68	15	138	105	116	111.000	2893.4
Hampshire x Rambouillet	m_2								94	0	0	0	0	5	79	10	22	7	65	52	42	57.709	1199.0
Suffolk x Rambouillet	m_3									97	0	0	0	1	73	23	23	8	66	49	48	57.065	1259.8
North Country Cheviot	m_4										19	0	1	18	0	0	4	2	13	13	6	10.850	232.0
Border Leicester x N.C.C.	m_5											26	0	26	0	0	4	0	22	8	18	11.521	281.3
Age of Dam																							
Yearling	a_1												25	0	0	0	22	1	2	19	6	11.785	306.0
2 Years Old	a_2													100	0	0	26	4	70	45	55	50.575	1209.8
3-7 Years Old	a_3														299	0	62	21	216	143	156	169.167	3950.3
8 Years and Older	a_4															33	11	6	16	20	13	16.618	399.4
Type of Birth and Rearing																							
Single	t_1																121	0	0	71	50	67.671	1643.9
Twin or Triplet Reared as Single	t_2																	32	0	18	14	16.221	407.8
Twin	t_3																		304	138	166	164.253	3813.8
Sex																							
Wether	s_1																			227	0	128.840	2878.8
Ewe	s_2																				230	119.305	2986.7
	ss	A.D.G.																				144.516745	
	ss	Sl. Grade																					76912.65

* Variable which was deleted

APPENDIX D

Outline of IBM Procedure

The available International Business Machines, Card Punch, Accounting Machine, Reproducing Punch, Card Sorter and the Type 650 Magnetic Drum Data Processing Machine, were used in punching, listing, sorting and making the computations. The IBM equipment was used to adjust the data and to list them in the form in which they were required. The remaining calculations were done on a Marchant automatic desk calculator.

The original data were punched into standard 80-column IBM cards as follows:

1-4	lamb number
5	sex
6	station
7-8	year
9-10	type of birth and rearing
11-13	day of birth
14-17	dam's number
18-19	dam's breed
20-21	dam's age
22-26	sire's number
27-28	sire's breed
29-30	initial weight
31-33	initial date
34-36	initial age
37-39	final weight
40-42	final date
43-45	daily gain on test
46-48	slaughter grade
49-51	carcass grade
52-54	yield
55-56	treatment

ABSTRACT OF THESIS

Submitted in Candidacy for Degree of

MASTER OF SCIENCE

in

ANIMAL HUSBANDRY

EARLY WEANING AND OTHER METHODS OF INTENSIVE LAMB PRODUCTION

by

Lilia Cesana

Early weaning onto pasture, separate grazing for ewes and lambs on pasture, and weaned and nonweaned lambs in a drylot were compared with control groups of ewes and lambs grazed together at Blacksburg and Glade Spring in 1960 and 1961.

Data were available on 457 lambs for average daily gain and slaughter grade and on 311 lambs for carcass grade and yield. The data were adjusted for the effects of breed of sire, breed of dam, age of dam, sex, and type of birth and rearing.

Comparing the pasture treatments at both Blacksburg and Glade Spring in 1960 and 1961, in a two-way classification, in the analysis of variance there was a highly significant interaction between years and treatments.

There was no significant difference between the high and low roughage ration that was fed to weaned and nonweaned lambs at both stations.

The weaned lambs on the low roughage ration at Blacksburg performed significantly better at the 5 per cent level than the pasture groups,

for average daily gain. The means were higher for the other three traits, though not significantly so.

At Glade Spring the drylot lambs that were weaned had a significantly higher mean at the 5 per cent level for yield over the control group, and the means were higher for the other three traits.