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AN ECONOMIC STUDY

OF

LAMB FATTENING ON RAPE

By A. H. FLAY - 1928.

Code word

M. Agr. Sc. 1928

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CHAPTER 1.

INTRODUCTION

1. The Rise of the Fat Lamb Industry and Its Present Position.
2. Systems of Farming under which Fat Lamb Raising is carried out.
3. Breeds of Lambs and their Distribution.
4. Feeding of Sheep and Lambs.

C H A P T E R 1.

INTRODUCTION

THE RISE OF THE FAT LAMB INDUSTRY AND ITS PRESENT POSITION.

The advent of refrigeration in the early eighties marked the beginning of the frozen meat trade of the world. The first shipment of New Zealand frozen meat was made by the sailing ship "Dunedin" in 1882. Since that time the trade has made great strides. There was no great quantity of frozen lamb shipped from New Zealand until the early part of this century. The supplies of ewe mutton on the English market were fairly large, but with the return of prosperity to the English and New Zealand consumer alike, in the early part of this century, the real development of the fat lamb trade began. The English consumers were demanding a higher quality meat and the excellence of the fat lamb joint was becoming more common knowledge. By 1910 the number of carcasses of fat lamb exported from the Dominion was over three million. The price at this time was 3½d. to 4d. per lb. During the Commandeer Period, from the beginning of 1916 to the end of 1918, much higher prices were paid. Towards the end of the Period, the prices were approximately 10d. per lb. Thus a great development of the sheep industry, due partly to the high prices for wool as well, had consequently taken place, and in 1918 the sheep returns for the Dominion were given as 26,538,302 sheep, the highest ever recorded. The fat lamb trade suffered in the general slump of 1921-22 but is now again making rapid strides. At

present it is in a very sound position and holds third place in the value of exports from the Dominion. For the export season ending June 30th 1928 the value of the main items of export were:-

Wool	£16,548,869
Butter	11,315,756
Frozen Lamb	6,669,196
Cheese	6,360,766
Mutton	2,085,607

The number of fat lamb carcasses exported for the same year was over five million.

Some idea of its importance compared with other meat industries may be obtained from the following table:-

TABLE 1.

Killings for Export at all works during 1926/27. 1st. Commencing November 1926 to 30th September 1927.			Season
Frozen Meat	North Island	South Island	Total
Beef (quarters)	181,454	2,877	184,331
Wether Mutton (Carcases)	1,154,393	139,200	1,293,593
Ewe Mutton "	571,304	229,457	800,761
Lamb "	2,498,427	2,882,694	5,381,121
Pork (Porkers) (Carcases)	45,057	90	45,147
Bacon (Baconers) (Carcases)	29,015	471	29,486
Boneless Beef (Fat Carcases)	195,416	46,638	242,044
Sundries	55,482	14,052	69,534

SYSTEMS OF FARMING UNDER WHICH FAT LAMB RAISING IS CARRIED OUT.

The raising of fat lambs is not restricted to any particular system of farming, but limitations are imposed by many physical factors the major ones being soil, climate, topography, and transport facilities. In all systems, fat lamb raising and wool production constitute joint products. The returns from the fat lamb enterprise, compared with the returns from wool, depend on the extent to which the farm specialises in fat lamb raising. Where farmers specialise in the raising of fat lambs the income from that source is usually about three times the income from wool. In the Auckland and Southland districts, fat lamb raising and dairying are carried out on adjacent farms, and on the same farm. Throughout the Gisborne, Hawkes Bay, and Wellington districts, lambs are fattened on the flats and the hills, and on the small and the large farms alike. On the Canterbury plains, lamb fattening is carried out along with cropping, few lambs being fattened on the hills. In some districts fat lamb raising is secondary to cropping, while in others cropping is secondary to fat lamb raising. The prospective profit from cropping or from fat lamb raising influences the farmer in his decision as to his degree of specialisation in one or the other.

BREEDS OF LAMBS AND THEIR DISTRIBUTION.

Twenty years ago the predominant type of fat lamb was obtained from the mating of an English Leicester ram and a half-bred¹ ewe. Of recent years the prevailing practice has been to mate half bred and quarter bred ewes with Border Leicester rams, and to mate cross bred and three quarter bred ewes with Southdown rams. The following tables 11 and 111, (p. 4 and 5.) show the distribution of the various breeds throughout the sheep farming districts.

1.

The half bred ewe was the progeny from the mating of a long wool ram, principally an English Leicester, with a Merino ewe.

TABLE 11

SHEEP RETURNS ON APRIL 30TH 1927 - EWES NOT ENTERED IN FLOCK BOOK TO
BE BRED FROM 1927 SEASON

	Land District	Merino	Lincoln	Romney	B. Leicester	E Leicester	Shropshire	Southdowns	Rye- Lands	Corriedale	Half-bred	Cross-bred
North Island	Auckland	3,769	4,209	172,257	1,916	1,452	2,768	1,371	-	1,166	1,477	1,046,888
	Gisborne	-	350	332,196	270	-	-	1,566	-	-	-	935,517
	Hawkes Bay	12,055	10,216	494,450	6	557	-	4,411	12	-	250	1,805,453
	Wellington-West Coast	14,638	13,097	580,572	527	155	4,63	17,604	22	9,248	5,329	2,338,449
	Marlborough - Nelson - Westland	77,009	2,591	70,685	2,302	4,492	645	107	-	11,970	122,237	423,688
S. Island	Canterbury - Kaikoura	178,061	4,579	45,063	10,151	16,398	1,928	5,066	282	307,590	395,784	2,214,228
	Otago-Southland	127,164	9,928	120,863	16,253	2,457	1,290	182	-	151,604	126,505	2,365,579
Total North Island		30,462	27,872	1,579,475	2,719	2,164	3,231	24,952	34	10,414	7,056	6,126,307
Total South Island		302,234	17,098	236,611	28,706	23,347	3,863	5,355	282	471,164	644,526	5,003,895
Total for Dominion		412,696	44,970	1,816,086	31,425	25,511	7,094	30,307	316	481,578	651,582	11,130,202

TABLE 111

SHEEP RETURNS ON APRIL 30TH 1927 - RAMS NOT ENTERED IN FLOCK BOOK, 2 TOOTH AND OVER.

		E.										
Land District		Merino	Lincoln	Romney	B. Leicester	Leicester	Shropshire	Southdown	Ryelands	Corriedale	Half-Breds	Cross-Breds
North Island	Auckland	308	11,033	23,848	1,307	1,032	730	3,576	225	483	130	-
	Gisborne	3	1,592	31,228	537	166	61	1,910	1	71	-	-
	Hawkes Bay	176	2,098	44,327	343	730	184	9,203	326	1,010	277	-
	Wellington-West Coast	187	2,416	51,942	145	185	378	20,547	143	1,132	190	-
S. Island	Marlborough-Nelson-West Coast	3,822	281	6,247	308	1,710	375	688	44	948	5,775	-
	Canterbury-Kaikoura	8,684	197	6,526	11,838	13,756	3,253	6,484	469	15,109	11,912	-
	Otago - Southland	8,118	186	33,080	10,224	1,015	1,201	1,065	99	12,257	4,969	-
Total North Island		674	7,139	151,345	2,332	2,115	1,353	35,236	695	2,696	597	-
Total South Island		20,624	664	45,853	22,370	16,481	4,829	8,237	612	28,314	22,656	-
Total for Dominion		21,298	7,803	197,198	24,702	18,596	6,182	43,473	1,307	31,010	23,253	-

From these tables it may be seen, since those entered under the heading of cross-breds are mainly of the Romney type, that in the North Island there are over 7½ million breeding ewes of this type. In the North Island, also, except for Romney rams, the Southdown rams are in the majority. Border Leicester and English Leicester rams are much more common in the South Island than in the North Island and overshadow the Southdown in the former Island. Corriedales, half-breds, and to a small extent, Merinos are fairly numerous in the South Island only. Shropshires play a small part in the South Island. From the matings of these breeds the fat lambs of New Zealand are obtained.

FEEDING OF SHEEP AND LAMBS

Throughout New Zealand, the sheep are grazed on natural tussock, surface sown English grasses, and permanent or temporary pastures of various types. At no time of the year are the sheep housed, but with the greater carrying capacity on some of the better farms, hand feeding with good hay in racks, or chaff or crushed oats in troughs is becoming more commonly practised. Turnips, swedes, and other root crops, and green feeds such as oats, and kale and chou mollier, in that order of importance, are used extensively for wintering the ewes, especially in the South Island. The extension of top-dressing and pasture management throughout New Zealand permits the farmer to make less provision in the nature of supplementary crops for his ewes in winter. The extension of the growing season into the winter and the promotion of earlier spring grass, combined with the increased carrying capacity, are the benefits of systematic top-dressing with lime and phosphatic manures. Nitrogenous manures, in the near future, will play an important part in this scheme of increasing the carrying capacity.

The object of every fat lamb raiser is to get as many as possible of his lambs fat while on the mother. This is the most economical procedure. That it has not been fully accomplished in the past is no evidence that 100% of the lambs will not be fattened on the mothers on grass alone in the future. In the past, however, in some cases, none of the lambs were fattened before weaning, being fattened on supplementary feeds after weaning. In other cases a few lambs were sent away as fat direct off the mothers, but the greater proportion were fattened on supplementary feeds. The universal supplementary feed that fitted in with the farm work, the crop rotation, and provided the best fattening feed for lambs, was rape. The extent to which rape has

been grown in the past was, no doubt, greater than it is today. The extent of its use today and its probable future use are discussed in Chapter 11.

CHAPTER 11.THE RAPE CROP IN THE ROTATION IN CANTERBURY- ITS FUTURE IN NEW ZEALAND

1. Rape as a Fattening Feed and the Extent of Its Use in Canterbury.
2. Fertility of the Soil.
3. Fertility Maintained without growing Rape.
4. Position of Rape in the Rotation.
5. Extent to which Rape is grown in New Zealand.
6. Future of Rape growing in New Zealand.

CHAPTER 11.THE RAPE CROP IN THE ROTATION IN CANTERBURY- ITS FUTURE IN NEW ZEALANDRAPE AS A FATTENING FEED AND THE EXTENT OF ITS USE IN
CANTERBURY

Rape is considered the best fodder crop for fattening lambs after weaning, . . . According to T.B. Wood,¹ it is a balanced ration for lambs, having a nutritive ratio of 1:3 i.e. one part of protein to three parts of carbo-hydrate. Farming in Canterbury, at any time, has often been described as a gamble. The risks of crop failures from disease, and adverse weather conditions at critical periods are responsible for this idea. The total amount of rainfall and its distribution affect the growth of the crops and grass, and consequently, the amount of feed for the live stock. Farmers in Canterbury cannot rely upon getting the whole of their lambs away fat off the mothers upon grass alone. An investigation by the writer into this matter revealed the fact that, on the average of six farms in Canterbury, in the districts in which the inquiry to be described was carried out, only $48.0 \pm 8.7\%$ of the lambs were fattened off the mothers on grass alone, $45.3 \pm 6.8\%$ on rape, and the remaining 6.7% not fattened. As the large probable error indicates, there is considerable variation between the farms, but the figures do show the importance of rape as a crop upon which lambs are "finished off". No doubt many of the lambs fattened on the rape were almost ready for sale when they

1.

"Rations for Live Stock" T.B. Wood. Pub. by Ministry of Agr. and Fisheries. Eng.

were weaned, but a few weeks on rape gave them that finish which makes the difference between the first quality and the second quality lamb. The average number of ewes per flock was 401 (lowest 200, highest 670). Thus each farmer had from 100 to 330 lambs to fatten upon rape. The number of lambs fattened per acre varies according to the yield of the crop; the age, size, and condition of the lamb. A five ton crop fattened about 20 lambs per acre (see p. 55.), so that the area of rape grown would vary from five acres to fifteen acres. Actually, farmers usually err on the safe side, as rape is a good feed for fattening old ewes and wethers. The area of rape grown on these farms thus varied from eight acres to twenty five to thirty acres. These areas of rape are extremely typical in Canterbury for farmers with flocks of the size mentioned. Many farmers grow additional areas for fattening store lambs, obtained from the farmers on the hills, or the run-holders. The above reasoning leads to the conclusion, which is confirmed by observation and talks with the farmers, that as a class the farmers of Canterbury grow one or not more than two fields of rape, according to the size of their flock of sheep. On some farms where much cropping is done and few sheep are kept, rape is rarely grown. The fertility of the land is maintained by other means.

FERTILITY OF THE SOIL.

In order to maintain the fertility of the soil under cultivation, a rotation of crops is one of the essentials. The use of artificial manures assists to a considerable extent, but it is the humus content and mechanical condition of the soil that are the real considerations when rape or a similar crop is being grown. If farm yard manure could be applied to a field in abundance, wheat could be grown upon the field with good results year after year, just so long as the organic content of the soil was maintained. In Canterbury the rain-

fall and the moisture retaining capacity of the soil are important limiting factors in crop production. It is the increase in the moisture holding capacity, as well as in the increase of the plant food and the improvement in the mechanical condition of the soil, that gives humus its pre-eminent position as a manure. Since the application of farm yard manure for the maintenance of this soil fertility is less economical than the alternative of growing crops, such crops as rape, chou mollier, peas, green feed, oats, oats and vetches, and Italian rye grass temporary pasture are grown. Permanent pasture also has a similar beneficial affect in maintaining the humus content of the soil.

FERTILITY MAINTAINED WITHOUT GROWING RAPE.

In the first section of this chapter we saw that the amount of rape grown does not bear any relationship to the area of land under the plough, but is determined by the number of lambs to be fattened. The soil fertility is maintained by the growing of the other crops mentioned above equally as much as by rape, for the area under wheat, oats and barley is several times, probably about eight times on the average cropping farm, greater than the area under rape. The growing of autumn green feed, the sowing of peas in the spring, and the growing of short rotation pastures and one year temporary pastures, are probably most important means of maintaining the fertility where rape is rarely grown.

THE POSITION OF RAPE IN THE ROTATION.

A scientifically correct rotation in Canterbury for land broken out of grass would be rape, wheat, peas, oats or barley and grass, and grass, which means that the land is under the plough for five or six years. During this time two crops of wheat are obtained before the land is sown down to grass again. In practice, every conceivable variation in the rotation

is practised and generally with no detrimental effects, except where wheat crops are taken off the land in almost continuous succession. Some land is able to stand a good deal of such treatment. Rape may be, and usually is grown after any crop, according to the system of cropping and farm management. On the farms investigated, rape was grown mainly after turnips and grass. The growing of it after grass is to be recommended for an excellent seed bed for wheat is thus prepared. Land ploughed directly out of grass cannot be converted into that tilth so necessary in order to grow a good wheat crop without an intervening crop which allows the turf to become thoroughly decayed. Putting rape in to land ploughed out of grass, allows the use of that pasture during the winter as a run off from green feed, turnips, or as a field in which to feed out hay and mangels. It also allows the use of the team in the late spring and early summer, rendering their cost per unit of cultivation less than otherwise would be the case. Also if the field is infested with twitch or other weeds spring cultivation extending into the summer if necessary gives an excellent chance of eradication. On the lighter lands higher up on the plains, however, rape is annually grown partly as a lamb feed and partly as a means of laying down the new pasture. It forms an excellent cover crop for the young grass. Turnips are the main crop for supplementary feed. The only rotation on these farms is rape, turnips and pasture. Areas of oats are sometimes grown.

EXTENT TO WHICH RAPE IS GROWN IN NEW ZEALAND.

In New Zealand, other than Canterbury, rape is grown to a less extent. In Southland an investigation covering twelve farms gives $45.0 \pm 3.9\%$ as the proportion of the lambs fattened on grass while still on the mothers. On one well managed and top dressed farm as many as 93% were

fattened off the mothers last year (1927-28 season). Turnip tops and turnips are used for fattening fairly extensively. In the Waikato, renowned as a dairying area, a considerable amount of fat lamb raising is practised. In this area on an average of five farms the percentage of the lambs fattened off the mothers while on grass was 80.7 ± 3.5%. A small proportion were fattened on good succulent clover, English rye, and cocksfoot pasture, and a very few on rape. In the ^{ra}Wairapa, and Hawkes Bay Districts rape is grown to a large extent.

FUTURE OF RAPE GROWING IN NEW ZEALAND.

.In collecting the information on the number of lambs fattened on grass while still on the mothers, and on rape after weaning, each farmer was visited personally, the raising of fat lambs and the extent to which rape could be used economically, being discussed. The information obtained from every farmer was that the fattening of the lambs off the mothers was the most profitable enterprise. Some recommended fattening lambs after weaning on grass alone, but the majority "finish" the remaining lambs by the use of rape, turnip tops and chou mollier, in Southland, and in a few cases red clover or lucerne. Those that grow rape positively declare that if they could be certain of fattening all their lambs without the rape, the growing of rape would not be continued.

The fact that some farmers, by the aid of top dressing and systematic grazing, are now getting practically all the lambs away fat off the mothers on grass alone, in both the Waikato and in Southland, which are grassland farming areas, points out that, in the near future, rape growing will be more and more confined to Canterbury, where succulent pasture cannot be obtained in the middle of summer. It is the economic factor of costs and returns that is bringing this change

about. The cost of ploughing, cultivating and sowing rape may in some cases give a profit, but the profit from top-dressing and pasture management in those areas where grassland farming can be carried out is much greater, for the same cost. The climate and rainfall are the limiting factors in regard to this type of farming. It was not possible to visit the other areas mentioned above, where fat lamb raising is extensively carried out, but the newspapers, farmers' periodicals, and the Journal of the Department of Agriculture state that these areas are being top-dressed extensively. It would seem probable that the greater proportion of the farming land in districts with a rainfall over 40 inches per annum will, in the future, be regarded as "top-dressing country". Even on the hills, considerable areas are being topdressed by hand, and, when a suitable mechanical means of applying artificial fertilisers to hill country is introduced, the provision of more and better grass will bring about a greater percentage of lamb fattening on the mothers. In districts, however, subject to very dry summers rape will hold its place as the main lamb fattening forage crop.

CHAPTER 111.

THE PRESENT INQUIRY

1. Aims.
2. Scope
3. Method.
 - (a) Visiting Farms and Recording Data.
 - (b) Determination of the Rape Yields.
 - (c) Weighing the Lambs.
 - (d) Measuring the Returns from Grazing.
 - (e) Methods of Experimentation.

C H A P T E R 111.THE PRESENT INQUIRY.

AIMS. The Investigation was directed towards obtaining information on

- (a) the cost of producing rape,
- (b) the productive value or gross returns from rape as a fat lamb producer, and
- (c) the profit or loss on the rape crop when grazed by fattening lambs.

SCOPE.

It is always a difficult proposition to determine the cost of production of any crop, and rape certainly is no exception. Such factors as the previous crop, texture of soil, weather conditions, interest payable on the value of the land, rates, taxes etc., are all influencing factors. Since rape is extremely common as a crop for fattening lambs in Canterbury, one might be inclined to think that there would be no difficulty in obtaining the necessary information. Actually, however, if information of any degree of accuracy is desired, the information at present available is of little value.

By taking a sufficient number of fields distributed over a fairly large number of farms, it was hoped there would be information on the costs of growing the crop upon different soils, after various crops, and under different systems of management, such as horse and tractor cultivations, and mixed and purely sheep farms. That this was not achieved will be seen later.

The area covered was limited to a twelve mile radius from Lincoln College, that area embracing farms of soil types varying from heavy alluvial silts to light shingle. The farms on this area might be classified as

(1) Sheep farms, where the cropping consists of winter and summer provision of sheep feed, rape being the main summer feed,

(2) Cropping farms, where any rape grown would be grazed by store lambs, and

(3) Mixed farms where sheep are a secondary consideration, extending to the most important item on the farm. On these farms, in most cases, rape is grown for the purpose of fattening the lambs not fattened on the mothers on grass, but, in some cases, store lambs may be bought for fattening.

METHOD (a) VISITING FARMS AND RECORDING DATA.

The farms were visited in the winter and spring of 1927 and the procedure explained to the farmers in detail. As a class, the farmers did not mind the work of keeping the records of cultivation and work put into the fields, but, during the spring, several visits were necessary to ensure that the work was being done satisfactorily, and to maintain the interest of the farmers. No difficulty was experienced in obtaining confidentially the Government Land Values, the value of the stock, implements and equipment etc., for the purpose of interest and depreciation allotment per acre, over the farm.

To determine the productive value of rape or the grass returns from rape, it was necessary to know the yield of rape, the live weight increase of the lambs, and the number of grazing days. This was explained to the farmers, but the work required was sufficient to cause some to object. It was arranged for the farmer to ring me by telephone when he

had decided the day upon which he would put his lambs on the rape. The yield of rape was then determined and preparation made for weighing the lambs when he had them in the yard for weaning, drafting or crutching, as may have been the case. When the break or field of rape was finished and the lambs again yarded for drafting out the fats, the second weighing was made. From the live weight increase, the number of grazing-days, and the yield of rape, the returns from rape as a fat lamb producer were calculated.

(b) DETERMINATION OF THE RAPE YIELDS.

For the purpose of determining the yield of rape, the assistance of a fellow student was obtained. A few sacks, a tape measure, a set of scales, and a spade were the necessary equipment. The rape was cut approximately one inch, not more, above the ground with the spade. This is the best tool for the purpose. (It is used by the Department of Agriculture for this purpose in the determination of yields in their manurial trials on rape). A strip 28 inches wide by 33 feet long which is $1/566$ of an acre was measured off, cut, bagged, and weighed immediately. The size of the plot taken meant that either two rows or four rows of rape were cut, according to whether the drills were 14 inches or 7 inches apart. This size of plot was decided upon because of the convenience of measurements, and also that it did not mean the cutting of too great a quantity of rape. For the purpose of speed, with a sufficient degree of accuracy, only sufficient plots were cut to give a probable error not greater than 5%, as determined by statistical methods. After having viewed a certain number of fields it was decided that random sampling i.e. taking plots at random, would not give the desired degree of accuracy without entailing the weighing of a large number of plots in those cases where the fields were uneven. Most of the fields were uneven. The

method of selection of plots had to be used. By this method a walk was taken over the field, the rape surveyed and the number of plots to be taken from each portion of the field according to the nature and evenness of the crop, decided. Sometimes 10 and even 12 weighings were necessary, while in an even crop 6 weighings gained the necessary accuracy. That the method was reliable the following typical example will show. The actual weights taken on each plot were:-

Weight of rape on 1/566 ac.

	d.	d. ²	
37 lb	4.5	20.25	
48 "	6.5	42.25	P.E. = $\sqrt{\frac{Ed^2}{N}} \times .67$
45 "	3.5	12.25	
45 "	3.5	12.25	= $\frac{\sqrt{450}}{8} \times .67$
48 "	6.5	42.25	
49 "	7.5	56.25	= 1.8
30 "	11.5	132.25	
30 "	11.5	132.75	
—		—	
<u>332</u>		<u>450.00</u>	

Mean = 41.5 ± 1.8 lb.

= 10-5 ± .45 tons per acre.

This field was surveyed and it was considered about $\frac{1}{8}$ was of one yield, $\frac{1}{8}$ of another and $\frac{2}{8}$ of another, and so the samples were taken in that proportion. It could be seen that the yields varied between those three portions of the field, but it was not possible to see any difference between the plots decided upon in each portion. Of course the three portions merged into each other, but care was taken to see that the plots chosen were evenly distributed over the entire field. The field in the case mentioned was 11 acres in area, and yet with only 8 samples, the error was not more than 5 %, actually being 4.3%. This, it must be noted, was

the error accruing when the weighings were considered as random samples.

Actually the error was something less than 4.3%, in this case, for the weighings of each different portion of the field did not show the variation that was shown by the field as a whole. All the fields were treated by this method and in each case the error must be considered something less than that recorded.

(c) WEIGHING THE LAMBS.

Concerning the weighing of the lambs no real difficulty was encountered so far as method was concerned. The apparatus consisted of a sheet, spring balance, and cross bar. The lamb was caught, handled carefully, and laid on his back upon the sheet. The four rings on the ends of short ropes which were attached to the four corners of the sheet were hooked on to the scales. An iron bar supported from the shoulders of the weighers held the scales and the lamb was lifted off the ground by the weighers standing upright. As the number of lambs varied from 60 to 500 in the flocks it was decided to weigh a representative sample. The lambs were penned and caught for weighing just as they happened to be nearest the catcher in the case of small flocks, while in the larger flocks a portion of the flock was run off, then those for weighing were run off through the same gate into a separate pen. This ensured that the larger and more robust lambs, which go first in a run off were not those that were weighed, but the medium lambs that followed. By this method it was considered a more representative sample was obtained. The number weighed varied with the evenness of the flock and the size of the flock, but an attempt was made to weigh sufficient to keep the probable error of the average less than 1%. In a flock of 220 lambs, by weighing 30 lambs, the average live weight

per lamb and its probable error was $72.4 \pm .72$ lb. Other samples are $55.7 \pm .77$ lb by weighing 50 lambs in a flock of 500, $57.4 \pm .79$ lb by weighing 40 lambs in a flock of 550 lambs, $63.84 \pm .81$ lb by weighing 25 lambs in a flock of 120 lambs, and $62.42 \pm .62$ lb by weighing 40 lambs in a flock 560 lambs. After the second weighing, however, the difference which was between 12 lb and 20 lb more than the above weights, gave the live weight increase for the period, but the probable error of this difference was, on the average, about 12% as calculated by statistical methods. Each lamb was branded at the time of the first weighing thus enabling and ensuring that the same lambs were weighed again when the rape was finished.

(d) MEASURING THE RETURNS FROM GRAZING.

The live weight increase at $4\frac{1}{2}$ d. per lb for the first growth and the grazing-days at 3d. per week for the second growth, gave the gross returns for the crop and per ton of rape. The reason for reckoning the live weight increase at $4\frac{1}{2}$ d. per lb is discussed in Appendix 11, p. 91, while 3d. per week for grazing is erring on the safe side. Ewes are rarely grazed much above this figure and in fact $2\frac{1}{2}$ d. is quite common in Canterbury. The charge for grazing however is not fixed, but is influenced by the supply of feed and the demand for it from month to month and season to season. In normal seasons the second growth of rape is valuable as it is ready for grazing when other feed is scarce, and, on many farms, is specially reserved for flushing ewes.

It would have been desirable in this work to determine the value of gross returns from the rape by the returns from the buying of store lambs and selling them fat, the net return on the fat lamb transaction representing the value or gross return on the rape crop. Actually only two farms used

such lambs on the rape fields in question, and one of them used the same lambs to graze two fields. Also the price rose during the fattening season from $9\frac{1}{2}$ d. to $11\frac{1}{2}$ d. per lb, thus the late and perhaps lighter lambs brought a higher price than the earlier lambs. In both cases the lambs were bought under the impression that the prices were stable, for in the earlier portion and practically until the middle of the season, there was an indication that prices were going to rise. Under these conditions the actual returns from the sale of the lambs would be quite unfair even if the items of supervision and sundry labour could be assessed with any degree of accuracy. The gross profit from the rape will then be the difference between the cost of production and the gross return or productive value of the rape.

(e) METHODS OF EXPERIMENTATION.

The purpose of all experimentation is to obtain new knowledge or to confirm already existing ideas. In Agricultural experimentation two methods may be used, (1) a detailed method where every factor except one is controlled, or where, in the case of comparisons, all the conditions are the same except one, and (2) a general method where none of the factors that cause variations are controlled, or conditions necessarily the same.

(1) THE DETAILED METHOD. When exact and precise information is desired this is the best method. The information will be exact only for the particular set of conditions under which the experiment is conducted. Thus in manurial trials the results will show clearly which manure gives the greatest yield, and which the greatest profit. These results can be considered reliable only on that particular soil, with the amount of cultivation it received, its moisture content, and the season prevailing.

If the experiment had been conducted a few chains away in one direction or another the results may have been different, due to the variation in the soil, even though all the other conditions were the same. By numerous experiments in different areas and in different seasons a definite body of knowledge is built up concerning the manures and how they react under every set of conditions.

This was the method used in the supplementary investigation (See Chapter VII). The results are true for the conditions under which the experiment was conducted. By repetition in several seasons and with one condition at a time being varied a body of knowledge would be built up showing what results might be expected under any set of conditions.

(2) THE GENERAL METHOD. This method is not considered as good as the detail method. Since at one particular time there is not one factor being varied, but many, the results are averages occurring under the complexity of these variables. The repetition of the experiment gives averages due to perhaps a different complexity of variables. In a number of years the results are true for average conditions, but no information is available to say what might be the result if any one of the variables is controlled. This was the method used in the main inquiry for the determination of the live weight increase per day, weight of rape eaten per day, etc. The result is an average, each item of the average being true for its own set of conditions. The average is not necessarily true for any particular farm and no information is available to indicate what might occur under a given set of conditions. The extent of the effects of the variables on each farm is not known. In the supplementary investigation these variables exerted the same influence at the same time on each lot of lambs,

the only difference between the lots being the breed in one experiment and the method of feeding in the other experiment.

CHAPTER IV.COST OF PRODUCTION OF RAPE

1. Subsidiary and Complicating Factors that must be considered in Costing.
2. Assessing Overhead or Supplementary Costs and Prime Costs.
3. Overhead or Supplementary Costs.
 - (a) Costs considered as overhead.
 - (b) Period rape crop occupies ground - apportionment of overhead costs.
 - (c) Analysis of overhead costs.
4. Prime Costs.
 - (a) Costs considered as prime.
 - (b) Analysis of prime costs.
5. Total Costs.

CHAPTER IV.COST OF PRODUCTION OF RAPESUBSIDIARY AND COMPLICATING FACTORS THAT MUST BE CONSIDERED
IN COSTING.

In costing any farm crop or product whether individually jointly, or as an item in the entire farm costing, many arbitrary margins, estimates, and considerations have to be made. After dealing at length, with the difficulties of farm costing King¹ says, "It may be said, therefore, that in general the individual farm product has no final cost that is determinable independently of the costs of other produce. It is true that a crop may involve particular operations of which the out-of-pocket costs for manual and horse work and for seed, etc., may be computed; it is also true that the amount of these out-of-pocket costs have a direct bearing upon the suitability of the crop for finding a place within the farming system, having regard to the yield obtainable under the conditions of the farm; but the expenses incurred on the crop are no real measure of its effective cost of production unless all subsidiary and complementary processes can be carried on without loss, and unless the quantity grown is limited to the amount that will fit conveniently into the whole scheme of farming. The farmers problem is to balance his enterprises, so that the total net return is the greatest possible. Adjustments may have to be made slowly, and, if made, they must be based upon considerations of extra expenditure required to obtain a given increase in the output of particular products, bringing into account any incidental losses that may be incurred in the processes."

1. "Cost Accounting Applied to Agriculture" J.S. King p. 26.

In an attempt to cost a single farm product the allotment of the overhead costs, since such costs form a very large part of the total cost, will influence the more or less arbitrary figure ultimately obtained.

ASSESSING OVERHEAD OR SUPPLEMENTARY COSTS AND PRIME COSTS.

Costing investigations are usually divided into overhead costs and prime costs. The distinction between these is quite definite in such items as interest on capital, rates, and taxes, which come under the former division; and seeds, manures and cultivation which come under the latter division. Even cultivation might be considered as partly an overhead cost, since a portion of the cost of the team is an overhead cost and is going on all the time whether rape is grown or not. Items such as repairs to implements and fences, might be considered as current expenses. They really are, it might be supposed, but how can they be allotted to an isolated crop? This year, let us say, because a field is going into rape the entire hedges around it are cut and the water races cleaned out, or the repair bill to implements may be very high one year and low the next. As the investigation was for one season only, the farmer was asked to estimate the average annual expenditure on these items. This expenditure then could only be allotted to the farm on a per acre basis. It is a fixed charge for every acre on the farm and hence for every crop, so has been considered as an overhead cost.

OVERHEAD OR SUPPLEMENTARY COSTS.

The following costs are included in overhead costs; interest on capital value, depreciation on improvements, depreciation on implements, interest on implements, land taxes local rates, insurance; repairs to buildings, implements, and fences, and gorse cutting and ditch cleaning. The capital

value used in each case was that recorded as the Government valuation. This it was considered would be as fair a value as it would be possible to obtain, for, although there is much discrepancy between land values in different districts, yet in one locality they tend to be similar even though that value may be too high. The interest on the capital value and implements was reckoned at 6%. Depreciation on implements is reckoned at 10%. This might be considered high and in reality it would be if the implements were all new. On the average it was found that the implements had passed through about half their life and the value given by the farmers was their present day value. Thus taking 10% on this value is really obtaining 5% on their new value. The value of improvements was considered as the difference between the Government capital value, and unimproved value and is subject to the same considerations and errors as the capital value. A depreciation of 3% is allowed on the improvements, because a building with some repairs might be considered to last 33 years, while gorse fences with repairs and cutting last indefinitely. Post and wire fences have practically finished their usefulness by the end of the 33 years period. Some varieties of timber as posts last a much shorter time. (The Department of Agriculture also uses this figure for depreciation on improvements). The annual charge for each of the above items was calculated on a per acre basis and then $\frac{2}{3}$ (two thirds) of this amount taken as the overhead charge on each acre of rape grown. On the average the rape crop occupies the ground for only eight months of the year. Rape is most commonly grown:-

(a) After grass. This practice has the advantages of permitting early skim ploughing (July-August). Further the strong rooting power of the rape assists in the disintegration and decomposition of the old turf. This would be a 9 month period.

(b) After grain crops. In this case the time between

harvest and the sowing of rape may well be filled in by a crop of winter green feed, or, on the other hand, the stubble may provide valuable volunteer growth for autumn and winter feed. This case would be just under an eight month period.

(c) After turnips. In this case the turnips are fed off by August or early September allowing just sufficient time for the cultivation and preparation of the soil for rape. The period in this case would be less than eight months.

Each of the above items has been allotted on a per acre basis over the whole productive area of the farm. The unproductive land, such as that occupied by buildings, yards roads, fences, and ditches, subtracted from the area of the farm gives the productive area. This allowance is made because the producing areas of the farm have to meet the expenses incurred by the non-producing areas. There was to some extent a greater unproductive area per 100 acres on the smaller farms, due to smaller fields, and to some extent the same area of buildings and yards as the larger farms. This is shown in the following table.

TABLE IV.

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6
Area of farm.						
Acres unproductive land	351	229	212	219	159	432
per 100 acres	1.85	1.31	3.30	3.65	2.20	1.62

The details of the overhead costs are shown in Table V page 28. The interest on the capital value amounts to 28/6 per acre for eight months on average - farms 1 and 2 not included (see p. 33) - or 42/9 per acre for a twelve month period. This amounts to 73.7% of the overhead costs. The other costs enumerated bring the total cost on average to 38/8

TABLE V.

OVERHEAD CHARGES PER ACRE ON 6 FARMS GROWING RAPE.

	Farm 1.		Farm 2.		Farm 3.		Farm 4.		Farm 5.		Farm 6.		X Average.	
	s. d.	%	s. d.	%	s. d.	%	s. d.	%	s. d.	%	s. d.	%	s. d.	%
Interest on Capital @ 6%	32.7	73	8.11	62.5	26.10	70.2	30.3	70.5	31.9	79.6	25.3	75.0	28.6	73.70
Depreciation on Improvements @ 3%	1.10	4.12	9	5.08	1.2	3.06	1.11	4.46	1.3	3.13	1.8	4.93	1.6	3.88
Depreciation on Implements at 10%	3.0	6.75	3	1.75	2.7	6.7	2.3	5.25	1.7	3.96	1.11	5.67	2.1	5.38
Interest on Implements at 6%	1.10	4.12	3	1.75	1.7	4.15	1.3	2.91	1.1	2.30	1.2	3.45	1.3	3.23
Land Taxes	1.11	4.31	-	-	-	-	2.10	6.61	-	-	9	2.22	11	2.37
Local Rates	1.7	3.55	1.3	8.78	1.7	4.15	1.9	4.07	1.8	4.17	1.5	4.2	1.7	4.09
Insurance	2	.37	1	.70	5	1.09	3	.58	2	.42	3	.74	3	.65
Repairs on Buildings	5	.93	3	1.75	10	2.18	5	.97	5	1.04	4	.98	6	1.29
Repairs on Implements	7	1.30	1.5	10.16	1.7	4.15	.9	1.75	5	1.04	4	.98	9	1.94
Fence Repairs, ditching and gorse cutting	9	1.67	1.1	7.43	1.7	4.15	1.3	2.91	1.9	4.38	9	2.22	1.4	3.45
Total	44.8		14.3		38.2		42.11		39.11		33.10		33.8	100.00
Area of farm (Acres)	351		229		212		219		159		432			

X

This average is for farms 3, 4, 5, and 6 only.

per acre. There seems to be no relation between the overhead charge per acre per farm and the area of the farm. There are many factors preventing such a relation, the most important being the value of the land. There is a fair amount of variation between the same items on the different farms, but no relationships are shown, probably because the number of farms is too small to allow them to become visible. Farm 2 is an exceptional case, the land being of light shingly nature, and it is run as part of another farm for which due allowances have been made.

PRIME COSTS

The prime costs of producing a rape crop consist of all horse and manual labour expended in cultivation and drilling, carting manure, cost of manure, and seed used. In the case of farm 2 there was also the item of plough shares worn out on the stones. On the other farms this item is negligible. From the records of the hours of manual, horse, and tractor labour expended the cost on each farm was calculated by reckoning a man's labour at $1/3$ per hour, a horse's labour at $5/9$ per day (eight hours), and a tractor's cost at $5/9$ per hour (see Appendix III p. 95.). A man's labour at $1/3$ per hour is almost on a par with the current wage for day labour on farms. The details of these costs, also the hours worked, are shown in table VI. p. 30. Farms 1 and 2 are neglected from the average. Farms 3 (1), 3 (2), 4 and 5 are strictly comparable in regard to their prime costs in that the soil and type of farming and farm organisation are very similar. Farm 6 uses a tractor and is on lighter land with a rather different type of farm organisation. The average is also given including this farm. The table shows that on farms where no tractor was used the manual hours of labour expended per acre amounted to 9.04 hours an average, horse hours per acre 44.54 hours. On the farms strictly comparable there is little variation. The manual cost is $11/4$, and the horse cost $32/-$ per acre. The average prime cost for these farms is $53/8$ per acre.

The average cost of manures on the five farms is $8/4$ per acre, and of seed is $2/4$ per acre while the average total cost for these five farms is $48/9$ per acre. Farm 6 shows itself to be much more efficient in the prime costs and consequently lowers the average to the figure mentioned. Considering the seven farms the dispersion is fairly considerable. As mentioned above the farms are not comparable. In respect to prime costs, as mentioned above, only four are comparable.

TOTAL COSTS.

The total cost per acre^{of} producing the rape crop is shown in detail in table VII. as follows:-

TABLE VII
TOTAL COST PER ACRE

Farm	Overhead Cost		Prime Cost		Total Cost
		(%)		(%)	
1	44/8	(47.6%)	49/1½	(52.4%)	93/9½
2	14/3	(31.02)	31/9	(69.0%)	46/-
3(1)	38/2	(42.4%)	51/10	(57.6%)	90/-
3(2)	38/2	(40.6%)	55/10	(59.4%)	94/-
4	42/11	(45.0%)	52/6	(55.0%)	95/5
5	39/11	(42.3%)	54/6	(57.7%)	94/5
6	33/10	(53.8%)	28/11	(46.2%)	62/9
	38/7	(44.3%)	48/9	(55.7%)	87/4

There is a certain amount of variation, but the farms 3 (1), 3 (2), 4 and 5 show little variation, being in the neighbourhood of 94/- per acre. The average of the five farms however is $87/4$ per acre. The percentage of overhead and prime costs to total costs show variations, but the overhead cost is on the average 44.3% and the prime cost 55.7% of the total cost.

C H A P T E R V.

LIVE WEIGHT INCREASES, GROSS RETURNS
AND PROFITS

1. General Considerations.
2. Grazing-days, Live Weight Increases
and Rape Eaten.
3. Gross Returns.
 - (a) First growth or main crop.
 - (b) Second growth.
 - (c) Total gross returns.
4. Profits.

C H A P T E R V.LIVE WEIGHT INCREASES, GROSS RETURNS
AND PROFITSGENERAL CONSIDERATIONS.

As mentioned in Chapter III the returns could be determined only by the live weight increase of the lambs and the grazing-days. The live weight increase per day for each flock of lambs upon each field of rape was determined. On farm 3 the same flock grazed the two fields. Also on this farm several deaths of the weighed lambs rendered the second weighing unreliable, so that the average daily live weight increase of 144 lambs (see p. 51.) has been substituted for the purpose of calculations. It is admitted that the resulting return may not be that actually obtained by the farmer, but when it is remembered that the probable error of the live weight increases of the lambs on the other farms is on the average $12\frac{1}{2}\%$, (see p. 34 Column - Live Weight Increase per lamb for period) this substitution does not materially affect the accuracy. Since in every field there was a second growth of rape, the returns from the grazing of this growth were calculated on the basis of 3d. per sheep per week (see p. 10) The live weight increase of the lambs @ $4\frac{1}{2}$ d. per lb (see Appendix II p. 91) was used as the basis for the calculation of the returns from the main crop or first growth. In some cases the second growth afforded as many grazing days as the first growth, due to the exceptional season. The second growth is usually grazed by ewes or wethers. It may be used for lambs, but is extremely liable to cause sudden and severe scouring unless grazed very judiciously.

In those cases where lambs were grazed on the second growth, the lamb grazing-days were converted into sheep grazing-days and the returns calculated from the number of sheep days at 3d. per week as mentioned above. In the conversion of lamb-days to sheep-days, the lamb-days were multiplied by the fraction $18/25$, a lamb at that stage of its growth eating approximately $18/25$ as much as a full grown sheep. This fraction was obtained from previous work on grazing records of fields carried out by the Animal Nutrition Research Department of Lincoln College for the purpose of converting lamb-days to sheep-days. On some of the farms wethers or ewes were grazed with the lambs on the first growth. In these cases the lamb-days were obtained by multiplying the sheep-days by the fraction $25/18$.

On farm 1 the lambs had a run off on to grass and on farm 2 grass was sown with the rape, so that these two farms had to be excluded from the average. This left five fields on four farms from which the averages were obtained.

GRAZING DAYS, LIVE WEIGHT INCREASES AND RAPE EATEN

The details of the area of the fields, and yields per acre, grazing-days per acre and per ton of rape, live weight increases per day, per acre, and per ton of rape are shown in Table VIII page 34. . As would be expected there is a distinct relation between the yield per acre and the grazing-days per acre. The grazing-days per ton of rape show some variation, the greatest being for the lightest yield, while the next largest is for the field with the heaviest yield. The average, however is 109.2 ± 2.93 grazing days per ton of rape. There is a certain amount of variation in the live weight increases per lamb and consequently in the live weight increases per lamb per acre of rape eaten. The best daily live weight increase was .409 lb., the worst .314 lb.

TABLE VI11

FIRST GROWTH- GRAZING RECORD AND GROSS

RETURNS

Farm	Area of Field	Yield per acre	Lamb Grazing-Days per Acre	Lamb Grazing-days per ton of rape	Live Weight Increase per lamb for period	Live Weight Increase per lamb per day	L W I. per acre	L W I per ton of rape	Gross Returns @ 4½d. per lb live weight increase	
									per acre	per ton of rape
	acres	tons			lb	lb	lb	lb	£	s. d.
1	9.3	3.86 ± .09	662	174	Gain in 32 days = 6.87 ± 1.41	.208	138	36.2	2 - 11 - 9	13 - 7
2	28	0.58 ± .045	127	2.19	Gain in 54 days = 17.30 ± 2.21	.320	41	70.0	15 - 4½	1 - 6 - 3
3 (1)	16	3.07 ± .15	394	128	-	.325	128	41.5	2 - 8 - 0	15 - 7
3 (2)	9	3.80 ± .205	412	108	-	.325	134	35.0	2 - 10 - 3	13 - 1½
4	9	6.0 ± .28	577	96	Gain in 39 days = 12.24 ± 1.27	.314	180	30.0	3 - 7 - 6	11 - 3
5	8	7.53 ±	743	99	Gain in 27 days = 9.15 ± 1.07	.339	252	35.5	4 - 14 - 6	12 - 7
6	12	10.50 ± .45	1219	115	Gain in 21 days = 8.59 ± .68	.409	499	47.6	9 - 7 - 2	17 - 10
X Average	10.8 ± .88	6.18 -	469	109.2 ± 2.93		.342(.354) ^{1.}	238.6	37.5 ± 1.87	4 - 9 - 6	14 - 1

X
This average is for the 5 fields only.

1
The figure in brackets is the average for the three farms 4, 5, and 6.

Of the farms not considered in the average .208 lbs was the daily live weight ~~minimum~~^{increase} per lamb for farm 1. These lambs were not in a good thriving condition. The live weight increase per acre shows a relation to the grazing-days per acre and the yield per acre. The live weight increase per ton of rape shows some variation with an average on the five farms of 37.5 ± 1.87 lb per ton of rape eaten.

The following table shows the weight of rape eaten by a lamb in one week on the farms investigated and the weight of rape required to produce 100 lb live weight increase.

TABLE 1X

Farm	Weight of Rape eaten per lamb per week	Rape required for 100 lb Live Weight increase	Dry matter in Rape required for 100 lb. L.W. Increase
1	lb 90.2	lb 6190	lb 874
2	71.6	3200	451
3 (1)	122.4	5400	761
3 (2)	145.0	6400	902
4	163.3	7470	1053
5	158.4	6685	943
6	136.2	4720	666
Average	145.1 ± 4.45	6135 ± 282	865 ± 42

The average of five fields is 145.1 ± 4.45 lb of rape per lamb per week. Farms 1 and 2 excepted there is still a certain amount of variation as shown by the actual figures and the probable error. There is also a good deal of variation in the amount of feed required for 100 lb live weight increase, the average being 6135 ± 282 . The error here is 4.6%, although the accumulated error is in the neighbourhood of 20%. This is because of the 5% error in the

rape weights, and 12.5% error approximately in the live weight increases. The same table shows the weight of dry matter¹ eaten per 100 lb of live weight increase. The average of the five farms is 865 ± 42 lb, but there is a considerable variation, the most economical using only 666 lb. of dry matter, and the least economical using 1053 lb. of dry matter for 100 lb of live weight increase. This difference is, no doubt, brought about by many factors, the most important being the plane of nutrition of the lambs and the water content of the rape.

GROSS RETURNS.

Table VIII p 34. . shows the gross returns per ton of rape and gross returns per acre for the first growth or main crop. The returns are proportional to the yield, and the grazing-days per acre. It is influenced by the daily live weight increase. The 3.07 ton crop gives a return of £2-8-0 per acre while the 10.50 ton crop gives a return of £9-7-2 per acre. In the latter case the grazing-days per ton of rape were less, but the daily live weight increase was more than in the former. This brings out clearly the importance of yield in determining the profitableness of the rape crop. It is the extra yield over and above the amount required to pay for the cost of production that is net profit. The gross return per ton of rape is fairly even in the five fields ranging from 11/3 to 17/10, the average being 14/1.

The second growth afforded a considerable amount of grazing in several cases. The following table shows the sheep-days per acre and the gross returns for the same.

1.

The dry matter content of rape is given by T.B. Wood in "Rations for Live Stock" as 14.1%

TABLE XSHEEP GRAZING-DAYS AND GROSS RETURNSPER ACRE FROM 2ND GROWTH OF RAPE

Farm	Area	Sheep days per Acre	Gross Returns @ 3d. for 7 sheep days per acre.		
			£	s.	d.
1	9.3	402		14	4½
2	28	139		5	-
3 (1)	16	527		18	10½
3 (2)	9	38		1	4½
4	9	385		13	9
5	8	332		11	10½
6	12	451		16	1½

There is considerable variation in these returns. When it is remembered that the second growth is influenced by many factors some of which are the period over which the first yield is grazed, the period between the completion of the first grazing and the commencement of the second grazing, the weather conditions and the time of ploughing for wheat, this is to be expected. The returns however are quite significant, farm 3 (1) giving as much as 18/10½ per acre, while 3 (2), the other field on the same farm, gave only 1/4½ per acre. This was due to the fact that this field was grazed after the other in the first place, then left for a short time, eaten out and ploughed early in the autumn.

The total gross returns from the rape are the sum of the returns from the first and second growths and are shown as follows:-

TABLE XI.TOTAL GROSS RETURNS FROM RAPE PER ACRE

Farm	Area	Yield	Gross Return 1st Growth	Gross Return 2nd Growth	Total Gross Return.
1	ac. 9.3	3.80±.09	£2-11-9	14-4½	£3-6-1½
2	28	.58±.045	15-4½	5-0	1-0-4½
3 (1)	16	3.07±.15	2-8-0	18-10½	3-6-10½
3 (2)	9	3.80±.205	2-10-3	1-4½	2-11-7½
4	9	6.0±.28	3-7-6	13-9	4-1-3
5	8	7.53	4-14-6	11-10½	5-6-4½
6	12	10.50±.45	9-7-2	16-1½	10-3-3½
		6.18	4-9-6	12-5	5-1-11

The total gross returns, also, show a relation to the yield except in the case of farm 3 (2) on which, as already explained the 2nd growth was not allowed to come away, the field being ploughed early in the autumn. The average gross return per acre is £5-1-11, but there is considerable variations between the fields, just as there is considerable variation in the yield of rape and the returns from the first and second growths.

PROFITS

The difference between the cost of production and the gross returns of the rape gives the gross profits or loss. The profits or loss are shown in table XII as follows:-

1. This must be gross profits for no allowance has been made for supervision, drafting, crutching etc., of the lambs when they were fattening upon the rape.

TABLE XII
GROSS PROFIT OR LOSS PER
ACRE.

Farm	Yield	Cost	Gross Return	Gross Profits (+) or Loss (-)
1	3.80 ± .09	93/9½	66/1½	- 27/8
2	.58 ± .045	46/-	20/4½	- 25/6½
3(1)	3.07 ± .15	90/-	66/10½	- 23/1½
3(2)	3.80 ± .205	94/-	51/7½	- 42/4½
4	6.00 ± .28	95/5	81/3	- 14/2
5	7.53	94/5	106/4½	+ 11/11½
6	10.50 ± .45	62/9	203/3½	+ 140/6½
	6.18	87/4	101/11	+ 14/7

There seems to be a relationship between the yield and the profits. The higher the yield the greater the profit or the less the loss. Only farms 5 and 6 show a profit on the growing of rape. The 6 ton crop of farm 4 shows a loss of 14/2 while the 7½ ton crop of farm 5 shows a profit of 11/11½ per acre. It would thus appear that a crop yielding about 7 tons would be likely to show a profit. The importance of yield is clearly shown in this table when a 10½ ton crop gives a profit of 140/6 per acre, and even if the cost of this crop had been as great as that of farm 5, say, the profit would still have been as much as 108/10½ per acre. Of the other farms 1, 3 (1), and 4 would have shown a profit had their costs been as low as that of farm 6. The average for the five farms is a profit of 14/7.

CHAPTER VI.SOME FACTORS CAUSING VARIATIONS IN COST
OF PRODUCTION OF RAPE, GROSS RETURNS AND
PROFITS FROM RAPE

1. Previous Crop
2. Type of Soil.
3. Weather Conditions and Date of Sowing.
4. Stage of Ripeness when Grazed.
5. Presence of Insect Pests.
6. Presence of Weeds.
7. ^{Period}~~Method~~ of Grazing - Use of Breaks.
8. Breed and Condition of Lambs.
9. Organisation of the Farm.

CHAPTER VI.SOME FACTORS CAUSING VARIATIONS IN COST
OF PRODUCTION OF RAPE, GROSS RETURNS AND
PROFITS FROM RAPE

It will no doubt be realised that yield is probably the most important factor affecting the profits from the production of a rape crop. The farm organisation and efficiency of the farmer in respect to permitting the lambs to use their ability most economically, in converting rape into meat affect the profits. The price paid for lambs is also important (see Chapter VIII). Some of the factors that influence this yield and affect the costs of production, gross returns and thus profits are shown in Table XIII and are discussed in the following paragraphs.

PREVIOUS CROP

The amount of cultivation necessary is often affected by the previous crop. After grass, for instance, two ploughings are considered necessary, but are not always given. After such crops as turnips, wheat etc. one ploughing is all that is necessary. The number of ploughings and the amount of labour show no relation to the previous crop in this investigation (see table VI. p. 30), probably because of the limited number of farms.

TYPE OF SOIL.

In the cultivation of land for crops heavy land requires more work than light land. It is usual for the heavier land to give the better yield. In the investigation there was no

TABLE X111

SOME FACTS CAUSING VARIATION IN FIELDS,COSTS AND PROFITS

Farm	Area	Previous Crop	Type of Soil	Date Sown	Date Grazing of 1st growth commenced	Date 1st growth completed	Grass & Rape or Rape only	Yield	Stage of Ripeness when Lambs put on	Breed of Lambs.	Condition of Lambs	L.W. Increase per day per lamb.
1	Acres 9.3	Turnips	Medium and Light Loamy	Dec. 8th	Feb. 6th	Feb. 23rd	Run off on grass	3.80 ± .09	Just at ripe stage	E. Leicester - Romney	Poor, weaned and put on rape.	lb. .208
2	28	"	Light shingly plain	Dec 6th 7th and 8th	Feb. 4th	Feb. 23rd	Rape & grass sown together	.58 ± .045	Dead ripe and dry	Southdown - Romney E. Leicester B. Leicester	Good) Bought as "stores" Fair) Fair)	.320
3(1)	16	Wheat	Light and Medium loam	Dec. 17th & 19th	Feb. 17th	Mch 27th	Rape only	3.07 ± .15	Ripe	E. Leicester B. Leicester Romney-Southdown	Fair) Bought as "stores" Fair) Poor)	-
3(2)	9	Turnips	Good medium to clay loam	Jan 7th	March 27th	April 12th	" "	3.80 ± .205	Slightly on green side	"	" "	-
4	9	Grass	Good heavy clay to Med. clay	Nov. 3rd	Jan 20th	Feb. 28th	" "	6.0 ± .28	Ripe	Southdowns	Good -weaned and put on rape	.314
5	8	Grass	Medium loam in good heart	Nov. 4th 4½ ac. Nov. 12th 3½ ac.	Jan 10th	Feb. 6th	" "	7.53 ±	Ripe	Romney - E. Leicester cross	Good-weaned and put on rape	.339
6	12	Grass	Light to Medium loam	Nov. 2nd	Jan 20th	Feb. 24th	" "	10.50 ± .45	Slightly on green side	Corriedale cross	Good -thriving - just weaned	.409

relation between the type of soil and the yield. Some of the very best agricultural land gave only 4 tons per acre, while a medium light land (Farm 6) gave 10.5 tons per acre. The date of sowing and the weather conditions during growth probably play a greater part in the determination of yield than the soil type. Such was the case last season (1927-28).

WEATHER CONDITIONS AND DATE OF SOWING

The weather of last season was, however, exceptional and thus the information obtained is very limited in its application. The spring was good for grass and crops alike, the rainfall being well distributed throughout the spring and early summer. Those fields in which the cultivation was well under way by November 1st had the advantage of accumulated moisture. When the seed was sown in the same month it germinated and grew continually from the time of sowing, resulting in fairly good yields. Those fields not sown till December were considerably worse off, not only because of the less moisture conserved in the soil, as a result of late preparation, but also because the growth of the crop was not sufficient to form a shade covering to the soil and so conserve the soil moisture. These late crops suffered from the ensuing dry weather sooner than the earlier sown crops. In another season the reverse may have been the case so far as the rainfall was concerned, but usually the November or early December sown crops are more likely to give the best crop. Last season the early sown crops had 11 (eleven) weeks in which to grow, the later sown only about 9 weeks, before the ripe stage began to set in. The shortage of moisture and the hot dry weather is the cause of the ripening of the rape. Since the greatest increase in such a leafy crop as rape takes place in the last period of growth, or towards the end of the growing state, the extra two weeks gave the

earlier sown crop a considerable advantage. That the earlier crop gave the heavier yield is borne out in Table XIII p. 41. By its effect upon yield, the factor of weather has probably the greatest influence upon profits.

STAGE OF RIPENESS WHEN GRAZED

It is considered that the stage of ripeness is an important factor in its effect upon lambs and their live weight increase per unit quantity of rape eaten. The highest food value is at the ripe stage which is that stage when the bluish tinge is just beginning to extend from the edges of the leaf to the whole of the leaf. Lambs rarely scour, eat the rape freely, appear contented, and thrive well when put on rape at this stage of its growth.

PRESENCE OF INSECT PESTS.

It is not infrequent that entire fields have to be re-drilled because the grass grub beetle (*Odontria striata*, and *O. Zealandica*) has taken the whole crop just at the seedling stage. This is an extra cost. Also the diamond back moth (*Plutella maculipennis*) may reduce the yield considerably, or the aphid (*Aphis brassicae*) take the whole crop just as the rape ripens. Controlling of these pests is an important item affecting returns and profits. Last season the crops were remarkably free from attacks of insect pests.

PRESENCE OF WEEDS.

Annual weeds such as fat hen and spurrey, and the perennial twitches often affect the yield of a crop. If twitch is present it usually indicates that extra cultivation has been required. Of the farms investigated spurrey was a harmful factor on farm 4 only. The others had but few weeds.

PERIOD
METHOD OF GRAZING - USE OF BREAKS

It seems probable that the length of the grazing period will affect the returns from a crop. If the period is short and the lambs moved frequently onto new breaks of rape, they should do better, but if the mob is fairly large as it must be to eat out the rape quickly, there would be a certain wastage through trampling down of the rape. This is very slight. On most breaks there are rarely more lambs than 50 per $1\frac{1}{2}$ acres or 40 per acre. In the supplementary investigation (see Chapter VII p. 46) there was no apparent waste when the breaks were grazed to this extent. The eating out of the breaks quickly allows the second growth to come away. It is generally agreed among farmers that it is better to fence a field into breaks for grazing, but on the farms investigated only two grazed the rape in breaks. There is no definite information on this point available. On two farms the rape was sown in two breaks at an interval of 8 days, but only one is recorded (Farm 5). This allowed the first break to be eaten out before the other was too ripe.

BREED AND CONDITION OF LAMBS.

Little information is available on the relative rates of live weight increase for a given period on a given quantity of rape for the various breeds of lambs. The condition of the lambs, however, at the time of going on to the rape is probably of greater importance than the breed - compare Corriedale cross lambs on farm 6 with the English Leicester cross lambs on farm 1 (Table XIII p. 41). As a general rule the English Leicester lamb is one of the best fattening lambs and the Corriedale type is supposed by some to be the worst, the Merino excepted.

ORGANISATION OF THE FARM

All the previously mentioned factors will always exert an influence on the profits from the growing of rape. But perhaps the greatest producer of profits in any enterprise, other things being equal, is business ability. This applies in agriculture, equally as much as in manufacturing and commercial undertakings. The business ability of the farmer is reflected in his organisation and efficiency. The wise direction of labour for instance might make a great difference in the cost of producing a crop. The use of the natural weathering agents will assist in cultivation. A study and close observation of his local conditions in relation to weed control by the most economic methods, and the utilisation of proper crop rotations to minimise the liability to disease and insect attacks, and to increase the ease of cultivation mean greater profits. The greater and more detailed attention paid to all these points in relation to the crop in particular and the farm in general will determine the efficiency of the farm and hence the profitableness of its undertakings.

How the yield of rape and the scheduled price for fat lambs affects the price of store lambs and hence the profits from the rape is elaborated in Chapter VIII.

C H A P T E R V I IFAT LAMB EXPERIMENT - SUPPLEMENTARY
INVESTIGATION

1. Aim of the Experiment.
2. Method.
 - (a) Size of breaks- weighing the rape.
 - (b) Buying the lambs - type of lambs.
 - (c) Management.
3. Grazing days and Live Weight Increases.
4. Gross Returns.
 - (a) Reckoned on live weight increase.
 - (b) Obtained under market conditions.
5. Returns from the Southdown ~~Cross~~ compared with those from the Corriedale cross.
6. Returns from the Feeding of Crushed Oats in Addition to Rape.

CHAPTER VII.FAT LAMB EXPERIMENT - SUPPLEMENTARYINVESTIGATIONAIM OF THE EXPERIMENT

Some doubt, as to the success and completeness of the previously discussed investigation on rape as a fat lamb producer, arose when the work was half completed. This was the reason for carrying out the following experiment on the College farm where every factory was under control. Information was sought on the following points.

1. (a) the gross returns from rape as a fat lamb producer.
- (b) the economy of fattening the Southdown cross lamb compared with the Corriedale cross lamb.
- (c) the economy of feeding crushed oats in addition to the rape.

METHOD.

To enable the investigation to be carried out a portion of the twenty five acre rape field on the College farm was fenced off into $1\frac{1}{4}$ acre breaks, this area being taken only because of the convenience of fencing. There were six breaks in all, thus allowing each lot of 50 lambs two breaks each. The yield of the rape was determined the day or morning before the lambs were put on, the method, the size of the plot, and the probable error of the yield being the same as that described on p. 17. The rape was at that stage of growth considered by graziers and shepherds as the

1.

Gross returns, unless otherwise, stated, is the total income received for the rape reckoned at $4\frac{1}{2}$ per lb. on the total live weight increase for the period the lambs were on the rape.

"ripe" stage (see p. 43.) before the lambs were put on.

The lambs, unselected, were bought in the Addington yards at the ruling price, on January 18th 1928, when there were some 10,000 lambs yarded, the 50 Southdown crosses at 23/2 and the 100 Corriedale crosses at 20/4. The Southdown crosses came from Murchison, West Coast, off English grasses, had been weaned a fortnight, and were bred from Romney cross ewes mated with a Southdown ram. The Corriedale crosses were from North Canterbury, off tussock country, were just weaned, and were bred from Corriedale ewes mated to a Corriedale ram. An experienced sheep authority commented that the Corriedale cross lambs had been weaned about a month too soon.

The 150 lambs were run together for one week, the first few days on rather short but fresh picking, and the remainder on good red clover, rye grass pasture, to allow them to get quite "right" after having been starved for several days. During this week they were crutched and dipped. Dipping not only controls the sheep tick (*Melophagus ovinus*), but also acts as a preventative against blow fly (*Lucilia serviata*, and *Pollenia stygia*) attack, while crutching keeps the lambs clean, thus rendering attack by the blow fly still less liable.

The one hundred Corriedale crosses were divided in to two lots of fifty lambs each, similar in size, weight and appearance as near as the eye could judge. Each lamb of the three lots was weighed (for method of weighing see p. 19) and marked with a distinguishing mark representing the lot and a number. This was done by the use of differently coloured brands. The lots were:-

Lot I - 50 Corriedale crosses, fed with rape and crushed oats.

Lot II - 50 Southdown crosses, fed with rape.

Lot III - 50 Corriedale crosses, fed with rape.

Each lot was put on the first break of rape on January 26th. They were supplied with rock salt which they licked freely throughout the fattening period. The weather being hot and dusty at that time it was decided to give them water also. The water consumption on exceptionally hot days amounted to as much as $\frac{1}{2}$ pint per lamb, but when the weather changed and became more moist they drank practically no water at all. The lambs were left on rape the whole time, except for one night of 12 hours on February 27th, when they were put on oat stubble, and $1\frac{1}{2}$ days beginning on March 8th when they were put on permanent pasture, both these cases being due to the wet weather. This procedure of leaving the lambs on the rape all the time cannot be regarded, in the light of general practice, as the best treatment to give fattening lambs. The use of a grass or stubble paddock as a "run off" from the rape is usually desirable, but in this case the amount of drafting and driving prohibited such treatment. Also, more important still, the value of the grass eaten when off the rape, a difficult point with which to deal, would have increased the difficulty of determining the gross return from rape alone as a fat lamb producer. The lambs that were fed on crushed oats, received it out of troughs twice daily, being given just what they would clean up before the next meal. This amount was soon found to be approximately $\frac{1}{4}$ lb per lamb per day. The actual amount of crushed oats given was weighed and the weight recorded. A little difficulty was experienced in getting them to take the oats at first, but by quietly driving them to the troughs at each feed, by the end of the first week they were taking it freely. The lambs were weighed periodically throughout the experiment with the object of obtaining information on any variations of live weight increases that might occur. As is always the case when lambs are put on rape they ate out the weeds and grass amongst the rape, before making any apparent impression on the rape itself.

Particularly was this so with the Southdowns on whose break at the end of about 8 or 9 days there was not a bite of grass even along the fences. This seems to account for the perhaps more general practice of allowing a run-off on to grass or shifting the lambs on to grass or stubble fields at intervals while the rape is being grazed. Rape and grass are often sown together also. While the mixture affords valuable feed for fattening lambs, it is usually sown with the object of a cheap and safe establishment of the pasture, as previously mentioned rape providing the cover crop. No experimental evidence is available to confirm either practice. Farmers as a general rule do not give lambs water for the first few days when on rape because of the danger of scouring, or else they are ready to cut it off as soon as scouring appears. This, no doubt is important, but if the lambs are "right" when put on the rape there seems to be little danger. Of the 150 lambs in this experiment not one scoured during the period on the first growth of rape. When the 82 lambs still not fat were put on the 2nd growth for a fortnight before going to the freezing works slight scouring was noticed in about 15 of the lambs. The lambs were weighed also when they came off the field just prior to being taken to the freezing works and again approximately 24 hours later the next morning just before being killed. Each lamb, by means of a numbered tag, was followed from the killing pen to the freezing chamber. The weight of the skin, the dressed weight, and the freezing weight were recorded for each lamb. Immediately the skin was removed from the lamb it was weighed, the weight being that of the skin and wool. The dressed weight was taken approximately one hour after the lamb was killed and represents the actual weight of the carcass at that time. The carcass was practically cold. To allow for evaporation of moisture from the carcass due

to the time which elapses between despatch from the freezing works and delivery to the English consumer it has been found that a deduction of $4\frac{1}{2}\%$ must be made from the actual dressed weight recorded in the works. Thus in each works scales are graduated in such a manner that the weight given has this $4\frac{1}{2}\%$ deducted. This weight is the freezing weight and is the weight upon which the price per lb is quoted to fatteners. It amounts to approximately $1\frac{1}{2}$ lb being deducted from the dressed weight of each lamb.

The details for each lamb of the above weights are shown in Appendix IV p. 97. The first and third drafts were driven the 12 miles to the works, but the second draft was transported by motor truck. With the necessary handling of the lambs in order to weigh them twice within approximately twenty four hours some fear of bruising them was entertained. As the result of careful handling, however, not one of the 144 lambs, on examination when on the hooks, showed any signs of bruising.

GRAZING DAYS AND LIVE WEIGHT INCREASES.

The variations in the rate of growth of the individual lambs of each lot may be seen by reference to tables in Appendix IV p. 97. Each lot showed a distinct variation from the other two as shown in Table XIV A and XIV B. On the first break of rape each lot shows a greater number of grazing days per ton of rape than when on the second break (see table XIV A), although in the case of lot 11, the South-down crosses, the difference can scarcely be considered significant. The reason for this might be suggested to be due to the more rapid growth with consequently greater consumption of food per day when on the second break. Lot 1, however, does not allow this conclusion, as the live weight increase per lamb per day when on the second break of rape was only .220 lb against .240 lb per day when on the first break. The

TABLE XLV A.

GRAZING RECORD AND GROSS RETURNS OF EACH BREAK OF RAPE
IN SUPPLEMENTARY INVESTIGATION

Break of Rape	Yield per acre tons	Grazing-days per acre	Grazing-days per ton of rape	Live Weight Increase per acre lb	Live Weight Increase per ton of rape lb	L.Wt. Increase per day for period lb	Oats eaten for period lb	Value of oats @ 3/3 per bushel	Gross returns @ 4½d. per lb. Live Weight Increase		Breed of Lamb
									per acre	per ton of rape	
1.	4.00 ± .19	1000	250	240	60	.240	350	£1 - 8-6	£3-7-2½	16-9½	Corriedale Cross - oat fed
V	3.68 ± .28	867	235	190	51.8	.220	228	18-6	3-2-7	17-0	Corriedale cross - oat fed
III.	4.55 ± .23	1120	247	277	60.9	.247	-	-	5-3-10	1- 2-10	Corriedale Cross
VI.	3.39 ± .24	745	220	190	68.7	.312	-	-	4-7-3	1- 5-9	Corriedale Cross
11.	4.52 ± .21	716	158.5	240	53.4	.337	-	-	4-10-4	1- 0-0	Southdown-Romney cross
IV?	4.55 ± .36	698	153.5	241	53.2	.347	-	-	4-10-7	19/11	Southdown-Romney cross

TABLE XLV. B.

GRAZING RECORD AND GROSS RETURN OF EACH LOT OF LAMBS IN SUPPLEMENTARY
INVESTIGATION

Average of Breaks	Yield per Acre	Grazing-days per acre	Grazing-days per ton of rape	Live Weight Increase per acre lb	L. Weight I. per ton of rape lb	L. Weight I. per day for period lb	Gross Returns @ 4½d. per lb L.W. Increase		Breed of Lamb
							per acre.	per ton of rape	
1 & V	3.84 ± .24	933.5	242.5 ± 3.57	215.0	55.9 ± 1.94	.230	-X- £3-4-10½	16-10½	Corriedale cross - Oat fed. Lot 1.
III & VI.	3.97 ± .24	932.5	233.5 ± 6.40	233.5	64.8 ± 1.85	.2795	4-15-6½	24/3½	Corriedale Cross Lot III
11 & IV.	4.53 ± .29	707.0	156.0 ± 1.18	240.5	53.3 ± 0.05	.342	4-10-5½	19/11½	Southdown - Romney Cross Lot 11.

-X-

The value of the oats eaten has been deducted here as in A.

grazing-days per ton of rape for the Southdowns were 156.0 ± 1.18 , for the Corriedale on rape only 233.5 ± 6.40 , and for the Corriedales receiving oats in addition to the rape 242.5 ± 3.57 grazing-days. The difference between the two Corriedale lots is only 9.0 ± 7.05 grazing-days and statistically this cannot be considered significant. The Southdowns were the older and larger lambs, being on average 68.8 lb, while lot 1 was 57.4 lb, and lot 111 55.6 lb. when the three lots were put on the rape. This enabled the Southdowns to eat more rape per day and is clearly brought out in the following table.

TABLE XV.

LOT	Weight of rape eaten per lamb per week.
Lot 1 - Corriedales- oat fed	64.7
Lot 111 - Corriedales- rape only	67.2
Lot 11 - Southdowns - rape only	100.5

This table shows that the Southdowns were able to eat on the average 100.5 lb of rape per lamb in a week, while the Corriedales were able to consume only slightly over 60 lb.

The Corriedale crosses are the most economical converters of rape into flesh due no doubt to the fact that they were younger animals than the Southdown crosses. The greater efficiency of young animals in the conversion of food into flesh is well recognised in all avenues of economical meat production. Over the period for the two breaks the Southdowns averaged 53.3 ± 0.05 lb. live weight

increase per ton of rape, the Corriedales receiving oats 55.9 ± 1.94 lb, and those not receiving oats 64.8 ± 1.85 . For the wide difference between the two Corriedale lots no explanation can be given. It was expected that Lot 1, since in addition to the same amount of rape was receiving $\frac{1}{4}$ lb of crushed oats per day, would show a greater live weight increase per ton of rape than the other lot. The experiment, however, failed to show that the lambs received any benefit from feeding oats. For rapidity of growth the older Southdowns lambs are about equivalent to the younger Corriedales when the daily live weight increase is reckoned as a percentage of the live weight. The following table shows that the percentage increase per day for the Southdowns was .497%, for the Corriedales .400% and .505%.

TABLE XVI.

Lot	Live Weight when put on rape	Daily live weight increase	Daily Live Wgt. Increase as %age of live weight
	lb	lb	%
Corriedales- oat fed	57.4	.230	.400
Corriedales	55.6	.280	.505
Southdowns	68.8	.342	.497

The rape eaten by each lot to give one hundred pounds of live weight increase is shown in the following table:-

TABLE XVII.

Lot	Weight of rape eaten for 100 lb. live weight increase		Dry Matter requir- ed for 100 lb L.W.I.	
	lb	lb (oats)	lb	lb (oats)
Corriedales - oat fed	4007	+ 107	574	+ 93
Corriedales	3460		488	
Southdowns	4200		592	

This table brings out clearly the most economical converter of food. Lot 1 which received oats however is not as economical as the other Corriedales which did not receive oats. When the weight of dry matter eaten for 100 lb of live weight increase is considered it is seen that a wide margin exists between the two lots of Corriedales. Those receiving oats consumed a greater quantity of dry matter than the older Southdowns.

The weight of dry matter was calculated by the use of the accepted figure of 14.1% in the case of rape and 1. 86.7% in the case of oats. It is recognised that there is considerable variation in the water content of rape and in this case ~~these~~ samples actually gave the dry matter content as 20.1 ± .62%. Using this figure the dry matter consumed per 100 lb of live weight increase would be:-

Corriedales (oat fed)	819 + 93	=	912 lbs.
Corriedales			696 "
Southdowns			844 "

The details of the number of lambs that were fattened per ton of rape are shown in Table XVIII as follows:-

1.

T.B. Wood - "Rations for Live Stock".

TABLE XV111

Lot	Rape eaten per week per lamb.	Average Fatten- ing Per- iod per lamb.	Total rape eaten for fattening period per lamb.		Number of lambs fattened per ton of rape.
			lb.	tons	
Corriedales (oats)	64.7	8	518	.231	4.33
Corriedales (no oats)	67.2	8.3	558	.249	4.02
Southdowns	100.5	5.5	577	.258	3.88

The rape eaten during the fattening period shows some variations between the lots, those lambs receiving oats eating the least, and the Southdowns the most. The fattening period was approximately 8 weeks for the two Corriedale lots, but the Southdown lots fattened in the shorter period of 5½ weeks. The Southdowns, however, do not permit more than 3.88 lambs to be fattened per ton of rape, while the Corriedales receiving oats fattened 4.33 lambs per ton and those not receiving oats 4.02 per ton of rape.

The grazing-days per acre and the live weight increase per acre (see table XIV A and XIV B. p. 51), are not directly proportional to the yield per acre, being influenced by the daily live weight increase and the age of the lambs. The Southdowns show the smallest number of grazing-days per acre although the yield is the greatest. The grazing-days are however influenced by the yield. The variations in the grazing-days, the live weight increases and daily live weight increase per ton of rape are summed up in the gross returns per ton of rape.

In the driving or transport of the fat lambs from the farm to the freezing works there is a certain loss of weight. This loss is mostly due to the evacuation of the contents of

the stomach. In the 24 hours from the time the fat lambs left the farm until they were weighed just prior to being killed, the loss was $7.6 \pm .15$, 7.7 ± 1.2 lb, and $9.1 \pm .15$ lb or 10.2%, 10.7%, and 11.0% of their unfasted live weight for the Corriedales (fed with oats), the Corriedales and the Southdowns respectively. The details are shown in the tables in Appendix IV page 97. There is a significant difference between the Southdowns and the Corriedales in respect to the total weight lost. The former were, however, larger lambs and the loss as a percentage of the unfasted live weight is not significant.

The second drafts were transported by motor truck and kept in the yards for the remainder of the 24 hours, while the third and first drafts were driven the 12 miles to the works and kept in the yards over night. There is little difference between the losses in weight when transported and when driven. None of the lambs showed bruising when on the hooks. It seems that careful driving over that distance need not be detrimental to the lambs.

The percentage of the freezing weight to fasted and unfasted live weight appear very similar for the three lots (see the above mentioned tables). As a percentage of the fasted weight the freezing weight is approximately 48% and of the unfasted weight it is approximately 42.5%. There is a fair amount of variation as the probable error, or a glance at the figures for the individual lambs show. The weights of the skins for the Corriedales averaged just over 9 lb and for the Southdowns 10.23 lb.

GROSS RETURNS.

The gross returns reckoned on the basis of $4\frac{1}{2}$ d. per lb for the live weight increases are, in the case of Lot 1, after the value of the oats eaten is deducted, $16/10\frac{3}{4}$ d. per

ton of rape, for Lot 111 24/3½, and for Lot 11 19/11½d. on the average of the two breaks (see table XLV A and B). The gross returns are proportional to the live weight increase per acre, but are influenced by the yield of rape per acre. For lot 1 the gross return per acre is £3-4-10¼ for Lot 11 £4-10-5½, and for Lot 111 £4-15-6½. There may be an inclination to think that the Corriedale cross is ^amore economical lamb than the Southdown cross after having perused the above information. The age difference hardly allow such a conclusion. A study of the returns under market conditions (see p. 59 and Appendix IV. p. 97) will soon show which was the more profitable type of lamb when price is considered. It is quite conceivable however that if the price of the Corriedale - cross store lamb had been sufficiently low or at the same rate per lb as that of the Southdown the returns under market conditions would have been favourable. The fact that each lot was typical of thousands sold at similar prices enables a very valuable comparison to be made.

If the gross returns calculated from the live weight increases are compared with the gross returns ^{1.} obtained under market conditions the Southdown cross lambs show the highest return. This is clearly shown in Table XIX, as follows:-

1. Gross return here is the difference between the price of the lambs when they went on the rape and when they came off. It is the sum of the expenses before the lambs went on the rape plus the expenses after they came off (see Appendix IV p. 97, 98, 99) deducted from the total receipts for the lambs when fat.

TABLE XLX

RETURNS FROM RAPE

Lot	1. Gross Return @ 4½d. per	L.W.I. lb.	2 Gross Return - Conditions	Market	Return after except	Deductions ³ labour 4.
	per ton of rape	per acre from a 7 ton crop	per ton of rape	per acre from a 7 ton crop	per ton of rape	per acre from a 7 ton crop
Corriedale (fed with Cats	16/10¾	118/3	10/11	76/5	8/7¾	60/6
Corriedales	24/3½	170/-	16/6¾	115/11	15/4	107/4
Southdowns	19/11½	139/9	21/4¾	149/9	19/5½	136/2

1. Total Income from the rape reckoned on the basis of live weight increase.
2. It is the difference between the price of the lambs landed on the rape and the price when they came off the rape. In other words, it is the sum of the expenses before the lambs were put on the rape plus the expenses after they came off, deducted from the total receipts for the lambs when fat.
3. See Appendix LV p. 97, 98 and 99.
4. This includes the labour of fencing, driving, drafting etc., and supervision.

1.
 In Lot 1 the gross return is reduced by the value of the oats eaten and is also affected by the lower live weight increase per ton of rape (see tables XLV V and XLV B p. 51)
 The Southdowns give a return of 4/10 greater than the Corriedales on rape only, and 10/5 $\frac{1}{4}$ above the Corriedales receiving oats, per ton of rape. The gross returns for the Southdowns was 21/4 $\frac{1}{4}$ per ton of rape, so that the differences seem great enough to be real differences. The same proportional differences are shown in the gross return per acre from a 7 ton crop. The gross returns under market conditions for the two Corriedale lots are less than the gross returns reckoned from the live weight increase, while the Southdowns show a greater return under market conditions than when the returns are calculated from the live weight increase. If all allowances (see Appendix IV. p.97,98,99) are taken off the gross returns except the labour of fencing, driving, drafting etc., and supervision then the returns for the lots are shown in the third column in Table XLX p. 58 . The Southdowns give 19/5 $\frac{1}{2}$ d. per ton of rape or 6d. per ton less, than the gross return reckoned from the live weight increase. The Corriedale lots show fairly significant differences.

These differences between the gross returns computed under market conditions and on the basis of live weight increase are partly due to the fact that the price actually received for the lambs when fat was 10d. per lb, whereas the live weight increase is calculated on the basis of 9d. per lb for fat lambs; but mainly due to the price of store lambs being too high. The fact that a number of the Corriedales were sold as second quality lambs also accounts to some extent for the difference. The live weight increase method is only useful for comparisons of the efficiency of feeds, or in com-

1.
 Gross return here is the difference between the price of the lambs when they went on the rape and when they came off. It is the sum of the expenses before the lambs went on the rape plus the expenses after they came off (see Appendix IV. p.97,98,99) deducted from the total receipts for the lambs when fat.

parative costs as used in the main inquiry. Returns and profits in relation to the price of store lambs and rape yields are discussed in Chapter VIII p.63.

RETURNS FROM THE SOUTHDOWN CROSS COMPARED

WITH THOSE FROM THE CORRLEDALE CROSS

The market returns for these two breeds of lambs are set forth in Table XX as follows:-

TABLE XX

MARKET RETURNS

Lot	Gross Returns		Return after deductions except labour 2.	
	per ton of rape	per ac. on 7 ton crop	per ton of rape	per ac. on 7 ton crop
Southdown cross	21/4 $\frac{3}{4}$	149/9	19/5 $\frac{1}{2}$	136/2
Corriedale cross	16/6 $\frac{3}{4}$	115/11 n	15/4	107/4
Difference in favour of the Southdown cross.	4/10	33/10	4/1 $\frac{1}{2}$	28/10

1. See Appendix IV. p. 97, 98 and 99.
2. This includes labour of fencing, driving, drafting, etc., and supervision.

This table shows that the returns for the Southdowns are 4/1½ per ton of rape or 28/10 per acre on a 7 ton crop, better than for the Corriedales. The labour not deducted from the returns which give this difference can be considered practically the same for the two breeds and so does not alter the comparison. The Southdowns on the average went off fat sooner than the Corriedales (see Table XVlll p. 55), in the former 32 lambs in the first and 12 in the second draft and in the latter only 9 lambs in the second draft, the remainder in the third draft. With store lambs prices showing the variation between the breeds (see p. 47) as was the case last season (1927-28) the Southdown cross gives the greater return. With a yield of 7 tons (see p.39) it seems probable that the Southdowns would give a profit, but with a yield of 4.5 tons, as was the case in the experiment, they could not give a profit. (See Chapter Vlll sect. 2) at the price paid for them as stores.

RETURNS FROM THE FEEDING OF CRUSHED OATS IN
ADDITION TO RAPE

The details of this experiment are set forth in Table XXI as follows:-

TABLE XXIMARKET RETURNS (FEEDING CRUSHED OATS)

	Gross Return		Return after deductions ^{1.} except labour ^{2.}	
	per ton of rape	per acre from a 7 ton crop	per ton of rape	per ac. from a 7 ton crop
	Oats	10/11	76/5	8/7 $\frac{3}{4}$
No oats	16/6 $\frac{3}{4}$	115/11	15/4	107/4
Difference in favour of no oats	5/7 $\frac{3}{4}$	39/6	6/8 $\frac{1}{4}$	46/10

The feeding of crushed oats in addition to rape has shown a loss in this experiment of 46/10 per acre on a 7 top crop, or 6/8 $\frac{1}{4}$ per ton of rape eaten. Reference to Table XV p. 52 shows that the lambs receiving oats ate almost as much rape per week as the ones without oats and yet the live weight increase (see table XLV B p. 51) was less. The feeding of oats to lambs on rape seems to have had a detrimental effect. This cannot be explained until further experimental work has been done.

1. See Appendix IV p. 97, 98, 99.
2. This includes labour of fencing, driving, drafting, etc., and supervision.

C H A P T E R VIII.

THE BUYING OF STORE LAMBS IN CANTERBURY.

1. The Store Lamb Market.
 - (a) Price in its relation to supply and demand.
 - (b) Forward buying.
 - (c) Speculation.

2. Prices the Fattener can afford to pay for Store lambs - the Relations of Rape Yield, Fat Lamb Prices and Store Lamb Prices to Profits.

CHAPTER VIII.THE BUYING OF STORE LAMBS IN CANTERBURY.

As a part of the investigation I had hoped to obtain some information concerning the price that could be paid for store lambs assuming that fattening is to show a profit. The price paid must vary with the size, breed, and condition of the lambs as well as with the supply of lambs and the demand for lambs. It was under these headings that I desired information. Actually I was only able to indicate in a general way the price to be paid and that from the experiment on the College farm.

THE STORE LAMB MARKET.

Store lamb prices vary from season to season and from time to time in the same season. If scheduled prices for fat lambs are constant with no rising or falling tendency for a season or for several seasons the production of lambs will tend to be fairly stable. With steady prices then for fat lambs the only reason for variations in store lambs can be the supply of them and the demand for them.

The demand for store lambs under the above conditions is determined by the quantity of feed the fattening farmers have available. A good spring and summer favours the production of large quantities of feed for their own lambs and the greater proportion are sold fat off the mothers. Those that remain do not require all the rape or other fattening feed. There has been a definite cost in the production of this feed, in rape £4-7-4 per acre (see P. 31). The

cost of production is constant, but the yield is variable and in a good season may be very high. A rape crop instead of fattening 25 lambs per acre might fatten as many as 40 lambs or more per acre. If this rape or other feed is not grazed it will be a dead loss, and farmers dislike to see feed going to waste. Since lambs allow the greatest margin and a quick turnover they are usually bought. This margin may be only 4/- per lamb, but the greater carrying capacity enables more to be fattened. The returns per acre may be greater than the cost of production, but in any case an otherwise complete loss is prevented. The greater proportion of farmers are of the same opinion at the same time and hence the increased prices..

Again the season, if good on the plains, is usually good on the hills also. The feed there is more plentiful and the summer carrying capacity higher. As a result more of the lambs are fattened upon the mothers and possibly more of the better ewe lambs retained for breeding purposes. The result is that a limited supply of lambs are offered to a much stronger market and so the prices tend to rise on account of competitive buying. In a bad season the reverse occurs. The farmers and run holders on the hills owing to lack of feed wish to sell their store lambs in large numbers. The fattening farmers have only feed for a few, after fattening those of their own breeding. The supply is increased and the demand decreased so that the prices must fall. In very bad seasons severe slumps in the store lamb market are experienced. Sometimes within one season the above mentioned conditions of supply and demand bring about changes. Season 1927-28 is probably a good example. The spring and early part of the summer had been favourable for grass and forage crops and rape in particular promised to yield well. In the first few sales of store lambs only a few were offered

and the prices paid merely allowed a margin of about 4/- per lamb. Towards the middle of January a dry spell had set in and promised to continue. The rape crop did not come up to expectations and the feed generally was drying up on the plains and hills alike. With remarkable rapidity the supply of store lambs on the market increased, but the decreased demand was equally rapid. In a few weeks the price had fallen several shillings per head and remained practically stationary until the raising of the scheduled price for fat lambs later in the season caused an upward trend in store lamb prices. There was some difference between the early and late lambs in quality but not sufficient to alter this trend. The above description applies in a general way over the entire store lamb market, and it would be difficult to find a clearer and more perfect example of the relationship between supply, demand, and price. Alterations in the scheduled price have the same effect upon the store lamb market as the seasonal changes in the amount of feed available.

There is a certain amount of forward buying by farmers and by speculators. The risk and fore-thought required in forward buying prevents the small farmer taking advantage of it. Large scale farmers rarely buy otherwise. The small farmer desires small lines of perhaps not more than one or two truck loads (80 or 160 lambs), but the large scale farmer desires large numbers, sometimes of several thousands of a uniform line. These can be obtained from one or two run-holders at less expense than numerous small uneven lines at the "yards". The run-holders prefer to sell their lambs in large lots rather than in small lots, when they sell by the forward method.

In the speculation that does occur the lambs are

usually bought forward and they may be sold again forward, or they may be held until the general seasonal demand starts. There is a certain amount of risk in the speculation on a market liable to such fluctuations and it is even sometimes difficult to see that profits, are made, while at other times huge gains occur such gains being quasi-rents. It is doubtful if speculation in store lambs can be credited with the general benefits of speculation. Certainly the hill farmers and station owners are assured of a certain income, at a certain cost no doubt to themselves, as well as a possibly greater cost to the fatterer. There are some cases in which the supply is taken from where it has a lesser utility to where it has a greater utility and hence price variations from place to place are reduced. In general, in the store lamb trade, it is difficult to see that the speculator performs any really useful service.

PRICES THE FATTENER CAN AFFORD TO PAY FOR STORE LAMBS -
THE RELATION OF RAPE YIELD, FAT LAMB PRICES, AND STORE
LAMB PRICES TO PROFITS

A more detailed study of the price farmers can afford to pay for store lambs is now necessary. Reference to table VII. p. 31 shows that the average cost of producing a rape crop is 87/4 per acre. It takes approximately a 7 ton crop to show a small gross profit (see p. 31), reckoned on a stable basis, such as live weight increase. The returns (see Table XLX p. 58) obtained under market conditions in the supplementary investigation (see Chapter VII) for the Southdown-cross lambs were 19/5½d. per ton of rape. An estimate for labour, not yet deducted, at 2d. per lamb, i.e. 8d. per ton of rape (see Table XVII p. 55, 4 lambs fattened per ton of rape) reduces this figure to 18/9½d. per ton of rape giving a net return per lamb of

4/8. A 7 ton crop would fatten 28 lambs giving a net return, considering the lamb transaction alone, of 130/8. Deduction of the cost of production leaves a net profit of 43/2 per acre. According to the main inquiry, based on live weight increase, there should be a gross profit of only a few shillings per acre for a 7 ton crop. Causes for this disparity are:-

(1) The market price for fat lambs was 10d. per lb. while the live weight increases are reckoned at 9d. per lb.

(2) The two investigations are not reconcilable in regard to the live weight increases (compare table LX p. 35 with tableXVII p. 54)

(3) The second growth in the supplementary investigation has not been taken into account. Further work and experimentation are necessary to determine if the difference exists.

With the net returns per lamb of 4/8 obtained in a 4.5 ton crop, the net returns under the existing conditions are 84/- per acre. Deduction of the cost of production of 87/4 leaves a loss of 3/4 per acre, or 2½d. per lamb. The price paid for these Southdown lambs was 23/2. With a 4.5 ton crop of rape the price paid for the lambs was therefore 2½d. per lamb too high, if the fatterer ^{was} neither to gain nor to lose on the transaction. With a higher yield of rape a higher price can be paid for "stores", the price for "fats" remaining stable. If the price for fat lambs had risen sufficiently, the price of 23/2 per lamb for the "stores" would have shown a profit. With a 4.5 ton crop a fatterer can only afford to pay 23/2 less 2d. i.e. 23/- per lamb per "stores". With a 12 ton crop he could fatten 48 lambs. A profit of 4/8 per lamb gives a net return of 224/-. Deduction of the cost of production

of the rape ($87/4$ per ac.) leaves a net profit of $136/8$ per acre i.e. $2/10$ per lamb. If he is neither to gain nor to lose on the transaction he could afford to pay $2/10$ per lamb more than he could with a 4.5 ton crop, i.e. the price of the store lambs would be $25/10$ each. This disproves the perhaps popular belief - one that often causes farmers to pay too much for "stores" - that a margin of $5/-$ or $6/-$ between "store" and "fat" prices is necessary to show a profit on the fattening of "stores". The joint factors,

- (a) rape yield and
- (b) scheduled price for fat lambs influence the demand for "stores."

The Southdown and the Corriedale crosses in the supplementary experiment were bought on a day when approximately 10,000 lambs were yarded and the prices paid for them were representative of those paid by the fatteners. A few of the latter had good crops of rape and could afford to pay fairly high prices. The price paid for the Southdown cross lambs, as stated above, was 2d. per lamb, and for the Corriedale cross lambs, calculated on the same basis, $5/4$ per lamb, too high. A very much higher yield than 4.5 tons would be necessary to show a profit on the Corriedales. Farmers with the higher yield set the prices for those with poorer crops, but the latter know that if they do not buy lambs to eat off the rape the loss will be greater. They may not make any profit but they can reduce the loss on the growing of rape. No allowance has been made for the improvement in the soil fertility as a result of growing rape. On every farm this improvement does occur, but no measure of the return has yet been made.

C H A P T E R I X

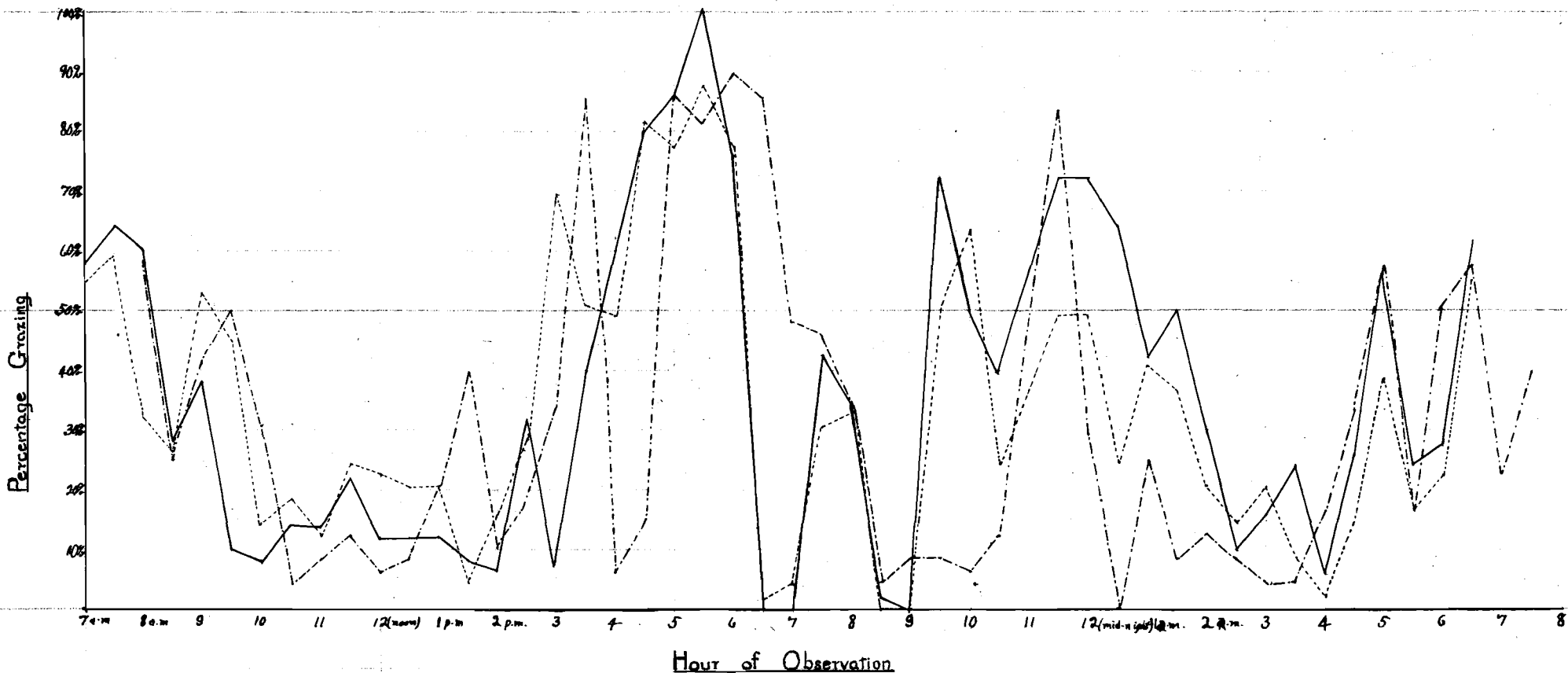
CONCLUSION

1. Difficulties and Limitations of
 the Inquiry.
2. Farm Costing.
3. Animal Nutrition Information.
4. Financial Averages.
5. Summary of Main Points.

Graph I:- Percentage of Lambs actually grazing on the Rape

Readings taken at half-hour intervals

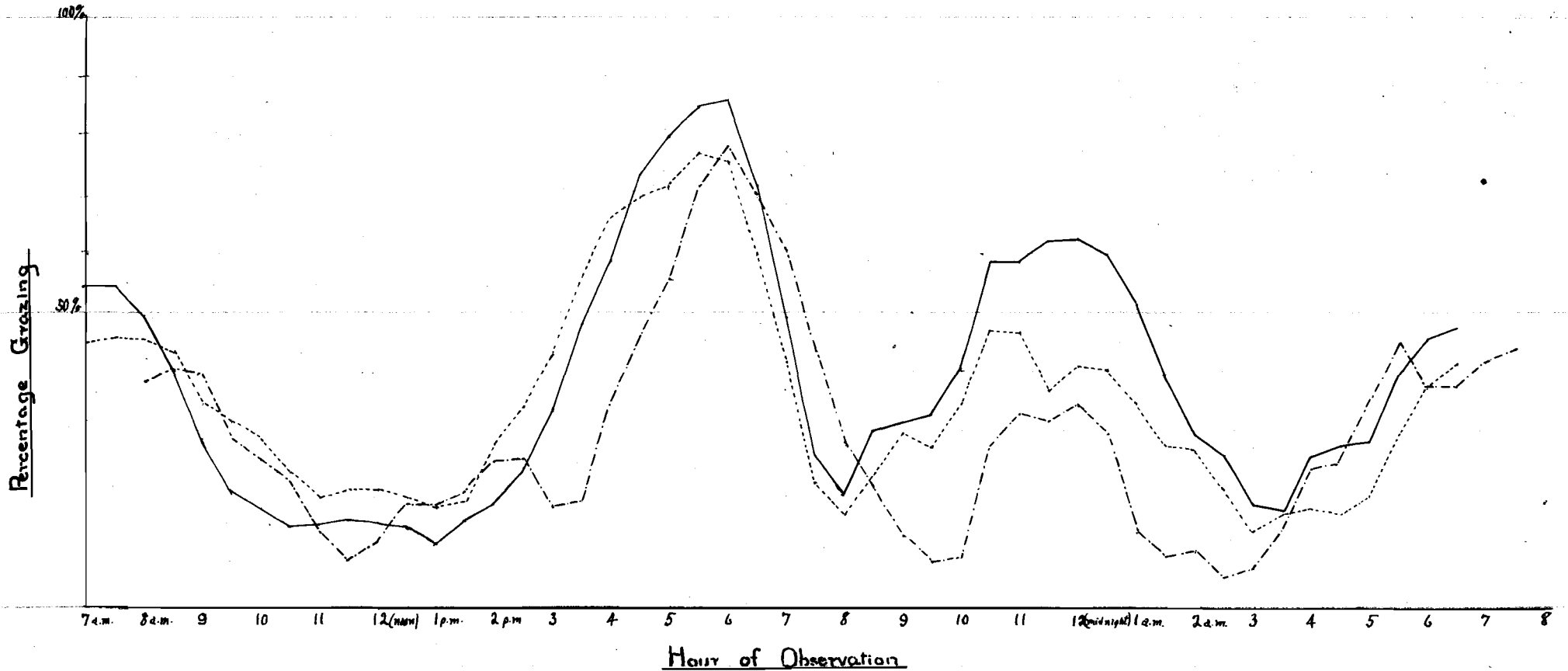
— 50 Corriedales Observations on Feb 14th and 15th
 - - - 49 Southdowns
 - · - · 48 Corriedales " " " Mar 1st and 2nd



Graph II:- Moving Average of the Percentage of Lambs actually grazing on the Rape

Readings taken at half-hour intervals

— 50 Corriedales
 - - - 49 Southdowns
 - - - 48 Corriedales
 Observations on Feb 14th and 15th
 " " " Mar 1st and 2nd



CHAPTER LXCONCLUSIONDIFFICULTIES AND LIMITATIONS OF THE INQUIRY.

Agriculture is an art. Jethro Tull has said "Writing and ploughing are two different talents; and he that writes well must have spent in his study that time which is necessary to be spent in the fields by him who will be master of the art of cultivating them". The work of the agricultural investigator or experimenter necessitates that he has practised in the field. He must understand the practice of agriculture and then apply the scientific and economic facts to improve his practical ability. In conducting an agricultural inquiry he must know and understand the multiplicity of factors bearing upon the point at issue.

The carrying out of the inquiry necessitates much field work. The difficulty of obtaining reliable and accurate data is almost overwhelming. A start may be made to obtain information on a particular agricultural problem which, it is afterwards found, is related to many other problems, all of which are inter-dependent and incapable of isolated investigation. The greatest difficulty, then, in agricultural inquiries is to obtain or collect the data. Firstly the data are not recorded. The agricultural economist, starting in a new country may obtain information:-

(1) By recording that obtained from the questioning of farmers. Information obtained in this manner is usually

in the nature of estimates.

(2) by confirmation of such information through directing the farmer in the keeping of actual records and through personal experiment.

In the past in this Dominion, estimates have been the only information available concerning the cost of many farm operations, but there is no guarantee of their validity nor any measure of their error. In carrying out the present inquiries both recording of farm operations and experimentation were necessary.

FARM COSTING.

In industry, where nearly all of the factors governing production are under control, it is possible to state the cost of producing a unit of goods, or the cost per unit of capital and labour employed in a certain production. Agriculture is a different type of business and cannot be standardised. The type of farming practised is governed by many physical and economic factors. Thus mixed farming predominates on the Plains and Downs land of Canterbury, dairying in Taranaki and in the Waikato, and sheep grazing and fattening in Gisborne and Hawke's Bay districts. Even in the one district the type of farming in a valley may be dairying while on the neighbouring hills sheep farming constitutes the only means of making a living. On a single farm there are many joint products such as grain and straw, wool and mutton, cows, calves and pigs. There is no possible way of determining the real cost of producing a unit of mutton on a sheep farm, or a pound of butter or park on a dairy farm. Arbitrary figures may be obtained and will vary according to the ability, judgment and discretion of the "costings" officer in allotting the costs

he considers are concerned in the production of the goods. Even on the same farm, in the case of cropping, the costs between two fields vary. No two soils are exactly alike and the prevalence of weeds might considerably affect the cost of producing a crop. The eradication of the weeds is a permanent improvement and must either be charged against the general farm profits - the farm being treated as a unit of production - or be apportioned to the succeeding crops over a series of years. Even if it is spread over a number of years the proportion to be charged to each year must be a matter of judgment. Then again the difficulty of deciding the proportion of the total cost which was due to the weeds alone is a matter of judgment. Some seasons, crops are complete or partial failures, in which cases, the costs are extremely high per unit of product, but may be equivalent to other crops of the same kind on the basis of costs per acre. The cost of producing a crop must have some relation to the fertility of the soil. A crop may be produced cheaply to the detriment of the soil fertility, or the soil may be improved. There is, in a single season, no way of measuring, in regard to soil fertility, exactly to what extent it is being depleted or improved.

In any system of farming, the growing of crops such as wheat, peas, oats, rape etc., are complementary to each other, and to the pasture land and live stock carried. The grazing of wheat and other stubble makes a certain return to those crops, but it is difficult to put a figure upon such grazing. It must necessarily be an arbitrary figure, for there may be plenty of other feed on the farm and the stubble only grazed to "clean" it up.

Enough has been said to show that the costing of a single farm product is not really satisfactory. If done it must be hedged around with qualifications. The only

there was little preliminary work of any kind in connection with the costings of farm products in Canterbury when the present inquiry was commenced.

ANIMAL NUTRITION INFORMATION

In the determination of returns and profits from the fattening of lambs upon rape both in the main inquiry and the supplementary investigation a great deal of animal nutrition work had to be carried out. The returns depend on the ability of the lambs to convert rape into flesh. The rate of growth and the live weight increase per ton of rape eaten are of extreme importance as they have a direct bearing on the time taken to fatten and the number of lambs fattened for a given quantity of rape. The profits are affected by these factors. The figures and averages obtained are subject to many variations and are not claimed to be at all final, but they are instructive and indicative. Summarised they are:-

(a) Those in the main inquiry.

(1) that the number of lamb grazing-days per ton of rape was 109.2 ± 2.93

(2) that the live weight increase per lamb per day was $.354$ lb.

(3) that the live weight increase per ton of rape eaten was 37.5 ± 1.87 lbs.

(4) that the weight of rape eaten per week was 145.1 ± 4.45 lb.

(5) that the rape required per 100 lb live weight increase was 6135 ± 282 lb.

(b) those in the supplementary investigation.

(1) that the number of lamb grazing-days per ton of rape was for

1. Corriedales receiving oats 242.5 ± 3.57

2. " not " " 233.5 ± 6.40

3. Southdowns 156.0 ± 1.18

(2) that the live weight increase per ton of rape was

1. Corriedales receiving oats	55.9 ± 1.94 lb
2. " not " "	64.8 ± 1.85 lb.
3. Southdowns	53.3 ± .05 lb

(3) that the daily live weight increase while on the rape was

1. Corriedale receiving oats	.230 lb.
2. " not " "	.279 lb.
3. Southdowns	.342 lb.

(4) that the weight of rape eaten per week was

1. Corriedale receiving oats	64.7 lb
2. " not " "	67.2 lb
3. Southdowns	100.5 lb

(5) that the weight of rape required for 100 lb of live weight increase was:-

1. Corriedale receiving oats	4007 lb
2. " not " "	3460 lb
3. Southdowns	4200 lb.

(6) that the fattening period was

1. Corriedale receiving oats	8 weeks
2. Corriedales not " "	8.3 "
3. Southdowns	5.5 "

(7) that the number of lambs fattened per ton of rape was

1. Corriedale receiving oats	4.33
2. " not " "	4.02
3. Southdowns	3.88

These details are set forth in Table XXII as follows:-

TABLE XXI

	Lamb grazing- days per ton of rape	L.W.I. per ton of rape	(Arith. Aver- age) Daily L.W.I.	Wt of rape eaten per week	Wt of rape reqd. for 100 lb of L.W. in- crease	Fattening period	Number of lambs fatt- ened per ton of rape
		lb	lb	lb	lb	weeks	
Average of main inquiry	109.2 ± 2.93	37.5 ± 1.87	.354	145.1 ± 4.45	6135 ± 282	-	-
Corriedales receiving oats	242.5 ± 3.57	55.9 ± 1.94	.230	64.7	4007	8	4.33
Corriedales not " "	233.5 ± 6.40	64.8 ± 1.85	.279	67.2	3460	8.3	4.02
Southdowns	156.0 ± 1.18	53.3 ± 0.05	.342	100.5	4200	5.5	3.88

75.

As already mentioned (p. 67.) the figures for the number of grazing-days per ton of rape, and the weight of the rape eaten per week and per 100 lb live weight increase do not coincide in the two investigations. The main inquiry certainly is the average of only five fields, but is just as worthy of respect because of that fact as the other investigation where all the factors were under control. Without further experimentation the discrepancy is not reconcilable. The probable errors given are for the average of the five farms in the main inquiry and for the two breaks in the supplementary investigation. Each field or break of rape had an error of approximately 5%. The error of the live weight increase per day in the main inquiry is approximately 12% so that the real error of the averages is statistically in the neighbourhood of 20 to 25%. The live weight increase per day in the supplementary investigation does not suffer from the same large error.

FINANCIAL AVERAGES.

The financial returns suffer from the same errors and must be similarly qualified as the cost of production. The returns under market conditions are precise for that market only. The results must be regarded as indicative only, and summarised they are:-

(a) those in the main inquiry.

(1) that the average cost of production was £4-7-4 per acre, the overhead costs £1-18-7 (44.3%) and the prime costs £2-8-9 (55.7%) per acre.

(2) that on four strictly comparable farms the manual labour was 9.04 ± .04 hours, and horse labour was 44.54 ± .93 hours per acre with respective costs of 11/4 and 32/e per acre.

(3) that the average gross return per ton of rape, reckoned on live weight increase, was 14/1.

(4) that the average gross return per acre for the first growth, reckoned on the same basis was £4-9-6.

(5) that the total gross return per acre was £5-1-11,

(6) that the average gross profit was 14/6 per acre, but a 7 ton crop was necessary before any profit was shown;

(b) those in the supplementary investigation,

(1) that the gross returns per ton of rape reckoned on live weight increase were;

1. Corriedales receiving oats	16/10 $\frac{3}{4}$ d.
2. Corriedales not " "	24/3 $\frac{1}{2}$ d.
3. Southdowns	19/11 $\frac{1}{2}$ d.

(2) that the gross returns per ton of rape under market conditions were:-

1. Corriedales receiving oats	10/11
2. Corriedales not " "	16/6 $\frac{3}{4}$ d.
3. Southdowns	21/4 $\frac{3}{4}$ d.

(3) that after all deductions^{1.} except labour^{2.} the returns per ton of rape were:-

1. Corriedales receiving oats	8/7 $\frac{3}{4}$ d.
2. " not " "	15/4
3. Southdowns	19/5 $\frac{1}{2}$ d.

(4) that under the market conditions the Southdowns gave a return of 4/10 per ton of rape and after deductions^{1.} except labour^{2.} 4/1 $\frac{1}{2}$ per ton of rape better than the Corriedales not receiving oats.

(5) that the feeding of crushed oats caused a loss of 5/7 $\frac{3}{4}$ per ton of rape and after deductions^{1.} except labour^{2.} 6/8 $\frac{1}{4}$ per ton of rape compared with those of a similar type not receiving oats.

1. See Appendix IV p. 97, 98 and 99.

2. This includes the labour of fencing, driving, drafting etc., and supervision.

SUMMARY OF MAIN POINTS

RAPE CROP. The investigations review the importance of rape as a fattening crop and the circumstances under which it is grown. It appears that rape will continue to be grown in the drier areas of the Dominion. It need not be considered essential in the maintenance of soil fertility, but it fits in well with the organisation of labour on cropping farms.

COSTS AND PROFITS. The cost of growing the rape crop and the gross returns are influenced by numerous factors, many of which are outside the farmers control. The profit from the crop in those cases where store lambs are bought and fattened, is governed mainly by the rape yield and the price of store lambs. Under average conditions for farmers to make a profit by buying store lambs and fattening them on rape, there is a tendency for the prices of store lambs to be too high.

BREEDS OF LAMBS. Both Southdown and Corriedale lambs are good thrivers on rape as shown by their live weight increases and the value given to a ton of rape calculated from the live weight increase.

CONCLUSION. Finally investigation has shown that the field to be covered is very complex, conditions varying with the efficiency of the farmer, with soil, weather, crop yield and breed of lamb as well as with the margin between store and fat lamb prices. Another factor, more difficult to measure, is the benefit obtained from rape in the general crop rotation and farm management. But the inquiry outlined has shown clearly that almost every aspect of the work requires further research and experiment. The difficulty of obtaining preliminary information was largely due to the fact that this particular field of inquiry was practically untouched. The most that has been attempted in this work

is to open up the problem, outline some of its principal phases and so point the way to fuller and more adequate investigation.

APPENDIX 1.

TWENTY FOUR HOURS CONTINUOUS OBSERVATION
ON LAMBS FATTENING ON RAPE

1. Scope method and limitations.
2. Details of observations.
 - (a) grazing periods.
 - (b) percentage of 24 hours spent grazing.
 - (c) minor observations.
3. Comparison with a somewhat similar observance at the Welsh Plant Breeding Station.
4. Conclusions - time spent in grazing on index of the nutritive value of the food.

A P P E N D I X 1.TWENTY FOUR HOURS CONTINUOUS OBSERVATION ON LAMBSFATTENING ON RAPESCOPE, METHOD AND LIMITATIONS.

The time spent by fattening lambs may be divided into periods of grazing, chewing the cud and resting. When chewing the cud the lambs may be either standing or lying down and when resting either awake or asleep. Attempts were made to obtain information on all these points with lambs fattening on rape, but eventually observation was confined to grazing, standing and lying because of the number of lambs and the size of the break of rape - 50 lambs on $1\frac{1}{4}$ acres, being too large for more detailed counts. The observations were taken each half hour for twenty four hours on two occasions commencing in the morning and ending the following morning. The lambs had been on the breaks of rape for several weeks, so were well accustomed to the size of the pen, the food, and the surroundings. During the night an electric torch was used to assist in making the lambs visible, being handled in such a manner that the lambs were disturbed as little as possible. The first observation was taken on February 14th and 15th 1928, the second on March 1st and 2nd 1928. The results are tabulated in Table XXIII. on the next page and reproduced in Graphs 1 and 11. on pages 84 and 85.

TABLE XXIII.

NUMBER OF LAMBS GRAZING, STANDING, AND LYING FOR THREE
LOTS OF LAMBS ON TWO OCCASIONS, WHEN FATTENING ON RAPE

Observation taken on Feb. 14th & 15th 1928.								March 1st & 2nd 1928			
Hour of Day	Weather conditions.	50 Corriedales			49 Southdowns			Weather Conditions	48 Corriedales		
		G	S	L	G	S	L				
7 a.m.	Sky cloudy	29	10	11	27	5	17				
7.30	fine and...	32	14	4	29	3	17				
8	Blight N.E. breeze	30	5	15	16	3	30	Clear sky	28	2	18
8.30		14	2	34	13	22	14	warm and a	12	6	30
9	Sun shining hot day	19	10	21	26	8	16	gentle E. wind	15	5	28
9.30		5	18	27	22	5	22		24	4	20
10	Wind shifted to N.	4	10	38	7	7	35		15	0	33
10.30		7	12	31	9	8	32		2	5	41
11	Wind N.W.	7	9	34	6	8	35		4	3	41
11.30		11	5	34	12	7	30		6	7	35
12		6	12	32	11	5	33		3	8	37
12.30		6	15	29	10	7	32		4	9	35
1 p.m.	Blowing strong "Nor-	6	17	27	10	11	28		10	8	30
1.30	Wester"	4	8	38	2	8	39		19	5	24
2		4	3	43	8	7	34		5	13	30
2.30	Sky becoming cloudy	16	7	27	14	6	29		8	10	30
3	Wind becoming steady	4	26	10	34	2	13		16	6	26
3.30	Wind starts from S.W.	20	6	24	25	5	19		41	3	4
4	storm approaching - cooler	30	2	18	24	0	25	Becoming Cooler	3	12	33
4.30		40	0	10	40	0	9		7	3	38
5		43	1	6	38	9	2		41	0	7
5.30	Beginning to rain	50	0	0	43	3	3		39	5	4
6		36	1	13	38	2	9		43	0	5
6.30	Raining heavily	0	40	10	1	45	3		41	7	0
7		0	37	13	2	46	1		23	25	0
7.30	Rain easing	21	28	1	15	33	1		22	23	3
8	Rain stopped sky cloudy	17	33	0	16	33	0		16	10	22
8.30	Gentle rain again	1	49	0	0	49	0		2	4	42
9	Rain ceased sky cleared	0	50	0	0	49	0		4	6	38
9.30		36	14	0	25	24	0		4	2	42
10		25	25	0	31	16	2		3	3	42
10.30		20	25	5	12	31	6		6	6	36
11		-	-	-	-	-	-		-	-	-
11.30		36	14	0	24	22	3		40	6	2
12		36	11	3	24	20	5		14	3	31
12.30		32	12	6	12	27	10		0	3	45
1 a.m.		21	21	8	20	9	20		12	0	36
1.30		25	10	15	18	9	22		4	0	44
2		15	15	20	10	14	25		0	1	47
2.30		5	30	15	7	36	6		4	0	44
3		8	12	30	10	5	34		2	0	46
3.30		12	20	18	4	17	28		2	0	46

Warm sun and gentle easterly breeze throughout the day

Becoming Cooler

Night calm and mild generally

4 a.m.	Sky becom-	3	4	43	1	6	42	Slight mist	8	3	37
4.30	ing over-	13	5	32	7	8	34	comes over	16	3	29
5	cast	28	5	17	19	6	24		28	2	18
5.30	Drizzling	12	35	3	8	20	21		8	40	0
6	rain										
6	Drizzle	12	30	6	31	20	18		24	12	10
6.30	stopped	31	11	8	27	8	14		28	12	8
7.00	and								11	19	18
7.30	cloudy							Sun shining	19	9	20
8.	generally							warmly	18	7	23

DETAILS OF OBSERVATIONS.

Table XXIII records the actual counts of the number of lambs on each break grazing, standing, and lying for each half hour during the periods, along with a brief account of the weather. The numbers grazing as a percentage of the total number of lambs on the breaks are plotted in Graph 1 which indicates that there are distinct grazing periods even though the curves are much broken by weather variations. Graph 2 with these irregularities smoothed by the use of a moving average indicates that there are three distinct periods for general grazing, even though some of the fifty lambs were grazing at every half hour of the day, the only exception being the hours of rain shown at 7 p.m. and 9 p.m. for the observations in Graph 1. The evening meal is the largest, while the meal in the middle of the night is the smallest.

TABLE XXIV

Lot	Percentage of time spent grazing during the periods			
	8 a.m. to 4 p.m.	4 p.m. to 8 p.m.	8 p.m. to 4 a.m.	4 a.m. to 8 a.m.
	8 hours	4 hours	8 hours	4 hours
50 Corriedale crosses	21.6%	53.2%	37.8%	43.8%
49 Southdown crosses	29.1	47.7	28.0	34.2
48 Corriedale crosses	25.6	74.4	15.1	38.9

The above table assists in bringing these points out, the 48 Corriedale crosses on the normal night showing clearly the two large meals in the evening and morning. The percentage of time for the 24 hours spent in grazing is about 33% for the 3 lots, the actual figures being as in the

following table:-

TABLE XXV.

50 Corriedale crosses	35.0 %
49 Southdown "	33.3 %
48 Corriedale "	31.3 %

The following minor observations seem worthy of record. From Table XXIII or the graphs it can be seen that when heavy rain falls the lambs do not graze, but stand. During the showers or drizzles that occurred the numbers grazing fell considerably (see Graph 1 at 5.30 a.m.). The reason for the few or none grazing at 9 o'clock in the evening after the rain at 8.30 p.m. was the disturbance by the electric torch. The rise in the number grazing for the 48 Corriedale cross lambs at 3.30 p.m. was due to the lambs not having lain down after being disturbed by a dog at 3.10 p.m. These observations, also those when it was raining at 6.30 p.m. and 7 p.m. have been neglected in the moving average on Graph 2 and in the percentages of time spent in grazing. During the heat of the day the lambs stood and lay in small mobs, in the corners of the breaks in particular, being troubled by the nasal bot fly (*Oestrus ovis*). As soon as the wind began to blow the fly ceased to annoy the lambs. In the first observation when the sky clouded over in the afternoon and the atmosphere became cooler, the lambs started to graze and by 4.30 p.m. over 75% were grazing. Although this observation cannot be considered as having been taken on a normal night, it shows a distinct relation with the one taken at a later date under fine weather conditions (see Graph 2). In the second observation the lambs did not start grazing so early in the day, but continued a little later in the evening. The

Midnight meal was not so large, but is distinctly evident. In the three lots the lambs started grazing in the morning at or shortly after day break.

COMPARISON WITH A SOMEWHAT SIMILAR OBSERVATION AT THE
WELSH PLANT BREEDING STATION.

At the Welsh Plant Breeding Station, Aberystwyth
1.
M.G. Jones M. Sc. conducted observations of a similar nature with three lambs in pens on three types of pasture, temporary pasture, permanent pasture and rough pasture. The weather is described as "ideal, the night being calm and clear with the moon shining, while the day was dry, but not sufficiently hot to cause disturbance of the sheep by flies". The observations were taken every five minutes on each individual lamb.

In the Welsh trial a marked similarity of behaviour was shown between the lambs of the same pen and those of all the pens. This was also the case with the lambs on rape under the observations here recorded and 250 lambs in the neighbouring field. This means that lambs tend to graze at the same periods of the day, although in a large flock there are always some that do not follow closely the actions of the majority. This is borne out by the figures in Table XXIII page 82. Graphs showing the amount of time spent grazing in each hour are drawn and the same trend is present as that shown in Graphs I and II. The main feeding periods were during the morning and evening, the evening meal being the greater. No distinct mid-night meal is mentioned or represented in the graph shown, but the author mentions that approximately one third of every hour was spent in chewing the cud and that during the day
1.

Welsh Journal of Agriculture Vol IV. p. 191-196.

short periods of rest were taken every four hours approximately.

The time spent on the various functions upon the three types of feed was different, but only a difference of degree. The following table shows that the better and more nutritious the pasture the shorter the time spent in grazing and chewing the cud, and the longer the time spent in resting.

TABLE XXVI

Type of Pasture	%age of 24 hrs grazing	%age of 24 hrs chewing cud	%age of 24 hrs resting.
	%	%	%
Temporary	29	22	49
Permanent	31	24	45
Rough	37	32	31

This table shows also that lambs penned on good feed spent about 30% of their time in grazing. In the case of lambs on rape approximately 33% of the time was spent in grazing.

CONCLUSIONS - TIME SPENT IN GRAZING AN INDEX OF THE NUTRITIVE VALUE OF THE FEED.

Jones further mentions that the lambs on the temporary and permanent pastures gave a greater live weight increase than those on rough pasture, and infers that "this difference in the proportion of time spent resting, and also in chewing the cud on various pastures probably gives a very useful index of the nutritive value of such a pasture, and also an important indication of the nature of the pasture, that is to say, whether it is suitable for production in the form of live weight increment or merely for the maintenance of

the grazing animal." It appears that by watching animals for a period say 24 hours, on different types of food it would be possible to determine the relative values of these foods from the record of the percentage of time spent in eating, chewing the cud, and resting. There is no information concerning how long it would be necessary to give the animals the particular foods before a normal eating, chewing, and resting equilibrium would be set up for that food, nor how long it takes for animals to become accustomed to confinement in a pen or enclosure small enough to allow the observation. These matters are still in the experimental stage, but they will, no doubt, be further investigated in the near future.

To a certain extent the information given by the present observations, may be considered confirmatory of the general conclusions reached in Jones' paper, though the impossibility of taking night cud-chewing observations on a large number of sheep makes the parallel less exact than could be desired.

APPENDIX 11.THE VALUE OF 1 LB. OF LIVE WEIGHT IN-
CREASE IN FATTENING LAMBS

Since fat lambs kill out at approximately 50 per cent of their fasted live weight it seemed satisfactory to credit 1 lb. increase at one half the price being paid per lb. for fat lambs. This price was at the time (January 1928) over 9d. by a fraction, so that 9d. per lb was decided upon, this giving $4\frac{1}{2}$ d. as the value of 1 lb. of live weight increase. Further thought revealed that this could be only an arbitrary figure, for it seemed reasonable that there would be a greater increase in the weight of the carcass, than in the offal from a given amount of food. In other words, that the percentage of carcass to live weight would be lower in the store than in the fat lamb. Reference to the Rothamstead Memoirs established that this is so in sheep, but no lambs had been experimented upon.

If the figures were available giving the freezing weight as a percentage of the unfasted live weight for store lambs, half fat lambs, and fat lambs, then the increase in the freezing weight of the carcass could be determined. The lambs used in the experiment were weighed when going on the rape and when half fat (2nd quality) or fat (1st quality) coming off the rape. An attempt was made to deduce some information from the unfasted live weights and the freezing weights of the 144 lambs slaughtered, 90 of which were first quality, and 54 of which were second quality giving the following results when the freezing weight is represented as 1.

Freezing weight is the dressed weight of the carcass less $4\frac{1}{2}\%$.

a percentage of the unfasted live weight.

		Freezing Wt. as %age of Unfasted L. Wt.		
1st Quality	20 lambs	43.6	± .185	%
2nd	" 54	42.0	± .187	%
Difference		1.6	± .242	%

Odds in favour of significance thousands to 1.

The second quality lambs were mostly light lambs, hence this difference may be due to the size and not the primeness of the lamb. By taking all those lambs 33 lbs and above and those 32 lbs and under they give:-

33 lbs and above	72 lambs	43.9	± .184	%
32 lbs and under	72 lambs	41.8	± .144	%
Difference		2.1	± .232	%

Odds in favour of significance thousands to 1.

By taking those 30 - 32 lbs. (both inclusive) and those 29 lbs and under we find:-

30 - 32 lbs	30 lambs	42.7	± .201	%
29 lbs and under	42 "	41.2	± .168	%
Difference		1.5	± .26	%

Odds in favour of significance 9999 to 1.

Also again

33 lbs and above	72 lambs	43.9	± .184	%
30 - 32 lbs	30 "	42.7	± .201	%
Difference		1.2	± .271	%

Odds in favour of significance 369 to 1.

Thus we see that the heavier the lamb the higher the percentage of carcass will be.

By taking in the first and second quality lambs those 33 lbs and above and those 32 lbs and under we get:-

1st quality

33 lbs and above	61 lambs	44.2	± .193	%
32 lbs and under	29 "	42.3	± .189	%
Difference		1.9	± .27	%

Odds in favour of significance thousands to 1.

2nd quality

33 lbs and above	11 lambs	43.2	± .50	%
32 lbs and under	43 "	41.5	± .180	%
Difference		1.6	± .48	%

Odds in favour of significance 40 to 1.

There are significant differences between the first and the second quality lambs, between the heavy and the light lambs, between the heavy and light lambs in the first quality group, and between the heavy and light lambs in the second quality group. Hence it is evident that the more prime the lamb and the heavier the lamb, the higher will be the percentage of carcass.

TABLE XXVII.

	Wt. of carcass on basis of:-	
	42% of Unfasted L. Wt.	40% of Unf. L. Wt.
Total L. Wt (Unfasted when put on rape = 8772 lbs.)	3685 lb.	3510 lb.
	43% of Unfasted L. Wt	43% of Unfast- ed L. Wt.
Total L. Wt (Unfasted) when taken off rape = 1094 lbs.	4690 lbs.	4690 lbs.
	Gain in Carcass.	
Gain in Live Weight = 2132 lb.	1005 lb.	1180 lb.
Carcass increase expressed as a percentage of Live Weight Increase	47.1%	55.3%
1 lb. carcass @ 9d. per lb. is therefore equivalent to 1 lb of Live Weight Increase @	4½d.	@ 5d.

Since the average freezing weight as a percentage of the unfasted live weight of 144 lambs is 43 per cent and that of 54 second quality lambs is 42 per cent, second quality being considered as store lambs, table XXVII shows that 47.1 per cent of the live weight increase was an increase in the carcass which at 9d. per lb gives 1 lb of live weight increase as worth 4½d. If it be assumed that the percentage of freezing weight to the unfasted live weight in store lambs is 40 per cent, then, as in the table, 55.3 per cent of the live weight increase would be carcass increase which at 9d. per lb would give 1 lb. of live weight increase as worth 5d. After full consideration of these facts, it

was decided to take the value of 1 lb of live weight increase at $4\frac{1}{2}$ d. or one half of the price paid per lb. for fat lambs. It must be remembered that this figure may be giving a lower return than is actually realised, but until further information is available on the percentage of carcass in store lambs, it must suffice.

APPENDIX 111.

THE COST OF KEEPING A SIX HORSE TEAM -
THE COST OF WORK DONE BY A HORSE AND
A TRACTOR

1.

E.J. Fawcett B.A. gives £548-5-8 as the cost of maintaining a working a six-horse team in Canterbury for one year. In this average of twenty-seven farms it is estimated that the team works 250 days of eight hours each per year. The cost includes the wages, bonus, and keep received by the teamster, interest, depreciation and repairs on the buildings necessary for the horses, their feed and equipment, insurance, plough shares, shoeing, machinery, and oil. In the costing of rape these items have already been allowed in the overhead charges or else are negligible. For example, shoeing was not done on any of the six farms investigated, while plough shares were appreciable on one farm only in which case they are allowed in the prime charges along with the manure and seeds. The sum of these items already allowed amount to £297-17-3 and taken from the average given leave £250-8-5 as the annual cost of keeping six horses. This cost includes the items interest and depreciation on the horses, harness, covers, blocks and trees, and the cost of the feed and the labour expended in caring for the team. As this cost is given for 250 days of 8 hours each the cost of the team for one day is £1-0-0, for 1 horse for one day 3/4 and for 1 horse for one hour 5d. These costs are tabulated as follows:-

1.

New Zealand Journal of Agriculture. Vol 27. p. 355-364.

TABLE XXVlll.

Number of Horses	Time	Cost
6 horse team	1 year	£250-8-5
1 horse	1 "	41-14-9
6 horse team	1 day	1-0-0
1 horse	1 "	3-4
1 horse	1 hour	5

A fellow student gives the annual cost of a six horse team as £243-19-5 or £40-18-7 per horse. This result was obtained from actual records kept on six farms for one year, three of the farms being those upon which the investigation into the cost of rape production was carried out. The figure includes the same items as those mentioned in respect to the cost of a six horse team viz. £250-8-5 as deducted from Mr. Fawcett's result. The actual number of days worked per year on the average of the six farms by each horse is given as 147 days of 8 hours each. The cost for 1 horse for a day is therefore 5/9 or for 1 hour 8.63d. (8½d.)

He also records that the cost of using a tractor for one hour is 5/9 on the average of 11 farms.

This information was obtained during the same year as the inquiry into the cost of rape production was conducted. The results are up-to-date and were obtained from actual records kept for one year. I have, therefore, used them in preference to those obtained by Mr. Fawcett several years ago.

APPENDIX 1V.TABLE XXIXFINANCIAL DETAILS OF LOT 1 CORRIEDALES - FED
WITH CRUSHED OATS AND RAPE

<u>Receipts</u>	£	s.	d.
15½ lbs. crutching @ 6d. per lb		7	7½
3 lambs @ 21/-	3	3	-
47 lambs @ 24/3¼d.	57	2	7½
	<u>60</u>	<u>13</u>	<u>3</u>
 <u>Expenses</u>			
50 lambs @ 20/4	50	16	8
Railage and trucking charges @ 4d. per lamb		16	8
1 week's grazing on grass @ 3d. per week		12	6
578 lbs crushed oats @ 3/3 per bus.	2	7	-
432 grazing-days after rape completed @ 3d. for 7 days		15	5½
Rent for use of 3 troughs			3
	<u>55</u>	<u>8</u>	<u>6½</u>
 <u>Gross Returns</u> - £5-4-10½ for 9.6 tons of rape			
- 10/11 per ton			
- <u>£3-16-5 per acre on a 7 ton crop.</u>			
 <u>Other Expenses</u>			
Crutching @ 6/- per 100 (Coll. equipment used)		3	-
Dipping @ 2d. per head		8	4
3 lbs rock salt @ £6-4-4 per ton			2
Int. @ 6% on £51-13-4 for 2 months		10	4
		1	1 10
	<u>55</u>	<u>8</u>	<u>6½</u>
	<u>56</u>	<u>10</u>	<u>4½</u>
 -X- Returns - £4-3-0½ for 9.6 tons of rape			
- 8/7½ per ton			
- <u>£3-0-6 per acre on a 7 ton crop.</u>			

-X-

This return does not allow for labour of fencing, driving, drafting etc., and supervision.

TABLE XXX.FINANCIAL DETAILS OF LOT 111. CORRIEDALES - FEDWITH RAPE ONLYReceipts

	£	s.	d.
15½ lbs. crutchings @ 6d. per lb.		7	7½
1 lamb @ 21/-	1	1	-
49 lambs @ 24/8	60	9	1½
	<u>61</u>	<u>17</u>	<u>9</u>

Expenses

50 lambs @ 20/4	50	16	8
Railage and trucking charges @ 4d. per lamb		16	8
1 weeks grazing on grass @ 3d. per week		12	6
533 grazing-days @ 3d. for 7 days after rape completed		19	-½
	<u>53</u>	<u>4</u>	<u>10½</u>

<u>Gross Returns</u>	-	£8-4-3	for 9.92 tons of rape
	-	16/6½d.	per ton
	-	<u>£5-15-11</u>	<u>per acre on a 7 ton crop.</u>

Other Expenses

Crutching @ 6/- per 100 (Coll. equipment used)	3	-	
Dipping @ 2d per head	8	4	
2 lbs. rock salt @ £6-4-4 per ton			1½
Int. @ 6% on £51-13-4 for 2 months	10	4	
	<u>1</u>	<u>1</u>	<u>9½</u>
	<u>53</u>	<u>4</u>	<u>10½</u>
	<u>54</u>	<u>6</u>	<u>8</u>

-X- Returns	-	£7-11-1	for 9.92 tons of rape
	-	15/4	per ton
	-	<u>£5-7-4</u>	<u>per acre on a 7 ton crop.</u>

~~-X-~~ This return does not allow for labour of fencing, driving, drafting etc., and supervision.

TABLE XXXI
FINANCIAL DETAILS OF
LOT 11. SCUTHDOWNS - FED ON RAPE ONLY

<u>Receipts</u>	£	s.	d.
15½ lbs. crutchings @ 6d. per lb.		7	7½
49 lambs @ 28/7½	70	2	-
		<u>70</u>	<u>2</u>
		<u>70</u>	<u>9 7½</u>

<u>Expenses</u>	£	s.	d.
49 lambs @ 23/2	56	15	2
Railage and trucking charges @ 4d. per head		16	4
1 week's grazing for 49 lambs @ 3d. per week		12	3
98 grazing-days @ 3d. for 7 days after rape completed		<u>3</u>	<u>6</u>
	<u>£58</u>	<u>7</u>	<u>3</u>

Gross Returns - £12-2-4½ for 11.33 tons of rape
 - 21/4¾ for ton
 - £7-9-9 per acre on a 7 ton crop.

Other Expenses

Crutching @ 6/- per 100 (Coll. plant used)	3	-	-
Dipping @ 2d. per head	8	2	-
3 lbs. rock salt @ £6-4-4 per ton		2	-
Int. @ 6% on £57-11-6 for 2 months	<u>11</u>	<u>4</u>	<u>-</u>
	1	2	8
	<u>58</u>	<u>7</u>	<u>3</u>
	<u>59</u>	<u>9</u>	<u>11</u>

~~X~~ Returns - £10-19-8½ for 11.33 tons of rape
 - 19/5½ per ton
 - £6-16-2 per acre on a 7 ton crop.

~~X~~ This return does not allow for labour of fencing, driving drafting etc., and supervision.

TABLE XXXIIDETAILS OF SALESSOUTH DOWNS 1ST DRAFT FEB. 28TH

No. lamb in draft.	Grade.	No. lamb.	Total Wt.	Price	Amount		
					£	s.	d.
32	up to 36	17	570	10	23	15	-
	36-42	12	467	9½	18	9	8½
	above 42	2	89	9¼	3	8	7¼
	2nd Qual	1	33	9	1	4	9
		32	1159		46	18	-¾
				-	29/3¼ per head		
<u>2ND DRAFT. MAR. 12TH</u>							
12	up to 36	5	174	10	7	5	-
	36-42	2	77	9½	3	-	11½
	2nd Qual	5	182	9	6	16	6
		12	433		17	2	5½
				-	28/6½ per head		
<u>3RD DRAFT MAR. 27TH</u>							
5	up to 36	2	63	10	2	12	6
	2nd Qual	3	92	9	3	9	-
		5	155		6	1	6
				-	24/3½ per head		
				-	28/7¼ per head.		

CORRIEDALES (CAT-FED)1ST DRAFT FEB. 28TH

2	up to 36	2	71	10	2	19	2
				-	29/7 per head		

2ND DRAFT MAR. 12TH

12	up to 36	8	273	10	11	7	6
	36-42	1	37	9½	1	9	3½
	2nd Qual	3	99	9	3	14	3
		12	409		16	11	-½
				-	27/7 per head		

3RD DRAFT MAR. 27TH

33	up to 36	13	389	10	16	4	2
	2nd Qual.	19	548	9	20	11	-
	Reject	1	26	4½		9	9
	Skin	1				7	6
		33	963		37	12	5
				-	22/9½ per head		
				-	24/3½ per head.		

CORRIEDALES 2ND DRAFT MAR. 12TH

2	up to 36	6	207	10	8	12	6
	36-48	1	41	9½	1	12	5½
	2nd Qual.	2	72	9	2	14	-
		9	320		12	18	11½
				-	28/9¼ per head		

3RD DRAFT MAR. 27TH

40	up to 36	20	638	10	26	11	8
	2nd Qual	20	558	9	20	18	6
		40	1796		47	10	2
				-	23/9 per head		
				-	24/8 per head		

LIST OF N.Z.U.S.A. EXCHANGES.

AUSTRALIA.

"Honi Soit", Sydney University.
"Farrago", Melbourne University.
"On Dit", University of South Australia, Adelaide.
"Sempa Floreat", University of Queensland, Brisbane.
"The Pelican", University of Western Australia.
"Togatus", University of Tasmania, Hobart.

SOUTH AFRICA.

(5 copies) National Union of South African Students,
145, St. George's Street, Capetown.

ENGLAND.

(5 copies) National Union of Students,
3, Endsleigh Street, London.

"New University", Sheffield University.

"Student Form Ltd."
113 High Holborn, London, W.C. 1.

AMERICA.

(5 copies) National Student Federation of America,
1410 H Street, N.W. Washington D.C.

SWITZERLAND.

The Editor, I.S.S. Bulletin, 13 Rue Calvin, Geneva.

FRANCE.

World Student Association, 97 Bd. Arago, Paris - 14.

MEXICO.

D.A.F.P., Bucareli 12, Mexico City,

N.B. A supplementary list is to be forwarded later.

TABLE XXXIII

AVERAGE WEIGHTS PER LAMB FOR EACH LOT

	Unfasted Weight when put on rape	Unfasted Wgt. when taken off rape as "fats"	(Weighted Av- erage) Live Weight Increase per day.	Fasted Weight 24 hours after previous un- fasted weight at works.	Difference be- tween Unfasted and Fasted Wgt. from farm to works in 24 hours.	Dressed Weight	Freezing Weight	Frozen Weight as %age of fasted weight	Frozen Wgt as %age of unfasted weight	Weight of Skin
	lb	lb	lb	lb	lb	lb	lb	%	%	lb
Corriedale cross (fed with oats)	58.1 ± .55	74.2 ± .60	.265 ± .08	64.9 ± .68	7.58 ± .15	32.2 ± .65	30.7 ± .32	47.4 ± .20	42.4 ± .19	9.15 ± .10
Corriedale cross	55.2 ± .59	72.0 ± .60	.285 ± .07	64.3 ± .51	7.7 ± .15	32.3 ± .39	31.0 ± .36	48.0 ± .23	42.8 ± .25	9.05 ± .11
Southdown cross	69.0 ± .66	82.6 ± .71	.363 ± .13	73.5 ± .62	9.10 ± .15	36.6 ± .65	35.7 ± .37	48.5 ± .23	43.2 ± .24	10.23 ± .27

TABLE XXXIV.

DIFFERENCE BETWEEN UNFASTED AND FASTED WEIGHT FROM FARMTO WORKS IN 24 HOURS AS A PER-CENTAGE OF

	Unfasted Weight (off rape) %	Fasted Weight (at works) %
Corriedale cross (fed with oats)	10.2	11.7
Corriedale cross	10.7	11.95
Southdown cross	11.0	12.4

TABLE XXXV

WEIGHTS FOR EACH LAMB OF
LOT 1. CORREDALE CROSS - FED WITH OATS.

1ST DRAFT

Unfasted Weight Jan 26th	Unfasted Weight Feb 28th	Gain 33 days.	Gain per day.	Fasted Weight Feb 29th	Difference between Unfast- ed & Fasted Wgt From Farm to Works in 24 hours.	Dressed Weight	Freezing Weight	Grade	Freezing Weight as %age fast- ed weight	Freezing Weight as %age Un- fasted Weight	Weight of Skins.
lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs		%	%	lbs.
69	84.5	15.5	.470	75.5	9.0		36	1st Qual.	47.7	42.6	
68	75.5	7.5	.227	68.5	7.0		35	" "	51.1	46.4	
137	160.0	23.0	.697	144.0	16.0		71		98.8	89.0	
Av. 68.5	80.0	11.5	.348	72.0	8.0		35.5		49.4	44.5	

2ND DRAFT

	Unfasted Weight Mar 12th	Gain 46 days		Fasted Weight Mar. 13th							
58	75	17	.370	69	6.0	37	35	1st Qual.	50.8	46.7	8.0
61	83	22	.478	74	8	37	35	" "	47.3	42.2	12.5
67	80	13	.283	73	7	39	36	" "	49.4	45.0	9.25
72	83.5	11.5	.250	76.5	7	39	37	" "	48.4	44.3	10.0
59	71.5	12.5	.272	66	5.5	34	32	2nd "	48.5	44.8	9.25
61	74	13	.283	68.5	6.5	33	31	1st "	45.3	41.9	10.0
69	78	11	.239	70	8	37	35	" "	50.1	44.9	7.75
65	82.5	17.5	.381	74.5	8	38	35	" "	47.0	42.4	10.50
61	76	15	.326	68	8	34	32	2nd "	47.1	42.2	10.75
57	81	24	.522	74.5	6.5	37	35	" "	47.0	43.2	10.25
60	78	18	.392	68	10	38	36	1st "	53.0	46.2	10.25
X 49				62		33	30	" "	48.4		8.25
690	862.5	174.5	379	782	80.5	403	379		533.9	484.0	108.5
Av. 62.72	78.41	15.87	344	71.1	7.32	36.63	34.45		48.54	44.0	9.86

	Unfasted Weight Mar. 27th	Gain 61 days	Fasted Weight Mar. 28th									
54	70.5	16.5	.271	62	82.5	28	27	2nd Qual.	43.6	38.2	9.5	
62	68	6	.098	62	6	30	29	" "	46.8	42.6	9.5	
52	67	15	.246	60	7	29	28	1st "	46.7	41.8	9.0	
49	63	14	.230	56	7	28	27	2nd "	48.2	42.8	8.0	
52	70	18	.295	62	8	31	30	" "	48.4	42.8	9.25	
61	71	10	.164	64	7	31	30	" "	46.9	42.3	8.75	
58	72.5	14.5	.238	66	6.5	34	32	1st "	48.5	44.2	9.0	
57	66	9	.147	59.5	6.5	29	27	2nd "	45.4	40.9	8.0	
56	68	12	.197	59	9	29	28	1st "	47.5	41.2	9.25	
56	69.5	13.5	.222	63	6.5	31	30	" "	47.6	43.2	8.75	
51	67.5	16.5	.271	60.5	7	31	30	" "	49.7	44.4	7.75	
52	74	22	.361	67	7	32	31	" "	46.3	42.0	8.75	
60	72.5	12.5	.205	65.5	7	33	31	" "	47.4	42.8	10.5	
63	76	13	.213	69	7	36	34	" "	49.3	44.8	10.0	
51	67	16	.263	58	9	29	28	" "	48.3	41.8	9.0	
57	72.5	15.5	.254	63.5	9	33	31	" "	48.8	42.7	9.5	
54	68.5	14.5	.238	61	7.5	30	28	" "	45.9	40.9	9.0	
57	67.5	10.5	.172	59.5	8	27	26	" "	44.0	39.1	9.0	
62	75	13	.213	66.5	8.5	33	32	" "	48.2	42.6	8.0	
50	62	12	.197	57	5	27	26	2nd "	45.6	42.0	7.75	
57	75	18	.295	66	9	32	31	" "	47.0	41.4	9.0	
64	81	17	.279	71	10	36	34	" "	47.9	42.0	9.5	
69	85.5	16.5	.271	76	9.5	35	33	" "	43.4	38.6	10.0	
52	68	16	.263	61	7	29	28	" "	45.9	41.2	8.75	
56	70	14	.229	62	8	29	29	" "	46.8	41.5	9.0	
59	73	14	.229	65	8	30	29	" "	44.6	39.8	10.5	
51	69	18	.295	61	8	31	30	" "	49.2	43.5	8.25	
54	64.5	10.5	.173	58	6.5	29	28	" "	48.3	43.5	9.25	
61	72.5	11.5	.189	65	7.5	31	30	" "	46.2	41.4	10.25	
48	63	15	.246	56	7	28	27	" "	48.2	42.9	6.5	
54	73	19	.312	62	11	30	29	" "	46.8	39.7	9.25	
49	61.5	12.5	.205	53.5	8	26	24	" "	44.9	39.0	7.25	
52	64.5	12.5	.205	59	5.5	27	26	Reject (Thin)	44.1	40.3	8.5	

1840 2308.5 468.5 7.68 2056.5 252 1014 963 1546.5 1376.0 293.5

Av. 55.76 69.94 14.18 .233 62.30 7.64 30.73 29.18 46.85 41.7 8.87

Grand Average

58.1 ± .55 74.2 ± .60 .265 ± .08 64.9 ± .68 7.58 ± .12 32.2 ± .35 30.7 ± .32 47.4 ± .20 42.4 ± .19 9.15 ± .10

TABLE XXXVI

WEIGHTS OF EACH LAMB OF LOT 111 CORRIEDALE CROSS.2ND DRAFT

Unfasted Weight Jan. 26	Unfasted Weight Mar. 12	Gain 46 days	Gain per day	Fasted Weight Mar 13	Difference between Un- fasted and Fasted Wgt. from farms to works in 24 hours.	Dressed Weight	Freezing Weight	Grade	Freezing Weight as %age Fasted weight	Freezing weight as %age Unfasted weight	Weight of Skins
lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs		%	%	lbs
60	77.5	17.5	.381	69	8.5	37	35	1st Qual.	50.7	45.2	10.0
60	82	22	.478	73.5	8.5	37	35	" "	47.6	42.8	12.25
60	75	15	.326	69.5	5.5	35	33	" "	47.5	44.1	9.75
59	78.5	19.5	.424	69	9.5	35	33	" "	47.8	42.1	11.25
55	73	18	.392	66.5	6.5	37	35	" "	52.6	48.0	9.0
63	76.5	13.5	.294	70	6.5	38	36	" "	51.5	47.1	8.75
70	88.5	18.5	.402	81	7.5	43	41	" "	50.6	46.4	10.75
61	78	17	.370	70.5	7.5	40	38	2nd "	53.8	48.7	6.75
68	77	9	.196	70	7	36	34	" "	48.6	44.2	10.25
<u>556</u>	<u>706</u>	<u>150</u>	<u>3.262</u>	<u>639</u>	<u>67.0</u>	<u>339</u>	<u>320</u>		<u>450.7</u>	<u>408.0</u>	<u>88.75</u>
Av_ 61.76	78.44	16.68	.362	71.0	7.44	37.66	35.55		50.08	45.4	9.86

3RD DRAFT

	Unfasted Weight Mch. 27	Gain 61 days.		Fasted Weight Mch 28								
63	83	20	.328	73.5	9.5	36	35	1st Quality	47.6	42.2	10.5	
47	63	16	.263	56	7	28	27	" "	48.2	42.9	7.25	
61	80	19	.312	70.5	9.5	38	36	" "	51.1	45.0	9.5	
49	71	22	.361	62	9	32	30	" "	48.4	42.3	7.25	
59	75	16	.262	65.5	9.5	32	30	" "	45.8	40.0	9.25	
62	83.5	21.5	.353	72	11.5	36	35	" "	48.6	41.9	10.25	
55	74	19	.312	66.5	7.5	33	32	" "	48.2	43.2	7.75	
61	78.5	17.5	.287	70.5	8	35	33	" "	46.2	42.0	10.0	
61	74.5	13.5	.222	67	7.5	34	33	" "	49.3	44.3	9.25	
54	68	14	.229	60.5	7.5	29	28	" "	46.3	41.2	9.25	
60	76	16	.262	68	8	35	33	" "	48.5	43.5	9.5	
63	77	14	.229	70	7	36	35	" "	50.0	45.5	8.75	
56	73	17	.279	66	7	35	33	" "	50.0	45.2	10.0	
52	66.5	14.5	.238	59.5	7	31	29	" "	48.7	43.6	9.0	
49	72	23	.377	63.5	8.5	32	30	" "	47.2	41.6	8.0	
45	64	19	.312	60	4	33	31	" "	51.7	48.4	9.5	
62	81.5	19.5	.320	71	11.5	36	35	" "	49.4	42.9	10.0	
49	68	19	.312	60	8	30	29	" "	48.4	42.7	9.0	
62	74	12	.197	70	4	37	36	" "	51.5	48.6	10.25	
48	70	22	.361	62	8	30	28	" "	45.2	40.0	8.75	
52	63	11	.180	56.5	6.5	30	29	2nd	51.4	46.0	8.25	
59	66.5	7.5	.123	60	6.5	27	27	" "	45.0	40.6	10.5	
56	68	12	.197	61	7	28	27	" "	44.2	39.7	7.0	
46	66	20	.328	57	9	25	24	" "	42.2	36.4	9.25	
51	59.5	8.5	.139	53	6.5	25	25	" "	47.2	42.0	8.0	
57	68	11	.180	61	7	30	28	" "	45.9	41.2	8.25	
59	75	16	.263	66	9	31	30	" "	45.4	40.0	10.0	
56	73.5	17.5	.287	64	9.5	31	30	" "	46.9	40.8	10.5	
56	69	13	.213	64	5	32	31	" "	48.4	45.0	9.5	
52	69	17	.279	62	7	29	28	" "	45.2	40.6	8.75	
58	69	11	.180	61.5	7.5	30	29	" "	47.2	42.1	7.75	
48	67	19	.312	59	8	28	27	" "	45.8	40.4	9.0	
53	68	15	.246	59	9	29	29	" "	49.2	42.6	9.75	
48	69	21	.344	60.5	8.5	29	28	" "	46.3	40.6	8.25	
53	73	20	.328	65	8	32	31	" "	47.8	42.5	8.75	
46	61	15	.248	53	8	26	25	" "	47.2	41.0	7.0	
49	65	16	.262	58.5	6.5	27	26	" "	44.5	40.0	8.25	
47	67	20	.328	57	10	28	27	" "	47.4	40.3	7.5	
49	64	15	.248	58	6	28	27	" "	46.6	42.2	7.25	
59	70.5	11.5	.188	63	7.5	31	30	" "	47.6	42.6	9.0	
<u>2172</u>	<u>2823.5</u>	<u>651.5</u>	<u>10.68</u>	<u>2513</u>	<u>310.5</u>	<u>1244</u>	<u>1196</u>		<u>1901.7</u>	<u>1692.0</u>	<u>355.5</u>	
<u>Average</u>												
54.3	70.6	16.3	.267	62.8	7.76	31.1	29.9		47.54	42.4	8.88	
<u>Grand Average</u>												
55.2±.59	72.0±.60		.285±.07	64.3±.51	7.7±.15	32.3±.39	31.0±.36		48.0±.23	42.8±.25	9.08±.11	

TABLE XXXVII

WEIGHTS OF EACH LAMB OF LOT 11 SOUTHDOWNS

<u>1ST DRAFT</u>											
Unfasted Weight Jan 26th	Unfasted Weight Feb. 28th	Gain 33 days	Gain per day	Fasted Weight Feb 29th	Difference between Un- fasted and fasted Wgt. from farm to works in 24 hrs.	Dressed Weight	Freezing Weight	Grade	Frozen Weight as %age fast- ed weight	Frozen weight as %age Unfast ed weight	Weight of Skins
lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs		%	%	lbs
70	75.5	5.5	.167	67	8.5		33	2nd Qual	49.3	43.7	
67	82	15.0	.445	71.5	11.5		33	1st "	46.2	40.3	
74	86.5	12.5	.379	76.5	10.0		38	" "	49.6	43.9	
65	76.5	11.5	.349	68.5	8.0		35	" "	51.0	45.8	
76	90	14.0	.424	81.5	8.5		39	" "	48.0	43.4	
67	80.5	13.5	.409	73.5	7.0		37	" "	50.4	46.0	
80	90.5	10.5	.318	82	8.5		42	" "	51.3	46.7	
73	89	16.0	.485	78	11.0		38	" "	48.7	42.6	
65	68.5	3.5	.0106	63.5	5.0		29	" "	45.7	42.4	
76	90.5	14.5	.440	81	9.5		34	" "	42.0	38.7	
65	77.5	12.5	.379	69	8.5		33	" "	47.9	42.6	
65	76.5	11.5	.349	67	9.5		33	" "	49.3	43.2	
67	86.5	19.5	.582	74	12.5		38	" "	51.5	43.9	
84	98	14.0	.424	88.5	9.5		43	" "	48.7	43.9	
64	76.5	12.5	.379	68	8.5		32	" "	47.1	41.8	
69	82.5	13.5	.409	73	9.5		36	" "	49.3	43.6	
61	78.5	17.5	.531	68.5	10.0		32	" "	46.7	40.8	
72	87.5	15.5	.470	75.5	12.0		37	" "	49.0	42.4	
57	71	14.0	.424	63.5	7.5		31	" "	48.8	43.7	
68	80	12.0	.364	70.5	9.5		34	" "	48.2	42.5	
67	79	12.0	.364	69.5	9.5		34	" "	49.0	43.0	
80	93	13.0	.394	84.5	8.5		42	" "	49.8	45.2	
65	82.5	17.5	.531	72.5	10.0		37	" "	51.0	44.9	
67	77.5	10.5	.318	69.5	8.0		41	" "	59.1	53.0	
86	102.5	16.5	.500	91.5	11.0		46	" "	50.4	44.9	
76	92.5	16.5	.5	82	10.5		40	" "	48.9	43.3	
67	77.5	10.5	.318	73.5	4.0		35	" "	47.6	45.2	
61	75	14.0	.424	66.5	8.5		33	" "	49.7	46.7	
69	81.5	12.5	.379	73	8.5		36	" "	49.4	44.1	
65	83.5	18.5	.56	73	10.5		35	" "	48.0	42.0	
74	83	9.0	.272	73.5	9.5		35	" "	47.6	42.2	
68	86.5	18.0	.546	75.5	11.0		38	" "	50.4	44.0	
2230	2658	427.5	12.950	2365	293.0		1159		1569.6	1395.0	
<u>Average</u>											
69.7	83.1	13.4	.405	73.9	9.2		36.2		49.05	43.4	

2ND DRAFT

	Unfasted Weight		Gain 46 Days	Fasted Weight								
	Mch	12th		Mch	13							
59	72		13	.283	64.5	7.5	34	32	1st Quality	49.6	44.5	8.75
78	81		3	.007	73	8.0	37	35	" "	48.0	43.2	8.5
69	87		18	.392	77	10.0	41	39	" "	50.6	44.9	11.25
65	86		21	.457	76	10.0	39	36	2nd "	47.4	41.9	12.0
59	75.5		16.5	.359	68	7.5	34	32	" "	47.1	42.4	10.5
70	86		16	.348	77	9.0	38	36	1st "	46.7	41.9	10.25
68	85		17	.370	76.5	8.5	39	36	" "	47.1	42.4	12.5
81	84		3	.007	76	8.0	37	35	" "	45.1	41.7	11.25
79	97.5		18.5	.402	86.5	11.0	43	40	2nd "	46.3	41.1	14.0
71	83		12	.261	74	9.0	41	38	1st "	51.4	45.8	9.75
61	75.5		14.5	.316	70	5.5	35	33	2nd "	47.2	43.7	10.0
74	91		17	.370	82	9.0	43	41	" "	50.0	45.1	11.0
834	1003.5		169.5	36.84	900.5	103.0	461	433		576.5	518.5	129.75
<u>Average</u> 69.50	83.62		14.12	.306	75.04	8.6	38.42	36.1		48.04	43.2	10.81

3RD DRAFT

	Unfasted weight		Gain 61 days	Fasted Weight								
	Mch	27		Mch	28							
61	72.5		11.5	.187	64.5	8.0	30	29	2nd Quality	45.0	40.0	10.25
59	72.5		13.5	.221	62	10.5	30	29	" "	46.8	40.0	6.75
68	83.5		15.5	.254	72	11.5	36	34	1st "	47.2	40.7	9.0
53	73		20.0	.328	65.5	7.5	31	29	" "	44.3	39.7	9.75
72	80.5		8.5	.139	70	10.5	35	34	2nd "	48.6	42.3	8.5
<u>313</u> <u>Average</u> 62.6	<u>382</u> 76.4		<u>69.0</u> 13.8	<u>1.139</u> .226	<u>334.0</u> 66.8	<u>48.0</u> 9.6	<u>162</u> 32.4	<u>155</u> 31.0		<u>231.9</u> 46.38	<u>202.7</u> 40.6	<u>44.25</u> 8.84
<u>Grand Average</u> 69.0 ± .66	82.6 ± .71		13.8 ± .13	.363 ± .13	73.5 ± .62	9.1 ± .15	36.6 ± .65	35.7 ± .37		48.5 ± .23	43.2 ± .24	10.23 ± .27

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