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Meat Production per Acre

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OVER the past ten years at Ruakura we have been engaged in mapping the factors affecting efficiency of production in the sheep industry. In most instances the experimental approach has been used and the relative importance of major variables measured. From these studies have come more factual knowledge of the nutritional requirements of the ewe flock (1), the influence of varying levels of nutrition on flock performance (2), the requirement for full exploitation of flushing as a means of increasing lambing percentage (3), the relative merits of set-stocking and rotational grazing in raising fat lambs (4), the value of different breeds of fat lamb sire (5), and the relative importance of ewe conformation in fat lamb production (6).

All these studies have aimed at elucidating the specific contribution of some particular variable. None has attempted to measure all-over efficiency of production. The almost complete absence of production data in the meat industry has been in marked contrast to the wealth of such information in the dairy industry. Dairy farmers have long been conscious of the statistical structure of their industry. The pioneer studies of Fawcett (7) in 1928 early showed the total production picture, provided estimates of vital statistics of dairy farming, set the stage for more critical assessment of factors affecting efficiency of production, and, from the national viewpoint, provided a production target in terms of butterfat per acre which has been a stimulus to dairying ever since. Most dairy industry leaders, extension workers and practising dairy men will agree that this target of 200lb. of butterfat per acre has been a powerful force influencing the increasing efficiency of dairying over the past 20 years. Most research workers in the field are fully conscious of the way their thinking has been influenced by this target. A large proportion of current dairy research aims at shifting the figures to higher levels.

While it cannot be taken for granted that a comparable target for meat production will have similar repercussions on fat lamb and beef production, the accurate measurement of output achieved by methods of farming commonly accepted as sound should at least be of value in stimulating more widespread studies. In addition, it is obvious that studies of meat production on a farm basis must yield data on vital statistics, the dearth of which has often been stressed by various interested quarters of recent years.

Finally, a study of meat production on a total farm basis could be used to contrast the effect of the two variables under the direct control of any farmer—the number and type of meat animal run.

Accordingly, an experiment was commenced in 1950 which aimed at:—

1. Measuring output of meat per acre on grassland of fattening quality;
2. Measuring the vital statistics of ewe and lamb flocks;
3. Contrasting stocking ratios of sheep to cattle in terms of production per animal and per acre.

PROCEDURE:

The design of this project has been described in a recent issue of the *Journal of Agriculture*. Briefly, three "farms" comparable in total area, soil type, paddock number, initial pasture, shelter and contour were taken. As a basis of comparison farm (1) was stocked at the rate and sheep/cattle ratio characteristic of similar Waikato farms generally accepted as being efficiently run—that is to say, at 4 ewes per acre plus one-third cattle beast (equivalent) wintered per acre.

On the second farm the sheep were increased to 6 ewes per acre plus one-third cattle beast purchased in the spring. On the third area sheep were increased again to 8 per acre with no cattle. Topdressing was the same on each farm. Day to day management was in the hands of the same shepherd. The general aim in management was to ensure as full utilisation as possible of all feed grown on each farm.

A straight line of 900 5-year-old ewes was bought in each year and divided among the three farms. All the rams used were South-downs and were purchased from the same breeder throughout the three years.

On the farm carrying 4 ewes per acre 12 weaner steers were bought in each autumn and fattened off at 2 to 2½ years old. Two age groups were thus always on hand.

Weaners were done well through their first winter but older cattle were wintered harder when necessary. After the winter young cattle took second place and preference was given to older cattle intended for fattening in the current season.

Additional cattle were bought in spring for this area when required. This was warranted in each of the three seasons.

On the farm carrying 6 ewes per acre, 15 forward stores were bought-in each spring. They were sold on the hooks at schedule rates in autumn, usually at a financial loss. The fact that so many farmers follow a similar policy is evidence of the importance attached to the necessity for controlling sheep pastures with cattle. On the farm carrying 8 ewes per acre no cattle were run and the ewes managed to deal quite competently with all the feed available.

For this presentation all three seasons have been averaged. Some of the vital statistics are shown in Table 1.

TABLE 1.—VITAL STATISTICS

No. of ewes mated	Ewes Per Acre		
	4	6	8
570	882	1212	
Percent ewes died	6	5	4
Percent ewes dry	12	9	8
Lambing percentage	108	112	107
Percent lambs died	15	12	15

There was little difference between the three groups. Ewe mortality was similar on each farm. It was expected that on the farm with 8 ewes per acre some trouble might be experienced from pregnancy toxaemia, but no cases occurred. This was probably due to the fact that this group was on a continuous low plane of nutrition from the end of tupping until after lambing.

The percentage of dry ewes was slightly higher on the farm with 4 ewes per acre. Lambing percentages were low in the first year, when a poor line of ewes was farmed, but in the second and third years, with good ewes, percentages were quite high. The farm with 6 ewes per acre showed a slightly higher average over the three years. On the farm with 4 ewes per acre the ewes tended to be too fat and lazy to exert themselves either during parturition or in attending to their lambs after birth. At the other extreme, the ewes on the farm with 8 ewes per acre were sometimes too hungry to let the exigencies of birth delay their hunt for food for longer than was absolutely necessary and wandered away from their lambs. Losses also occurred in this group through mis-mothering owing to the greater number of ewes in the paddock.

The liveweight changes of the ewes are shown in the Graph 1. Weights were recorded at six crucial points during the year—on arrival, after tupping, just before the beginning of lambing, in mid-

season (that is, approximately half-way between lambing and drafting), and when the first draft of lambs was taken in mid-December. Weaning occurred at this stage. Ewes were finally weighed just before they left the property.

During winter (May to July) the 8-per-acre ewes showed only a slight increase in body-weight. If allowance is made for wool growth and foetal development, there was a loss in body-weight between the end of tupping and the beginning of lambing. In spite of this the ewes were fit and active, though hungry. By weaning time in mid-December most of the 4-per-acre and 6-per-acre ewes were over-fat for retaining for breeding or for killing. Remedial measures were taken during January. The 8-per-acre ewes still tended to be too thin to kill, though they were in good condition for breeding when the lambs were drafted.

Lambs were drafted by a commercial picker in the normal way. Table 2 shows the carcass weights and grades for all lambs drafted.

TABLE 2—LAMB KILLING DATA.

	Ewes Per Acre		
	4	6	8
No. of lambs fattened	589	939	1172
Carcass weight	34.5	33.3	31.6
Grading percent:			
Down	68	63	44
Prime	28	32	43
Second	4	4.5	13
Reject	—	0.5	1
No. of store lambs	—	13	53

The 4-per-acre lambs were about average for the district. They were just over 1lb. heavier than the 6-per-acre lambs and nearly 3lb. heavier than the 8-per-acre lambs.

There was little to choose between the grading of the 4-per-acre and 6-per-acre lambs. The lambs off the farm with 8 ewes per acre were undoubtedly leaner and did not grade as well. All the 4-per-acre lambs were fattened, but approximately one per cent of the 6-per-acre lambs and six per cent of the 8-per-acre lambs were sold as stores. If a really dry season had occurred during the three years of this

experiment, these figures would most certainly have been higher. The percentages of lambs sent away in the first draft in December were as follows:—

Farm with 4 ewes per acre	54 percent
Farm with 6 ewes per acre	44 percent
Farm with 8 ewes per acre	34 percent

The picker was instructed to take all lambs that would grade but no seconds in the first draft.

The average weight of meat per acre produced annually on each of the three farms is shown in Table 3:

TABLE 3—MEAN MEAT PRODUCTION (lbs. per acre per year)

	Ewes Per Acre		
	4	6	8
Lamb	142	215	254
Beef	117	44	—
Total	259	259	254

When the amount of beef carcass weight is added to the outputs of the farms carrying 4 and 6 ewes per acre it will be seen that there is a marked similarity in the production of quality meat from the three farms. This indicates how the fat lamb farmer can adjust his plans according to market demands and prices without any loss of

production. When lamb prices are high relative to the price of beef he can achieve the same meat production per acre by stocking more heavily with sheep, and if lamb prices fall, he can increase beef production.

The price of meat is not the only factor to be considered, however. Wool production is an important side-line of the fat lamb farm.

Wool production figures for the three farms are shown in Table 4:

TABLE 4—WOOL PRODUCTION PER YEAR

	Ewes Per Acre		
	4 (lb)	6 (lb)	8 (lb)
Ewe fleece weight	9.6	9.2	8.4
Ewe wool per acre	42	58	72
Lamb wool per acre	1	3	8
Total wool per acre	43	61	80

The 4-per-acre ewes produced nearly 11lb., of wool more than the 6-per-acre ewes and just over 1lb. more than the 8-per-acre ewes. After the second draft of lambs were slaughtered the remaining lambs were shorn and the lambs' wool brought the total wool production up to 43lb., 61lb. and 80lb. respectively, which is roughly the same ratio as the stocking rates.

The effect on wool quality of any check to a sheep is well known. Breaks and cotts and other wool faults occur when an animal is subjected to an uneven plane of nutrition or is in ill-health.

From the growth curves shown in the graph it was obvious that marked nutritional differences existed between the groups. It could be expected that the quality as well as the quantity of wool would be affected. Each fleece was graded for faults as it was shorn. Table 5 shows the percentage of fleeces in each group showing breaks and cotts, and the mean price per pound obtained in each group:

TABLE 5—WOOL QUALITY AND PRICES.

	Ewes Per Acre		
	4	6	8
Percent fleeces showing:			
Breaks	19	26	27
Cotts	9	11	16
Mean price per pound	36.7d	37.5d	38.1d

The percentages showing breaks were quite high in every group. As might be expected, wool off the 4-per-acre ewes showed the fewest breaks, but the 6-per-acre ewes were surprisingly close to the 8-per-acre ewes in this respect. The percentage of cotted fleeces increased more proportionately with the rate of stocking. Generally, the 8-per-acre ewes' wool was inferior on both scores.

Though the main interest in this experiment was the production factor, records were kept of financial transactions pertaining to stock and are shown in a very summarised form in Table 6:

TABLE 6—ANNUAL FINANCIAL ASPECTS FOR STOCK.

	Ewes Per Acre		
	4	6	8
	£	£	£
Outlay	1091	1346	1320
Returns	1856	2237	2332
Profit (total)	765	891	1012
Profit (per acre)	16	18	20

The outlay, returns and profit relate to each 50-acre farm. The low level of sheep stocking and the purchase of young growing cattle in autumn involved the lowest capital outlay. The outlay was greatest on the farm which carried 6 ewes per acre, involving the purchase of cattle at high prices in spring. Returns were highest from the farm carrying 8 ewes per acre. The profit per acre increased as the ewe stocking rate increased. The peak wool prices of 1951 are not involved, so the returns from the farms stocked with the greatest number of sheep have not been unduly favoured. All these figures can be greatly altered by price changes, particularly in respect to wool. Over the three years the average opening price for lamb was 18½d per pound. The price for beef in February-March was 11d per pound, and the price of wool approximately 37d per pound.

No attempt has been made to assess labour and working charges. On a commercial scale the doubling of ewe numbers would probably necessitate the employment of extra labour.

The mean production records for the three years on the three farms can be summarised as follows:—

1. Lamb production per acre increased with increasing ewe stocking rates. Thus, relative to the standard 4 ewes per acre level, 6 ewes per acre gave a 52 percent increase and 8 ewes per acre a 79 percent increase in lamb meat per acre.
2. Total meat production per acre was virtually identical for the three farms. The added beef per acre from the cattle run on the farms with 4 ewes and 6 ewes per acre made the total meat outputs almost equal.
3. Wool production per acre increased with increasing ewe stocking rates. Thus, relative to the standard 4 ewes per acre level, 6 ewes per acre gave 42 percent increase and 8 ewes per acre 86 per cent increase in weight of wool per acre.
4. Vital statistics of the three flocks on the three farms showed only small differences over the total period. Effective lambing percentages, lamb mortality, percentage of dry ewes, and ewe deaths tended to be in favour of the farm carrying 6 ewes per acre.
5. Despite the same total meat outputs, returns from stock transactions increased with increasing ewe stocking rates. Relative to the standard 4 ewes per acre level 6 ewes per acre showed an increased cash return of 12½ per cent and 8 ewes per acre of 25 per cent per acre. This situation resulted from the higher value per pound of lamb relative to beef, and also from the comparatively high wool prices.
6. The performance of the three farms for the three years has shown that a target of 250lb. of meat per acre is a reasonable objective on the country typical of that used for fat lamb production in the Auckland Province.

Two major points emerge from this study. First is the scope the fat lamb farmer has to adjust the ratio of sheep to cattle to meet market demands, changes in price levels, or personal preferences without affecting his per acre production of quality meat. Second, just as a target of 250lb. of butterfat per acre should be attainable by every dairy farmer, so should a target of 250lb. of meat per acre be the objective of every fat lamb farmer on grassland fattening farms of the North Island.

This project is being continued with the modification that the 6 and 8 per acre ewe farms have been replaced with two beef farms, one running breeding cows to produce chillers and the other fattening bought-in bullocks. The 4-ewe farm remains as a connecting link so that ultimately a production picture under stocking ratios varying from all sheep to all cattle will be obtained. This data will also provide

some evidence of the relative efficiency of the breeding cow compared with the fattening steer in the production of beef, as well as factual information of the growth performance of cattle of different ages, weights and types.

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Discussion

Professor FLAY: Which system does the Farm Manager prefer? Could you explain the higher prices for the cotted fleeces?

Miss WALKER: The 6 ewe farm was the easiest to manage. The higher prices for the cotted fleeces were probably due to the fact that these fleeces were slightly finer.

Professor McMAHON: What was the method of handling the wool?

Miss WALKER: The wool from each farm was binned and separate returns were furnished by the brokers.

Professor COOP: What would be the long term effect of the three systems on the pastures?

Miss WALKER: There is no actual information on this but after four years a pasture survey by members of the Grasslands Division found a definite deterioration in the 6 and 8 ewe pastures.

Mr. WILLOUGHBY: Could a higher stocking rate have been achieved?

Miss WALKER: Possibly, but it would have been very difficult. Feed was very short at times on the 8-ewe farm.

Mr. SMALLFIELD: The sheep stocking rate over the winter should be light enough not to eat out the white clover.

Miss WALKER: There was a good recovery of clover on the 8-ewe paddocks after the trial finished.

Mr. REEVES: Was any attempt made to assess the cost of running the various farms?

Miss WALKER: No.

Mr. FAWCETT: A similar project is to be run on light land in Canterbury capable of carrying 7 ewes per acre with irrigation. It is planned to divide the Winchmore Dairy Farm into three farms to see if comparable results can be achieved.