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Simulation of a System of Lowland Sheep Production with Different Times of Lambing

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ABSTRACT

A simulation model of a flock of Masham sheep rotationally grazing a sward of S24 perennial ryegrass in England was used to show the economic differences between three times of lambing. Under U.K. prices for 1976, early-lambing was most profitable overall since the lambs could be fattened quickly on the spring flush of grass and sold early at a higher price. Late-lambing was most profitable only if a catch crop of stubble turnips was used to fatten lambs in October to December, and the lambs sold at a high price in late December. Year-to-year variations in gross margin due to variations in herbage production were lowest in the early lambing system since year-to-year variation in herbage production is lowest in the first half of the year.

INTRODUCTION

Systems of sheep production in temperate countries are generally timed so that the peak requirement for feed coincides with spring grass growth. This means that mating takes place during the autumn peak in the ovulation rate of the ewes (10) and hence maximises the conception rate and lambing percentage. If, however, the lower production obtained by lambing earlier or later is compensated by a higher lamb price or by lower production costs, then early or late-lambing may be worthwhile from the farmer's point of view.

In order to test this possibility, a simulation model was used to compare early and late-lambing with a conventional system. The model that was used has been described in detail elsewhere (6, 7, 8, 9) and only a brief summary of the main points of the model is given here. The model simulates a flock of Masham ewes and their lambs over one grazing season from spring until autumn. Stochastic variables are used to describe the variation between individuals within the flock of animals, so that each animal grows differently. In particular, the distributions of lambing and selling dates are simulated explicitly which, in combination with a seasonal curve for selling price, enables the effect of management treatments on the distribution of lamb growth rates to be evaluated in economic as well as biological terms. Lambing occurs over a 24-day period, starting on a date which can be varied. A lambing percentage is specified,

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depending on mating date, and the model assumes appropriate proportions of ewes with singles, twins and triplets and barren ewes.

A sward of S24 perennial ryegrass is used in the model, growth rate data coming from cutting trials carried out at the Grassland Research Institute in England. The effect of defoliation on regrowth is taken from cutting trials where defoliation intervals were varied (5) and seasonal production curves from a series of trials carried out from 1965 to 1975 (4). Details of these calculations are given in Edelsten (6) and Edelsten & Newton (9). An eight paddock rotational grazing scheme is used with forward creeps for the lambs, as recommended by Young and Newton (15). Some of the paddocks can be reserved for silage production and put back into the rotation later in the season. However, if there is excess herbage later in the year, further plots can be cut for silage.

Lambs can be sold either for slaughter when they reach a given weight or as store lambs on a given date. A seasonal price structure for fat lamb is included so as to show the advantage of selling out-of-season. The work was carried out at a time of changing price structures due to the effects of inflation during 1973 to 1976 and to changing patterns of supply and demand for sheep meat in the UK. The seasonal pattern of the selling price of lamb does not, however, appear to have changed greatly, there being an advantage of about 50% for selling in December to April compared with the price in August. Considering the problems associated with producing lamb for sale in early spring in northern latitudes, this is a trend which seems likely to continue. Prices and costs based on those prevailing in 1976 (Table 1 and Fig. 1) were derived from records for a flock of sheep kept at the Grassland Research Institute, enabling a gross margin to be calculated for each run of the model. It is hoped that the results using these figures will hold good for the next few years, but it will be necessary to reevaluate the conclusions in the light of any marked changes in cost-price relationships.

Functions for the intakes of ewes and lambs, for the lactation of ewes, and for the conversion of feed inputs into liveweight gain were derived from several sources, including ARC (1) and experimental data from the Grassland Research Institute. A listing of the computer program (written in FORTRAN for an IBM 370) can be obtained from the authors.

Table 1 Prices and costs used in the model.

Item	Price	Units
Fat lamb	see Figure 1	£/kg liveweight
Store lamb	0.48	£/kg carcase weight
Wool (3.02 kg/ewe)	0.70	£/kg
Ewe depreciation (cost of replacements less sales of culls)	3.00	£/ewe/year
Concentrates	80.00	£/tonne
Turnips	45.00	£/ha of turnip crop
Silage	30.00	£/tonne of hay equivalent
Fertilizer (250 kg N/ha)	0.21	£/kg N
Cultivation and seeds (amortized over 2 years)	18.90	£/ha/year
Fencing (amortized over 6 years)	11.60	£/ha/year
Miscellaneous (medical and marketing)	1.45	£/ewe

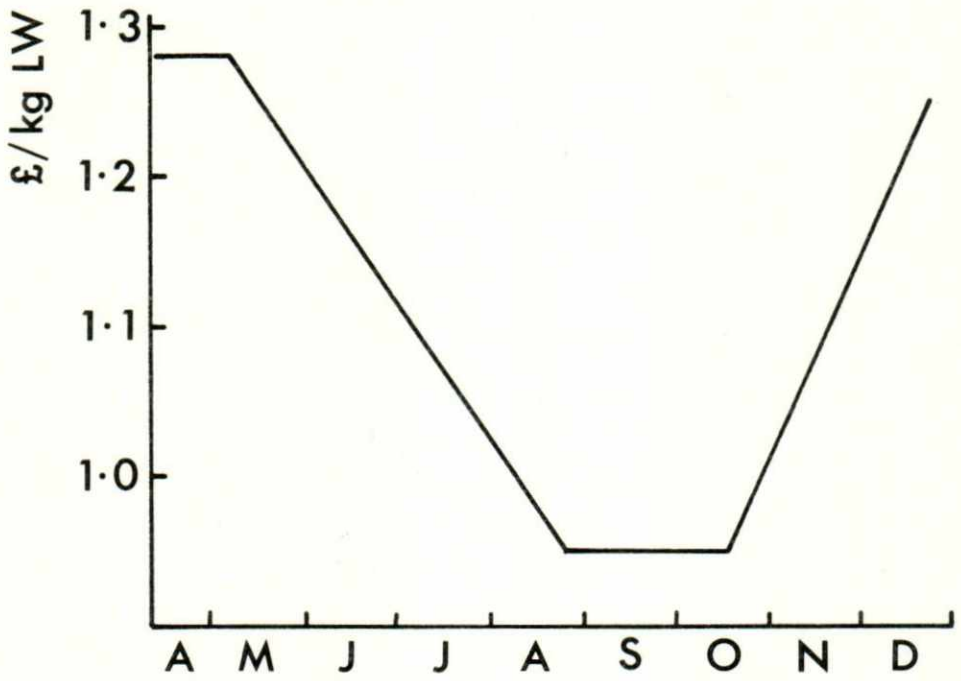

Fig. 1. Price of fat-lamb.

DESCRIPTION OF THE SIMULATION EXPERIMENT

Materials and methods

Three times of lambing were simulated with the computer model: early (February 15–March 10), mid (March 15–April 7) and late (May 15–June 7).

In the early-lambing system, ewes are housed during late pregnancy and then put out to pasture with their lambs, immediately after lambing. Ewes are fed silage *ad libitum* plus a ration of concentrates during the last four weeks of pregnancy and for four weeks after lambing. In addition, the ewes are offered silage or hay in the field until May 1. In the model, silage and hay are treated synonymously and a balance made up at the end of the season to see whether the silage produced during the season would have been enough to meet requirements. If there is a deficit or surplus then the balance is purchased or sold at the current price for hay. In the early-lambing system, three paddocks from the total of eight are set aside for silage production from July 17 until September 20. Lambs are sold for slaughter when they reach 36 kg liveweight, any remaining lambs being sold for slaughter, irrespective of their weight, on September 25. Ewes are fed concentrates, if necessary, to bring their average weight up to 65 kg by the start of mating on September 25. For the limited data available for Masham ewes from experiments carried out at the Grassland Research Institute, the start of oestrus appears to be about the middle of September, as for other British breeds (3, 14), continuing until about February. Ovulation rate rises until October and then falls slowly (3, 13). The combination of these two factors means that there is a maximum lambing percentage for a mating date in October with reductions for earlier or later mating dates. The results from field experiments carried out at the Grassland Research Institute indicate a maximum lambing percentage of about 200%, but the effect of mating before or after October is not yet clear. The lambing percentages assumed to

obtain the results given in this paper are 180% for early and late lambing and 200% for mid-lambing.

The mid-lambing system is similar to the early system except that silage is not fed to ewes at pasture. Animals are housed during pregnancy and put onto the grazing area after lambing between March 15 and April 7. Three paddocks are set aside for silage production from April 10 until June 13.

In the late-lambing system, the ewes are put onto the grazing area on March 11 and lamb in the field. Because of the later time of lambing, there is more grass available during early lactation, and therefore no concentrates are fed to the ewes during this period. Three paddocks are set aside for silage production from April 10 until June 13. Mating commences on December 23. Ewes are fed silage from December 23 until March 11.

The main difficulty of late-lambing is that there is insufficient herbage growth during late autumn to fatten the lambs. Two methods of overcoming this difficulty are therefore considered. The first method consists of selling all the lambs as store lambs on October 7 and thus leaving the herbage entirely for the ewes from this date. The second method consists of feeding the lambs on a catch crop of stubble turnips from October 7. When the stubble turnips are all eaten, the lambs are fed on silage. Lambs are sold for slaughter as late as possible in order to obtain the best price, the rule used being to sell lambs when they reach 48 kg liveweight, or on December 23 if they have not reached 48 kg by then. In practice, very few lambs reach 48 kg, the limit being set only to prevent lambs being sold over-weight. A yield of 3500 kg DM/ha is assumed for the catch crop, but only 1800 kg DM/ha of this can be utilized by the lambs (figures based on yields of stubble turnips at the Grassland Research Institute). The area of catch crop is half the area of grass. The costs of production of the catch crop are added to the total costs as a fixed cost without adding the area of catch crop to the area of grass for the purpose of calculating a gross margin per ha. This is because the land used for the catch crop is used for other purposes earlier in the year, and therefore can be assumed to have an opportunity cost of zero.

In all systems, a concentrate ration is fed to lambs if their average weight gain falls below 350 g/week.

The four systems (early, mid, late and late+catch crop) were run at four stocking rates (8, 11, 14 and 17 ewes/ha) for 11 years of herbage growth (1965 to 1975). The variation between years was used as a measure of the likely effect of year-to-year variations in herbage production.

RESULTS AND DISCUSSION

Early and mid-lambing

The results for the early and mid-lambing systems (Tables 2 and 3) show a number of differences.

Growth rates of the lambs were higher in the early-lambing system and fewer lambs were left at mating. This, together with the higher prices obtained for early lamb, effectively offset the lower number of lambs born. The net revenue per ewe was therefore similar for the two systems, with a small advantage to the early system at high stocking rates.

Stocking rate reduced total herbage production by only 10% between 8 and 17 ewes/ha. At 8 ewes/ha, about 50% of the production was grazed and 20% made into

Table 2 Results for early lambing system.

Stocking rate (ewes/ha)	8	11	14	17
Physical results (means over 11 years)				
Number lambs born	48	48	48	48
Number lambs left at end	1.7	2.0	2.0	4.8
Average weight of lamb at end (kg)	34.3	33.7	32.2	31.4
Average growth of lambs (g/day)	280	276	269	249
Herbage grown (t DM/ha)	7.4	7.1	6.9	6.7
Herbage eaten (t DM/ha)	3.6	4.8	5.8	6.4
Silage produced (t DM/ha)	1.3	0.9	0.7	0.5
Silage eaten (t DM/ha)	1.0	1.4	1.9	2.4
Concentrates eaten (kg/ewe)	37.0	37.4	41.0	57.4
Concentrates eaten (kg/lamb)	0.0	0.0	0.2	2.8
Average DOMD of herbage eaten by ewes and lambs (%)	73.0	72.5	72.8	73.4
Accounts (mean over 11 years)				
Fat-lamb (£/ewe)	34.06	33.91	33.53	32.50
Wool (£/ewe)	2.11	2.11	2.11	2.11
Less ewe depreciation (£/ewe)	−3.00	−3.00	−3.00	−3.00
Net revenue (£/ewe)	33.17	33.03	32.65	31.61
Concentrates (£/ewe)	3.37	3.40	3.76	5.67
Silage deficit (£/ewe)	−1.51	1.47	2.94	3.78
Fertilizer (£/ewe)	6.18	4.50	3.53	2.91
Cultivation and seeds (£/ewe)	2.23	1.62	1.27	1.05
Fencing (£/ewe)	1.37	0.99	0.78	0.64
Miscellaneous (£/ewe)	1.45	1.45	1.45	1.45
Total costs (£/ewe)	13.08	13.43	13.73	15.50
Gross margin (£/ewe)	20.09	19.59	18.92	16.11
Gross margin (£/ha)	170.63	228.83	281.18	290.76
Variation (S.D. over 11 years)				
Net revenue (£/ewe)	0.15	0.22	0.42	0.94
Concentrates (£/ewe)	0.00	0.12	0.86	2.61
Silage deficit (£/ewe)	1.86	1.04	1.00	0.67
Total costs (£/ewe)	1.86	1.12	1.72	3.17
Gross margin (£/ewe)	1.97	1.29	2.01	3.98
Gross margin (£/ha)	16.71	15.12	29.84	71.85

silage, whereas at 17 ewes/ha more herbage was utilized than was grown, the difference being accounted for by the aggregate reduction in herbage present over the season.

Silage production was lower in the early-lambing system at all stocking rates due to the silage being cut in the autumn instead of in the spring. This led to silage deficits of about £2 per ewe greater than in the mid-lambing system. At 8 ewes/ha, this was the main financial difference between the systems, and the gross margins therefore differed by this amount. At higher stocking rates, however, more concentrates were fed in the mid-lambing system because of low availability and quality of herbage later in the season. This gave higher total costs and led to substantially lower gross margins in the mid-lambing system at 14 and 17 ewes/ha.

Fixed per ha costs such as fertilizer and fencing differ slightly between Tables 2 and 3, due to the method of accounting for barren ewes. In the biological part of the model, barren ewes are ignored since they are assumed to be off-grazed on rough pasture

Table 3 Results for mid lambing system.

Stocking rate (ewes/ha)	8	11	14	17
Physical results (mean over 11 years)				
Number lambs born	52	52	52	52
Number lambs left at end	2.3	6.3	13.1	23.7
Average weight of lambs at end (kg)	32.9	32.9	32.2	31.5
Average growth of lambs (g/day)	259	244	208	174
Herbage grown (t DM/ha)	7.7	7.4	7.2	7.0
Herbage eaten (t DM/ha)	3.9	5.0	5.8	6.0
Silage produced (t DM/ha)	1.8	1.3	1.3	1.3
Silage eaten (t DM/ha)	1.0	1.4	1.7	2.1
Concentrates eaten (kg/ewe)	41.4	54.8	84.9	115.8
Concentrates eaten (kg/lamb)	0.3	2.4	9.2	19.0
Average DOMD of herbage eaten by ewes and lambs (%)	71.0	71.3	71.8	71.9
Accounts (mean over 11 years)				
Fat-lamb (£/ewe)	34.71	34.07	32.50	30.56
Wool (£/ewe)	2.11	2.11	2.11	2.11
Less ewe depreciation (£/ewe)	−3.00	−3.00	−3.00	−3.00
Net revenue (£/ewe)	33.83	33.18	31.61	29.68
Concentrates (£/ewe)	3.82	5.43	9.41	14.03
Silage deficit (£/ewe)	−3.50	0.05	1.02	1.66
Fertilizer (£/ewe)	6.38	4.64	3.65	3.00
Cultivation and seeds (£/ewe)	2.30	1.67	1.31	1.08
Fencing (£/ewe)	1.41	1.03	0.81	0.66
Miscellaneous (£/ewe)	1.45	1.45	1.45	1.45
Total costs (£/ewe)	11.85	14.27	17.65	21.88
Gross margin (£/ewe)	21.97	18.91	13.97	7.79
Gross margin (£/ha)	180.76	213.94	201.05	136.23
Variation (S.D. over 11 years)				
Net revenue (£/ewe)	0.40	0.94	1.32	1.37
Concentrates (£/ewe)	1.22	3.28	4.99	4.70
Silage deficit (£/ewe)	3.06	0.48	0.34	0.26
Total costs (£/ewe)	3.67	3.43	5.09	4.77
Gross margin (£/ewe)	3.94	4.31	6.18	5.49
Gross margin (£/ha)	32.42	48.76	88.99	95.92

during the summer, and the stocking rate therefore includes only non-barren ewes. In the accounts, however, the fixed costs are distributed among all the ewes, and since there were slightly more barren ewes in the early-lambing system, the per ewe costs appear slightly lower. This method of allowing for barren ewes also accounts for the gross margin per hectare being slightly greater than the gross margin per ewe multiplied by the stocking rate.

Late lambing

Results for the late-lambing system are shown in Tables 4 and 5. The late-lambing system without the catch crop gave lower gross margins than the mid-lambing system at all stocking rates, mainly due to the lower net revenue caused by selling the lambs at a lighter weight. With the catch crop, however, profits were increased, the extra net

Table 4 Results for late lambing (without catch crop).

Stocking rate	8	11	14	17
Physical results (mean over 11 years)				
Number lambs born	48	48	48	48
Number sold for stores	46.7	47.1	47.4	47.8
Number sold for slaughter	1.3	0.9	0.6	0.2
Average weight of stores (kg)	32.4	31.4	30.5	28.0
Average growth rate (g/day)	213	204	197	177
Herbage grown (t DM/ha)	8.4	8.2	7.9	7.7
Herbage eaten (t DM/ha)	4.3	5.7	6.6	7.0
Silage produced (t DM/ha)	2.2	1.5	1.3	1.2
Silage eaten (t DM/ha)	0.9	1.2	1.6	1.9
Concentrates eaten (kg/ewe)	40.8	58.2	72.0	92.7
Concentrates eaten (kg/lamb)	0.3	0.6	2.6	5.2
Average DOMD of herbage eaten by ewes and lambs (%)	68.5	67.9	68.6	69.6
Accounts (mean over 11 years)				
Fat-lamb (£/ewe)	1.01	0.72	0.50	0.14
Stores (£/ewe)	27.40	26.75	26.11	24.21
Wool (£/ewe)	2.11	2.11	2.11	2.11
Less ewe depreciation (£/ewe)	−3.00	−3.00	−3.00	−3.00
Net revenue (£/ewe)	27.52	26.58	25.73	23.47
Concentrates (£/ewe)	3.76	5.38	6.96	9.28
Silage deficit (£/ewe)	−5.41	−0.85	0.76	1.34
Fertilizer (£/ewe)	6.18	4.50	3.53	2.91
Cultivation and seeds (£/ewe)	2.23	1.62	1.27	1.05
Fencing (£/ewe)	1.37	0.99	0.78	0.64
Miscellaneous (£/ewe)	1.45	1.45	1.45	1.45
Total costs (£/ewe)	9.57	13.09	14.76	16.67
Gross margin (£/ewe)	17.95	13.49	10.98	6.80
Gross margin (£/ha)	152.47	157.53	163.13	122.74
Variation (S.D. over 11 years)				
Net revenue (£/ewe)	1.71	2.42	2.69	2.68
Concentrates (£/ewe)	2.33	1.93	2.79	2.94
Silage deficit (£/ewe)	3.77	1.32	0.37	0.29
Total costs (£/ewe)	5.81	2.95	2.97	3.09
Gross margin (£/ewe)	7.16	5.14	5.58	5.73
Gross margin (£/ha)	60.82	60.05	82.93	103.38

revenue per ewe (about £10) being much more than the increase in costs (about £3 per ewe). The money spent on planting the catch crop was, therefore, of considerable benefit to the system.

The late lambing system is likely to be more profitable than shown in the table on those farms where ewes can graze round the farm on rough or spare pasture from January until March and therefore consume less silage.

Effect of seasonal variation in herbage production

The economic differences between the three lambing times can be viewed as a consequence of the seasonal balance between herbage intake and production. Figure 2 shows the balance for the three systems at 14 ewes/ha. The graphs stop at mating time,

Table 5 Effect of catch crop on late lambing system.

Stocking rate	8	11	14	17
Physical results (mean over 11 years)				
Number lambs born	48	48	48	48
Number lambs left at end	36.6	37.1	38.4	41.3
Average weight of lambs at end (kg)	37.0	36.5	36.1	34.2
Average growth of lambs (g/day)	180	176	171	154
Catch crop eaten (kg/lamb)	58.6	42.6	33.5	27.6
Accounts (mean over 11 years)				
Net revenue (£/ewe)	37.63	37.29	36.85	34.95
Total costs without catch crop (£/ewe)	9.57	13.09	14.76	16.67
Cost of catch crop (£/ewe)	2.65	1.93	1.51	1.25
Other feed (£/ewe) (concentrates & silage)	0.09	1.40	2.13	2.53
Total costs (£/ewe)	12.31	16.42	18.40	20.45
Gross margin (£/ewe)	25.32	20.87	18.45	14.50
Gross margin (£/ha)	215.05	243.78	274.26	261.78
Variation (S.D. over 11 years)				
Net revenue (£/ewe)	1.34	2.03	2.26	2.78
Total costs (£/ewe)	5.85	2.98	2.95	2.90
Gross margin (£/ewe)	6.84	4.72	5.11	5.62
Gross margin (£/ha)	58.12	55.09	76.00	101.41

since there are no provisions for dealing with the pregnancy phase in the model at present. An estimate of herbage consumption by the ewes before lambing was, however, made in the late-lambing system.

In the mid-lambing system, the two graphs are well matched. Provided the spring surplus is cut for silage, production and intake can be balanced, so that the sheep are always provided with fresh herbage of an acceptable quality.

In the late-lambing system, most of the herbage intake is during the latter part of the season, when herbage production is lowest. Part of the animals' intakes are therefore made up of herbage which has been standing since the spring growth period, and is therefore of low digestibility (see Fig. 3). Consequently, unless another feed source is used, it becomes impossible to fatten the lambs before the onset of winter.

Examination of Figure 2 might suggest that the early-lambing system would suffer the reverse problem of the late lambing system, i.e. that a herbage production deficit early in the season might lead to shortages later on. This does not, however, appear to be a major problem since the deficit can be made up with silage and concentrates. In addition, the close grazing ensures that herbage quality is maintained, and it is therefore possible to fatten the lambs quickly, leaving adequate herbage for the ewes later in the season (Fig. 4).

Effect of year-to-year variation

In order to assess the effect of management on profitability, it is necessary to take account of the risks associated with year-to-year variations in herbage production, animal performance and prices. This is because the optimal management for a risk-conscious farmer may be different from that which maximises profit (12).

Variations in prices are not dealt with here because future price variations may be

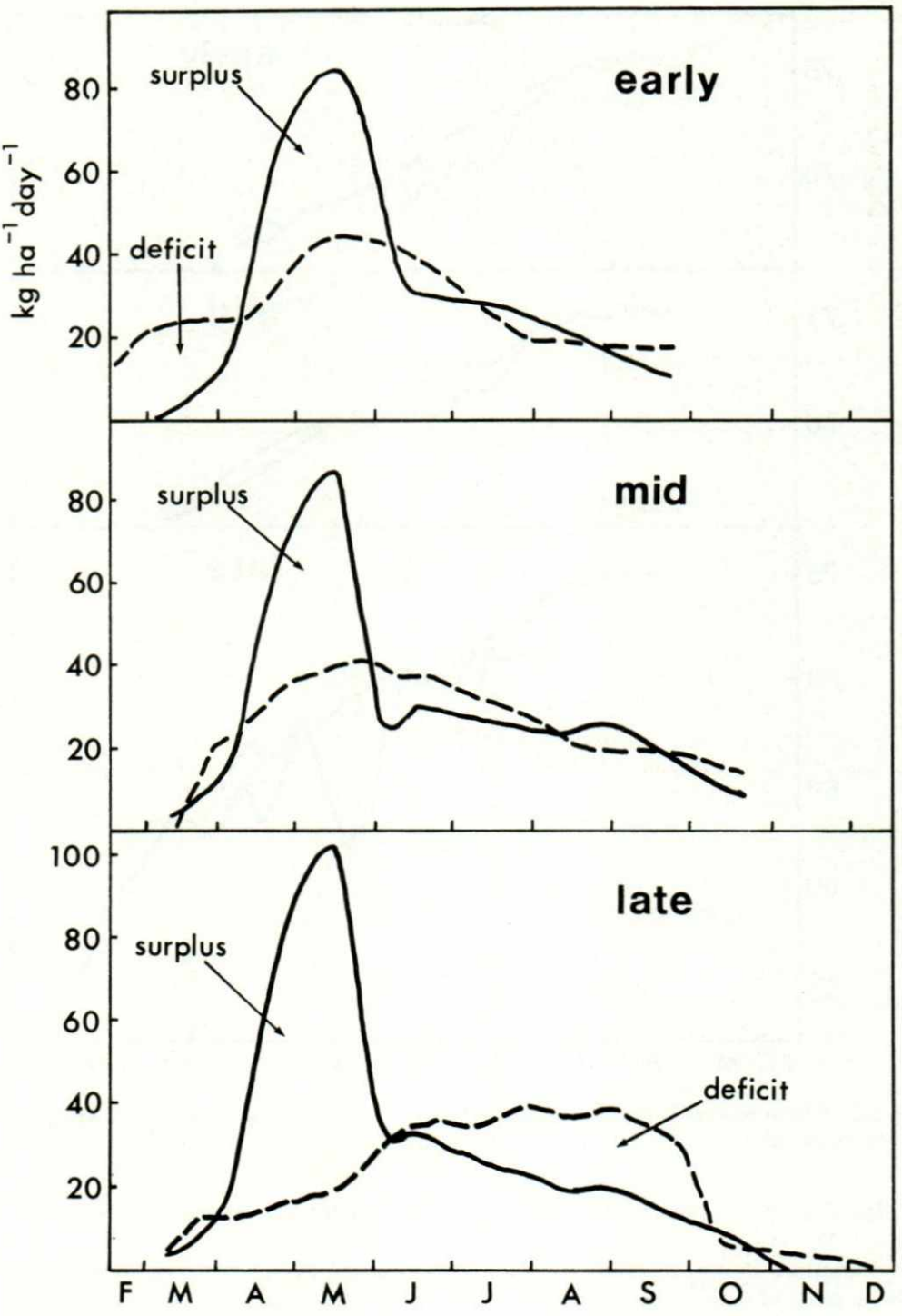

Fig. 2. Herbage production (———) and total consumption (— — —) at 14 ewes/ha for early, mid and late-lambing.

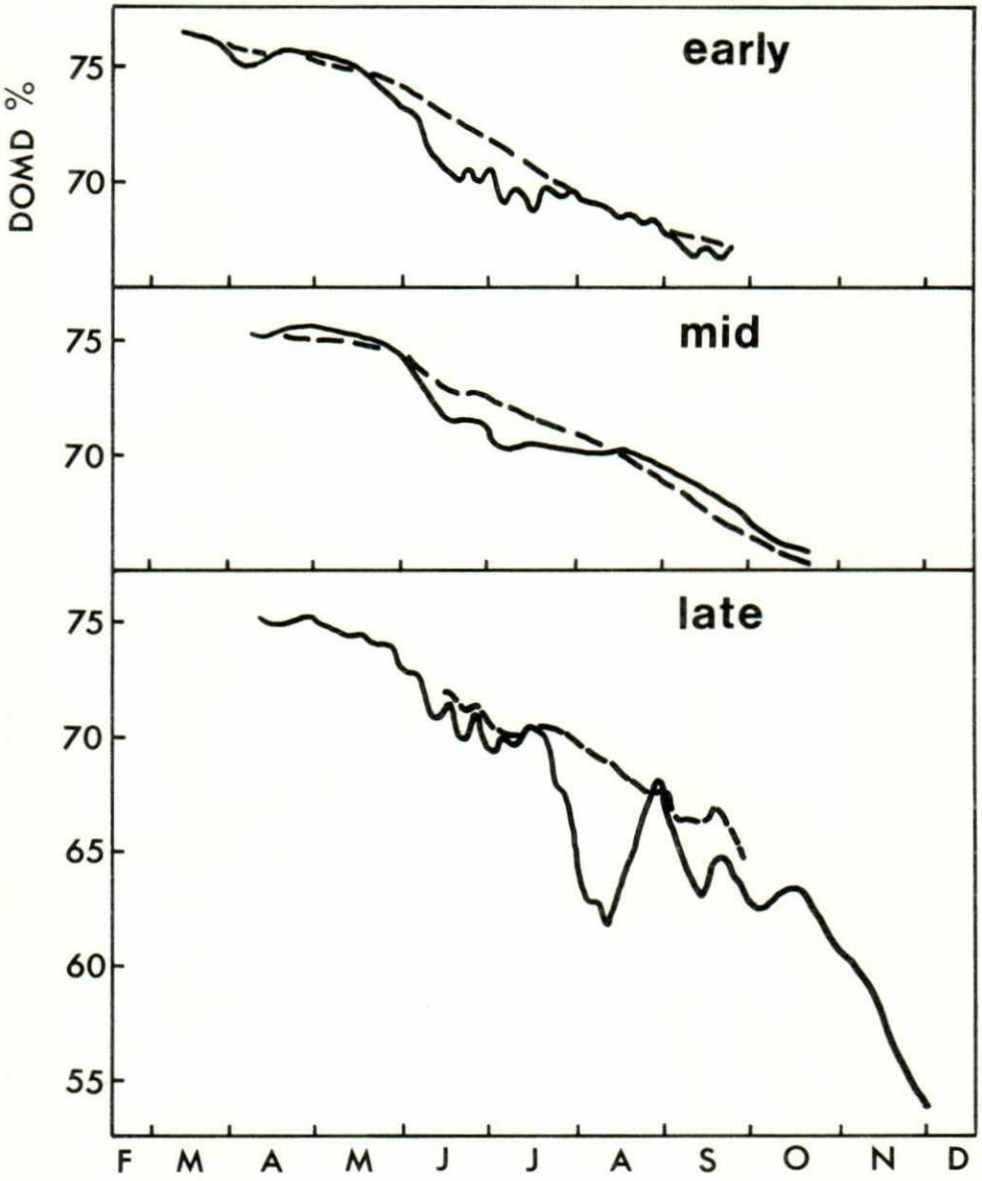

Fig. 3. Digestibilities of ewes' (———) and lambs' (– – –) intakes at 14 ewes/ha for early, mid and late-lambing.

affected by price stabilization policies. Minimum prices for the year are announced every March (11).

Variations in animal production are largely caused by variations in food supply. Some effect of year-to-year variations in lambing percentage may be expected but these are quite small (7) provided that ewes are mated in similar body condition each year. The runs of the model presented here were therefore made with a constant flock of animals whose performance depended only on their intakes of food.

Year-to-year variations in herbage production were used as the main cause of year-

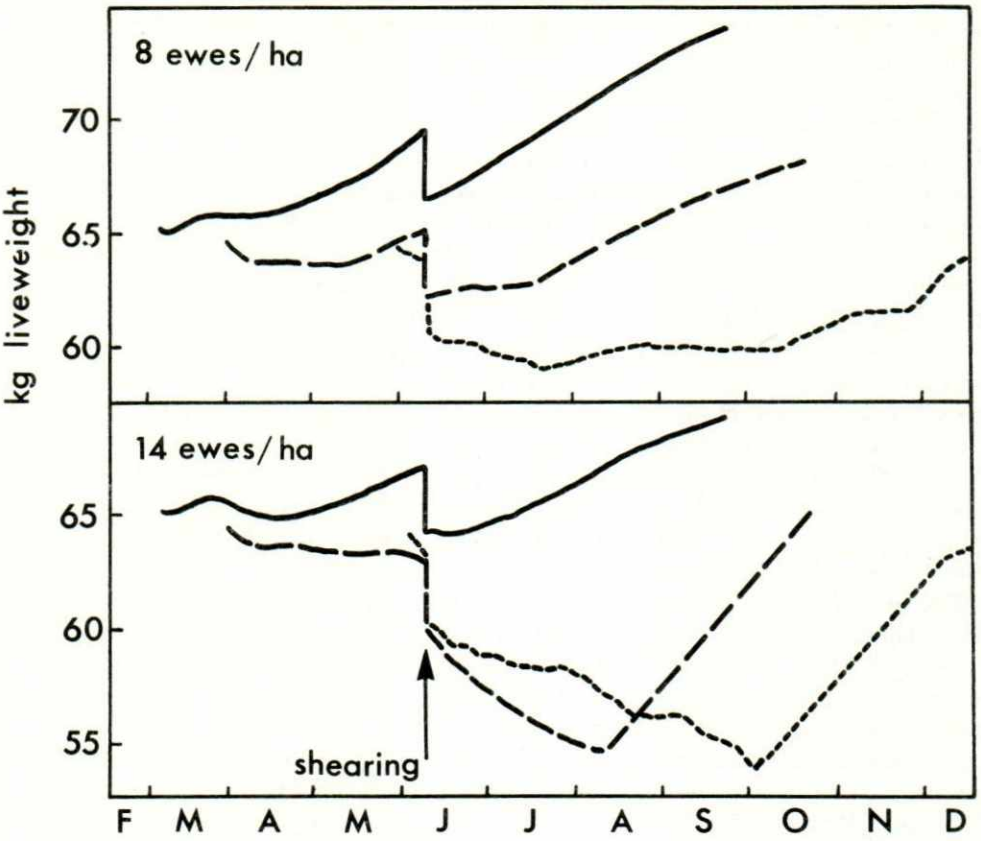

Fig. 4. Ewe weights at 8 and 14 ewes/ha for early (———), mid (— — —) and late-lambing (- - - - - -).

to-year variation in the model. Tables 2 to 5 show the effect of these variations on profitability. In all systems, the variation in gross margin increases with stocking rate on both a per ewe and a per ha basis. The variations are highest in the late-lambing system since variations in herbage production are higher in the second half of the year (Table 6). The catch crop makes little difference to this, the effect of the catch crop being to increase the average gross margin but not to smooth the variation. If year-to-year variations in the catch crop yield were also included the variation in profit might changes, especially if the catch crop yield were correlated with the yield of grass.

Variations in gross margin are particularly low in the early-lambing system. This is because spring herbage production, even in poor years, is sufficient to fatten the lambs

Table 6 Herbage production for different times of lambing at 14 ewes/ha.

Time of lambing	*early*		*mid*		*late*	
	mean	S.D.	mean	S.D.	mean	S.D.
Herbage production (t/ha)						
March–May	3.8	0.4	3.9	0.4	4.4	0.5
June–September	3.0	1.2	3.1	1.4	3.0	1.2
Total	6.8	1.4	7.0	1.4	7.4	1.6

quickly. It is possible, however, that the early-lambing system may be more susceptible to post-natal mortalities in cold weather.

It is widely felt amongst sheep farmers that the success of an early-lambing system largely depends on the price obtained for early lamb. The results from the models show that there are other reasons why early lambing may be profitable. The main reason is that, providing the lambs can be fattened on the spring flush of grass, they can be sold for slaughter before the effects of a summer drought are felt. This then allows an effectively lower stocking rate for the ewes for the remainder of the season. In an early lambing trial carried out at the Grassland Research Institute in 1976, an average growth rate of over 300 g/day was achieved, and all the lambs sold by mid-July.

Conversely, the late-lambing system can be thought of as a low-cost system since no supplementation is required in late pregnancy and early lactation. Unfortunately, the system is very susceptible to year-to-year variations in herbage growth so that, although the system may realize its potential in some years, in others supplementation is required later in the summer, and the system may make a loss. Support for this view can also be found from Australian experiments in which systems based on lambing in August-September were more likely to fail due to deterioration in pasture quality than a system based on lambing in July (2, 10).

Use of a catch crop in the late lambing system significantly improves profitability. There is, however, no reason why it could not be added onto the early or mid-lambing systems in order to provide food for ewes from October to December, or to fatten lambs to a higher weight. A catch crop of stubble turnips or rape is normally used as part of a cereal-grass rotation. The catch crop fits in well between winter and spring barley and, as shown above, makes a useful extension to the grazing season for an intensive sheep enterprise. Preliminary results of field trials carried out at the Grassland Research Institute in 1976 showed an increase in profitability of about £100/ha, by including a catch crop in the late lambing system.

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نموذج مصطنع لتربية الأغنام

ب . ادلستن وج . أى نيوتن

المستخلص

تم استعمال نموذج مصطنع لدراسة قطيع من ضأن يعرف بالماشام من نوع « س ٢٤ » حيث تركت هذه الحيوانات تتغذى على نباتات الجازون التي تنمو طول السنة ، وذلك لمعرفة الاختلافات الاقتصادية بين ثلاث دورات للتوالد . وبالقياس لأسعار اللحوم في المملكة المتحدة لعام ٧٦ م فإن التوالد المبكر يؤدى إلى أرباح أكثر نسبة لأن الخراف يمكن تسمينها سريعا بواسطة نباتات الجازون التي تنمو في الربيع ، ثم تباع مبكرا بأسعار عالية — أما بالنسبة للتوالد المتأخر ، فإن الأسعار ترتفع في الفترة بين شهرى أكتوبر وديسمبر لأن الخراف تسمن بنوع آخر من النباتات هى نباتات اللفت « الشلجم » ثم تباع الخراف بأسعار عالية في نهاية ديسمبر . إن التقلبات السنوية في الأرباح أو إجمالى الفائض المادى والتي تحدث نتيجة لاختلافات في كمية إنتاج العلف ، هذه التقلبات تكون طفيفة خلال التوالد المبكر والسبب في ذلك هو الانتظام في إنتاج العلف خلال النصف الأول من العام .