Maximising grazed grass in the diet of the ewe for mid season lamb production

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SUMMARY

With sheep output and associated financial incomes in decline over recent years, there is now a special focus on the need to reduce costs. The low cost of grazed grass relative to silage or

concentrates is therefore of special interest especially in the context of Strategy 2000 priorities.

In recent years also, shortage of labour for flock care and attention has emerged as a limiting factor and has prompted a search for labour saving practices that can reduce the man-hours associated with flock management. Extended grazing for in-lamb ewes as a substitute for winter housing and silage feeding is a practice which has potential for reducing feed, management and labour inputs.

A trial was conducted at the Knockbeg Sheep Unit, Co. Carlow over the years 1998/99 and 1999/00 with objectives centred on maximising the role of grazed grass in the diet of the ewe by accumulating autumn pasture and carrying it forward for winter grazing. Using a farmlet system approach, two systems of mid season lamb production, intensive and extensive, were compared for ewe productivity, lamb performance, carcass output per ha and associated management inputs. The stocking rates chosen for the two systems were: (1) 13 ewes per ha including silage conservation and housing for a 100-day winter and, (2) 10 ewes per ha with extended grazing in winter.

Choice of lambing date close to the onset of grass growth was critical for the provision of adequate supplies of grass for ewes post-lambing and, thereby, avoiding the need for concentrate supplements. The lambing date chosen was March 21. Ewes were therefore joined with the rams on October 19 and the rams were removed after 6 weeks. The grazing management of the two systems was planned around these critical dates.

Commencing in early September, plans were made for the breeding season and for the accumulation of grass for extended grazing. These plans were based on 7-paddock rotational grazing, the appraisal of grass supplies, body condition scoring of ewes and their feed demands for flushing and mating. In the extensive system pasture was accumulated by closing a number of paddocks sequentially during September and October and allowing grass to accumulate.

Ewes in the intensive system were housed in mid December. At about the same time, the ewes in the extensive system commenced extending grazing and were rationed to a daily grass allowance of 1.3 kg DM per head. The ewes were block grazed in daily shifts using portable electric fencing. Extended grazing was completed in early February following which the ewes were housed.

All ewes lambed indoor and were turned out with their lambs after 1 to 3 days mothering-up. Grass supply and feed demand estimates were used for the assessment of grazing capacity, i.e. the number of ewe grazing days (EGD) per ha. Ewes and lambs were moved to the next paddock when sward height was grazed down to 4 cm in April, 5 cm in May and 6 cm in June. In July/August pastures reserved for weaned lambs were managed for an average sward height of 8 cm.

The adequacy of the grass allowances during extended grazing was verified by the ewe liveweights and body condition scores recorded pre- and post-extended grazing. Compared with the intensive system, the housing period was reduced from 100 days to 43 days averaged for the two years of the trial. The system of block grazing proved simple to operate.

Extended grazing reduces the resting period for grass recovery in spring and, hence, may be expected to have impact on grass supplies coinciding with early lactation and peak feed demand during April/early May. Adequate supplies of grass, however, are relative to feed demand which, in turn, is a function of stocking rate. Results showed that extended grazing did not adversely affect grass supplies relative to feed demand. Grass recovered quickly following the 1-day grazing procedure that was practised. Indeed, the relatively fast regrowth of pasture subsequent to extended grazing was a notable feature of the trial.

Ewe productivity in terms of fertility, litter size and lamb vigour was high in both systems. The numbers of lambs reared per ewe joined were also high, i.e. 1.7 and 1.8 in the intensive and extensive systems respectively.

Lamb birth weights, growth rates and carcass weights were significantly higher in the extensive system with its lower stocking rates of ewes and lambs. Also, lambs produced in the extensive system were finished for slaughter at a younger age compared with their counterparts managed under intensive grazing conditions.

Output per ewe and output per ha are important measures of production efficiency. Output per ewe was high in both systems of intensive and extensive production with considerable advantages in favour of the extensive system in terms of lower inputs for ewe flock management. Output per ha, however, was significantly reduced in the extensive system due to the lower stocking rate.

INTRODUCTION

Prior to the introduction of quotas, lowland sheep producers maximised sheep sales from the farm by increasing flock size and stocking rate. This strategy resulted in rapid expansion and the national ewe population more than doubled within a period of 8 years, from 2.3 m ewes in 1986 to almost 5 m in 1993.

The introduction of quotas in the 1990's limited further growth in the sheep sector and it also changed the order of priorities for productivity. The size of the quota rather than the size of farm or area of land became the limiting factor on most farms. The importance of output per ha was diminished while output per ewe and the associated costs for ewe maintenance became the principal components of sheep production efficiency. Further EU policy changes are probable, with decline in financial supports in the context of World Trade Organisation agreements that are likely to result in increased free trade. It is necessary to position our sheep production systems to meet these changes. The impact of policy changes in the 1990's on the sheep sector have been reported (Connolly, 2000).

With sheep output and associated financial returns in decline, there is now a special focus on the need to reduce costs in order to maintain viable sheep incomes. In this regard the low cost of grazed grass relative to silage and/or concentrates is of central importance for maintaining/improving profit margins. To improve profitability, flock management costs must be examined as closely as flock performance.

Side by side with the ceiling on output imposed by quota, another limiting factor has emerged, i.e. the shortage of labour for flock care and attention. This constraint has prompted debate on current work practices on-farm and, in particular, a search for labour saving procedures that can reduce the man-hours associated with flock management. Extended grazing as a substitute for silage and winter housing is one such practice. Wintering systems based on grass grazed in situ for in-lamb ewes were developed in New Zealand and Australia during the 1970's (*Parker and Willis, 1973; Round-Turner, 1975; Rattray et al., 1978*). In these systems the technique of grass budgeting is used for allocating grass according to feed demand. Grass is rationed by block grazing the flock on a daily basis and a back fence is used to prevent access by the ewes to ground already grazed. As a consequence, the grass plant has the opportunity for immediate regrowth in contrast to the traditional practice of continuous grazing. The technique was examined under Irish conditions by Grennan (1982, 1983) who reported that although winter grazing reduced the amount of pasture available in April, nevertheless pasture recovery was relatively good when the 1-day winter grazing procedure was used. Extended grazing was practised at Knockbeg in the mid 1990's (Flanagan 1994, 1995).

In addition to the scope for reduction in labour demands, extended grazing as a substitute for housing also offers potential for ease of management in terms of reduced manure production. Obviously, the shorter the housing period, the less manure accumulates and the easier its storage and subsequent disposal in accordance with The Code of Good Agricultural Practices (DoE and DAFF 1996).

To reflect the above considerations, a trial was conducted at the Knockbeg Sheep Unit, Carlow during 1998-2000. The purpose of the trial was centred on the substitution of grazed grass in winter for silage feeding and housing. A 'whole system' approach was adopted and the project was undertaken within the framework of Teagasc 2000 priorities, in this case the development of technologies for increased enterprise competitiveness in the Irish sheep sector based on the maximum utilisation of grass.

The objectives of the trial were:

(1) to improve the competitiveness of sheep production by developing grassland management practices for extending the grazing season

(2) to measure the resulting output of lamb per ewe and per ha per annum

(3) to measure reductions in feed, forage and labour inputs compared with an integrated system of grazing, silage conservation and housing.

The results and conclusions are summarised in this report

METHODS

Two systems compared

Extended grazing was evaluated for mid season lamb production in a whole-farm context. Two systems of production were compared for flock performance and output, namely, an intensive grazing system incorporating silage making with winter housing and an extensive system in which extended grazing was used as a substitute for silage and housing. The grazing, silage and housing system was based on the grassland management principles practised for many years at Belclare and Blindwell and reported in Sheep Production (1984). A winter housing period of 100 days was incorporated in the system and the silage budget was 0.6 t per ewe. In the extensive system the annual stocking rate was relatively low in order to facilitate the resting of autumn pasture for grazing in winter. The critical components of the system were the closure of an appropriate area of pasture in September/October, allowing grass to accumulate and offering the resulting grass supply on a daily allowance basis sufficient to satisfy the feed requirements of the flock.

Commencing in autumn 1998 a flock of 290 Belclare x Cheviot ewes was subdivided and managed in two self-contained farmlet systems for 2 years as follows:

(1) Intensive system – Grazing, silage and housing: 9.6 ha of grass/clover pasture stocked at 13 ewes per ha in 1999 and 14 ewes per ha in 2000.

(2) Extensive System – Extended grazing : 15.0 ha of perennial ryegrass pasture stocked at 10 ewes per ha in both years.

Fertilizer nitrogen

The ewes were mated with Texel rams and the management of the farmlets was based on 7-paddock rotational grazing. Fertilizer N inputs were relatively low for both systems but for different reasons. In the intensive system the grass/clover pastures had a high content of clover, e.g. 160g/kg pasture DM in June. In order to exploit the N fixing capability of clover, no fertiliser N was applied during the main grazing season. Applications were limited to 50 kg N per ha around February 1 for early grass, 70 kg N in early April on the silage area and a further 34 kg N in late May for silage aftermath. This programme resulted in an annual fertiliser input of 80 kg N per ha. For the extended grazing system, application of fertiliser N was based on the principle that the optimum amount of N for sheep grazing depends on the stocking rate. Following a review of the responses in sheep production to varying levels of N (Grennan, 1979-1984), it was considered that a stocking rate of 10 ewes per ha on perennial ryegrass pasture rendered N fertiliser dressings during the main grazing season as unnecessary. N applications were therefore restricted to strategic dressings of 50 kg N per ha for early grass as in the grazing/silage/housing system and 34 kg N in autumn when closing paddocks for extended grazing. Silage requirements in this system were low as explained later and, hence, no special N dressings were applied. The annual N inputs resulting from this management plan for the extended grazing system amounted to 96 kg N per ha.

Other fertilizers

Soil sample analyses indicated high phosphorous levels in excess of 10 mg/l across the farmlets. The soils were therefore categorised as P Index 4 in the phosphorus guidelines for grazing drawn up by Johnstown Castle Research Centre. A Nutrient Management Plan was initiated in 1998 with the objective of reducing this index. No fertiliser P was applied either for grazing or silage conservation during the trial. Potassium levels were also high and applications were limited to maintenance dressings for silage. Sulphur in the form of Keiserite (22% S) was applied to the ryegrass/clover pastures at the rate of 25 kg S per ha in early June.

Grass budgeting

During mid-pregnancy, i.e. months 2, 3 and early 4, a maintenance level of feeding equivalent to an intake of 10 MJ ME per day is adequate for 70 kg ewes in good condition (AFRC, 1993). This can be supplied by either silage or grazed grass. Pasture sample analyses of autumn-saved pasture showed that the energy value was 11 MJ ME per kg DM. Thus, assuming high rates of utilisation, it was estimated that a daily ration of 1.3 kg grass DM per ewe would satisfy body maintenance requirements. The adequacy of this allowance will be discussed later in the context of results.

Lambing date

Choice of lambing date was given special consideration in the context of the objectives already stated, i.e. to achieve greater reliance on grazed grass relative to silage or concentrates. Priority was given to the elimination of concentrate supplements post-lambing. As a consequence, it was necessary to plan for adequate supplies of grass to satisfy peak feed demand during early lactation. Research information on ewe nutrient requirements and on seasonal grass growth provided the following guidelines for choosing an appropriate lambing date.

It was known that: (a) a 70 kg ewe producing 3 kg milk/day requires a metabolizable energy (ME) intake of 30 MJ (Meat and Livestock Commission, 1983; Robinson, 1986); (b) to satisfy this demand in terms of grazed grass a daily intake of 2.7 kg grass DM is required; (c) the peak voluntary intake of grazed herbage by a ewe suckling twin lambs is 3.4 kg DM/day in week 6 post-lambing (Vulich et al., 1991). Thus, in intensive grazing at a stocking rate of 14 ewes per ha, the feed demand in early lactation is almost 50 kg grass DM/ha/day. Results at Johnstown Castle showed that, on average, spring pastures do not reach this level of production until mid April (IFI/Teagasc, 1998). For lambing in March the success of grazed grass as the sole diet of the ewe is dependent on the accumulation of sufficient supplies of grass from earlier in the year. For example, to provide a daily intake of 2.7 kg grass DM/ewe/day for two weeks in March at a utilisation rate of 70%, a grass supply of 1000 kg DM per ha is required. Results at Belclare and Blindwell during the 1980's showed that this supply of grass can be provided for ewes lambing in mid to late March by resting pastures during winter, by applying fertiliser N in early February and by reserving the resultant grass growth for grazing post-lambing. Resulting from this review, the lambing date chosen at Knockbeg was March 21. As a consequence, the ewes were joined with the rams on October 19 for 6 weeks.

Grass supply and feed demand

Extended grazing reduces the resting period for grass recovery in spring and, hence, may be expected to have impact on grass supply. The adequacy of grass supply, however, is relative to feed demand and the ratio of these two components provides an estimate of grazing capacity i.e. the number of ewe grazing days (EGD). Moreover, grass growth in spring is unpredictable. Thus, relating grass supply to feed demand facilitates management and gives an important assessment of the feed status of the farm at this critical stage of the production cycle.

Feed demand estimates were based on grass intake results of grazing experiments reported by Gibb and Treacher (1980) and by Vulich et al. (1981). The results on grass intakes by ewes were interpreted as indicators of feed demand and were translated into a practical feed demand profile that recognises the need for supplying increasing amounts of grass for ewes during early lactation.

Grassland management

Before presenting the results the breeding and management practices common to both systems and the specific procedures to accommodate different requirements are summarised in this section in sequence with the flock management calendar commencing in autumn.

Autumn saved pasture: In early September plans were made both for the breeding season and for the accumulation of grass for extended grazing. These plans were based on 7-paddock rotational grazing, the appraisal of grass supplies, the body condition of the ewes and their feed demands for flushing and mating. In the intensive system, flushing of ewes for target body condition scores of 3.0 to 3.5 commenced in mid September. For the extensive system, however, it was necessary to commence this process in mid August in order to allow ewes to regain liveweight and body condition before paddocks were closed for the autumn. Pasture was accumulated by closing a number of paddocks sequentially during September and October, applying 34 kg N per ha and resting them until December when extended grazing commenced. The areas closed were 5.5 ha and 7.6 ha in 1998 and 1999 respectively and, as a result, the stocking rate in the extensive system on the grazed area during the breeding season was high, i.e. 15 ewes per ha and 20 ewes per ha in the two years respectively.

Winter management: The ewes in the intensive system were housed in mid December in a straw bedded shed and offered silage *ad libitum*.

Concentrate supplements were offered for 6 weeks pre-lambing, commencing at the rate of 250 g/ewe/day and increasing to 700 g in the final two weeks. In the extensive system extended grazing commenced in December. Grass supplies were measured by taking grass slips at ground level using a 0.25 m^2 quadrat followed by drying and weighing.

The ewes were block grazed in daily shifts using portable electric fencing including a back fence to prevent access to ground already grazed. The ewes were offered a ration of 1.3 kg grass DM/head/day. Grazing in both years was completed in early February. The flock was then housed and offered silage *ad libitum* plus concentrate supplements as already described.

Lambing: The ewes in both systems were turned out to grass after 1 to 3 days mothering up in individual pens. Triplet lambs were managed in a number of ways: they were cross-fostered to single bearing ewes whenever practicable, some sets of triplets were reared by their dams if milk supply was considered adequate and some were artificially reared. Ewes rearing triplets were grazed as a group and offered a supplement of 1 kg concentrates/head/day for 6 weeks post-lambing.

Grazing management and silage conservation: As stated earlier, the management of both farmlets was based on 7-paddock rotational grazing. Grass supply in April/May was calculated by measuring sward height (SH) with a rising plate metre and also by taking grass clips as already described. The movement of the flocks around the paddocks was determined by SH. Ewes and lambs were moved to the next paddock when SH was reduced to 4cm in April, 5 cm in May and 6 cm in June. In July/August pastures reserved for weaned lambs were managed for an average sward height of 8 cm. Creep feed was introduced at 8 weeks of age and offered at the rate of 300 g/lamb/day until slaughter.

The provision of winter feed was integrated with the management of each system and the appropriate silage areas were closed in early April. In the intensive system the silage budget for stocking rates of 13 to 14 ewes per ha housed for a 100-day winter was 8 t. This is equivalent to a silage production area of 0.3 ha on good grass-producing swards. On a per ha basis, therefore, 0.3 ha was closed from early April to mid June for silage conservation and subsequent growth of aftermath. In the extensive system the housing period was used mainly to facilitate lambing and hence the silage budget was significantly lower, i.e. 0.2 t per ewe. This silage budget required a conservation area of only 0.1 ha to produce 2 t silage for 10 ewes for a housing period of 35 to 40 days. In practice, however, grass surpluses arose occasionally due to the low stocking rate and these surpluses were conserved for silage. This decision-making process was formalised by using a SH of 10 cm or more as the definition of surplus grass.

Post-weaning: Lambs were dosed against worm parasites at 5 weeks of age, 10 weeks and at 14 weeks (weaning). In the intensive system, the dose at weaning was combined with a move to the silage aftermath. This management option was not available in the extensive system due to insufficient aftermath and, hence, the weaned lambs were returned to the pastures grazed pre-weaning. They were, however, grazed selectively on the best quality pasture available. A further dose in late July completed the dosing programme for lambs. The ewes were dosed at lambing time only.

Lambs were drafted for slaughter during summer/autumn at 38 to 44 kg liveweight after handling for a standard degree of body condition.

The management of the ewes post-weaning was determined by requirements to regain sufficient liveweight and body condition for mating, as described earlier. They were grazed tightly at 40 ewes per ha for about 6 weeks post-weaning. They were then scored for body condition in mid August and based on this appraisal, ewes were allocated an increased supply of grass and managed to attain condition scores of 3.0 to 3.5 at mating for the next production cycle.

Records: Flock performance information was collected on: ewe liveweight changes during winter, ewe reproductive performance, lamb mortality, lamb growth rate and carcass weight. Least squares procedures were used for analysing lamb performance results. For comparisons between the systems in winter management inputs, two components were recorded: (1) labour in terms of man-hours per day for feeding and herding; (2) usage of straw for housing.

RESULTS

Feeding capacity of extended grazing

Results on the grazing capacity of autumn-saved pasture and the liveweight changes of in-lamb ewes managed on the two contrasting wintering systems are shown in Tables 1 and 2. In 1998 the accumulation of autumn pasture managed as described resulted in a grass supply of 1550 kg grass DM/ha for extended grazing. The daily ration of grass was offered in the morning, most of it was consumed by mid day and by the following morning it was grazed off to such a degree that very little residual stubble remained. As a consequence, grass utilisation was not measured due to the practical difficulty of clipping and collecting the sparse stubble. Careful assessments by eye indicated that utilisation rates were of the order of 75% to 80%. Fifty days grazing were obtained after which the ewes were housed and managed indoors for lambing. Compared with silage and housing, extended grazing halved the housing period. The adequacy of the grass allowances for ewe body maintenance was verified by the ewe liveweights and body condition scores recorded in mid and late pregnancy, coinciding with pre- and post-extended grazing respectively. Small increases in both traits were recorded.

In the second winter the larger area of autumn-saved pasture increased the feeding capacity of extended grazing (Table 2). Due to grass scarcity on the main grazing area in late November in 1999, extended grazing commenced 2 weeks earlier than in 1998. Grass supply was 1700 kg DM per ha and, when rationed as described, grazing extended to February 9. Thus, the housing period was reduced to 40 days. As previously, the adequacy of the feeding allowances was again confirmed by the ewe liveweights and condition scores recorded pre- and post-extended grazing. There was a 7% increase in ewe liveweight on extended grazing and average condition score remained unchanged.

Table 1: Feeding capacity of extended grazing and the resulting liveweights of in-lamb ewes compared with housing : Winter 1998/1999

System	Silage and housing	Extended Grazing
No. ewes	125	148
No. ha autumn saved pasture	-	5.5
Extended grazing commenced	-	December 14
Grass supply (kg DM/ha)	-	1550
Grass allowance (kg DM/ewe/day)	-	1.0 to 1.3
Date of housing	December 16	February 2
No. days housed	95	47
Ewe live weight (kg.), (C. score):		
Mid pregnancy (December 9)	66.6	66.0 (3.2)
Late pregnancy (February 2)	N/A	69.3 (3.3)

Table 2: Feeding capacity of extended grazing and the resulting liveweights of in-lamb ewes compared with housing : Winter 1999/2000

System	Silage and housing	Extended grazing
No. ewes	137	158
No. ha autumn saved pasture	-	7.5
Extended grazing commenced	-	December 1
Grass supply (kg DM/ha)	-	1700
Grass allowance (kg DM/ewe/day)	-	1.0 to 1.3
Date of housing	December 12	February 9
No. days housed	100	40
Ewe live weight (kg.), (C. score):		
Mid pregnancy (December 12)	72.1	69.5 (3.5)
Late pregnancy (February 9)	N/A	74.7 (3.5)

Ewe lambing performance

Important assessments of the adequacy of feeding for in-lamb ewes are obtained from results on ewe lambing performance, lamb birth weights and lamb vigour as measured by lamb survival and growth rate. Results on ewe lambing performance are shown in Table 3. It is evident that ewe productivity was high in both flocks. High levels of fertility and litter size resulted in 1.7 and 1.8 lambs reared per ewe in 1999 and 2000 respectively, including triplets.

Table 3: Ewe lambing performance

	1999		2000	
System	Silage and housing	Extended grazing	Silage and housing	Extended grazing
No. ewes joined	125	148	137	158
Ewes lambing (%)	90	95	99	96
Litter size	2.06	2.12	2.12	2.15
No. lambs reared/ewe	1.68	1.77	1.86	1.78

Lamb birth weight: Results on lamb birth weight classified by birth type are shown in Table 4. The birth weights of the progeny of the ewes on extended grazing were significantly heavier (P<0.01) than those born to ewes managed indoor for a full 100-day winter. Moreover, the differences recorded in the case of twins and triplets/quadruplets born in 2000 were surprisingly large. In that year ewes were consuming high quality grass until February 9 while their counterparts were managed indoors since December 12 and fed silage. Further investigations are required to clarify the reasons for the differences in birth weight.

Table 4: **Lamb birth weights (kg)**

	1999				2000			
System	Silage and housing		Extended Grazing		Silage and housing		Extended grazing	
	No. lambs	Birth weight	No. Lambs	Birth weight	No. lambs	Birth weight	No. lambs	Birth weight
Singles	26	5.5	23	5.9	21	5.7	22	6.1
Twins	144	4.4	144	4.7	135	4.1	160	4.7
Triplets / Quads	99	3.7	107	3.8	89	3.2	96	3.9

Lamb vigour: After lambing, the subsequent rearing ability of the ewe is reflected in lamb survival and lamb growth rate. Results on these components of flock productivity are shown in Table 5. The lamb mortality figures relate to all live and dead-born lambs classified as (a) aborted and dead-born, (b) losses recorded to 5 weeks post-lambing. Losses attributable to lambs dead-born were similar in both systems and were associated with a relatively high frequency of triplets and quadruplets which constituted 36% of all lambs. Mortality to 5 weeks in lambs alive at birth was 2% to 3% higher in system 2. In summary, the overall differences in lamb survival rates between the two systems were small.

Milk supply is the other important component of a ewe's rearing ability and is a strong determinant of lamb growth rate. In 1999, growth rate to 5 weeks was similar in both systems but in 2000 it was significantly higher in the progeny of the ewes wintered on extended grazing.

Table 5: Lamb survival and growth rates

	1999		2000	
System	Silage and housing	Extended grazing	Silage and housing	Extended grazing
Lamb mortality (%):				
Dead-born	6.3	5.5	8.3	8.1
Birth to 5 weeks	3.6	6.6	3.5	6.0
Lamb survival rate (%)	90	88	88	86
Growth rate (g/day):				
Birth to 5 weeks	283	293	258	278

Extended grazing and grass supply in spring

As explained earlier in relation to the choice of lambing date and the elimination of concentrate feeding post lambing, the provision of adequate supplies of grass in spring is of central importance for satisfying the nutrient requirements of the ewe during early lactation.

Comparative estimates of grass supply and feed demand in the two systems during early lactation and the resulting grazing capacity of pastures are shown in Tables 6 and 7 for 1999 and 2000, respectively. Farm grass cover was similar in both systems with the exception of mid April 2000 when grass supply was 200 kg DM per ha higher in the extended grazing system. Relative to feed demand, this advantage added an extra 6 days to ewe carrying capacity. It is evident that in the two years of the trial, extended grazing did not adversely affect grass supply in mid April and early May, the period which coincided with peak feed demand at 3 to 6 weeks post-lambing. Indeed, the relatively fast recovery of pasture following extended grazing was a notable feature of the trial.

Table 6: Farm grass cover and grazing capacity in spring 1999

System	Intensive grazing		Extensive grazing	
	April 15	May 1	April 15	May 1
Grass supply (kg DM/ha)	837	1007	917	1025
Feed demand (kg grass DM/ha)	52	65	31	39
No. EGD*/ha	16	15	30	26

*Ewe grazing days

Table 7: Farm grass cover and grazing capacity in spring 2000

System	Intensive grazing		Extensive grazing	
	April 15	May 1	April 15	May 1
Grass supply (kg DM/ha)	1400	819	1600	806
Feed demand (kg/grass DM/ha)	56	71	34	43
No. EGD*/ha	25	11	47	18

*Ewe grazing days

This is thought to be associated with the daily system of block grazing whereby the grass plant is grazed for one day only, thus facilitating regrowth, in contrast to continuous winter grazing where grass root reserves are depleted on an on-going basis. The higher feed demand estimates in the intensive system were due not only to the higher stocking rate but also to a 30% reduction in the grazing area arising from silage conservation. In the extensive system, only surplus grass was conserved. The resulting differences in ewe grazing capacity in mid April were large, particularly in 2000 due to the large supply of grass. In May 2000, however, the ewe grazing capacity of the pastures in both systems declined to less than half that observed in mid April. This was associated with low temperatures and poor grass growth which characterised mid to late April 2000. No such decline was observed in 1999. This year-to-year variation raises the question of how to balance variable grass supplies with fixed animal requirements.

Grass growth is unpredictable and may cause difficulties for management systems operated by calendar date (Brereton 1995). In addition to year-to-year variation in grass growth, there is also seasonal variation in south-east Leinster due to summer drought. Relating grass supply to feed demand in terms of ewe grazing days gives an important assessment of the feed status of the farm and offers a key for a more flexible approach to grazing management. Such an approach must be underpinned by management adjustments based on regular assessments of the current feed status of the farm.

Lamb growth rate, carcass weight and output per unit area

Comparative results on lamb performance and output are shown in Tables 8 and 9 for 1999 and 2000 respectively. With the exception of lamb growth rate to 5 weeks of age in 1999 the differences in the components of lamb performance were highly significant. The higher growth rates and weaning weights on the extensive system in both years was due mainly to greater supplies of grass arising from the lower stocking rate. The differences in carcass weight, although not large, were nevertheless significant. In addition to higher carcass weights, lambs reared at the lower stocking rate were finished two weeks earlier than their counterparts on the intensive system.
As discussed later, it is evident in Tables 8 and 9 that although output per ewe was high in both systems, output per ha was reduced considerably by extensification.

Table 8: Lamb performance 1999 (least squares means)

System	Intensive grazing	Extensive Grazing	Sig.
No. ewes/ha	13	10	
No. lambs reared/ewe	1.68	1.77	
No. lambs sold/ha	21.8	17.7	
Growth rate (g/day):			
Birth to 5 weeks	283	293	
5 to 14 weeks	227	265	P<0.01
Weaning wt. (kg)	28.0	29.7	P<0.01
Carcass wt. (kg)	18.6	19.2	P<0.01
Age (days)	160	144	P<0.01
Lamb carcass output: kg/ewe	31.2	34.0	
kg/ha	405	340	

able 9:Lamb performance 2000 (least squares means)

System	Intensive grazing	Extensive grazing	Sig.
No. ewes/ha	14	10	
No. lambs reared/ewe	1.86	1.78	
No. lambs sold/ha	26.0	17.8	
Growth rate (g/day):			
Birth to 5 weeks	258	278	P<0.01
5 to 14 weeks	249	269	P<0.01
Weaning wt. (kg)	29.9	32.4	P<0.01
Carcass wt. (kg)	19.0	19.3	P<0.01
Age (days)	160	147	P<0.01
Lamb carcass output: kg/ewe	35.3	34.4	
kg/ha	494	344	

Performance of triplet lambs

Independently of intensification or extensification, the performance of triplet lambs is of interest from a management perspective. Lambs reared as triplets constituted 20% of all lambs in this trial. Pooled results for the two years categorised by rearing types are shown in Table 10. As expected, triplet lambs were significantly lighter at birth, had lower growth rates to 5 weeks of age and lower weaning weights compared with singles and twins. From 5 to 14 weeks of age, however, their growth rate was similar to twins indicating that triplets very likely compensated for their earlier disadvantages in competing for milk by consuming more grass. They nevertheless required an extended period of feeding in autumn for finishing, 2 and 4 weeks extra compared with singles and twins as measured by age at slaughter. In response to this extra feeding period their carcass weight was heavier than that of twins and carcass quality was excellent.

Table 10: **Lamb performance : Rearing types 1999-2000 (least square means)**

Rearing type	No. lambs	Birth wt. (kg)	Growth rate (g/day) Weeks of age 0-5	Growth rate (g/day) Weeks of age 5-14	Weaning wt. (kg)	Carcass wt. (kg)	Age (days)
Single	135	5.5	323	269	33.2	19.7	140
Twin	604	4.6	271	245	29.1	18.5	153
Triplet	188	3.6	237	244	26.6	18.9	167

Effects of extended grazing on management inputs

Conventional housing and silage feeding systems require the cutting and transport of grass to the farmyard for silage conservation, tractor transport and machinery for feeding, handling of straw on a regular basis for bedding pens, followed by the task of mucking out sheds and providing transport to the field for manure disposal. The shorter housing period resulting from extended grazing reduces demands for these management and associated labour inputs. It is, however, necessary to purchase electric net-fencing for managing extended grazing efficiently.

Comparative estimates for winter management inputs including fencing are shown in Table 11. Requirements for silage and straw in the extended grazing system were reduced by two-thirds leading to a cost saving of £651 per 100 ewes at year 2000 prices. Straw is worth approximately £90 per ha (Teagasc 2000) which at a yield of 2.5 t per ha is equivalent to 3.6 p per kg. The cost of straw, however, varies widely depending on whether it is home grown or purchased. The fencing cost incurred by extended grazing must be set against these savings and may be discounted over 5 years as shown, resulting in net savings of £555 per 100 ewes.

Labour as measured by man-hours required for feeding and herding was reduced by over two-thirds. The financial savings attributable to this factor depend on the opportunity cost of the stockman's own labour. If it is included at the current agricultural wage of £7 per hour, labour cost is reduced by over £600 per 100 ewes. In practice, however, the opportunity cost varies from farm to farm and the values shown here should be adjusted accordingly.

Table 11: Winter management in-puts and cost savings arising from extended grazing: Average estimates for 1998/1999 and 1999/2000

	Silage and housing	Extended grazing	Savings*/100 ewes (£)	
Housing period (days)	100	43		
Per 100 ewes:				
Silage (t)	60	20	480	
Straw (kg)	7480	2720	171	651
Less cost of electric fencing:				
300 m @ £1.60/m discounted over 5 yrs.			96	555
Labour (man-hours/day)	1.0	0.3		
Labour (man-hours)	100	13		
Wage @ £7/hour	700	90		610

* Costs: Silage £12/t; straw 3.6p/kg; electric fencing £80 per 50 metre roll.

Production and disposal of farmyard manure

Although the volume of farmyard manure produced in this trial was not measured, the effect of the shorter housing period arising from extended grazing on the production of manure may be gauged from the measurements recorded in published reports. Output of faeces and urine by housed in-lamb ewes of 60 kg to 80 kg liveweight varies from 6 kg to 10 kg/head/day (FBIC 1983). Per 100 ewes, therefore, comparative estimates for total faeces and urine output during the housing periods corresponding with the two systems as shown in Table 11 were 35,000 kg and 15,000 kg respectively. To these outputs of course must be added the straw component which is relatively large.

Animal manure storage and disposals are subject to the measures drawn up by the DoE and DAFF (1996). Reduction in manure output facilitates ease of management in its disposal..

Effects of extensification practices on output and profitability

As stated in the introduction, farm management policy since the introduction of quotas has been switched from maximum output per ha to maximum output per ewe, lower costs and more effective use of farm resources including labour. It is evident from the results of this project that in the process of increasing the role of grazed grass in the year round diet of the ewe, the application of extensification practices has a number of important consequences for mid season lamb enterprises:

1. With prolific ewes and good management, high levels of output per ewe are obtainable.
2. Management inputs associated with housing and silage are reduced, resulting in lower costs

of ewe flock maintenance and, thereby, more profit per ewe.

3. On a whole-farm basis, extensification results in reduced output per ha.

The financial effects of extensification practices on production costs and profitability can be illustrated by expressing the results relative to the intensive grazing, silage and housing system at year 2000 prices. These results are summarised in Table 12 in which the values for the conventional system were given a standard index of 100 and the values for the extended grazing system were calculated relative to this index. Labour expenses are not included. Depending on the unit of production, per ewe or per ha, the financial consequences associated with extensification are clearly evident. Details on costs and gross margins are listed in Appendix 1.

Table 12: Comparative costs and profitability

	Silage and housing		Extended grazing	
	£	Index	£	Index
Direct costs/ewe	34	100	27	79
Gross margin/ewe	48	100	56	117
Gross margin/ha	672	100	560	84

Financial income is the main determinant of sheep enterprise competitiveness. Income however is dependent on the volume of output and, hence, on flock size (number of ewes). Many mid season enterprises are relatively small scale - average flock size is about 100 ewes – and extensification must be accompanied by financial support measures to compensate for lower output per ha.

In general, extensification practices are recommended where flock size is of sufficient scale for producing enough output per labour unit to generate a commercially viable income. There is considerable scope for increasing profit margins by reducing unit costs of production, e.g. costs per ewe or per labour unit, as shown by the results. Extensification is also relevant to part-time farmers who require labour saving systems for ease of management. Current research is aimed at further reductions in management inputs by expanding grass budgeting and extended grazing procedures to include lambing at grass. Ewe productivity, lamb survival rates and labour inputs will be compared with conventional housing and indoor lambing practices.

CONCLUSIONS

- Extended grazing can be used as a substitute for housing and silage, leading to significant reductions in management inputs, such as, silage, straw and labour. When costed at year 2000 prices, these reductions range from £555 to £1165 per 100 ewes depending on the opportunity cost of the stockman's own labour.

- To facilitate extended grazing, the annual stocking rate must be relatively low, e.g. 10 ewes per ha, in order to allow for the accumulation of autumn-saved pasture carried forward for grazing in winter.

- The technique of grass budgeting whereby grass is allocated daily according to animal feed requirements is relatively simple to operate. It is, however, necessary to undertake assessments of grass supply and relate such assessments to the feed demand of the flock.

- For in-lamb ewes of about 70 kg liveweight and condition scores 3.0 to 3.5, a daily allowance of 1.3 kg grass DM per ewe is adequate for maintaining ewe liveweight and body condition up to the last 4 to 5 weeks of pregnancy.

- On free draining soils with perennial ryegrass-based pastures and good management, grass supply in spring following extended grazing is more than adequate to satisfy the relatively low feed demand associated with a stocking rate of 10 ewes per ha.

- With good management high levels of output per ewe can be achieved under intensive and extensive conditions, e.g. 34 kg carcass lamb per ewe.

- Extensification practices result in significantly higher levels of lamb performance and carcass weights compared with intensive grazing. This is due to the lower stocking rate.

- Extensification results in substantial reduction in carcass output per ha due to relatively low stocking rate compared with intensive grazing.

- The adoption of extensification practices facilitates labour-saving systems for ease of flock management.

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Appendix 1: Mid season lamb production 2000 : Comparative outputs, costs and gross margins

System	**Grazing, silage and housing**		**Extended grazing**	
No. ewes	137		158	
No. ewes/ha	14		10	
Fertilizers (kg/ha)	80 kg N		96 kg	
	42 kg K, 25 kg		N	
Carcass wt. (kg)	S		38 kg	
Carcass price (p/kg)	19.0		N	
	239		19.3	
Output per ewe (£)			239	
1.8 Lambs				
Wool + premium	81.74	97.42		98.71
Less replacement	15.68	15.00	83.03	15.00
		82.42	15.68	83.71
Direct costs per ewe (£)				
1. Fertilizers for grazing[1]				
65 kg N/ha				
90 kg N/ha	1.56			
25 kg S/ha				
2. Silage 0.6 t[2]	2.11		3.30	
0.2 t[2]	7.20			
3. Concentrates[3]: Pre-lambing 20				
kg	2.90		2.40	
Post-lambing for ewes suckling			2.90	
triplets	0.71			
16 ewes @ 1 kg/ewe/day for 6				
weeks[4]			0.81	
21 ewes @ 1kg/ewe for 6 weeks				
4. Creep feed[2] 34 kg/lamb	5.23			
31 kg/lamb	2.00	32.92	5.23	25.69
5. Flock health	2.34		0.62	
6. Straw		**£49.5**	2.34	**£58.0**
7. Shearing/levies		**0**		**2**
		693		**580**
Gross margin per ewe (£)				
Gross margin per ha (£)				

[1]Urea @ £155/t, Supernet @ £105/t, Muriate of Potash £170/t, Keiserite £250/t
[2]Silage @ £12/t including fertilizer costs
[3]Ewe-and-lamb pelleted compound @ £145/t
[4]Costed on a whole-flock basis
[5]Introduced at 6 weeks of age and offered @ 300 g/lamb/day until slaughter, £145/t