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## **EASY FEEDING OF HOUSED SHEEP**

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*Sheep Research Centre, Athenry, Co. Galway*

# **Easy Feeding of Housed Sheep**

by

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## SUMMARY

In recent years sheep producers have emphasised the amount of labour required for managing sheep enterprises. In particular, the winter management of the flock during the past 25 years has been concentrated on silage, housing and associated labour inputs. One approach to reducing dependence on silage is the practice of extended grazing. On intensively stocked farms, however, the scope for this practice is limited. An alternative approach is the use of complete concentrate diets as substitutes for silage.

A trial was conducted at the Knockbeg Sheep unit, Carlow for the purpose of examining the feasibility of feeding complete concentrate diets to ewes housed during late pregnancy and early lactation. A flock of ewes managed for lambing in January was divided into three groups at time of housing in November, each allocated to one of three diets: silage *ad libitum* plus concentrate supplements, a cereal-based loose mix concentrate or a pelleted concentrate diet. Levels of feeding offered in late pregnancy and early lactation were calculated to satisfy the energy requirements of 70 kg twin-bearing ewes. In addition to the dietary comparisons for ewes the resulting lamb crop provided the opportunity to compare two feeding systems for finishing, namely, early weaning onto grazed grass plus creep feed and early weaning onto a complete concentrate diet.

Results on the components of ewe productivity, i.e. litter size, lamb survival rate and number of lambs reared, were similar on all three diets. Lamb birth weight was significantly heavier (0.4 to 0.6 kg) in the progeny of ewes offered the complete concentrate diets compared with the progeny of ewes offered silage. Nevertheless, the birth weight resulting from the ewes fed the silage diet was similar to results in previous years and, as a consequence, was considered satisfactory.

Growth rate to 5 weeks of age in the progeny of the ewes offered the concentrate diets was relatively low due to an outbreak of pasteurellosis. Following recovery, compensatory growth was evident from 5 weeks to sale with the effect that the progeny of the three ewe diets were finished for slaughter at similar weights and ages.

Ewes offered the complete concentrate diets increased significantly in liveweight and most of the increase was observed in ewes rearing singles. It is recommended that when feeding complete concentrate diets to ewes during late pregnancy and early lactation, single and twin bearing ewes should be accommodated separately and offered concentrate allowances appropriate to their requirements.

Labour demand for feeding was highest on the silage diet and lowest for the pelleted formulation. Labour demand for feeding silage and concentrate supplements can be halved by using a pelleted concentrate diet.

At 2001 prices the difference in costs between the silage and loose mix concentrate diets was small. When this factor is combined with reduced labour demand, it is considered that loose concentrate mixes offer an attractive alternative to silage feeding.

There was no evidence in favour of early weaning of lambs onto grazed grass plus creep feed compared with the conventional system of early weaning indoor onto complete concentrate diets.

## INTRODUCTION

Ease of management is an important component of the annual cycle of sheep production. In recent years its significance has been increased by changing trends in farm economics, labour availability and feed prices. In debating these issues, sheep producers have emphasised the amount of labour required for managing sheep enterprises (Connolly 2000). The significance of labour has been increased by the growth in off-farm employment. On farms with sheep as the main enterprise, 50% of holders or spouses have off-farm jobs (NFS 2000). As a result, less man hours are available for flock management and supervision. It is predicted that by 2005 four out of every five drystock producers will be engaged in part-time employment. It follows that in order to maintain flock numbers at present levels, current on-farm work practices need to be reviewed.

In particular, winter management of the flock during the past 25 years has been concentrated on housing, silage and associated labour inputs. The feeding of silage as the main winter diet is machinery dependent, labour demanding and time consuming. It involves tractor transport, silage cutters or power loaders with associated maintenance costs. In the case of baled silage, plastic must be unwrapped, the silage unrolled and manually forked into troughs. Connolly (2000) reported that the time recorded for harvesting, collecting bales and feeding silage accounted for 17% of total hours devoted to flock management.

One approach towards reducing dependence on silage is the practice of extended grazing. Flanagan (2000) reported that by adopting a relatively low stocking rate of 10 ewes per ha, by accumulating autumn grass and by rationing it on a daily basis during winter, the housing and silage feeding period can be reduced to 40 days, i.e. the last 6 weeks of pregnancy. As a consequence labour inputs can be reduced by two-thirds, thus facilitating ease of management. On intensively stocked farms (over 12 ewes per ha), however, the scope for extended grazing is limited due to the limited amount of autumn pasture that can be saved.

An alternative approach towards reducing dependence on silage is the use of complete concentrate diets as substitutes for silage. Various formulations of complete concentrate diets have been fed successfully to intensively managed ewes and lambs by Sheehan et al. (1977), Slade (1980), Sheehan and Quirke (1984), Robinson (1988) and Flanagan (1997, 1999). These formulations ranged from cereal-based loose mixes and ground pelleted roughage concentrate diets to all-concentrate pelleted compounds. Compared with silage, complete concentrate diets have potential to facilitate ease of management in housed flocks. In the past their use for commercially managed ewe flocks has been inhibited by costs.

Recent trends in feed prices, however, indicate that silage has become increasingly expensive relative to cereals. During the mid 1990's the cost ratios between grass, silage and concentrates were 1:2.2:3.7 (O'Kiely 1994), indicating that silage energy was only 60% of the cost of concentrate energy. By the end of the decade these relativities had changed. Published reports vary on the extent of these changes. Using a range of technical and economic assumptions Sheehy (1999) estimated that the aforementioned ratios were 1:2:2, i.e. silage energy had become as expensive as concentrate energy. Other estimates may be derived from the costs listed in Management Data for Farm Planning (2001). The calculated costs of producing clamp silage, baled silage and spring barely are €76, €112 and €118 per t of dry matter, respectively. Thus, the cost of making silage varies from 65% to 95% that of growing and harvesting barley. These cost changes together with the logistics of silage making and feeding warrant a review of the role of silage and concentrates in sheep production systems.

Although the great majority of ewes lamb in spring there is a significant number of early lamb enterprises supplying niche markets around the Easter season. Compared with their spring lambing counterparts, early lambing ewes command a greater degree of intensive management indoor due to the workload associated with compact lambing followed by housing for a number of weeks in order to avoid weather hazards associated with outdoor management in

January. Again, complete concentrate diets have potential for reducing labour inputs for ewes housed during early lactation.

Arising from the foregoing considerations a trial was conducted at the Knockbeg Sheep Unit, Carlow for the purpose of examining the feasibility of feeding complete concentrate diets to ewes housed both for late pregnancy and for early lactation. The objectives of the trial were:

1. To measure the lambing performance of ewes offered either silage or concentrates as the main diet in late pregnancy.
2. To evaluate the growth rate of lambs when their dams were offered silage or concentrates as the main diet in early lactation.
3. To compare the labour inputs and feed costs required for managing the two systems.

The results and conclusions are summarised in this report. In addition, the lamb crop provided an opportunity for further examination of early weaning systems. For finishing, early lambs are usually turned out with their dams to early grass, creep fed concentrates and drafted for slaughter directly off their dams. Supplies of early grass in such systems are often limiting relative to the feed demand of lactating ewes. Early weaning at grass and the removal of the ewes elsewhere, e.g. indoor on silage, would reduce grass feed demand. To examine whether this approach would affect lamb performance the lambs were allocated to two finishing systems, the results of which are also presented in this report.

## METHODS

A flock of 130 ewes managed for lambing in early January 2001 was housed for 7 weeks pre-lambing and for 5 weeks post-lambing. The ewes were mainly Suffolk crosses, sponged on July 28 2000, injected with 750 i.u. PMSG at time of sponge removal and compact mated with Suffolk and Texel rams on August 11-13. The ewes had a mean liveweight of 69 kg at mating.

### Ewe diets

The ewes were housed on November 17, weighed, divided into three groups and offered the following diets:

1. Silage *ad libitum* + pelleted concentrate supplement
2. Cereal based loose mix concentrate only
3. Pelleted concentrate only

Baled silage conserved without additive on May 25 from a perennial ryegrass dominant sward was used unchopped for diet 1. The loose mix concentrate consisted of whole barley, molassed sugar beet pulp and soyabean meal in the ratios 50:30:20; a mineral/vitamin mix was added at the rate of 20 g/ewe/day. The pelleted concentrate consisted of a commercially available 'ewe-and-lamb' compound. This compound was also used to provide the supplement in diet 1. A pre-trial adjustment period of 1 week was arranged for the ewes allocated to the complete concentrate diets. Some silage plus a daily ration of 0.5 kg concentrates was offered initially, followed by gradual withdrawal of silage and increase in concentrates to 1 kg per ewe at the end of the week.

The levels of feeding offered in late pregnancy and early lactation were calculated to satisfy the energy requirements of 70 kg twin-bearing ewes and were derived from data published by the Meat and Livestock Commission (1983) and CAB International (1993) together with sample chemical analyses of the feeds offered. The daily energy requirements per ewe at weeks 6, 5 and 2 pre-lambing and for the first 5 weeks post-lambing (maintaining body condition) were estimated at 13, 15, 17 and 30 MJ ME per ewe, respectively. Sample chemical analyses of the feeds are summarised in Table 1 and the dietary treatments computed to satisfy the energy requirements listed above are shown in Table 2.

**Table 1: Chemical analyses<sup>1</sup> of silage and concentrates**

	Silage	Pelleted Concentrate	Loose mix <sup>2</sup>
Dry matter (DM) (g/kg)	182	875	871
pHs	4.2	-	-
Crude protein (g/kg DM)	132	193	170
DOMD (g/kg DM)	704	800	826
NH <sub>3</sub> - N (% of total N)	12.6	-	-
Crude fibre (g/kg DM)	-	75	61
Ash (g/kg DM)	-	78	45
Estimated ME (MJ/kg DM)	11.0	12.7	12.2

<sup>1</sup>Grange Laboratories <sup>2</sup>Chemical analyses of the ingredients are shown in Appendix 1

**Table 2: Dietary treatments in late pregnancy and early lactation (kg/ewe/day)**

	Weeks pre-lambing			Post-lambing
	6-5	4-3	2-1	Birth to 5 weeks
1. Silage + concentrate	<i>Ad libitum</i> 0.2	<i>Ad libitum</i> 0.4	<i>Ad libitum</i> 0.6	<i>Ad libitum</i> 1.6
2. Loose mix concentrate	1.2	1.4	1.6	2.8
3. Pelleted concentrate	1.2	1.4	1.6	2.7

### Housing management

The ewes were group penned in a straw bedded shed at a floor space of 1.4 m<sup>2</sup> per ewe. Feed was offered once daily and to facilitate equal opportunity for all ewes to consume concentrate rations a trough feed space of 600 mm per ewe was provided. Troughs were cleaned as required; fresh water was continuously available from wall mounted drinkers. At lambing time the ewes were removed with their lambs to individual pens for 1 to 2 days mothering up following which they were returned to their respective diets for 5 weeks as shown in Table 2. For ease of management during this feeding period they were penned in two groups of about 20 ewes plus lambs per diet and they were allocated a floor space of 1.8 m<sup>2</sup> per ewe. All lambs were offered creep feed from week 1.

### **Measurements**

To measure the comparative performance of ewes and their resulting progeny on the three diets, records were collected on the following components: ewe liveweight, ewe lambing performance, lamb survival rate, growth rate, sale weight and age at slaughter. Labour demands for feeding were estimated by recording the time required by the stockman to complete the component tasks: unwrapping, unrolling baled silage and feeding into the fodder troughs, mixing loose concentrates, weighing concentrates and trough feeding the concentrate diets. Loose concentrates were mixed by hand shovel on 3 days per week and the time recorded for this task was converted to man hours per day for a 7-day week. Concentrates were dispensed manually into feed troughs by the stockman from 15 kg containers. Group size in this trial was relatively small (n=43 ewes) and to provide information on a larger scale, time records were also collected on the housed mid season flock (n=140 ewes) which was similarly managed during late pregnancy on baled silage and concentrate supplements.

### **Early weaning systems**

To examine whether early weaning at grass would affect lamb performance, lambs were allocated at about 5 weeks of age to the following finishing systems:

- (a) Turned out to early grass with their dams, weaned at 9 weeks of age and finished on grazed grass plus creep feed offered *ad libitum*.
- (b) Early weaned and finished indoor on a complete concentrate diet, namely, the pelleted compound described in Table 1.

Creep feed was introduced to all lambs at 1 week of age and was on offer at all stages. Lambs at grass were grazed on a perennial ryegrass dominant sward offered on an unrestricted basis. Concentrate supplements to ewes were terminated at turnout. Weaned ewes in both systems were housed and offered baled silage *ad libitum* until grass supplies became plentiful in April/May. When drafting for slaughter, lambs were weighed unfasted and handled for body condition on the day prior to factory delivery.

## RESULTS

Results on ewe lambing performance are shown in Table 3. The components of ewe productivity listed in the table determine the size of the lamb crop produced for sale. 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 of age. Losses due to dead born lambs were relatively high and were similar to previous results reported by Flanagan (1998). Abortions accounted for 25% of dead born lambs. The results on the components of ewe productivity were similar on all three diets.

**Table 3: Ewe lambing performance**

	Silage + concentrate	Loose mix concentrate	Pelleted concentrate
No. ewes lambing	43	43	42
Litter size	1.84	1.86	1.81
Lamb mortality (%):			
Dead born	8.9	8.7	7.9
Birth to 5 weeks	5.0	5.0	5.3
Lamb survival rate (%)	86	86	87
No. lambs reared/ewe lambing	1.58	1.60	1.57

### Lamb birth weight

Results on lamb birth weight and performance classified by ewe diet are shown in Table 4. Lamb birth weight provides an important assessment of the adequacy of feeding pre-lambing. The progeny of ewes offered complete concentrate diets had significantly higher birth weights compared with the progeny of ewes offered silage. There are two likely explanations for this effect. Firstly, the concentrate diets had higher digestibility and protein values (Table 1) and secondly, silage feeding is associated with variation in intake when unchopped, as was the case with the baled silage used in this trial. Although 0.4 to 0.6 kg lighter, the lamb birth weight resulting from the ewes fed the silage diet was considered satisfactory and similar to results in previous years, e.g. in 1990, 1991 and 1995 (Flanagan, 1998).

**Table 4: Comparative results on lamb performance**

Ewe diet	Silage + concentrate	Loose mix concentrate	Pelleted concentrate	Significance
No. lambs	66	73	67	
Birth wt. (kg)	4.7	5.3	5.1	P<0.001
Growth rate (g/day):				
Birth to 5 weeks	277	248	244	P<0.001
5 weeks to sale	328	353	358	P<0.001
Sale wt. (kg)	40.1	40.4	40.2	NS
Carcass wt. (kg)	19.0	18.9	18.9	NS
Age (days)	116	114	114	NS

### Growth rate and sale weight

There were significant differences in growth rate. In particular, growth rate to 5 weeks of age in lambs reared by ewes fed the concentrate diets was poor. This effect is attributable, not to deficiencies in the quality of these diets (see Table 1), but to an outbreak of pasteurellosis at 2 to 3 weeks of age which manifested itself in varying degrees of breathing difficulty. Badly affected lambs (n=26) were treated with long acting antibiotic (oxytetracycline) and of these, 6 required a second treatment; mildly affected cases (n=20) were left untreated. Although all lambs recovered the rate of recovery varied. It is considered that the low growth rate to 5 weeks of age was due to pasteurellosis. Following recovery, the trend in growth rate to slaughter was in the opposite direction to that recorded earlier. Compensatory growth was evident with the effect that all three groups of lambs were finished for slaughter at similar ages.

### Ewe liveweight

Results on ewe liveweight changes are shown in Table 5. There were significant increases in liveweight from 5 weeks pre-lambing to 5 weeks post-lambing in the ewes offered the complete concentrate diets compared with the ewes offered the silage diet. Feeding levels during lactation were calculated to satisfy the requirements of 70 kg ewes suckling twin lambs and producing 3 kg milk daily. For management reasons, however, both single and twin suckling ewes were penned and group fed together for each diet. Most of the liveweight increases were observed in single

sucklers which constituted 40% of all ewes rearing lambs. Pooled results for the two concentrate diets showed that the mean liveweight increases in single and twin sucklers were 12.1 and 3.5 kg, respectively. It is recommended that when feeding complete concentrate diets to ewes during late pregnancy and early lactation, single and twin bearing ewes should be accommodated separately and offered concentrate allowances appropriate to their requirements.

**Table 5: Ewe liveweight changes**

	Silage + concentrate		Loose mix concentrate		Pelleted concentrate	
	No. ewes	Livewt. (kg)	No. ewes	Livewt. (kg)	No. ewes	Livewt. (kg)
6 weeks pre-lambing	43	73.3	43	72.4	42	73.0
5 weeks post-lambing	43	71.5	43	79.6	42	77.2
Significance		NS		P<0.05		P<0.05

### Labour

Comparative demands for labour as measured by the number of man-hours required for feeding are shown in Table 6. The feeding of silage included the process of unwrapping and unrolling bales prior to filling fodder troughs. As expected, labour demand was highest for the silage diet and lowest for the pelleted formulation. The labour saving effects of feeding complete concentrate diets are illustrated in the table by expressing the results relative to the silage diet. Labour demand for feeding the latter diet is given a standard index of 100 and the values for the complete concentrate diets are expressed relative to this index. It is evident that the labour input required for silage feeding can be halved by using a pelleted concentrate diet. Loose mix concentrates offer an intermediate alternative and if there are facilities for mechanised mixing the time factor can be reduced further. Alternatively, loose concentrates may be purchased ready-mixed in which case the labour demand for feeding will be similar to that for pelleted formulations.

**Table 6: Labour demands for feeding : number of man hours adjusted to 100 ewes**

Ewe diet	Silage + concentrate	Loose mix concentrate	Pelleted concentrate
<u>Late pregnancy</u>			
Feed baled silage	0.50	-	-
Mix concentrates	-	0.25	-
Feed concentrates	0.33	0.33	0.33
Man hours per day	0.83	0.58	0.33
Index	100	70	40
<u>Early lactation</u>			
Feed baled silage	0.83	-	-
Mix concentrates	-	0.25	-
Feed concentrates	0.83	0.83	0.83
Man hours per day	1.66	1.08	0.83
Index	100	65	50

### Feed costs

Critical appraisal of the role of complete concentrate diets must include cost as an important determinant of profitability. Comparative costs at 2001 prices are shown in Table 7. For the 6-week late pregnancy period, the silage budget per ewe was 0.25 t as fed, supplemented by 20 kg concentrates. The budget for each of the complete concentrate diets at the feeding rates shown in Table 2 was 60 kg per ewe. The difference in the cost of the silage and loose mix diets was small.

There was a similar pattern in feed costs for the 5-week early lactation period. The silage budget was similar to late pregnancy and was supplemented by 56 kg concentrates, i.e. 1.6 kg/ewe/day. The feed budgets for the loose mix and pelleted concentrate diets were 98 kg and 95 kg, respectively, at the feeding rates shown in Table 2. Again, the difference in cost between the silage and loose mix diets was small.

As in the case of labour inputs shown in Table 6, comparisons in feed costs are illustrated in Table 7 by expressing the results relative to the silage diet indexed at 100. When the labour inputs and feed costs shown in Tables 6 and 7 are combined, it is evident that loose concentrate mixes offer an attractive alternative to silage feeding at 2001 prices.

**Table 7: Comparative costs of ewe diets in 2001 (€/ewe)**

Ewe diet	Silage + concentrate	Loose mix concentrate	Pelleted concentrate
<u>Late pregnancy</u>			
Silage <sup>1</sup> 0.25 t	4.76		
Concentrates <sup>2</sup> 20 kg	<u>3.81</u>	8.57	
Loose concentrates <sup>3</sup> 60 kg		9.75	
Pelleted concentrates <sup>2</sup> 60 kg			11.43
Index		100	133
<u>Early lactation</u>			
Silage 0.25 t	4.76		
Concentrates 56 kg	<u>10.67</u>	15.43	
Loose mix concentrates 98 kg		15.92	
Pelleted concentrates 95 kg			18.09
Index		100	117

<sup>1</sup>Production cost €19 per t; <sup>2</sup>Purchase cost €190 per t; <sup>3</sup>Purchase cost €163 per t

### Management perspectives

The results presented above should be interpreted in the context of on-farm circumstances under which sheep enterprises are managed. All the ingredients in the loose mix used in this trial were purchased. In practice, home grown cereals may be available and their inclusion in loose mixes offer possibilities for cost-saving depending on opportunity costs associated with this practice. The use of pelleted concentrates as a complete diet is more difficult to assess because of higher costs. Again, however, there may be an opportunity cost in favour of the stockman's own labour relative to off-farm employment and resulting income.

### Early weaning systems

Results on lamb performance in the contrasting outdoor and indoor early weaning systems are shown in Table 8. Growth rate was significantly higher in the lambs managed indoor on the concentrate diet. However, following weighing and handling for body condition, sale weight and carcass weight were similar in both systems. But the grass-fed lambs were significantly older when finished, i.e. they required an extra 8 days feeding compared with their counterparts managed indoor. The high intake of creep feed at grass was very likely due to offering the feed *ad libitum* in contrast to previous trials when it was restricted.

**Table 8: Performance of early weaned lambs**

Diet	Grazed grass + creep feed	Concentrates	Significance
No. lambs	99	105	
Growth rate (g/day):			
5 weeks to sale	333	360	P<0.001
Sale wt. (kg)	40.6	39.8	NS
Carcass wt. (kg)	18.8	19.1	NS
Age (days)	119	111	P<0.001
Feed intake (kg/lamb)	55	82	

The extra feeding period required by the grass-fed lambs for finishing was a significant factor in the context of the early season market. Production of early lambs must be programmed to meet target sale dates in April/early May. Previous results by Flanagan (1999) showed that this objective can be achieved either by: (1) turning out ewes and lambs to early grass and offering creep feed, drafting finished lambs directly off their dams and weaning the remaining lambs at 12 to 14 weeks for further feeding, or (2) early weaning the lambs onto an all-concentrate diet for finishing indoor. Early grass is usually limiting and in this trial lambs were weaned 3 weeks earlier than normal so that grass resources for lambs could be maximised by removing the ewes and offering them silage indoor. For a full evaluation of this approach, however, the inclusion of a control group involving conventional weaning at 12 to 14 weeks would be required.

## CONCLUSIONS

For ease of management in housed flocks, concentrate rations can replace silage as the main diet for ewes in late pregnancy. Labour demand is reduced.

In early lambing flocks that are retained indoor post-lambing, concentrate rations can replace silage as the main diet during early lactation. Again, labour demand is reduced.

At 2001 prices the difference in the cost of feeding loose - mix concentrates as a complete diet compared with the conventional silage diet was relatively small.

Provided that complete concentrate diets are introduced gradually, that ewes are allocated appropriate feed trough space and that clean drinking water is continuously available, there are no management or health problems associated with the feeding of such diets.

There was no evidence in favour of weaning at 9 weeks of age onto grass plus creep feed compared with early weaning and finishing indoor on concentrates.

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## Appendix 1.

### Chemical analyses<sup>1</sup> of ingredients for loose mix

	<b>Whole barley</b>	<b>Sugar beet pulp</b>	<b>Soyabean meal</b>
Dry matter (DM) (g/kg)	876	846	877
Crude protein (g/kg DM)	111	114	547
DOMD (g/kg DM)	835	836	852
Crude fibre (g/kg DM)	43	138	44
Ash (g/kg DM)	23	90	66
Estimated ME (MJ/kg DM)	13.1	11.5	12.1

<sup>1</sup>Grange Laboratories