End of Project Report

EFFICIENT BEEF PRODUCTION FROM GRAZED PASTURE

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Contents

SUMMARY

Grass growth

- Experiments with small-scale field plots indicated that increasing the grass regrowth rotation length from 3 to 4 weeks had a marked effect on annual grass growth. This was similar in magnitude to the effect of an additional 150 kg N/ha year. This finding provides an opportunity, to be investigated in larger-scale experiments, to improve animal productivity per ha without increasing input costs. However, substantially new grazing management systems will need to be developed to harness the full potential of this exciting opportunity.
- Annual grass accumulations of 10 to 13 t/ha can be produced with an application of 300 kg N/ha. Nitrogen application rates and regrowth intervals have major effects on herbage production. Translating these findings into farm practices will provide significant advances for livestock production.

Early grazing

- Early turnout to pasture could reduce the winter feeding period for beef cattle by 3 to 4 weeks. This was achieved by having access to silage swards during the first grazing cycle, thus having the entire farm available for grazing.
- Grazing swards in spring reduced silage yields in May. Early defoliation was associated with the smaller yield reduction when swards were cut in late May. Later defoliations were associated with the greater yield losses in late May. However, when the herbage removed in the first grazing (spring) is taken into account, the effects on first cut silage yields are considerably reduced. The later swards are harvested (in May/early June), the smaller was the effect of spring grazing.
- Grazing swards in December or March reduced grass DM yield in mid May, the effects being greatest at the most severe grazing. The combined DM yield of grass harvested in December, March, May and July was not affected by treatment in December, but was reduced by the severe defoliation in March. Grazing swards in March increased DMD in May, particularly where swards

were not grazed in December.

- Substituting silage with a low allowance of grazed grass during the winter did not effect final carcass weight when animals were killed at the end of the subsequent grazing season. Compensatory growth was exhibited during the summer. However there was an economic advantage to substituting silage with grazed grass.

Autumn pasture production

- In undisturbed growth, herbage dry matter yield accumulated steadily during the first 9 weeks after closing (i.e. until late October/early November). The yield was then maintained for a further 5 to 6 weeks (until mid December), then declined.
- The summation of yields from a multiple of short growth intervals was less than those from a single longer growth intervals.
- However, accumulated yields from regrowths exceeding 5 weeks added little extra to dry matter production.
- Higher digestibilities were observed with short rotation herbage and the differences increasing with the age of regrowth.
- The results suggests that defoliation after short rest intervals in the autumn/winter, may produce more herbage in the following spring, and give better responses to applied nitrogen.
- Grazed autumn pasture is capable of supporting 0.75 kg liveweight/day. A 2% daily allowance (2% of bodyweight offered as herbage DM) resulted in an estimated carcass gain of 41 kg (over 92 days) and little extra gain was achieved by offering cattle a 50% higher herbage allowance.

Pasture cover estimation

- Measurement of pasture cover can be used as a useful grassland management technique to aid the decision making process in relation to herbage supply and herd demand.
- Sward height can be used as a management aid in determining pasture supply.
- A plate meter, when correctly used and calibrated can estimate herbage yields on grazing swards with an acceptable degree of

accuracy.
- On many drystock farms, pasture cover was found to be low for most of the grazing season.
- Considerable scope existed to improve animal performance throughout the year on many beef farms especially in the last third of the grazing season. Overall average daily gain for heifers and steers on all farms was 0.76 kg/day across the grazing season.
- In well-managed grazing swards, seasonal changes in digestibility are small.

Grazing preference
- In general, cattle exhibited a preference for tetraploids over diploids.

GRASS GROWTH STUDIES

BACKGROUND

Grass, either grazed or conserved, accounts for the largest component of ruminant diets in Ireland. Grazed grass is generally the cheapest feed source available on Irish farms. Maximising herbage production, should facilitate the inclusion of grass in the ruminant diet for a greater part of the year. Herbage production is affected by many factors both within and outside the farmers control. Grass growth varies widely between seasons and within season as a result of plant physiological and climatic changes. The ability to accurately predict or even measure current grass growth is of importance in relation to planned grassland management, where feed supply and demand need to be matched throughout the season. With a fixed number of animals, the feed demand on a beef cattle farm increases steadily over time which is not matched by grass supply. Documented data comparing both cutting and grazing grass growth rates in Ireland are minimal. Most protocols for measuring grass growth involve a cutting regime of either 3 or 4-week cycles. The effect of the grazing animal is absent in most situations. However, herbage production can readily be affected by the rate of fertiliser nitrogen used and the frequency of grazing/cutting management practices employed. The first two experiments reported here were undertaken to assess grass growth under grazing and cutting regimes and to determine the extent of differences which may arise from different harvesting procotols. The third experiment investigated the effect of nitrogen application rate and regrowth interval on annual herbage production.

Experiment 1.

Effect of varying nitrogen inputs, rest interval and method of herbage harvesting on grass dry matter production.

Methods used.

Grass growth rates (kg DM/ha/day) and total annual production (kg DM/ha) were determined throughout the growing season on a *Lolium perenne* (cv. Talbot) dominant sward. Comparisons were made of either a 3-week grazing (A) or cutting (B) cycle, receiving an annual fertiliser input of 300 kg N/ha or a 4-week cutting cycle receiving fertiliser inputs of either 300 kg N/ha (C) or 600 kg N/ha (D). Plots for cutting (Treatments B, C and D) were cut to a 4.0 cm stubble. Grazing plots were harvested similarly and were immediately grazed, until there was no visual (height) difference between the cut strip and grazed areas. Following grazing, which lasted about 6 hours, plots were cut to 4.0 cm and surplus grass removed. Average grass growth rates were determined by dividing the dry matter yield by the number of days growth (i.e. 21 or 28). Total annual dry matter production was the summation of the weekly growth for the calendar year.

Results.

Weekly grass growth and herbage DM accumulation is shown in Figures 1 and 2. Yield assessment by grazing as opposed to cutting had a significant effect on both growth rate and total production. Mean growth rates from Week No. 13 to 18 (April/May) were 30, 26, 40 and 50 kg DM/ha/day for treatments A, B, C and D, respectively. Differences in growth rate between treatments A and B during the first 5 weeks of measurement were generally not significant. However, increasing N application significantly increased estimated growth compared with treatment A. These differences disappeared during weeks 24 to 35, but were again evident at the end of the season . Protocols C and D resulted in significantly higher estimates of grass growth. Treatments B, C and D resulted in significantly (14, 44 and 54%) greater production than grazing on a 3-week interval.

Conclusions.

Increasing rotation length from 3 to 4 weeks markedly increased grass growth rates and thus total yields. Assessment under a cutting regime resulted in higher overall yields than using a grazing animal. Increasing the annual rate of fertiliser N from 300 to 600 kg N/ha increased herbage production, particularly in the early part of the season when grass growth rates were high.

Figure 1. Estimation of grass growth rate

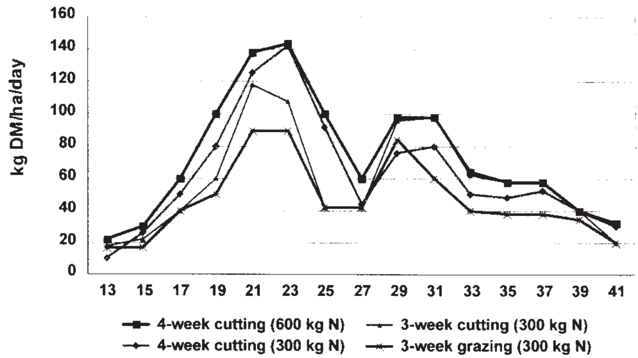
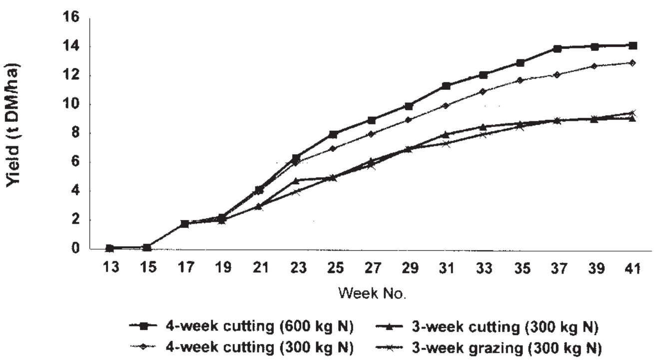


Figure 2. Dry matter accumulations



Experiment 2.

Effect of nitrogen application rate and grass regrowth interval on annual herbage production

Methods used.

Treatments consisted of either a 3-week cutting cycle receiving an annual fertiliser input of 0, 150 or 300 kg N/ha or a 4-week cutting cycle receiving fertiliser inputs of 0, 150 or 300 kg N/ha. A grazing treatment consisting of a 3-week regrowth interval and receiving 300 kg N/ha was also included.

Results.

Weekly grass growth and herbage accumulation data are shown in Figures 3 and 4. Total herbage production for the season was 5161, 8952 and 10,735 kg DM/ha on swards allowed to regrow for 3 weeks and receiving 0, 150 or 300 kg N/ha, respectively (Figure 5). Swards grazed by cattle on a 3 week regrowth cycle had an annual grass dry matter production of 11,500 kg DM. Allowing herbage to grow for an extra week (4 week regrowth) resulted in annual production increasing to 6340, 10,265 and 12,454 kg DM/ha on swards receiving 0, 150 and 300 kg N/ha (Figure 6). Both regrowth length and nitrogen application rate had a significant effect on herbage production. There was no nitrogen x regrowth period interaction. Within the 3 week regrowths, the mean production response to the first 150 kg N/ha was 25 kg DM/kg N applied and 12 kg DM/kg N applied for the second 150 kg N/ha increment. Within the 4 week regrowths, the corresponding response to the first and second increment of nitrogen were 26 and 15 kg DM/kg N. On the grazed swards, applied nitrogen (300 kg) gave a herbage production response of 21 kg DM/kg N.

Conclusion.

Allowing grass to regrow for an extra week (4 weeks compared with 3 weeks), resulted in extra herbage production which was equivalent to the production response to 150 kg N/ha.

Figure 3. Grass growth rate (kg DM/ha/d) on swards harvested at the end of 3-week regrowth

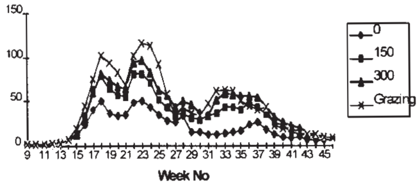


Figure 5. Total dry matter production (kg DM/h'a) for swards harvested at the end of 3-week intervals.

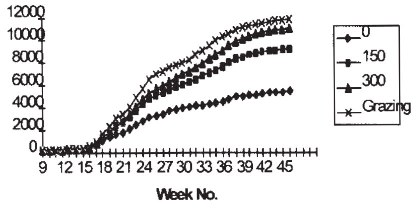


Figure 4. Grass growth rate (kg DM/ha/d) on swards harvested at the end of 4-week regrowth intervals.

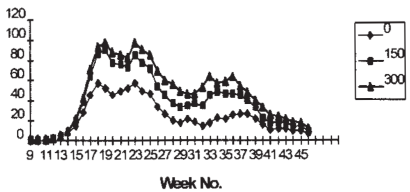
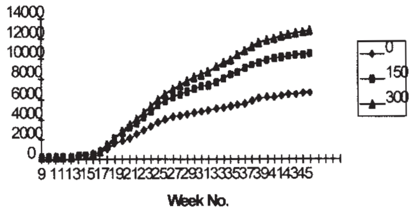


Figure 6. Total dry matter production (kg DM/h'a) for swards harvested at the end of 4-week intervals.



Experiment 3.

Effect of regrowth interval and nitrogen application rate on herbage production

Methods used.

Treatments consisted of either a 3-week or a 4-week cutting cycle, receiving an annual fertiliser input of 0, 150, 300 or 450 kg N/ha or a 3-week grazing cycle receiving an annual fertiliser input of 300 kg N/ha. Average grass growth rates were determined by dividing the dry matter yield by the number of days growth (i.e. 21 or 28). Total dry matter production was the summation of the daily growth throughout the year.

Results.

Weekly grass growth data are shown in Figures 7 and 8. Total herbage production for the season was 5372, 8960, 10240 and 13437 kg DM/ha on "cutting" swards with 3-week regrowths receiving 0, 150, 300 or 450 kg N/ha, respectively. Swards grazed by cattle (on a 3-week regrowth cycle) had an annual grass DM production of 13,099 kg. Allowing herbage on "cutting plots" to grow for an extra week (4-week regrowth) resulted in annual production increasing to 8273, 11837 and 13695 and 15793 kg DM/ha on swards receiving 0, 150, 300 or 450 kg N/ha, respectively. Both regrowth length and nitrogen application rate had a significant effect on herbage production. There was no nitrogen x regrowth interval interaction.

Within the 3-week regrowths, the mean production response to the first, second and third increment of 150 kg N/ha was 23, 8 and 21 kg DM/kg N applied. The corresponding response for 4 weeks regrowth to the first, second and third increment of nitrogen were 24, 12 and 14 kg DM/kg N. On the grazed swards, applied nitrogen (300 kg) gave a herbage production response of 26 kg DM/kg N. In general, greater production responses were obtained from an extra weeks grass regrowth than from the next increment of nitrogen applied. Thus, increasing nitrogen input within a 3-week regrowth cutting system, from 150 to 300 kg N/ha increased yield form 8533 to 9728 kg DM/ha, but production at 150 kg N/ha/year was increased to 11209 kg DM/ha when allowed to grow for 4 weeks. A similar observation was made when nitrogen was increased from 300 to 450 kg N/ha at a 3-week regrowth compared with a 4-week regrowth receiving 300 kg N/ha.

Conclusion.

The effect of allowing grass to regrow for an extra week (3 versus 4 weeks) resulted in extra herbage production which was equivalent to the production response to approximately 150 kg N/ha.

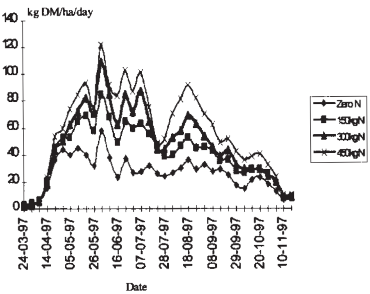


Figure 7. The effect of nitrogen level on grass growth

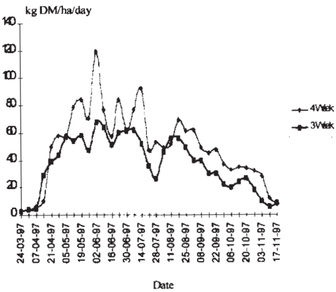


Figure 8. The effect of regrowth interval on grass growth

EARLY GRAZING

BACKGROUND

While grazed grass is the cheapest feed source on Irish farms, the provision of adequate winter forage is an essential requirement for efficient year-round livestock production. However, the associated costs of winter feed production and storage make silage a relatively expensive feed. To reduce animal production costs, a short indoor feeding period in association with a long grazing season is the option of choice. Little herbage DM accumulates during the period December to early March. Therefore, turnout of livestock to pasture in spring has to be delayed until grass growth begins and sufficient has accumulated to partly or fully support animal feed demand. Lack of available herbage, may be further complicated by poor grazing conditions especially on wet soils. However, stocking rate in spring can be reduced if the full farm is grazed during the first grazing cycle. The areas first grazed may be those destined for silage production and the negative yield effects of early grazing may be diminished by the extended time period available for the swards to recover. Start to the grazing season depends largely on location and it can vary by 3-4 weeks within Ireland. The digestibility of grass harvested in May for ensilage can be highly variable. This has been attributed to the failure to remove excess herbage from the sward the previous winter, or considerable accumulation of vegetation during growth in a mild winter. The experiments reported here were conducted to examine the effects of early turnout to grass on beef cattle production and on sward productivity.

New approaches to grassland management can shorten the winter by 3-4 weeks

Experiment 1.

Effect of early grass in the diet, on liveweight gains of beef cattle

Methods used.

The effects of early spring turnout to pasture on beef animal liveweight gains were investigated in two studies. In study 1, 48 yearling Friesian and Charolais cross steers with an initial weight of 320 kg, were assigned on a weight and breed basis to the treatments: A) early turnout on 22nd March, and B) normal turnout date on 12th April. Between turnout dates, animals on treatment A grazed 5 ha of pasture intended for silage production in late May and then grazed a separate 4.5 ha area (similar in size to treatment B) until mid June. Both treatments grazed separate areas (of similar size) throughout the year. Two silage harvests (late May and early July) were taken. Animal liveweights were recorded at every 14 days.

In a second study 2, 30 continental cross heifers, with an initial weight of 309 kg were assigned to one of three treatments on 15th March: 1) indoors full-time on an ad libitum silage, 2) pasture full-time, and 3) pasture for 3 to 4 hours/day, where a daily herbage dry matter allowance of 4 to 5 kg/head was offered. Treatment 2 had access to 3.6 ha of pasture intended for silage in late May, the paddocks within which were grazed once in sequence between 15th March and 12th April. Treatment 3 was offered a new daily allowance on a strip grazing basis. All animals were offered 2 kg rolled barley/head/day. After final turnout to pasture on 12th April, the three treatment groups grazed together.

Results.

In study 1, early turnout to pasture was associated with greater liveweight gains though the difference was not significant in early April (327 vs 319kg). Later weighings (July) were significantly (8 to 16 kg/animal) better for those livestock that were turned out early. From July onwards, weight differences decreased and were generally not significantly different for the remainder of the grazing season.

In study 2, both animal groups that had access to pasture had similar liveweights, which in turn were heavier (5 to 10 kg) than those turned out later. When weighed on 12th April, the early turnout group was 10 kg heavier. A difference of 5 to 6 kg remained until late August, after which treatments did not differ significantly.

Relative silage yields harvested on 22nd and 29th May, in the grazed areas of study 1, were 0.81 and 0.93, respectively. The 990 and 410 kg DM/ha lower yields on the grazed area compared with the ungrazed areas were significant. However, when the second silage harvest was taken on 7th July, the yield on the early spring grazed areas was 1.22 compared with the normally ungrazed control.

In study 2, the 10 animals on the 3.6 ha of silage sward (Treatment 2) exerted a grazing pressure of 900 kg liveweight/ha. Estimated grass dry matter and total dry matter intakes were 5.5 and 7.2 kg DM/head/day. Animals on Treatment 3 were offered 4.5 kg grass DM/head/day and grazed 1.25 ha over the 4-week period, exerting a grazing pressure of 2580 kg liveweight (8 animals/ha). An estimated 2.4 kg grass DM/head/day was consumed by the strip grazing animals, which decreased silage intake by 35% but increased total forage intake by 30%. The negative effects of grazing on silage yields decreased as the harvest date was delayed. When harvested on 18, 24 or 31 May, yields in the grazed areas were reduced by 21, 15 and 11% when rotationally grazed (Treatment 2) and by 25, 21 and 14% when strip grazed. However, only one third of the potentially available silage area was grazed by the strip grazing group so the net reduction in silage yield on the full silage area for the 3 harvest dates were 8, 7 and 5%, respectively.

Conclusions.

Based on these results, beef cattle could have the winter period reduced by 3 to 4 weeks as a result of early turnout to pasture. While silage yields in May were reduced by early spring grazing, this loss was less than the savings made by having a shorter winter. Second cut silage yields (early July) were higher on the areas which were grazed early in spring and this yield difference made up for the yield losses on the first harvest.

Experiment 2.

Spring grazing of silage swards: effects on yield

Methods used.

Cutting to simulated grazings was imposed at two severities (cut to 3 or 6 cm) on three dates in spring (30th March, 6th April and 13th April) on a three-year-old perennial ryegrass sward. Fertiliser applications of N, P and K were applied at rates of 150, 35 and 150 kg/ha, respectively after the spring defoliation dates. Respective control plots were similarly fertilised on these dates. Treatments were then harvested at four predetermined dates: 12th, 19th, 26th May and 2nd June where herbage was cut to a residual sward height of 4 cm. Yields were recorded and representative samples were obtained for chemical analyses and for separation into leaf, stem and dead materials. The proportion of seed-head emergence at silage harvesting was recorded.

Results.

Removal of herbage in late-March or April significantly reduced silage yields on all harvest dates (Table 1). Yield reductions on 12th May ranged from 56 to 18% compared with the uncut treatments fertilised on the same date. By 19th May, reductions were proportionally smaller and ranged from 44 to 26%. Yields had not fully recovered by 26th May, and by 2nd June the effect of grazing on 13th April was still associated with a significant yield reduction. The proportion of leaf in the undefoliated control treatments, decreased from 61% on 12th May to 50, 36 and 26% on 19th, 26th May and 2nd June. The corresponding proportions of stem increased from 32% to 43, 50 and 51%, respectively. Generally, defoliating to 3 cm in spring increased the proportion of leaf in the sward but the effects on the proportions of stems were less clear. The level of seed-heads emerging was significantly affected by spring grazing when harvested on 26th May, however, differences observed on 19th May or 2nd June did not attain significance.

Conclusion.

Spring defoliation of swards reduced silage yields in May. Earliest defoliation in spring was associated with lowest yield reductions in late May. Later defoliations were associated with the greater yield losses in late May. However, when the herbage removed in the first defoliation (spring) is taken into account, the effects of spring defoliations are much less when harvested in late May. Delaying harvesting to late May/early June, reduces the effect of early defoliation.

Table 1. **Effect of spring grazing on silage production.**

	Silage yield (t DM/ha) harvest date			
	May			June
	12	19	26	2
Not grazed Fertilised on				
30th March	6834	7954	8962	10572
6th April	5599(.82)[1]	7558(.95)	9762(1.09)	9801(.93)
13th April	5882(.86)	6960(.87)	9383(1.05)	10130(.96)
Grazed on 30th March				
to 3 cm	3606(.53)	4669(.59)	6706(.75)	7917(.75)
to 6 cm	4587(.67)	5880(.74)	7872(.88)	9178(.87)
Grazed on 6th April				
to 3 cm	3758(.67)	5034(.67)	6906(.75)	8200(.78)
to 6 cm	4599(.82)	5749(.76)	7627(.78)	8908(.91)
Grazed on 13th April				
to 3 cm	2690(.46)	3901(.56)	5541(.59)	6492(.64)
to 6 cm	3041(.52)	4688(.67)	6979(.74)	8074(.80)
s.e.	239	283	331	354
F-test	***	***	***	***

[1]proportion of control

Experiment 3.

Effects of defoliating grass swards in winter on subsequent silage yield and quality.

Methods used.

Four replicate blocks of nine plots were laid out in a permanent grass sward. Plots selected at random were left uncut (U) or were cut to 10 (H) or 5 (L) cm stubble height on 4th December. Within each of these 3 treatments, the three plots per block were subsequently left uncut (U) or were cut to a 10 (H) or 5 (L) cm height on 19th March to simulate grazing. All plots were harvested to a 5 cm stubble height on 20th May, precision-chopped and sub-samples ensiled in laboratory silos. The yields of the regrowth were determined on 7th July.

Results.

When grass was cut to nominal stubble heights of 10 (H) and 5 (L) cm on 4th December, the mean yields of DM harvested at that stage for the HU, HH, HL, LU, LH and LL treatments were 0.45, 0.38, 0.40, 1.34, 1.44 and 1.30 t/ha, respectively. Dry matter yields on 19th March were 0.91, 2.40, 0.34, 1.56, 0.20 and 0.47 t/ha for the UH, UL, HH, HL, LH and LL treatments, respectively. Table 2 summarises the yield data.

Table 2. First cut silage yield and quality and second cut yield.

	Uncut (U)			10 cm cut (H)			5 cm cut (L)				Significance		
	U	H	L	U	H	L	U	H	L	SEM[1]	D	M	D x M
Grass													
First-cut (May 20)													
DM yield (t/ha)	7.34	6.11	4.79	6.86	5.88	4.86	6.10	5.82	4.71	0.155	**	***	*
DM (g/kg)	157	153	142	154	149	143	151	154	150	3.8		*	
WSC (g/kg DM)	121	125	128	124	166	149	122	112	162	8.0	*	**	**
Buffering capacity													
(m.Eq/kg DM)	504	542	554	545	526	542	560	540	531	13.9			
NO3 (mg.l)	136	307	571	385	352	410	555	366	580	168.2			
Crude protein (g/kg DM)	179	190	196	181	181	196	182	194	193	8.4			
In vitro DMD (g/kg)	771	807	828	838	837	835	837	838	851	7.8	***	**	*
In vitro DOMD (g/kg)	685	719	738	753	754	749	753	749	767	8.5	***	*	*
Ash (g/kg DM)	114	99	100	93	98	92	94	91	96	4.3	**		
Regrowth - cut (July 7)													
DM yield (t/ha)	5.62	5.70	5.66	6.32	6.00	5.82	5.52	6.05	5.66	0.198			
DM (g/kg)	161	169	184	191	181	180	171	185	179	6.5			
Combined yields of DM (ha)													
May and July	12.96	11.80	10.45	13.18	11.87	10.68	11.62	11.87	10.36	0.278	*	***	
Dec. + March + May + July	12.96	12.71	12.85	13.63	12.59	12.64	12.96	13.51	12.13	0.299		*	*

[1]interaction SEM

Conclusions.

Defoliating swards in December or March reduced grass DM yield in mid May, the effects being greatest at the lower cutting height. The combined DM yield of grass harvested in December, March, May and July was not affected by treatment in December, but was reduced by low defoliation in March. Defoliating swards in December increased grass DMD in May, while defoliating to 5 cm in March increased DMD in May, particularly where swards were uncut in December. Defoliation did not alter grass buffering capacity, whereas, it did increase WSC concentration under some conditions. Defoliation, particularly, in December, reduced effluent production.

Experiment 4.

The role of grazed grass in beef production during the winter

Methods used.

In January, 36 continental crossbred weanlings were divided into 12 blocks on the basis of breed, sex, age and liveweight and randomly assigned from within blocks to three treatments. The treatments were (1) silage *ad-libitum* plus 3 kg concentrate, (2) silage *ad-libitum*, 3.5 kg grass DM plus 3 kg of concentrates and (3) 3.5 kg grass DM plus 3 kg of concentrate. In late September of the previous year, an area of grassland having been cut for silage was fertilised with 25 kg N/ha. Cattle on treatments 2 and 3 grazed this area from 9th January until 4th March, after which all treatments were grazed until slaughter (19th October and 9th November for the heifers and steers, respectively). Treatment 2 and 3 were let out each day for three hours to graze an area large enough to allow each animal a herbage allowance of 3.5kg of grass dry matter (above 4 cm). Concentrates were offered once daily after the grazing animals were re-housed. The grazing animals were housed (21 hr/day) in the same slatted-floor shed as those on Treatment 1. The mean herbage mass offered was 1956 kg DM/ha. The concentrates was composed of barley (0.82), soya (0.15) and min/vit (0.03).

Results.

Animals offered grass during the winter had lower liveweight gain (Table 3). However they fully compensated for this loss during the summer with a higher liveweight gain. Overall there was no effect of winter diet on liveweight gain over the full production year. There was no advantage in animal performance in offering a mixture of two forages. Feed intake and estimated feed costs are shown in Table 4. Grazed grass was the cheapest diet.

Table 3. The effects of winter diet winter liveweight gain, subsequent summer liveweight gain, total liveweight gain and carcass weight on suckler weanlings.

Diet	Winter liveweight gain	Summer liveweight gain	Total liveweight gain	Carcass Weight
Silage	1.25	0.82	0.93	316
Silage & Grass	0.86	0.88	0.88	309
Grass	0.68	1.00	0.93	316
SEM	0.041	0.039	0.033	5.3
Significance	***	*	n.s.	n.s.

Table 4. The effect of diet during the winter on silage intake and cost per day.

Diet	Silage intake (kgDM/hd/day)	Feed cost/day[1] (p)
Silage	4.55	70
Silage & Grass	3.52	73
Grass	0	46.5

[1] Assuming costs/kg DM: Grass = 3p, Silage = 7p, concentrate = 13p

Conclusion.

Substituting silage with a low allowance of grazed grass did not effect final carcass weight due to compensatory growth during the subsequent grazing season. However there was an economic advantage (Table 4) to substituting grazed grass with silage. There was no beneficial performance or economical advantage to offering cattle grass as a supplement to silage.

AUTUMN PASTURE PRODUCTION: EXTENDED GRAZING

BACKGROUND

The practise of building up grass in August/September and offering it to stock in October/ December has been advocated as a means of extending the grazing season. However, the reality on many well-stocked beef farms, is that the demand for grass in the autumn period far exceeds total farm supply. This can result in reduced animal performance at grass in the autumn. Clearly, if improved grass supply could be maintained in the autumn period, better animal performance may be expected along with a possible shortening of the winter period. The concept of deferred grazing has been introduced from New Zealand where autumn/winter climatic conditions differ significantly from those in Ireland. In New Zealand winter growth rates of 10 to 20 kg grass DM/ha/day in the main cattle farming regions are common. This contrasts sharply with the Irish scenario where grass growth rates are between 0 and 5 kg DM/ha for up to 15 weeks of the winter period. The challenge facing Irish grassland farmers is to successfully transfer any surplus late summer grass (if it arises) into the autumn/winter period. The present series of experiments investigated the effects of autumn closing dates on herbage yield and quality as well as their effects on sward productivity. The effects of short and long grazing rest intervals were evaluated in the context of autumn grass growth and their effects on subsequent spring growth.

Better animal performance in autumn can be achieved on many beef farms

Experiment 1.

Effect of regrowth interval in the autumn on growth of grass in the autumn/ winter period.

Methods used.

The effects of autumn regrowth intervals on grass accumulation were studied during the autumn/winter periods of two consecutive years. Fertiliser nitrogen in the form of calcium ammonium nitrate was applied on 1st September at rates of 35 and 50 kg N/ha in years 1 and 2, respectively. Treatments consistings of continual grass growth intervals ranging from 3 to 22 weeks after 1st September, were laid out in a randomised complete block design with five replications. Plots were harvested to a stubble height of approximately 4 cm. Further plots in the same design allowed for the comparison of repeated harvesting (such as 3, 4, 5 or 6 weeks), with the longer unharvested growth intervals.

Results.

Data presented represents the mean of the two years results. Grass dry matter yield accumulated (linearly) during the first 9 weeks (i.e. 1st September to 1st November) of continual growth, then plateaued until week 15 (mid-December) before declining (Table 5). The proportion of dead material in the sward increased from a value of 0.05 (average over weeks 3 to 7) to 0.16 and 0.34 in weeks 15 and 19, respectively.

Sward digestibility (in vitro DMD) was maintained over the first 9 to 10 weeks after closing at approximately 780 g/kg, declining to 700 g/kg in mid-December (week 15), and to 610 g/kg in late January.

Swards which were repeatedly harvested, generally produced less herbage dry matter than the corresponding continual growth treatments (Table 6). However, when repeatedly defoliated, extending the regrowth interval beyond five weeks showed little yield benefit. While short regrowth intervals tended to have higher digestibilities than longer regrowth intervals, these differences did not attain significance until the continual growth interval reached 12 weeks.

Table 5. Effect of growth interval from 1st September on total dry matter yields and on the proportion of dead matter and on sward digestibility.

	Weeks of uninterrupted growth (after 1st September)																
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	19	22	s.e.
Dry matter yield (kg/ha)	695	907	1168	1399	1670	1855	1979	1834	1830	1988	1985	2062	1857	1843	1646	1504	96.6
Proportion dead	0.07	0.05	0.06	0.03	0.04	0.07	0.09	0.08	0.10	0.12	0.13	0.13	0.16	0.21	0.34	0.29	0.009
DMD (g/kg)	782	774	796	785	799	804	788	786	762	768	750	717	706	719	668	611	7.0

Conclusions.

Dry matter accumulated in a linear manner during the first 9 weeks after 1st September closing date (i.e. until late October/early November). These accumulations were then maintained for a further 5 to 6 weeks (until mid December), but then declined. A summation of yields from short growth intervals produced less herbage than corresponding longer growth intervals. However, accumulated yields from regrowths exceeding 5 weeks added little in terms of extra production. Higher digestibilities were observed with the short rotation herbage and differences increased with time.

Table 6. Comparison of long and short regrowth intervals (closed on 1st September) on grass dry matter yields in autumn/winter (kg DM/ha)

			Dry matter production in favour of long rotation (kg DM/ha)	Sig. of effect of rotation length
Long rotation		Short rotation		
6 weeks growth	vs	2 x 3 week cycles	+49	NS
8 weeks growth	vs	2 x 4 week cycles	+401	**
9 weeks growth	vs	3 x 3 week cycles	+659	***
10 weeks growth	vs	2 x 5 week cycles	+339	*
12 weeks growth	vs	4 x 3 week cycles	+307	*
12 weeks growth	vs	3 x 4 week cycles	+558	***
12 weeks growth	vs	2 x 6 week cycles	+232	NS
14 weeks growth	vs	2 x 7 week cycles	+34	NS
15 weeks growth	vs	5 x 3 week cycles	+301	*
15 weeks growth	vs	3 x 5 week cycles	+383	**
16 weeks growth	vs	4 x 4 week cycles	+123	NS
16 weeks growth	vs	2 x 8 week cycles	-123	NS

Experiment 2.

Effects of autumn grazing interval on herbage production and sward composition.

Methods used.

The effects of autumn closing date and regrowth intervals on grass accumulation were studied in the autumn/winter period of 1995/96. In study 1, the experimental design consisted of 3 closing dates (1st August, 14th August and 18th September) laid out in a randomised complete block design with 4 replications. In study 2, the latter closing date (18th September) was used to further investigate the effects of regrowth intervals on herbage production. Treatments consisting of grass growth intervals ranging from 3 to 16 weeks were laid out in plots in a randomised complete block design. All treatments received 50 kg N/ha on their respective closing dates. Following yield estimation, plots were grazed by beef animals (400 kg liveweight) to a residual sward height of 4 to 5 cm.

Results.

The effects of harvest and closing date in the autumn on herbage DM production are summarised in Table 7. Similar dry matter yields were observed for the two August closing dates in study I where maximum yields of 2500 to 3000 kg were obtained in mid-November. However, yields began to decrease from mid-November onwards and by late December yields had reduced to half. The 1st August closing dates were characterised by a large proportion of dead material in the swards which increased from 19% on 18th October to >55% in late December, and from 13 to 50% over the same dates when closed on 1st and 14th August, respectively. Areas closed on 18th September reached a peak yield 7 to 8 weeks later. Yield generally decreased after this date and was associated with a large increase in sward dead material. Study 2, data comparing long and short regrowth intervals (Table 8) show that the yield after a 6-week growth was significantly higher than 2 x 3 week cycles, the yield difference being approximately 500 kg. The yield advantage (200 to 400 kg DM/ha) of the longer rest intervals 8, 9 or 10 weeks over the shorter regrowths failed to reach significance. The data shows that significantly less herbage was produced when rest intervals of 12 weeks or greater were compared with multiples of shorter grazing cycles. Analysis of the data shows that grass accumulation over the first 7 weeks after the 18th September closing date, was linear.

Table 7. Effect of date of harvest (in autumn) and closing on herbage dry matter yields (kg DM/ha) and proportion of dead matter in the sward.

	Harvest date														
Closing date	11/10	18/10	25/10	1/11	8/11	15/11	22/11	29/11	6/12	13/12	20/12	27/12	4/1	11/1	s.e.
1st August yield		2612	2367	2282	2941	2570	2500	2015	2239	1593	1607	1622	1852	1303	148.5
Proportion dead		.19	.19	.16	.32	.40	.44	.60	.52	.61	.58	.55	.65	.66	.043
14th August yield		1609	2014	2176	2528	2323	2389	1930	2020	1648	1790	1450	1740	1251	148.5
Proportion dead		.13	.18	.18	.23	.28	.28	.47	.57	.56	.49	.47	.62	.65	.043
18th September yield	941	1375	1747	1868	2060	2095	1747	2089	1856	1185	1502	1458	1620	1086	140 .1
Proportion dead	.01	.06	.10	.12	.17	.25	.17	.38	.40	.44	.50	.49	.59	.58	.043

Conclusion.

These data show that in terms of total herbage production there was little advantage in increasing regrowth intervals beyond 6 weeks.

Table 8. Comparison of long and short regrowth intervals on grass dry matter production (kg DM/ha) in the autumn/winter period (18th September closing date only).

Long growth period (weeks after closing)		Multiples of short rotations	Dry matter in favour of long rest intervals	Significant effect of rotation length
6	vs	2 x 3 week cycles	+494	*
8	vs	2 x 4 week cycles	+394	NS
9	vs	3 x 3 week cycles	+275	NS
10	vs	2 x 5 week cycles	+200	NS
12	vs	2 x 6 week cycles	-794	***
12	vs	3 x 4 week cycles	-990	***
12	vs	4 x 3 week cycles	-597	**
14	vs	2 x 7 week cycles	-671	**
15	vs	3 x 5 week cycles	-583	*
15	vs	5 x 3 week cycles	-162	NS
16	vs	2 x 8 week cycles	-1104	***
16	vs	4 x 4 week cycles	-1089	***

Experiment 3.

The effect of autumn grazing interval on subsequent spring herbage production

Methods used.

In spring plot from Experiment 2, Study 1 was divided into four subplots and randomly assigned to a spring nitrogen application treatment of either 0, 25, 50 or 75 kg N/ha.

Results.

Spring herbage production showed that when common final closing dates are compared, highest yields were observed on swards which were more frequently defoliated during the previous autumn (Table 9). Nitrogen application in spring increased herbage DM yields (from 940 to 1525 kg DM/ha). The yield response to 25, 50 and 75 kg N was 7.32, 8.3 and 7.75 kgDM/kg applied N. Greatest yield responses were associated with swards which had been managed under a repeated defoliation regime during the previous autumn.

The trend for autumn tiller counts (at the time of grazing) was for a higher tiller population under the more frequently defoliated swards. However, this increase was mainly due to an ingress of non-sown species and the contrast was greatest when swards were closed for the longer period of time. For example, swards which had been rested for one 12-week cycle had 6331 tillers per m^2 while swards which underwent four 3-week cycles had 7950 tillers per m^2. There were some exceptions to this trend but these differences were only significant in the two 3-week and one 6-week comparison (Table 10). In spring the number of Lolium tillers did not differ significantly with defoliation frequency. As nitrogen application increased from 0 to 75 kg N/ha there was an increase in total tiller populations with greatest response occurring as nitrogen was increased from 0 to 50 kg N/ha.

Conclusion.

The data indicate that shorter rest intervals in the autumn/winter produce more herbage the following spring and gave best responses to applied nitrogen .

Table 9. Comparison of spring yields in swards with common closing dates in the autumn/winter period.

Common closing dates	Yield of long rotation	Yield of short rotation	Yield advantage of long rotation	Significance of rotation
12 vs 2 x 6 week cycles	1114	1247	- 133	NS
14 vs 2 x 7 week cycles	1154	1682	- 528	***
15 vs 3 x 5 week cycles	774	1379	- 605	***
15 vs 5 x 3 week cycles	774	1264	- 490	***
16 vs 2 x 8 week cycles	769	1037	- 268	*
16 vs 4 x 4 week cycles	769	1181	- 412	***

Table 10. Comparison of tiller populations (/m2) for long and multiples of short rotations in the Autumn/Winter period (closed 18th September)

	Autumn		Spring	
Regrowth Interval weeks)	Total tillers ($/m^2$)	% Lolium Perenne	Total tillers ($/m^2$)	% Lolium Perenne
12 week	6331	85	11472	80
2x6 week	5319	82	10562	85
14 week	4787	92	9477	80
2x7 week	6094	78	10829	83
15 week	6587	80	11209	77
3x5 week	5450	59	10366	75
5x3 week	6306	50	11519	74
16 week	5156	97	11215	80
2x8 week	4281	77	9814	95
4x4 week	6969	23	11591	63

EFFECTS OF HERBAGE ALLOWANCE ON BEEF PRODUCTION FROM AUTUMN-GRAZED PASTURES

BACKGROUND

Grazed grassland is normally the cheapest feed source for ruminant livestock in temperature climates. Maximising the efficient use of grassland is a critical factor in reducing animal production costs. Thus, a long grazing season is desirable where animal performance is maintained. Generally, satisfactory performance by grazing cattle is achieved between May and August, but a late turnout in spring, often associated with poor grass supplies, together with poor daily gains by cattle in autumn have not been adequately investigated. Many farmers have, over the last 2 to 3 years, been supplementing grazed grass with concentrates. Previous studies have shown that, when pasture supply was adequate (although not defined), there was an uneconomic response to the concentrate supplement and that it merely replaced grass in the diet. The present study, looking at the effect of autumn grass supply on beef cattle performance, was undertaken to define the relationship between autumn herbage allowance, offered on a daily basis, and animal performance.

Methods used.

Forty continental cross breed steers (mean initial weight 660 kg) were assigned, based on breed and weight, to three herbage allowances and one indoor feeding treatment. Herbage allowances (kg DM/hd/day) (above 4 cm) of 1%, 2% and 3% body weight were given on a daily basis. Animals were weighed weekly and the weights used to assign the appropriate group mean herbage allowance. The indoor group was accommodated in slatted floor housing and offered a rolled barley (+ 1 kg straw DM/hd/day) based diet *ad libitum*. The experiment began on late August and lasted 92 days until 29th November. Herbage yields were determined twice/week and allowances offered on a daily basis.

Results.

The low herbage allowance (1%), supported a low level of animal performance (<0.4 kg/hd/day). The 2% and 3% herbage allowance generated similar daily liveweight gains of 0.75 kg/hd/day. Weight differences to the end of September were small and not significant, and subsequent weight differences were largely a reflection of the difference between the lowest herbage allowance and other treatments. Final liveweight was significantly affected by pasture herbage allowance. The weight difference between the 1% and both 2% and 3% herbage allowance treatments were significantly different. However, final carcass weight difference of 15 kg between the 1% and 2% allowances was significant, but the 5 kg difference between the 2% and 3% allowances did not attaining significance (Table 11). Estimated carcass gain over the 92 days were 25, 41 and 42 kg, for the 1%, 2% and 3% herbage allowance rates, respectively. While there was a tendency towards fatter carcasses with increasing herbage allowance, the differences failed to reach significance. Neither kill-out proportions nor carcass conformation score were affected by herbage allowance.

Housed animals that were assigned the rolled barley-based diet initially lost weight, but rapidly recovered. An outbreak of pneumonia in mid-October seriously restricted performance for approximately 3-weeks, after which stage, daily gains began to increase steadily. Animals offered the concentrate diet, despite the mid-term set-back, gained weight at approximately 1.25 kg/hd/day, overall, and resulted in carcass which were heavier and tended to have a better conformation and higher fat score than the animals fed grass outdoors.

Table 11. Effect of herbage allowance (kg DM/hd/day) and ad libitum diet on final liveweight, carcass weight and conformation and fat scores.

Herbage allowance (kg DM/hd/day) (on % bodyweight basis)	Final liveweight (kg)	Carcass weight (kg)	Conformation[1] score	Fat[2] score
1	701	370.5	3.4	3.93
2	730	385.1	3.1	4.01
3	730	390.1	3.2	4.14
Ad libitum barley	776	414.0	2.8	4.42
s.e. (for herbage allowance)	8.30	5.50	0.22	0.18

[1]Conformation score, 1 = best, 5 = poor
[2]Fat score, 1 = lean, 5 = fat

Conclusions.

Grazed autumn pasture was capable of supporting 0.75 kg liveweight/day and thus could be achieved with acceptable pasture utilisation. A 2% daily allowance resulted in an estimated carcass gain of 41 kg (over 92 days), and a further 50% reduction in stocking rate (2% vs. 3%) only resulted in an extra 5 kg carcass.

PASTURE SUPPLY/PASTURE COVER AND ITS ESTIMATION

BACKGROUND

The use of sward height as a rapid, non-destructive means of assessing pasture yields would be an aid to grassland management if close correlation between sward height and pasture yield was established. This would greatly facilitate grassland management decisions on issues such as herbage allowance pre-grazing and residual herbage mass post-grazing. While there are data in the literature which relate height and yield, there are little published data available in Ireland except those reported by Grange Research Centre. In the present study the sward height yield relationships were extended to include a wider range of pasture conditions both at Grange Research Centre and on commercial farms.

A plate meter can be used as a useful grassland management aid

Experiment 1.

Sward height as a measure of pasture herbage supply

Methods used.

Throughout the 1996 grazing season (April to December), sward height measurements, using a plate meter, and pasture yields, were determined under a range of pasture conditions. Sward height and pasture yields were recorded at weekly intervals at Grange Research Centre and at approximately two week intervals on eleven farms where swards were grazed by cattle or cattle and sheep. Swards at Grange Research Centre were predominantly *Lolium perenne* swards (2 to 3 years old) but also included grazed *Lolium perenne/Trifloium repens* swards and were typically yielded at 3 to 4 weeks stage of regrowth. Both grazing (cattle) and cutting swards were used. Nitrogen application rates ranged from 0 to 450 kg N/ha at Grange and 50 to 150 kg N/ha on commercial farms. On commercial farms, the Lolium perenne content of the swards ranged from 0.40 to 0.80. All swards were harvested to a stubble height of 4 cm. At farm level 0.25 m^2 quadrats were used to estimate yield and stubbles were again cut to 4 cm. Four to five sward height measurements were recorded within each quadrat before herbage was cut.

Results.

Regression equations derived from 2210 height-yield pairs which related sward height (x, cm) and herbage DM (y, kg DM/ha) for pre-grazing were described by the linear equation $y = 242x - 804$. This relationship accounted for 70% of the variation. Table 12 summarises the output from this equation.

Conclusion.

Sward height can be used as a management aid with acceptable reliability, in determining pasture supply. Further calibration at farm level on differing sward types would further strengthen the usefulness of sward height as a grassland management aid.

Table 12. Relationship between sward height and pasture yield (kgDM/ha) for pre-grazing swards (N=2210)

Height (cm)	Yield (kg DM/ha)	Height (cm)	Yield (kg DM/ha)	Height (cm)	Yield (kg DM/ha)	Height (cm)	Yield (kg DM/ha)	Height (cm)	Yield (kg DM/ha)
5.0	405	8.0	1131	11.0	1857	14.0	2582	17.0	3308
5.1	430	8.1	1155	11.1	1881	14.1	2607	17.1	3332
5.2	454	8.2	1179	11.2	1905	14.2	2631	17.2	3357
5.3	478	8.3	1204	11.3	1929	14.3	2655	17.3	3381
5.4	502	8.4	1228	11.4	1954	14.4	2679	17.4	3405
5.5	526	8.5	1252	11.5	1978	14.5	2703	17.5	3429
5.6	550	8.6	1276	11.6	2002	14.6	2728	17.6	3453
5.7	575	8.7	1300	11.7	2026	14.7	2752	17.7	3478
5.8	599	8.8	1325	11.8	2050	14.8	2776	17.8	3502
5.9	623	8.9	1349	11.9	2074	14.9	2800	17.9	3526
6.0	647	9.0	1373	12.0	2099	15.0	2824	18.0	3550
6.1	671	9.1	1397	12.1	2123	15.1	2849	18.1	3574
6.2	696	9.2	1421	12.2	2147	15.2	2873	18.2	3598
6.3	720	9.3	1446	12.3	2171	15.3	2897	18.3	3623
6.4	744	9.4	1470	12.4	2195	15.4	2921	18.4	3647
6.5	768	9.5	1494	12.5	2220	15.5	2945	18.5	3671
6.6	792	9.6	1518	12.6	2244	15.6	2970	18.6	3695
6.7	817	9.7	1542	12.7	2268	15.7	2994	18.7	3719
6.8	841	9.8	1566	12.8	2292	15.8	3018	18.8	3744
6.9	865	9.9	1591	12.9	2316	15.9	3042	18.9	3768
7.0	889	10.0	1615	13.0	2341	16.0	3066	19.0	3792
7.1	913	10.1	1639	13.1	2365	16.1	3090	19.1	3816
7.2	938	10.2	1663	13.2	2389	16.2	3115	19.2	3840
7.3	962	10.3	1687	13.3	2413	16.3	3139	19.3	3865
7.4	986	10.4	1712	13.4	2437	16.4	3163	19.4	3889
7.5	1010	10.5	1736	13.5	2462	16.5	3187	19.5	3913
7.6	1034	10.6	1760	13.6	2486	16.6	3211	19.6	3937
7.7	1058	10.7	1784	13.7	2510	16.7	3236	19.7	3961
7.8	1083	10.8	1808	13.8	2534	16.8	3260	19.8	3986
7.9	1107	10.9	1833	13.9	2558	16.9	3284	19.9	4010

Experiment 2.

Annual pasture cover on a dairy calf-to-beef system

Methods used.

Pasture availability was measured weekly on grazed grassland on a calf-to-beef production system, finished steers at 24 to 26 months of age. The system was stocked annually at 2.5 LU/ha and calves grazed in front of the yearlings in a leader follower system. The entire area (24 ha) was divided into two units. On each unit 0.40 of the area was grazed from turnout until mid-June, 0.55 grazed until mid-August and the entire area was grazed until housing (November). The units comprised either 5 or 10 paddocks until June, 6 or 12 paddocks until August and 8 or 16 paddocks until housing, on the Standard and New System, respectively. On one day per week (Monday), the availability of pasture was measured using a plate meter (32 x 32 cm). Ten sward heights were recorded on each paddock and mean height (weighted for paddock size) was recorded for each grazing unit. Sward height (cm) was converted to herbage yield (kg DM/ha) by an equation established at Grange Research Centre. The summation of weighted yield on each paddock was calculated to give pasture cover (expressed as kg DM/ha on the entire grazing area).

Results.

The mean pre-grazing yield for the leader (calves) group was 1949 and 2039 kg DM/ha on the Standard and New System, respectively. Corresponding post-grazing yield for the leading groups (also pre-grazing for the followers) was 1219 and 1238 kg DM/ha. The followers reduced herbage yield to 465 and 481 kg DM/ha. Grazing height for the Standard and New Systems was 10.5, 10.8 and 7.6, 7.7 and 4.6 and 4.8 cm for pre-leaders, post-leaders and post-followers, respectively. There was no significant difference between both systems in terms of herbage yield or grazing height.

Pasture cover at turnout (15 April, 1996) was less than 500 kg DM/ha and herd demand was estimated to be 40 kg DM/day on the grazing area (Figure 9). Pasture cover increased to reach a maximum cover of approximately 1400 to 1600 kg DM/ha at which point herd demand had increased to 56 kg DM/ha/day on each hectare of the grazing area. Grass surplus to herd demand was harvested (big bales) from 0.20 of the grazing area on both units in early June. The effect was to reduce pasture cover to approximately 900 kg DM/ha. A further 0.20 of the grazing area had surplus grass removed from the New Systems, but the availability of pasture for grazing remained similar on both units. A pasture cover of approximately 800 kg DM/ha was established in mid-summer and the overall pasture cover increased as silage aftermath became available from late summer (August) onwards. Pasture cover decreased from early September as the demand by the herd (35 kg DM/ha/day on whole unit) exceeded pasture growth rates. Animals were finally removed from pasture when the pasture cover decreased to less than 500 kg DM/ha and this occurred 14 days later on the New System.

Conclusion

Pasture cover can be used as a grassland management technique which aids in the decision making process in relation to herbage supply and herd demand.

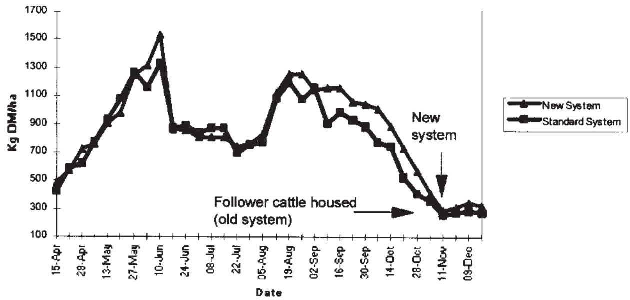


Figure 9 Pasture cover on a dairy calf-to-beef system (1996)

Experiment 3.

On-farm monitoring of grassland management and animal performance on beef farms.

Methods used.

Eleven farms were selected, ranging in size from 22 to 55 ha, and case-studies carried out. Rotational grazing was practised on all farms. Sward height was measured using a plate meter once per month in May, June, November and December, and at fortnightly intervals from July to October. These heights were converted into DM yields using a formula reported earlier. On each farm visit, four grass DM yield estimates were made per field where cattle (i) were grazing and (ii) had last grazed, and the herbage was cut to a stubble height of 4cm after measuring sward height. Estimates of DM yield (kg DM/ha) were also subjectively made by eye. On each farm visit, representative samples of herbage available for grazing were obtained for laboratory analysis (DMD, DOMD, etc.). Sward botanical composition was determined on representative sod samples taken from each field. Cattle weights were recorded at turnout (weight 1), twice during the summer (weights 2 and 3) and at housing (weight 4).

Results.

Botanical analysis showed total tiller counts ranging from less than 10,000 to approximately 14,000 tillers/m^2 (Table 13). Analysis of the swards show that within a farm the *Lolium perenne* content varied from field to field, but for the farm as a whole (weighted for field size) ranged from 39% to 77%, though typically 50% to 60%. The average post-grazing yield was 463kgDM/ha which approximated to a post-grazing height of 6cm. Heights as low as 2 to 3cm were recorded on occasions. Grass analysis results show DMD values ranging from 695 to 800g/kg, 634 to 793 g/kg, and 565 to 818 g/kg for July, late summer, and early autumn periods respectively. Pasture cover(kg DM/ha) is summarised (Table 14) for seven farms from 3rd June and at approximately three weekly intervals thereafter until 1st December. Animals were housed on most farms between weeks 43 and 46, leaving a ground cover range of 20 to 460kg DM/ha on pastures.

Animal performance data are summarised in Table 15. No farm achieved 1kg liveweight gain per day for the entire grazing season. However some farms did have gains of greater than 1kg/head/day from turnout until August /September, but failed to maintain this level of performance.

Table 13 Total tiller and Lolium perenne tiller numbers/m[2] and the percentage L. perenne on each of 11 farms during November 1996.

Farm	Total tillers/m2	L.perenne tillers/m2	% L.perenne per farm
1	10997	6683	61
2	12779	4962	39
3	14309	8782	61
4	9266	7116	77
5	10685	5796	54
6	12640	7016	56
7	12701	7007	55
8	11683	4582	39
9	12416	7913	64
10	10683	5934	56
11	10153	5905	58

Table 14 Pasture cover (kg DM/ha) for 7 farms for week no. 23(3rd June) and at three weekly intervals to week no. 48 (1st Dect) of the 1996 calendar year

Week No.	23	26	28	31	34	37	40	43	46	48
Farm	Pasture cover (kg DM/ha)									
1	NA	1200	980	960	1140	1100	550	240	100	20
2	920	1720	1040	600	1080	1080	320	120	50	30
3	680	1220	1650	960	720	760	680	460	280	160
4	1680	900	600	630	370	380	190	90	30	10
5	2250	1950	1000	640	900	890	800	450	250	60
6	1180	1190	1360	940	1200	110	760	360	120	40
7	1160	1220	880	430	450	470	380	160	20	0

Plate height readings on most grazing swards was between 7 to 9 cm (equivalent to pasture covers of 900 to 1400 kg DM/ha) (Table 16) during period 2. For some farms, average sward heights grazed during period 3 were between 4 to 5 cm (pasture cover of 150 to 400 kg DM/ha). These swards were mostly good quality, short, leafy swards. Average grass quality (DMD) of 753 g/kg and 746 g/kg was grazed by steers and heifers, respectively, on all farms during the grazing season (Table 17). Botanical analysis showed total tiller counts ranging from <10,000 to 14,500 tillers/m2 with *Lolium perenne* accounting for 55%. *Poa spp*. and *Agrostis spp*. accounted for 30% and 15%, respectively. Steers performed better than heifers by 0.1 kg/head/day. In general, animal performance was higher early in the season.

Table 15 Liveweights(kg), daily gains(ADG) for heifers(H) and steers(S) on nine farms during the 1996 grazing season

Farm	Sex	Weight 1 (kg)	ADG kg/day	Weight 2 (kg)	ADG kg/day	Weight 3 (kg)	ADG kg/day	Weight 4 (kg)	Overall ADG kg/day
1	H	381	0.35	410	----	----	0.41	466	0.38
2	H	283	0.89	336	0.91	428	0.73	465	0.84
	S	271	1.23	345	1.01	447	0.58	476	0.94
3	H	361	0.70	412	1.11	490	0.37	510	0.73
	S	402	1.03	477	1.30	569	0.31	586	0.88
4	H	316	0.83	390	0.74	446	0.44	468	0.67
	S	319	1.17	423	0.84	487	0.93	533	0.98
5	H	363	0.94	413	0.56	460	0.71	505	0.74
	S	435	0.88	504	0.64	544	0.68	587	0.73
6	H	365	0.23	378	0.95	433	0.97	500	0.72
	S	431	0.34	450	0.93	518	0.90	570	0.72
7	S	351	0.76	420	0.52	456	0.60	484	0.63
	S	227	0.81	300	0.55	338	0.91	380	0.76
8	H	343	1.34	427	0.58	456	0.54	508	0.82
	S	398	1.33	482	0.48	576	0.74	576	0.85
9	S	430	0.88	509	0.85	574	0.54	601	0.76

Conclusion.

Swards were predominantly *Lolium perenne*. Overall average daily gain for heifers and steers on all farms was 0.76 kg/day across the grazing season. Pasture cover, or the DM yield per hectare, was quite low on farms for most of the grazing season. Considerable scope existed to improve animal performance throughout the year on some farms, and in period 3 on most farms. In some cases it is suggested that grazing below 5 cm contributed to reduced animal performance. In well-managed grazing swards, seasonal changes in digestibility were small.

Table 16 Mean pasture cover, mean sward height being grazed and average daily gains for steers and heifers, for the periods between cattle weighings

	Mean pasture cover kg DM/ha			[2]Sward height (cm) Steers			ADG of steers kg/day			2Sward height (cm) Heifers			ADG of heifers kg/day		
Farm	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3
1	1088	816								7.5	6.5	6.5	0.35	0.41	0.41
2	914	991	222	4.4	8.2	6.5	1.23	1.01	0.58	6.4	7.8	6.5	0.89	0.91	0.73
3	545	903	691	7.1	6.7	6.7	1.03	1.30	0.31	7.1	6.7	6.7	0.70	1.11	0.37
4	2713	1198	738	20.2	9.6	6.5	0.88	0.64	0.68	20.2	9.6	6.5	0.94	0.56	0.71
5	1196	1168	937	8.2	8.3	7.2	0.34	0.98	0.90	6.5	6.9	8.7	0.23	0.95	0.97
6	239	189	318	4.5	4.9	5.0	1.33	0.48	0.74	4.2	3.2	4.8	1.34	0.58	0.54
7[1]	750	320	150												
8	443	787	722	4.4	4.9	7.8	0.88	0.85	0.54						
9	570	360	220	4.2	5.5	4.1	1.17	0.84	0.93	4.1	4.5	3.2	0.83	0.73	0.46
10	1069	623	337	6.8	6.8	3.4	0.76	0.52	0.60						
11	499	681	345	5.3	5.1	3.9	1.07	0.72	0.46	2.9	3.1	4.4	0.99	0.71	0.37
Mean	911	731	468	7.2	6.7	5.7	0.95	0.79	0.67	7.4	6.0	6.0	0.78	0.75	0.57

ADG = average daily gain
Period 1 is the time period between weight 1 and weight 2 (turnout to mid-June)
Period 2 is the time period between weight 2 and weight 3 (mid-June to late August)
Period 3 is the time period between weight 3 and weight 4 (late August to housing)
[1]Mean weight dates were used for this farm (weanlings only)
[2]Mean sward height being grazed (averaged for the number of visits) during each period

Table 17 Quality (DMD in g/kg) of grass being grazed by steers and heifers in the periods between weighings

	Farm	1	2	3	4	5	6	7	8	9	10	11	Mean
Steers	Period 2		721	736	778	746	755		756	769	718	713	744
	Period 3		679	776	787	783	771		789	796	774	704	762
Heifers	Period 2	749	755	696	778	779	734			727	754	765	748
	Period 3	749	679	776	787	771	762				743	684	743

Periods 2 and 3 are same as those given in Table 16
Weanlings only on farm 7

GRAZING PREFERENCE AMONG LOLIUM PERENNE CULTIVARS

BACKGROUND

Ireland, in common with many countries, does not routinely impose an animal grazing assessment on the grasses under evaluation for inclusion on the National Recommended List. Characteristics such as palatability or a grazing preference *in vivo* is not assessed. Livestock farmers sometimes claim that there are grazing preferences between different grasses. There is little evidence to support or contradict these claims. The aim of the present experiment was to determine if such preferences existed within the ryegrasses on the National List.

Methods used.

Twenty-four Lolium perenne cultivars were sown in autumn 1992, in a randomised, complete block design and replicated three times. Grasses were representative of the three heading date categories: early (E) (3 diploid and 3 tetraploid), mid-season (M) (6 diploid and 3 tetraploid) and late (L) (6 diploid and 3 tetraploid). The early heading date cultivars of both diploid (D) and tetraploid (T) were represented by Yatsyn, Ramore, Moy, Bastion, Green Isle and Rosalin. The mid-season cultivars were represented by Magella, Morgana, Talbot, Amigo, Carat, Respect, Nutria, Twins and Everest. The nine late-heading cultivars were Antara, Tyrone, Hercules, Portsteward, Sommora, Trani, Tivoli, Condessa and Belfort. All grasses received a similar pasture management during 1993 and 1994. In early March 1995, 50 kg N/ha equivalent was applied to each cultivar. On 5th May, dry matter yields (above 4 cm) were determined on each plot. Twenty-five Charolais cross heifers then grazed the entire site for 24 hrs until approximately 50% of herbage (assessed by eye) on the site was consumed. Animals were then removed and post-grazing yields were determined. The proportion of herbage grazed on each treatment was determined. The site was immediately grazed to approximately 5 cm stubble height before being topped and 100 kg N/ha was applied. The site was harvested for silage 6 weeks later, then fertilised with 35 kg N/ha and a second estimate of grazing preference conducted on 24th July. Yields assessment and procedures were as before. During each of the measurement periods, the same animals were used and each had free access to all grasses. After the second grazing, the site was again fertilised for silage production. The procedures were repeated in 1996 and three assessments were made in May, July and November with herbage being conserved between the three palatability measurement dates.

Results.

For the first year mean pre-grazing yields were 1891 and 1546 kg DM/ha for harvest 1 and 2, respectively and 2398, 1742 and 1533 kg DM/ha and 1510, 1485 and 1645 kg DM/ha for the early, mid-season and late heading date groups, respectively in harvest 1 and 2. The mean proportion of herbage on offer (above 4 cm) which was eaten was 0.66 and 0.53 for harvest 1 and 2, respectively. For harvest 1, tetraploids had significantly higher pre-grazing yields. There was no ploidy x heading date interaction. Ploidy had a significant effect on the proportion of herbage removed by cattle. Tetraploid grasses had 0.73 and diploids 0.53 of available herbage removed. Fitting pre-grazing yield as a covariate in the analysis model showed that in harvest 1, the proportions of herbage removed were 0.57, 0.56 and 0.60 for the three heading date diploid cultivars, and those for the tetraploids were 0.71, 0.73 and 0.75 for the early, mid and late season heading cultivars. The ranking of grazing preferences, as measured by the proportions of herbage offered being removed by grazing, are given in Table 18. The five highest preferences in harvest 1, were tetraploid grasses and the eleven lowest were diploids. Nine out of twelve grasses having the highest preference in harvest 1, were also highly rated in harvest 2 although not in the same order. Likewise, nine out of twelve ranked poorly in harvest 1, were also ranked in this category in harvest 2.

In harvest 2, neither heading date or ploidy were significantly different in relation to the proportion of herbage removed by grazing animals. However, when the pre-grazing yield was fitted as a covariate to the model, grass ploidy had a significant effect on the proportion of herbage removed. Again there was no grass ploidy x heading date interaction.

In year 2, mean pre-grazing yields for harvest 1, were 2430, 2070 and 1720 kg DM/ha for early, mid- and late-season ryegrasses, respectively. Corresponding values for harvest 2 were 2200, 2430 and 2350 kg DM/ha and 1380, 1400 and 1490 kg DM/ha for harvest 3. Ploidy had no effect on pre-grazing harvest yields. The mean proportion of herbage removed (pre- minus post-grazing yield) was 0.51, 0.76 and 0.53 for harvest 1, 2 and 3, respectively.

Ploidy had a significant effect on the proportion of herbage preferentially removed by grazing and there was a ploidy x harvest interaction. Heading date affected the proportion of herbage removal but there was no harvest x heading date interaction. The proportion of herbage removed ranged from 0.80 to 0.12 for harvest 1, from 0.84 to 0.65 for harvest 2 and 0.73 to 0.32 for harvest 3. For harvest 1 in 1996, ten of the twelve highest ranking grasses were similarly ranked in 1995, although not in the same order. The proportions of herbage removed in harvest 2 were high in all cases and meaningful grazing preferences could not be established. Tetraploid grasses predominated in the highest ranked grazing preferences.

Conclusions.

Grazing preferences were evident in May and there was a repeatability among cultivars in preference ranking in both years. In general, cattle exhibited a preference for tetraploids over diploids.

TABLE 18 Effect of ryegrass heading date and ploidy on the proportion of herbage removed by grazing beef cattle.

			1995				1996					
Cultivar	Heading Date		Proportion of herbage removed		Preference rank		Proportion of herbage removed			Preference rank		
Name		Ploidy	Harvest 1 May	Harvest 2 July	Harvest 1	Harvest 2	Harvest 1 May	Harvest 2 July	Harvest 3 November	Harvest 1	Harvest 2	Harvest 3
Condessa	Late	Tetraploid	0.82	0.51	1	12	.75	.81	.60	2	5	5
Nutria	Mid	Tetraploid	0.82	0.62	2	6	.80	.72	.73	1	19	1
Bastion	Early	Tetraploid	0.79	0.64	3	4	.71	.77	.58	5	11	7
Tivoli	Late	Tetraploid	0.78	0.58	4	8	.71	.76	.65	4	12	3
Everest	Mid	Tetraploid	0.75	0.69	5	1	.63	.78	.66	9	8	2
Talbot	Mid	Diploid	0.70	0.57	6	10	.51	.78	.32	14	7	24
Hercules	Late	Diploid	0.69	0.67	7	2	.64	.84	.62	6	1	4
Antara	Late	Diploid	0.68	0.47	8	17	.54	.73	.55	13	18	11
Rosalin	Early	Tetraploid	0.68	0.63	9	5	.55	.75	.52	11	15	12
Green Isle	Early	Tetraploid	0.67	0.57	10	9	.63	.73	.55	8	10	10
Belfort	Late	Tetraploid	0.66	0.51	11	14	.72	.82	.51	3	3	16
Portstewart	Late	Diploid	0.64	0.51	12	15	.63	.75	.59	7	14	6
Twins	Mid	Tetraploid	0.62	0.51	13	13	.56	.74	.48	10	17	18
Ramore	Early	Diploid	0.62	0.46	14	19	.30	.84	.40	20	2	20
Sommora	Late	Diploid	0.60	0.53	15	11	.54	.82	.40	12	4	22
Magella	Mid	Diploid	0.60	0.61	16	7	.46	.79	.52	16	6	13
Trani	Late	Diploid	0.59	0.29	17	24	.22	.71	.52	23	21	14
Moy	Early	Diploid	0.56	0.44	18	21	.12	.69	.41	24	22	19
Respect	Mid	Diploid	0.55	0.64	19	3	.24	.72	.34	22	20	23
Amigo	Mid	Diploid	0.54	0.46	20	18	.46	.67	.56	15	23	8
Yatsyn	Early	Diploid	0.54	0.38	21	23	.25	.78	.48	21	9	17
Morgana	Mid	Diploid	0.49	0.49	22	16	.45	.65	.40	17	24	21
Carat	Mid	Diploid	0.49	0.45	23	20	.33	.75	.52	19	16	15
Tyrone	Late	Diploid	0.43	0.38	24	22	.35	.75	.55	18	13	9

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