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Project 3158

Effect Of Grazing Management On The Maintenace Of White Clover

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Effect of grazing management on the maintenance of white clover

by

T. Nolan and E. J. Grennan
Sheep Production Department
Teagasc Research Centre
Athenry, Co. Galway

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SUMMARY

The objectives of the project were to compare different cultivar types and methods to establish and maintain them in reseeded and permanent pastures as a basis for efficient low cost sheep production. In Ireland only 3% of pastures are reseeded annually and permanent pastures rarely contain more than 5% white clover. Improved clover content offers benefits of higher lamb growth rate and reduced fertiliser N use.

Comparisons under cutting conditions provided no basis for replacement of Grasslands Huia by the new cultivar Aberherald. Grasslands Huia established successfully following direct reseeding and rotational grazing by sheep. It established more quickly than Kentish and gave higher yield only in the first year. A mixture of small and medium size white clovers should be sown for sheep grazing. Increasing seeding rate from 2 to 4 kg per ha increased pasture clover content only in the first year. Grasslands Huia persisted quite well for up to 5 years under rotational sheep grazing. It also survived under continuous grazing but leaf size was reduced.

Rotational grazing management with sheep increased the clover content of permanent pasture from under 2% to 4% over 2 years. Highest clover yields were achieved with rest intervals of 20 to 28 days. Simulated mixed sheep and cattle rotational grazing on permanent pasture resulted in intermediate (10 to 12%) clover dry matter contributions to total dry matter compared with cattle (15 to 18%) and sheep (5 to 8%). Lamb growth rate was about 35% higher when the clover content of the sward was increased from very low to about 35%.

INTRODUCTION

Improvement of the clover contribution to pasture production is important due to its ability to improve pasture quality and to substitute fertiliser N. Clover in old pastures is generally a small-leaf ecotype which is less productive than new cultivars. Low tolerance to cool, wet climatic conditions is a particular problem resulting in rotting of stolons in winter, reduced number of growing points in spring and inability to compete with companion grasses to make a worthwhile contribution over the growing season. Apart from ploughing and reseeding, which is not practical on a national scale, various methods of clover establishment, such as drilling, surface seeding, incorporation of clover seed with slurry etc., have been examined with generally unpredictable results. About 3% of pastures are reseeded annually. The development of a predictable and widely applicable methodology is of particular interest in Ireland where about 80% of pastures are of the semi-natural permanent type with an estimated growing season average clover contribution to dry matter (DM) of not greater than 5%. Efficient grassland production and use is critical when considered against current costs of concentrates, silage and grazed grass in Ireland in the ratio 5:3:1.

The aims of the research were to compare different cultivar types, seeding rates, grazing managements and grazing by cattle, sheep and their mixes on the development and maintenance of white clover using reseeded and permanent pastures. The effects on lamb growth rate of different white clover contents in grazed pasture were also measured at different stocking rates and at different pasture DM allowances.

COMPARISONS OF WHITE CLOVER CULTIVARS

Aberherald vs Grasslands Huia

The relative suitability of the new clover, cv Aberherald, compared with the widely used Grasslands Huia for cool, wet climates where winter survival is a problem was evaluated under cutting conditions. Both cultivars were sown with Hercules, a diploid, late season perennial ryegrass which flowers June 2 to 14, and Everest, a mid-season tetraploid perennial ryegrass which flowers May 21 to 29. Following ploughing and cultivation, grasses and clovers were sown at seeding rates of 25 and 3 kg/ha in spring 1994. N fertilisation at sowing, at the beginning of spring growth and after each cut was 25 kg per ha. Soil P and K levels were about 10 and 140 ppm. Periodically during winter, various morphological characteristics were measured and during the growing season 3 cuts, each of 10 cm x 1 m were taken to ground level each time grass growth reached a height of approximately 20 cm and the contributions of grass, clover and weeds to total DM were estimated.

Results show that Aberherald had significantly ($P<0.001$) higher specific stolon weight (g per cm length) (Table 1) and significantly ($P<0.001$)

Table 1: Specific stolon weight (g/cm) - results for Grassland Huia and Aberherald grown with Everest and Hercules ryegrass

Year	Huia		Aberherald	
	Everest	Hercules	Everest	Hercules
95/96	10.7	8.9	13.6	14.2
96/97	10.6	11.0	10.1	14.1

more leaves per m^2 of land area compared with Huia (Table 2). It had significantly ($P<0.05$) lower values for most other morphological characters (Table 2).

Table 2: Number of terminal buds/m^2, stolon length (m/m^2), number of nodal roots and leaves/m^2 for Grassland Huia and Aberherald grown with Everest and Hercules (Values per m^2 refer to grassland area)

Characteristic	1995/96		1996/97	
	Huia	Aberherald	Huia	Aberherald
Terminal buds	1895	1281	1062	383
Stolon length	97.8	70.9	75.1	33.3
Nodal roots	4199	3068	4772	2204
Leaves	1080	877	1785	2204

Results in Table 3 show that Aberherald had higher ($P<0.001$) percentage water soluble carbohydrates (%WSC) than Huia. There was no effect of he companion grasses (Everest 14.4 and Hercules 14.3). Aberherald had significantly ($P<0.001$) greater percentage total non-structural carbohydrates (%TNC) than Huia with no difference between clovers grown with Everest and Hercules (19.6 vs 19.4). The %WSC in stolons was higher in November/ December (29.4) than in March/April (12.6).

Table 3 : Comparisons of % water soluble carbohydrates (%WSC) and total non-structural carbohydrates (%TNC) in stolons of Grasslands Huia and Aberherald (1995/96)

	Huia	Aberherald
%WSC	13.3	15.4
%TNC	17.9	21.0

During the growing season the contributions of grass, clover and weeds to total DM were estimated on 4 to 5 occasions from cuttings taken between April and October. The highest average contribution by weeds to total DM in any of the four treatments was 1.5% and no differences were detected between them. Results for clover are in Table 4. Huia generally made a significantly higher percentage contribution to total biomass than Aberherald, (9.9 vs 6.4 in 1995/96 and 4.6 vs 1.8 in 1996/97), significantly so at some harvests and overall ($P< 0.05$). The marked reduction in clover

DM contribution in the 1997 growing season, especially for Aberherald, appeared to concur with the well known 'clover crash' which tends to occur in the third year after sowing.

Table 4 : Average percentage clover contribution to total DM yield

Treatment	Clover in total DM (%)	
	1995/96	1996/97
Huia + Everest	13.9	4.2
Huia + Hercules	5.9	5.0
Aberherald + Everest	9.1	1.6
Aberherald + Hercules	3.7	1.9

Grasslands Huia vs Kentish

The relative performances of Grasslands Huia (medium leaf size) and Kentish (small leaf size) cultivars when direct reseeded with Meltra tetraploid ryegrass were compared under sheep grazing over 2 years with the existing permanent pasture as control. The permanent pasture was dominated by *Agrostis* and *Holcus* and initially had little white clover. Dry matter yield and clover content were measured on samples taken by cutting caged areas (2 m x 2 m) which were relocated monthly. Results are in Table 5.

Table 5: Total dry matter (DM) yield (kg/ ha) and % clover contribution to total DM yield for two years

Treatment	Year 1		Year 2	
	Yield	Clover (%)	Yield	Clover (%)
Old pasture	11104	1.6	10048	4.1
Huia	12580	20.8	11233	16.8
Kentish	11573	10.2	11477	19.8

The larger seeded Huia established more quickly than the smaller seeded Kentish and gave higher total DM and clover DM yields in the first year. In the old pasture, starting from a very low base, the contribution of clover to

DM yield increased from under 2% in year 1 to 4% in year 2. It is likely that several years would be required to increase clover contribution to a worthwhile level. A longer-term grazing experiment may be required to evaluate the smaller leaved Kentish for sheep grazing.

SEEDING RATES FOR NEW LEYS

Seeding rates

Seeding rates of 2 or 4 kg/ha of Grasslands Huia with either 18 or 30 kg/ha of a tetraploid perennial ryegrass, Meltra, considered compatable with clover due to its open growth habit, were compared. Plots at two sites in the west of Ireland were direct seeded in late May following ploughing and cultivation. No N fertiliser was applied. Results are in Table 6 for site 1.

Table 6 : Effects of clover and grass seeding rates (kg/ha) on the establishment of Grasslands Huia white clover

	Seeding rates (grass + clover)			
	2 + 18	4 + 18	2 + 30	4 + 30
Total plants/m^2	373	367	543	580
Clover plants/m^2	155	333	156	383
Clover yield* (kg DM/ha)	128	187	133	195

* autumn of year 1

The higher seeding rate of clover increased the clover content of the sward in the year of sowing. Plant counts taken 6 weeks after sowing at each site showed that the number of seedlings of grass and clover was directly proportional to the quantity of seed sown. The advantage of the higher clover seed rate was still evident in autumn and resulted in higher clover yield in the first year. The effects of seeding rate were less clear cut in year 2 due to normal tillering of grass and stolon development in clover. The clover contribution to DM yield in May ranged from 2 to 6%. The higher

clover seeding rate significantly increased the clover content of the sward at that time but this difference between the two seeding rates decreased with overall improved clover development as the season progressed. Clover contributed about 12% of the DM yield in year 2 and 20% in year 3. At site 2 clover establishment was uniform across all treatments by year two. Ground cover of clover in May averaged 27% with little difference between treatments. By mid June clover contributed about 31% of the total DM. Management in subsequent years is likely to have a greater impact on the development and persistence of clover than the initial seeding rate.

EFFECTS OF GRAZING MANAGEMENT

Lenient vs severe grazing by sheep

In the comparison of different seeding rates outlined above plots were grazed periodically to simulate rotational grazing, with different numbers of sheep used to achieve lenient or severe (i.e. grazing down to 4 or 6 cm) grazing. Severe grazing tended to reduce yield at the next grazing but had not significant effect on clover content of the sward.

Effects of rotational and continuous grazing

Grasslands Huia white clover was established with Green Isle (tetraploid) and Frances perennial ryegrasses by direct seeding. Over the following 5 years plots were either grazed continuously, at sward heights of 4 and 7 cm, or grazed rotationally when sward height reached 10 to 15 cm. In rotationally grazed plots clover DM content was determined on samples taken at each grazing. Cages were located on continuously grazed plots and relocated at about monthly intervals and clover DM content was determined on herbage samples taken at the same time both in and outside caged areas. Results are in Table 7.

Table 7 : Average clover dry matter content (%) of herbage at the beginning of the rotational grazing periods for years 2 to 5.

Rotational	Continuous grazing	
Grazing	No cages	Under cages
8.8	2.9	2.0
11.0	5.5	13.8
17.7	8.8	27.3
25.7	5.6	21.4
18.0	6.4	9.7

With rotational grazing clover survived well, contributing up to 25% of the DM in summer compared with about 10% at that time under continuous grazing. However when protected from grazing in the caged areas, the contribution of clover increased to levels comparable with those under rotational grazing. The contribution of clover to total DM yield in years 2 to 5 averaged 15.5% (range 14 to 17%) for rotational grazing and 13.4% (range 10 to 18%) in caged areas. Clover survived well for up to 5 years under rotational grazing. It also survived under continuous grazing, though leaf size was reduced. Measurements taken in May showed that clover leaf width was 1.39 cm for rotational grazing, 1.32 cm in cages and 1.01 cm for continuous grazing. Under continuous grazing it is difficult to quantify the real contribution of clover due to its response to continuous selective grazing by sheep. For continuous grazing on mainly grass swards the sward should be maintained at a suitable height for sheep grazing to prevent the grass from shading out the clover.

In the experiment above comparing Grasslands Huia and Kentish white clovers, plots were either continuously or rotationally grazed by sheep over 2 years. Results in Table 8 shows that rotational grazing increased ($P<0.05$) the yields and percentage contributions of Huia and Kentish cultivars in the

first year but not in year 2. Total yield tended to be higher under rotational grazing in year 2.

Table 8 : Effects of grazing system on total dry matter (DM) yield (kg/ha) and % clover DM contribution

Treatment	Year 1		Year 2	
	Yield	Clover (%)	Yield	Clover (%)
Rotational	11969	12.3	11934	13.2
Continuous	11536	9.3	9899	14.2

Effects of stocking rate

In the experiment comparing Grasslands Huia and Kentish (see earlier) Blackface yearling wethers were rotationally grazed at 20 and 30 /ha and were moved between 4 plots every 5 days giving a 20-day rotation. Stocking rate had no significant effect on yield or clover content in either year, but again the method of yield measurement may have modified the results (Table 9).

Table 9 : Effects of stocking rate on total dry matter (DM) yield (kg/ha) and % clover DM contribution

Treatment	Year 1		Year 2	
	Yield	Clover %	Yield	Clover %
High stocking rate	11689	11.1	11359	12.7
Low stocking rate	11816	10.7	10474	14.7

Effects of grazing by cattle, sheep and cattle + sheep

A permanent pasture containing an initial clover DM content of about 5% was selected to measure the effects of sheep, cattle and mixed sheep + cattle grazing on the evolution of white clover. The area was divided into five blocks and each grazing treatment was randomly allocated to 30 m x 20 m plots within each block. All grazings were for short intense periods of 3-4 days, at about 21 day intervals, using 18-month old steers, yearling dry sheep and their mixture at 8 steers, 22 sheep and 4 steers + 11 sheep

respectively. Artificial N application was 51 kg/ha in Spring. Measurement of clover DM contribution was based on clipping five randomly selected areas each of 0.1 m^2 within each plot before each grazing. Average values for the 3 year period are in Table 10.

Table 10 : Average growing season % white clover contribution to total dry matter (DM) for cattle (C), sheep (S) and mixed C + S grazing

Treatment	Cattle	Sheep	Mixed C + S
	Permanent pasture		
Year 1	14.0	2.4	5.3
Year 2	7.8	3.3	3.1
Year 3	11.5	5.2	6.5
	Ryegrass/white clover reseed		
Year 1	15.1	4.2	12.1
Year 2	17.5	6.7	13.3

Mixed sheep + cattle grazing resulted in intermediate (3.1 to 6.5%) clover contribution compared with cattle (7.8 to 14.0%) and sheep (2.4 to 5.2%). Corresponding results, in an earlier experiment on a reseeded pasture were 10 to 12%, 15 to 18% and 5 to 8%.

Effect of rest interval on pasture yield and clover content

The objective of this study, conducted on the same plots as those used for the comparison of seeding rates above, over two seasons was to assess the effect of rest interval between grazings on yield and clover content of the sward. The swards of Huia white clover and Meltra (a tetraploid late perennial ryegrass) were established by direct reseeding in 225 m^2 plots with 4 replications. In the following years grazing intervals of 7, 14, 21 and 28 days were used in year 1, and 8, 12, 16 and 20 days in year 2. Sufficient sheep were introduced to grazed each plot in one day in a simulated rotational grazing system. Results are in Figure 1. The shortest

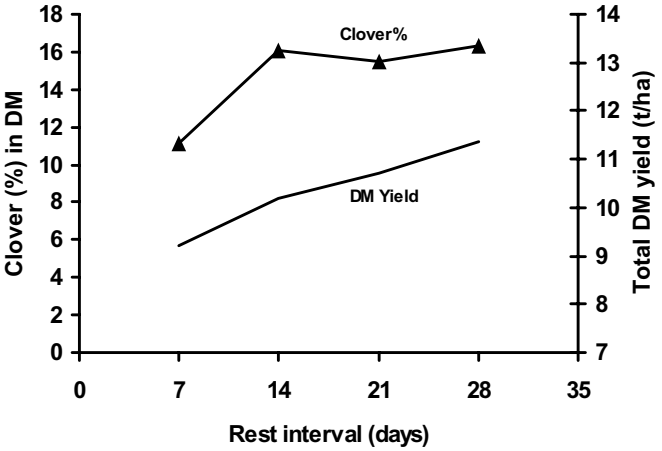

Figure 1. Effect of rest interval on tayal dry matter (DM) yield and on clover content

rest interval of 7 to 8 days tended to depress clover content. An interval of 14 to 28 days tended to increase total DM yield from 9210 to 11373 kg/ha without affecting clover content. The overall contribution of clover was higher in the second year when it was fully established. It is concluded that with rotational sheep grazing a rest interval of 14 to 28 days maintained a high clover content.

The reduction in clover content with the short rest interval parallels the reduction that tends to occur under continuous sheep grazing, due to frequent and selective grazing of clover.

EFFECTS OF CLOVER ON GROWTH RATE OF WEANED LAMBS

The effects of old permanent and mainly ryegrass pastures, both with a very low clover content, and ryegrass/clover pastures, allocated at daily herbage allowances of 1.5, 3.0, and 5.0 kg DM/head, on the growth rate of weaned lambs were compared. In the first trial the treatments were applied over a period of 51 days (28 July to 17 September) with replicated groups of 10 lambs per treatment. The second trial covered the 42 day period (2 October to 13 November) with unreplicated groups of 13 lambs per treatment. Results are in Table 11. There was a significant linear response in liveweight gain to increasing herbage allowance on each pasture in each grazing trial. Lamb growth rates were similar on the two mainly grass swards but were appreciably higher on the grass/clover sward.

Table 11 : Effect of herbage allowance and of pasture clover content on lamb growth rate (g/day)

	Herbage allowance (kg DM/lamb/day)		
	1.5	3.0	5.0
		July/September	
Old pasture	96	140	152
Ryegrass pasture	90	139	153
Ryegrass/clover	117	173	222
		October/November	
Old pasture	66	134	162
Ryegrass pasture	*89*	*132*	*146*
Ryegrass/clover	*111*	*167*	*197*

In a separate trial groups of lambs were set-stocked on three similar pasture types from the 11 July to the 12 September. Stocking rate was 30 lambs/ha and mean sward height was 7.5 cm. Lamb growth rates were similar on the two grass swards at 150 g/day, compared with 217 g/day on the grass/clover sward which contained 34% clover at the start of grazing.

In a short term trial (1 to 26 September) lambs (20 per group) were set-stocked at 40/ha on ryegrass or ryegrass/clover swards. Herbage was on offer *ad libitum* with a mean sward height of 9 cm. Lamb growth rate was 131 and 247 g/day on the grass and grass/clover swards. The latter contained 40% clover at the start of grazing.

It is concluded that the growth rate of weaned lambs is increased appreciably on high-clover-content pasture. The growth rate achieved on the grass/clover sward will depend on the clover content, and also on the stocking rate and severity of grazing. These will affect the proportion of the diet contributed by clover which has higher digestibility and intake characteristics than grass.

CONCLUSIONS

- The results would not support the substitution of Huia by Aberherald under Irish conditions. Comparison under grazing may be worthwhile especially in Ireland where grassland is so important.

- Huia established better than Kentish and gave higher yields only in the first year. Improved results for sheep grazing are likely from seeding variety/cultivar mixtures

- Longer term grazing is required to evaluate the smaller leaved Kentish for sheep grazing.

- Grasslands Huia persisted well under rotational sheep grazing and rest intervals between grazings of 20 to 28 days appear necessary. It also survived continuous sheep grazing but leaf size was markedly reduced.

- In old permanent pastures planned rotational sheep grazing can increase clover contribution but this may take a relatively long time.

- Under rotational grazing for reseeded and permanent pastures cattle grazing was most favourable to clover development with mixed cattle and sheep intermediate and sheep least.

- Weaned lamb growth was improved by about 25% when pasture clover DM contribution was increased to about 35%.

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