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Precision pasture management



Key external stakeholders:

Grassland industry, grassland farmers, business and technology advisors, seed merchants and dairy co-ops.

Practical implications for stakeholders:

- Increased efficiency through increased stocking rates, longer grazing season length and higher levels of sward renewal can increase grass utilisation on farms.
- Grassland farmers need to increase their usage of grassland management tools and technologies.
- Reseeding levels are too low on dairy farms and need to increase.
- Higher grass dry matter (DM) can be achieved at farm level by increasing the level of perennial ryegrass within grass swards.

Main results:

- Greater utilisation of pasture through increased stocking rates and improved grazing management can be achieved on Irish dairy farms.
- Uptake of grassland management technologies is low, despite the fact that many of the limitations reported by survey participants could be improved through greater adoption of such technologies.
- The level of sward renewal on dairy farms must increase if more intensive grass-based systems of production are to be adopted.
- The DM production capacity of a grass sward is significantly increased by increasing perennial ryegrass content.
- Perennial ryegrass ground score can be used as a method of estimating perennial ryegrass content and DM production capacity of pastures.

Opportunity / Benefit:

Dairy farmers have large financial gains to make if adoption of new improved grassland management techniques takes place. Stocking rate, milk solids per cow and per hectare, grazing season length and the level of concentrates offered all show that there is under utilisation of grassland taking place nationally. Large opportunities are available if these deficiencies are addressed, higher levels of grass utilisation can be achieved which will increase profitability on dairy farms. Perennial ryegrass content has a significant effect on grass DM production within swards. Increasing sward perennial ryegrass content will increase the DM production capacity of farms.

Collaborating Institutions:

University College Dublin (UCD)
Trinity College Dublin (TCD)
Agri-Food & Biosciences Institute (AFBI)
National Institute of Agronomic Research (INRA) France
Knowledge Transfer Directorate

Teagasc project team: Dr. Michael O'Donovan (PI)
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1. Project background:

Irish dairy farms have the potential to produce up to 15 t of grass dry matter (DM) ha over a long growing season providing the lowest cost feed source available, with the ability to supply a large proportion (>0.75) of the diet of the Irish dairy cow as grazed grass. It is estimated that, nationally, there is approximately 7.1 t of DM ha being utilised on the average specialist dairy farm, indicating that far higher levels of production can be achieved with greater grass utilisation on Irish dairy farms. Approximately 0.44 of the difference in net profit per hectare between farms can be explained by grass utilised per hectare. There is virtually no knowledge indicating the level of uptake of herbage mass measurement techniques at the farm level, even though it is promoted extensively. The renewal of swards is an expensive practice so sward persistence and lifetime DM production performance are important issues to address at farm level. Forage grasses and varieties of the same species vary in the rate of tiller survival. Over time, most swards will lose grass tillers, creating open spaces, which can become invaded by weed species. Grass persistency can be measured by evaluating the decline in percentage of ground covered by sown species, or by documenting the DM yield stability of the sown species over time. The development of a reliable method of assessing sward perennial ryegrass density, coupled with DM yield measurement, could significantly aid sward renewal management programmes on commercial farms, by more accurately predicting the optimum timing of sward renewal.

2. Questions addressed by the project:

Two main studies were undertaken in this project, the objective of study 1 was to quantify and understand: i) grassland management practices employed on Irish dairy farms including grazing season length, turnout and housing dates, and concentrate feed input; ii) the uptake of new grassland research and technology to increase grassland utilisation and reduce costs and iii) the frequency and methods of sward renewal, which are issues that are central to increasing and realising the competitive advantage of Irish dairy farming. The objective of study 2 was to quantify the effect of sward perennial ryegrass (PRG) density and defoliation method on seasonal and total DM yield, as well as the effectiveness of ground score (GS) estimates in predicting PRG density and dry matter (DM) yield, under simulated and animal grazing managements.

3. The experimental studies:

Study 1 – Survey analysis of Irish grassland dairy farms

A sample survey population was chosen from a proportionate representation of all milk suppliers taken from three of the largest dairy processors in Ireland. These three processors between them have a supplier base in the Southern, Eastern and Western geographical regions of Ireland, representing approximately 9,690 of the 19,400 national milk producers, and together supplying just under half of the national milk output of 5,440 million litres (DAFF, 2009). The sample was subdivided into three quota categories and three stocking rate categories post-data collection. A total sample size of 1,041 suppliers was selected. A telephone survey was the chosen method of data collection. In total, the survey contained 46 questions which were designed to create a profile of each individual farm by extracting data on the physical background, grassland management and reseeding. The survey focused on three primary sections:

- 1) Background: data on land area, stock numbers and milk output;
- 2) Grassland: the key grassland management indicators including herbage mass measurement (kg herbage DM ha available for grazing, grazing-season length, quantity of concentrates offered per cow, and perceived grazing limitations;
- 3) Reseeding: reseeding programme on the farm, timing of reseeding, area reseeded and cultivation method.

Study 2 – Effect of perennial ryegrass density on grass DM production

Intermediate perennial ryegrass (*Lolium perenne* L.; PRG, cv. *AberElan* (D), *Delphin* (T) and *Greengold* (T)), was sown at five different seeding rates 5, 7.5, 12, 20 & 30 kg/ha, based on viable seed numbers, to establish swards with relative PRG densities of 0.17(A), 0.25(B), 0.40 (C), 0.67(D) and 1.00(E), swards. The aim was to simulate a range of sward types from an old permanent pasture (sward A) to a recently reseeded sward (sward E). Two defoliation managements were imposed, a simulated mechanical grazing (SG) and animal grazing by dairy cows (AG). Both managements were defoliated concurrently, nine times from February to October to a residual sward height of 4 cm.

4. Main results:

In **Study 1**, both stocking rate and quota category had significant effects on the proportion of participants adopting grass-based technologies and on the amount of supplementary feed offered. Grazing season length increased from 228 days in quota category 1 (167,251 litres) to 249 days in quota category 3 (521,597 litres). Limitations to extending the length of the grazing season were similar for both the Spring and Autumn, with soil conditions and low grass availability the main limiting factors identified. Stocking rate had a significant effect on the total amount of concentrate offered per cow annually. Participants in SR1 (1.2 LU/ha) offered, on average, 645 kg concentrate/cow per year. This increased to 697 kg/cow per year for SR2 (1.8 LU/ha) and to 828 kg/cow per year for SR3 (2.7 LU/ha).

The proportion of the grazing area reseeded annually was significantly affected by stocking rate increasing from 0.04 to 0.10 of the grassland area as stocking rate increased from SR1 to SR3 with no effect of quota category. The results of this survey show that, on average, just 18% of Irish dairy farmers currently use grazing management technologies.

Study 2

Annual dry matter yield under simulated grazing was 10.7 (A), 11.0 (B), 11.3 (C), 11.8 (D) and 12.0 (E). Under simulated grazing the higher density swards (C, D and E) had significantly greater DM yield in Autumn and total DM yield than the low density swards (A and B). Annual dry matter yields under animal grazing were 10.3 (A), 10.7 (B), 11.0 (C), 12.1 (D), and 12.2 (E). Sward PRG density significantly affected DM yield in Summer, Autumn, and total DM yield under animal grazing. The production from all PRG sward densities was stable within specific grazing managements, i.e., the variance of high PRG swards was not significantly different to that in low PRG swards under either management. There was a significant effect of defoliation method on sward DM yield stability with simulated grazing yields more stable than animal grazing yields.

The relationship between sward DM yield and ground score was significant for both grazing managements with correlations based on raw data ranging from 0.84 to 0.92 for GS-June and GS-December, respectively, under simulated grazing and 0.80 to 0.94 for GS-June and GS-December, respectively, under animal grazing. The relationship between DM yield and ground score was investigated. Each one unit increase ground score in June (GS-June) related to a 350 kg DM ha increase in annual DM yield under simulated grazing and a 721 kg DM ha increase with animal grazing. For ground score densities recorded in December (GS-December), every unit increase gave an annual increase in yield equal to 460 kg DM ha or 1194 kg DM ha in simulated and animal grazing, respectively.

5. Opportunity/Benefit:

The information generated from this project has been disseminated by knowledge transfer personnel and is currently being integrated into reseeding management practices to assist the extension of the grazing season, thereby reducing feed costs and helping to improve overall farm profitability.

6. Dissemination:

Main publications:

A survey analysis of grassland dairy farming in Ireland, investigating grassland management, technology adoption and sward renewal. Authors – P. Creighton, E. Kennedy, L. Shalloo, T. Boland and M. O'Donovan. *Grass and Forage Science* 66, 251-264 (2011).

Creighton, P. Kennedy, E. Gilliland, T. Boland, T. and O'Donovan, M. Effect of sward *Lolium Perenne* density on productivity under simulated and actual cattle grazing, *Grass and forage Science* (accepted with changes November, 2011).

Shalloo, L. Creighton, P. and O'Donovan, M. The economics of reseeding a dairy farm. *Irish Journal of Agricultural and Food Research*, 50; 113-122 (2011).

Creighton, P. Kennedy, E., Gilliland, T., Boland T. and O'Donovan M. The effect of sward perennial ryegrass content and defoliation method on seasonal and total dry matter production. Proceedings of the British Society of Animal Science and the Agricultural Research Forum (2010). P149.

Creighton, P. Kennedy, E., Gilliland, T., Boland T. and O'Donovan M. The effect of sward perennial ryegrass content and defoliation method on seasonal and total dry matter production. Proceedings of Grassland Science in Europe, Vol. 15 (2010). P904.

Popular publications:

Irish Farmers Journal – 8 individual technical articles on reseeding from March – May 2010, edited by Jack Kennedy.

7. Compiled by: Dr. Michael O'Donovan