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Grass digestibility



Key external stakeholders:

Dairy farmers, dairy industry, grass breeders and evaluators, animal nutrition companies and consultants

Practical implications for stakeholders:

Grass is the cheapest feed available to Irish dairy farmers. Much information is available on the physical and chemical composition of grass and on dairy cow production performance. Information is lacking, however, on the degradability of grass in the rumen of the cow and the digestibility of grass in the total digestive tract of the cow. This project resulted in the generation of information on the rumen pH of grazing dairy cows, and on the digestibility of grass varying in quality and structure in different dairy cow genotypes.

Main results:

- Grazing dairy cows have a lower rumen pH than cows offered silage-based diets indoors.
- Rumen pH is lower in spring/early lactation than later in the grazing season/lactation.
- Despite the low rumen pH, grazing dairy cows do not generally exhibit signs of milk fat depression or lameness, as a result of low rumen pH.
- Grazed grass is highly digestible, indicating that it has a high energy content.
- High pre-grazing herbage mass results in lower grass digestibility than low pre-grazing herbage mass.
- The leaf and pseudostem are the most digestible parts of the grass plant, while the stem and dead material are the least digestible parts of the grass plant.
- Differences exist between dairy cow genotypes in the extent to which they digest perennial ryegrass, with Jersey cows able to digest more of the grass than Holstein-Friesian cows. Jersey x Holstein-Friesian cows had intermediate digestibility.

Opportunity / Benefit:

These results provide data on the digestibility of grass and on the effects of grazed grass on rumen pH to dairy farmers, the dairy industry and animal nutrition companies and consultants enabling them to safely offer grazed grass as a high quality feed to dairy cows.

Collaborating Institutions:

UCD, Ireland
INRA, France
Lincoln University, New Zealand

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1. Project background:

The optimal use of grazed grass is identified as a key component of profitability in Irish dairy production systems. Grassland is cited as an area of strategic national importance by Teagasc. In order to make the most efficient use of grass, it is important to maximise utilisation of the grass ingested by the animal, as well as to increase the proportion of grazed grass in the diet via management techniques. Hence, the objective of this project was to measure the rumen pH and total tract digestibility of grazed grass through the grazing season. The outcome of this project was a unique suite of results demonstrating the degradative and digestive profiles of grass through the grazing season. These data provide an important fundamental understanding of how dairy cows perform when offered a grazed grass diet.

2. Questions addressed by the project:

- What is the rumen pH of grazing dairy cows?
 - being offered different grass-based diets
 - at different stages of the lactation/grass growing season
- What is the digestibility of grass?
 - at different pre-grazing herbage mass
 - at different stages of the grass growing season
 - by different dairy cow genotypes

3. The experimental studies:

Rumen pH is an important factor related to milk fat %, fibre degradation, nutrient absorption and overall cow health and welfare. Most of the information on rumen pH derives from work done with feeding high grain diets however, with little information available on the rumen pH of grazing dairy cows. A system was developed to monitor rumen pH on a continuous basis throughout the day in order to measure the average rumen pH across 24 hours and the time spent below certain rumen pH thresholds. The rumen pH of dairy cows offered different grass-based diets at different stages of lactation/grass growing season was measured. Organic Matter Digestibility (OMD) is a common measurement of grass quality. High sward digestibility, or excellent quality, is key to the delivery of good nutrition to Irish dairy cows. With the abolition of the EU milk quota in 2015, milk production in Ireland is anticipated to increase by 50% by 2020. High grass OMD is essential to achieve this. Grass is composed of four morphological fractions: leaf, pseudostem, true stem and dead. These proportions change over the course of the grass growing season, and differ between grass cultivars. The digestibility of the four fractions, through the grazing season, in four different grass cultivars was measured. Pre-grazing herbage mass is used as a tool to aid grassland management. The digestibility of grass of different pre-grazing herbage mass was measured. Production efficiency differences exist between dairy cow genotypes but the digestibility of grass in these genotypes is not known. The digestibility of grass offered to three different dairy cow genotypes, namely Holstein-Friesian, Jersey and Jersey x Holstein-Friesian was measured.

4. Main results:

- Grazing dairy cows have a lower rumen pH than animals offered silage-based diets indoors.
- Rumen pH is lower in spring/early lactation than later in the grass growing season/lactation.
- Despite the low rumen pH, grazing dairy cows do not generally exhibit signs of milk fat depression or lameness, as a result of the low rumen pH. This is attributed in part to low lactic acid concentrations in the rumen of grazing dairy cows.
- Grazed grass is highly digestible, indicating that it has a high energy content, and that it is a high quality feed.

- High pre-grazing herbage mass results in lower digestibility than low pre-grazing herbage mass.
- Accordingly, detailed measurements of the grass plant revealed that the leaf and pseudostem are the most digestible parts of the grass plant, while the stem and dead material are the least digestible parts of the grass plant.
- Every attempt should therefore be made to offer medium to low pre-grazing herbage mass grass which is leafy and highly digestible to grazing dairy cows and to minimise the proportions of dead and stemmy material (seen in high pre-grazing herbage mass swards).
- Differences exist between dairy cow genotypes in the extent to which they digest perennial ryegrass, with Jersey cows able to digest more of the grass than Holstein-Friesian cows. Jersey x Holstein-Friesian cows had intermediate digestibility.

5. Opportunity/Benefit:

These results provide data on the digestibility of grass and on the effects of grazed grass on rumen pH to dairy farmers, the dairy industry and animal nutrition companies and consultants, enabling them to safely offer grazed grass as a high quality feed to dairy cows.

6. Dissemination:

The primary stakeholders for this research are Irish dairy farmers, animal nutrition companies and consultants and grass breeders and evaluators. The results of this project have been disseminated through the popular press and at the Teagasc Moorepark Open Days, as well as at scientific conferences and in scientific peer-reviewed publications.

Main publications:

Beecher, M., Hennessy, D., Boland, T.M., McEvoy, M., O'Donovan, M., Lewis, E. 2013. The variation in morphology of perennial ryegrass cultivars throughout the grazing season and effects on organic matter digestibility. *Grass and Forage Science* doi: 10.1111/gfs.12081

Lewis, E., Coughlan, F., Murphy, J.P., Galvin, N., O'Donovan, M., O'Neill, B.F. 2011. The effect of supplementing grazed grass with mixed ration on rumen pH and rumen ammonia, volatile fatty acid and lactic acid concentrations. In: *Proceedings of the 8th international symposium on the nutrition of herbivores*, Aberystwyth, Wales, 6-9th September, pg. 284

O'Donovan, M., Lewis, E., O'Kiely, P. 2011. Requirements of future grass-based ruminant production systems in Ireland. *Irish Journal of Agricultural and Food Research*, 50: 1-21

Popular publications:

Lewis, E. and Buckley, F. 2011. Variation in dairy cow feed efficiency amongst breeds. *Irish Dairying Planning for 2015 (Moorepark Open Day 2011)*. Teagasc IE pp. 50-52

Lewis, E., Hennessy, D., McEvoy, M., Enriques Hidalgo, D., Wims, C., Coughlan, F. 2012. Rumen function in grazing dairy cows. *TResearch* 7(3): 38-39

Lewis, E., O'Donovan, M., Kennedy, E., O'Neill, B., Shalloo, L. 2011. Feeding the dairy cow: supplementation requirements and responses. In: *Proceedings of the National Dairy Conference, Cork and Athlone, 15-16th November*, pg. 71-81

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