Possibilities and constraints for grazing in high output dairy systems

Deirdre Hennessy¹, L. Delaby², A. van den Pol-van Dasselaar³,⁴ and L. Shalloo¹

¹Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland; ²INRA, AgroCampus Ouest, UMR 1348, Physiologie, Environnement et Génétique pour l'Animal et les Systèmes d'Elevage, Saint-Gilles F-35590, France; ³CAH Vilentum University of Applied Sciences, Dronten, the Netherlands; ⁴Wageningen UR Livestock Research, the Netherlands.
Definitions

- High output
  - Per cow, per ha, per farm
  - Maximising output from the total farm area or per ha
  - Sustainability

- Grass based systems – diet mainly based on grazed grass and grass silage is the primary winter feed
Introduction

- Increasing global requirement for food
- Sustainable food production - environmental legislation
- Production of livestock for food
  - Minimise competition with humans for feed
  - Ruminants can convert grass into protein source for humans (meat)
- In temperate regions grazed grass is the lowest cost feed source for milk production (Dillon et al., 2005; Shalloo, 2009)
- Grazed grass less important in other regions but can contribute to the diet of livestock
- Generally in Europe the contribution of grazed grass to dairy cow diets is declining (van den Pol-van Dasselaar et al., 2008)
Grass growth variation – seasonal and annual

Source: PastureBase IRELAND
Grass growth

- Large variation
  - Seasonal and annual
  - Within farm
  - Between farms

![Grass growth chart]

**Year 2014**
- Grazing Herbage Production: 11,350 Kg DM/ha
- Silage Herbage Production: 2,522 Kg DM/ha
- Total: 13.9 t DM/ha
Grass quality

- Variable
  - Influenced by season
  - Vegetative v’s reproductive
  - Influenced by growth rate
  - Influenced by grazing management

**Grass OMD (>4 cm)**

Source: Beecher et al. (2015)
Plant animal interaction

• Interaction between the animal and the sward is challenging for a whole host of different reasons
  • Herbage DM intake/cow intake capacity
  • Milk production potential
  • Substitution rate
  • Grass allowance
• Most limiting factor – herbage DM intake

<table>
<thead>
<tr>
<th></th>
<th>Pasture</th>
<th>TMR</th>
<th>SE</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM intake (kg/cow/day)</td>
<td>19</td>
<td>23.4</td>
<td>0.6</td>
<td>0.01</td>
</tr>
<tr>
<td>NE(_L) (Mcal/d)</td>
<td>32.4</td>
<td>40.2</td>
<td>1.8</td>
<td>0.02</td>
</tr>
<tr>
<td>Milk yield (kg/day)</td>
<td>29.6</td>
<td>44.1</td>
<td>1.4</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Source: Kolver and Muller (1998)
Plant animal interaction

- Interaction between the animal and the sward is challenging for a whole host of different reasons
  - Herbage DM intake/cow intake capacity
  - Milk production potential
  - Substitution rate
  - Grass allowance
- Most limiting factor – herbage DM intake
- Grazing conditions
  - Affects DM content
  - Utilisation
Managing grass based systems
Grazing management

- Grazing management often perceived as complicated and uncertain
- Grassland management skills
  - Can be learned
  - Require regular practice and time to be comfortable with and trust the measurements
- Adapt existing technologies
  - Ireland adapted the spring rotation planner from New Zealand
  - The Netherlands introduced the FarmWalk
Herb Avenir
Calculate the grass supply and simulate the consequences of management decisions on supply.

Growing management inputs lead to changes in grass yield. It also includes the consideration of weather conditions on the grass supply for specific months.

Pâture-Plan
Le coup de pouce informatique à la gestion du pâturage

Réalisation : Vincent MOTIN

The Irish Agriculture and Food Development Authority
Tools for each season

Grass Growth

60:40 Rule
Incorporating grass into the dairy cow diet

- No one solution
- Restricted access to grazing
- Autumn management
- Extended grazing
- Maximising use when grass available
Technology

• Technology is increasingly important in agriculture and in dairy farming

• New technologies are continuously being developed and new grassland Decision Support Tools (DSTs) such as the Grasshopper (McSweeney et al., 2014), cow sensors (Ipema et al., 2014) and virtual fencing (McSweeney et al., 2014)

• Will increase farmers’ confidence when it comes to grazing management and herbage allocation
GrassHopper Network

Satellite - GPS

Data via Bluetooth to Smart Phone APP
- Grass Height
- Grass Density

Smart Phone

Grazing Allocation

Animal Demand (DM/day)

Dry Matter (%)

Number of Animals

PastureBase Ireland
Cow type

• Desirable cow traits for grass based systems
  • Robust, good confirmation for walking long distances
  • Easy care
  • High levels of performance from grass
  • Large intake of forage relative to potential milk yield
  • Fertile – calve every year, calve early in spring
  • Healthy
  • High survivability
  • Maintain body condition score

• Alternative breeds to Holstein
• Cross breeding benefits – hybrid vigour
France – Holstein compared to Normande

• Two breeds – Holstein Friesian & Normande

• Two feeding strategies
  • (1) high input – feeding adapted to the cow
  • (2) low input – cow adapts to the feed available
Interaction between breed and feeding system

**Holstein**

- Holstein - High
- Holstein - Low

**Normande**

- Normande - High
- Normande - Low

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milk Yield (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>+ 2382</td>
</tr>
<tr>
<td>Normande</td>
<td>+ 1496</td>
</tr>
</tbody>
</table>

Source: L. Delaby, Le pin data

The Irish Agriculture and Food Development Authority
Crossbreeding

Je × HF more likely (p<0.05) to be in-calf at end of 13 week breeding season
Scale and fragmentation

- Fragmentation of farms is an issue right across Europe
- Milk quotas have gone..........is land the new quota?
  - Environmental constraints
- In grass based milk production systems
  - Area of land available for the lactating herd and the quantity of grass it grows dictates the grass supply in the diet
Stocking rate (cows/ha) on farms growing different amounts of pasture and feeding different amounts of concentrate/cow

<table>
<thead>
<tr>
<th>Concentrate (t DM/cow)</th>
<th>Pasture grown (t DM/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>0.00</td>
<td>1.5</td>
</tr>
<tr>
<td>0.25</td>
<td>1.7</td>
</tr>
<tr>
<td>0.50</td>
<td>1.8</td>
</tr>
<tr>
<td>1.00</td>
<td>2.0</td>
</tr>
<tr>
<td>1.50</td>
<td>2.2</td>
</tr>
<tr>
<td>2.00</td>
<td>2.4</td>
</tr>
</tbody>
</table>

*Source: Roche and Horan (2013)*
Scale and fragmentation

- Amalgamation of dairy farms - cows grouped at one site to improve efficiencies around milking and labour use
  - Can increase grazing land availability when farmers are next to each other
  - Often reduces grazing area
    - Can increase N surplus on grazing area
    - Indoor feeding increases
    - Over all more machinery, more time feeding, less labour efficient
Animal Welfare

• General perception that the welfare of grazing animals is better than that of housed animals
  • Grazing animals have free access to exercise and roaming

• Once roadways are well maintained pasture based dairy cows can have reduced lameness and better locomotive ability compared to housed dairy cows (Olmos et al., 2007)

• Pasture can improve aspects of cow health such as mastitis (Washburn et al., 2002)
Milk quality and food safety

- Cows fed predominantly grazed grass have increased levels of the unsaturated fatty acids conjugated linoleic acids, vaccenic acid, and omega-3 fatty acids in milk compared to other diets (Coakley et al., 2007; Wyss et al., 2010; Butler et al., 2011)
- Milk from cows on largely grass diets is higher in vitamins A and E than from other cow diets (Martin et al., 2004)
- Milk processors increasingly aware of the health benefits of grass fed milk and use it as part of their marketing campaign’s, e.g. http://www.kerrygold.com/advertising
Milk quality and food safety

• Food safety is of increasing concern as the food supply chain lengthens
  • Sharing of knowledge, trust and understanding declines and ultimately ceases
  • Maximising the quantity of grazed grass, and home produced grass silage or hay, in the diet reduces purchased feed
Environment

- Requirement to reduce environmental losses and impacts is one of the key challenges facing agriculture today
- Many studies have been undertaken at country level examining the implications of different production systems on greenhouse gas (GHG) emissions, eutrophication and biodiversity
- All indicate that increasing resource use efficiency is associated with increased environmental sustainability
Environment

• Generally grass based systems are more resource efficient - use home grown feed stuffs, minimise requirements for purchased feedstuffs and therefore the resources associated with those feedstuffs (Le Gall et al., 2009)

• Methane production per cow reduced with high quality grass compared to low quality grass (Wims et al., 2010)

• Grassland soils and associated vegetation are an important sink for C (Peeters and Hopkins, 2010)
McCarthy et al. (2015) showed that increasing stocking rate while keeping concentrate input and fertiliser N input constant increased N use efficiency and reduced surplus N in grass based milk production systems.
Economic efficiency

• Removal of milk quotas increased milk price volatility one of the biggest challenges for European dairy farmers

• Many studies show that grazed grass is the lowest cost feed for milk production (e.g. Dillon et al., 2005; Finneran et al., 2012)
Economic efficiency

- 42% of the variation in milk production costs in Ireland can be explained by the quantity of grass utilised by the dairy herd (Shalloo, 2009)

\[ y = 161.31x - 287.39 \]

\[ R^2 = 0.42 \]

On average each tonne DM/ha utilised is worth €161/ha
Income from grazing minus income with summer feeding (silage indoors) relative to the quantity of fresh grass (kg DMI/cow/year) for three soil types in the Netherlands as simulated by DairyWise (Positive numbers indicate an economic advantage for grazing)

+600 kg DMI/cow/year = economic benefit

Source: Van den Pol-van Dasselaar et al. (2014)
Labour efficiency

- Labour is a high cost in any dairy production system
- Labour requirement is different and differently spread across the year depending on the calving pattern and the breeding season
- Grazing can lead to less labour hours, since the cows feed themselves and they transport manure to the field
  - Allows time for grassland management
Conclusions

• It is possible to include grazed grass in the diet of cows on high output systems

• Although there are many constraints to grazing in Europe, there are many possibilities to overcome those constraints

• Adapting existing grassland management tools

• New and evolving technologies

• Cow choice

• Maximising utilisation of grazed grass in all systems will contribute to increased sustainability
Thank you
Questions?

Contact: deirdre.hennessy@teagasc.ie