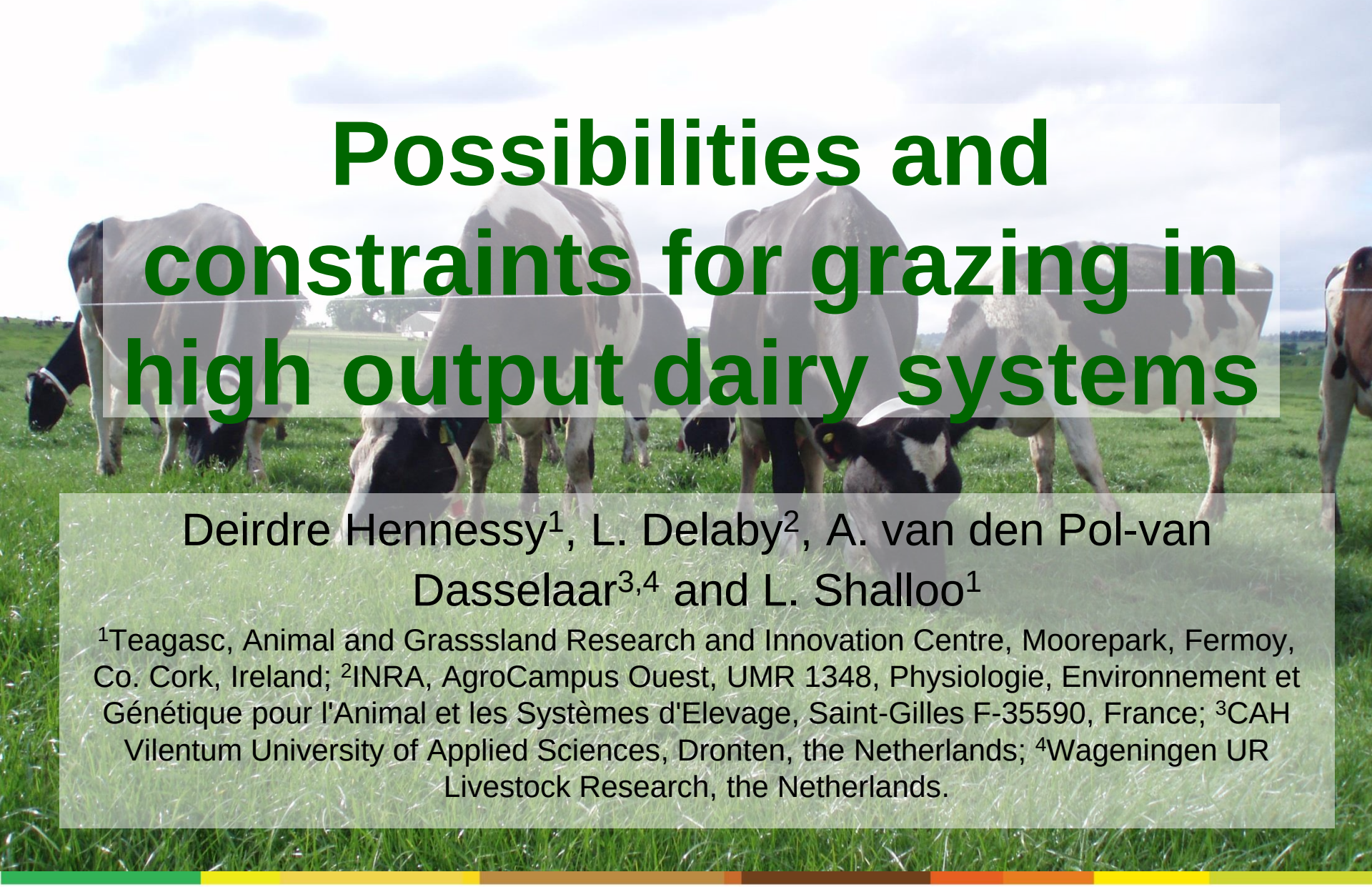


Possibilities and constraints for grazing in high output dairy systems

Deirdre Hennessy[1], L. Delaby[2], A. van den Pol-van Dasselaar[3,4] and L. Shalloo[1]

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

Scale & fragmentation

Economic and labour efficiency

Animal welfare

Grass growth & quality

Plant animal interaction

Milk quality

Animal type

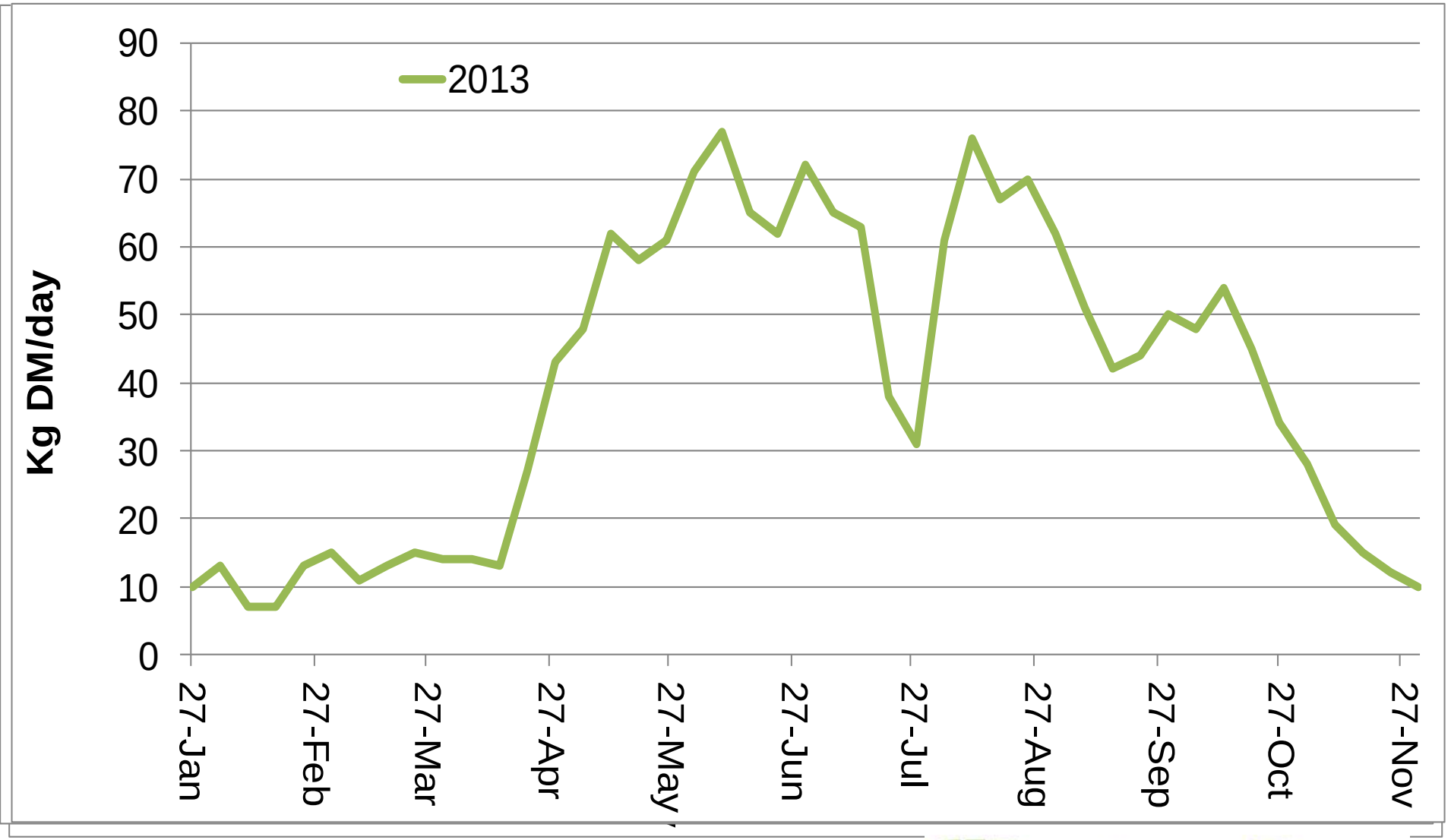
Grassland management skills

Technology

Environment

Grass growth

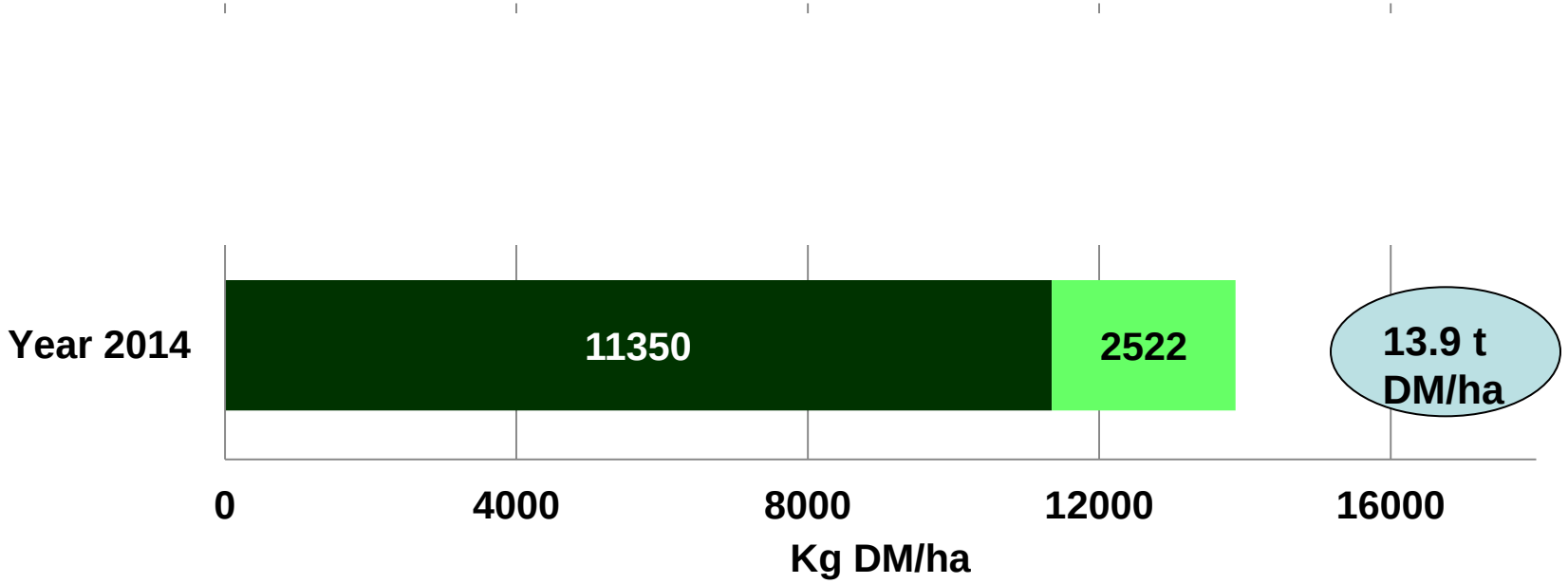
Grass growth variation – seasonal and annual



Source: PastureBase IRELAND

Grass growth

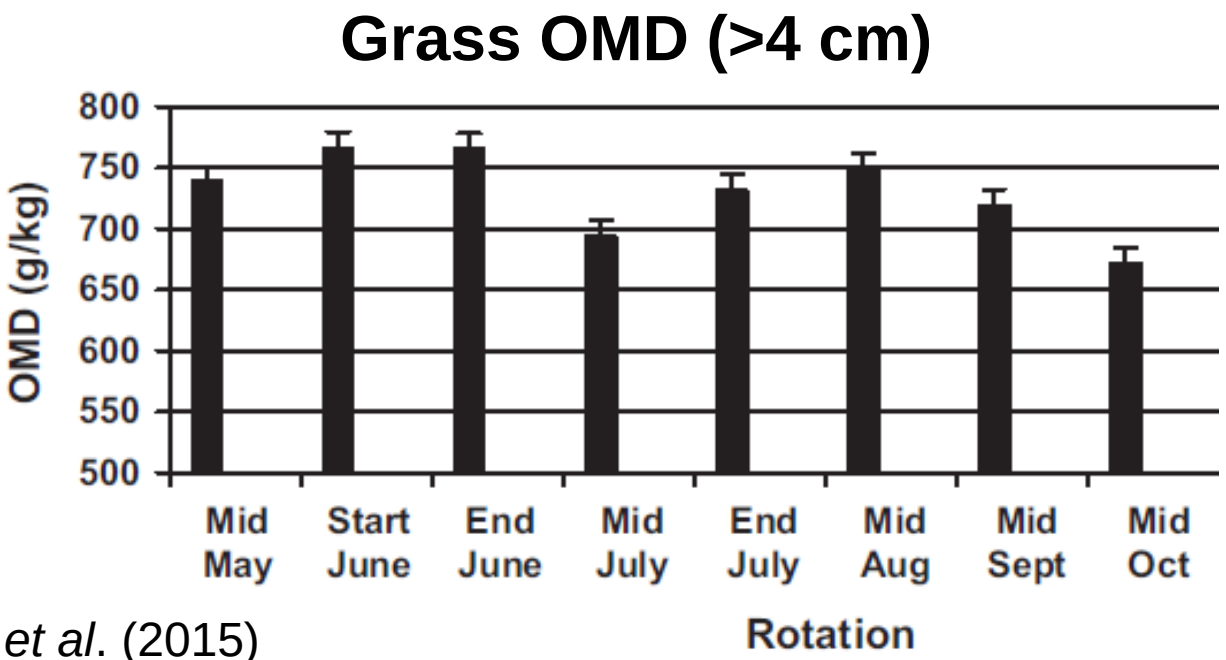
- Large variation
  - Seasonal and annual
  - Within farm
  - Between farms



PastureBase IRELAND

Grass quality

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



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

	Pasture	TMR	SE	P<
DM intake (kg/cow/day)	19	23.4	0.6	0.01
NE_L (Mcal/d)	32.4	40.2	1.8	0.02
Milk yield (kg/day)	29.6	44.1	1.4	0.01

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

Teagasc
Agriculture and Food Development Authority

The Irish Agriculture and Food Development Authority

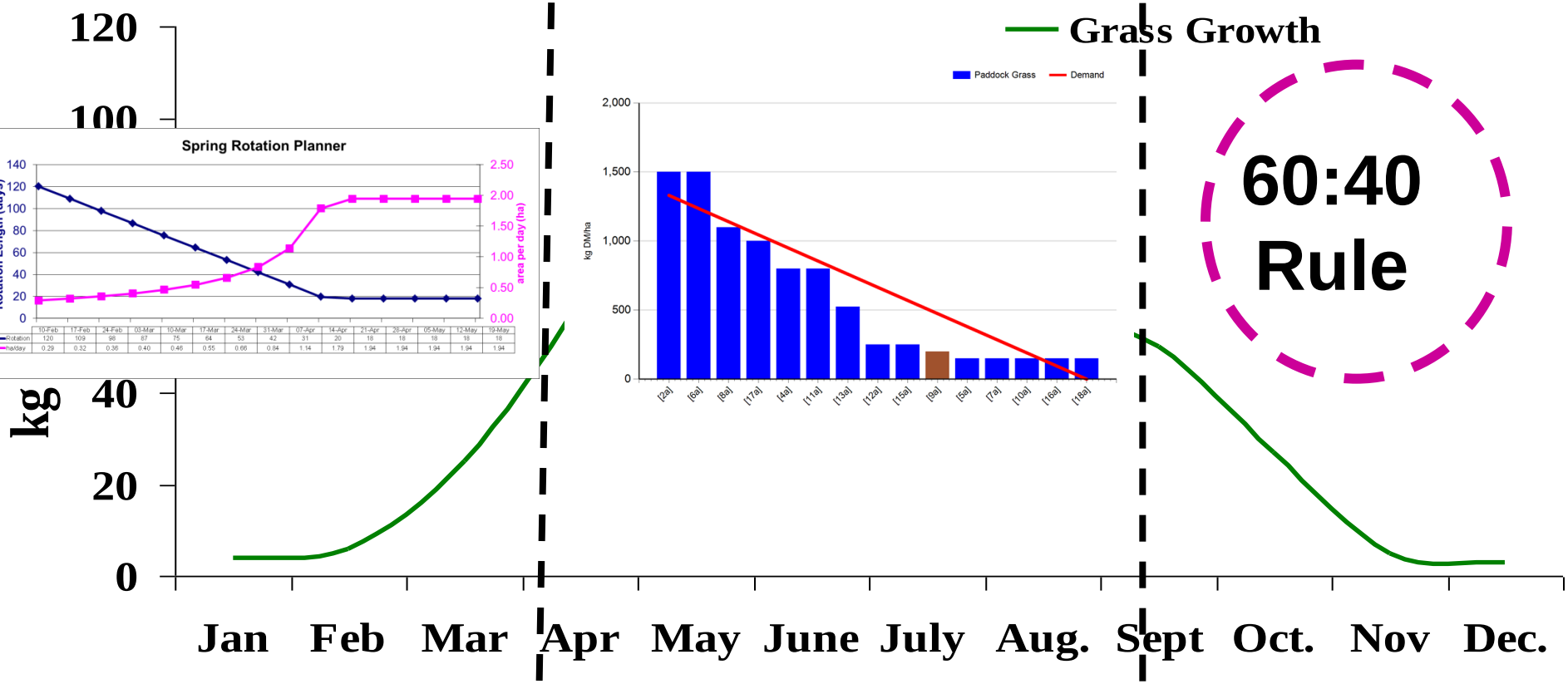
Grazing management

- 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

Teagasc
Agriculture and Food Development Authority

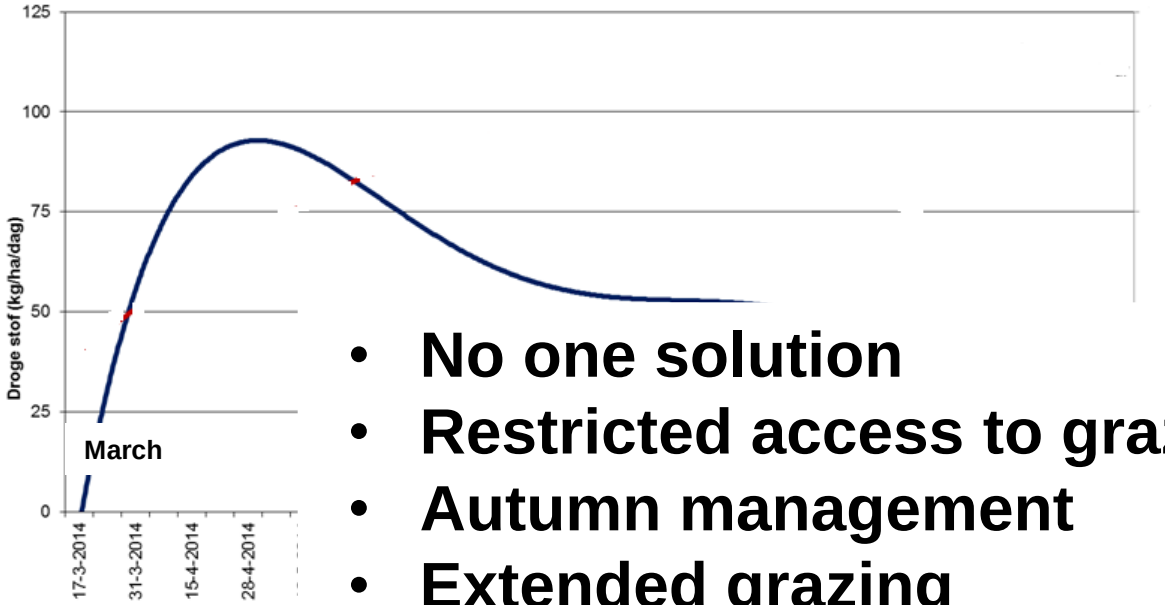
The Irish Agriculture and Food Development Authority

Tools for each season

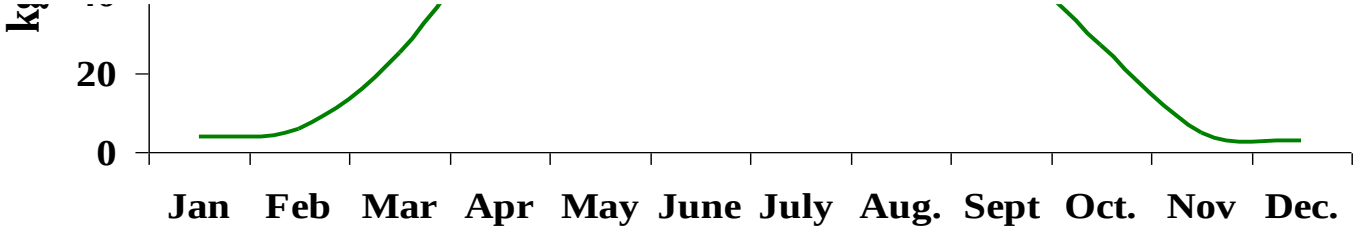


60:40 Rule

Incorporating grass into the dairy cow diet



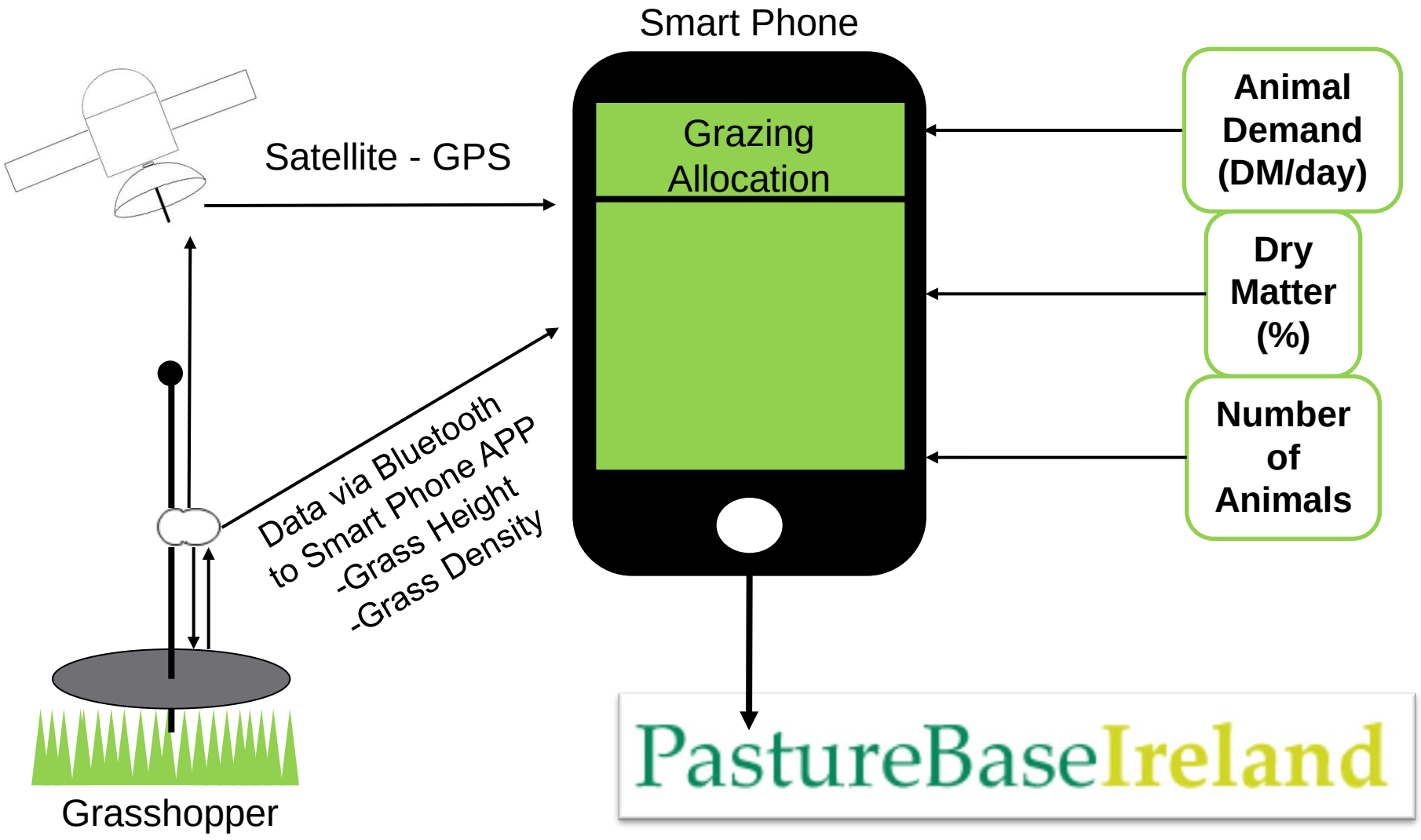
- No one solution
- Restricted access to grazing
- Autumn management
- Extended grazing
- Maximising use when grass available



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



Cow type

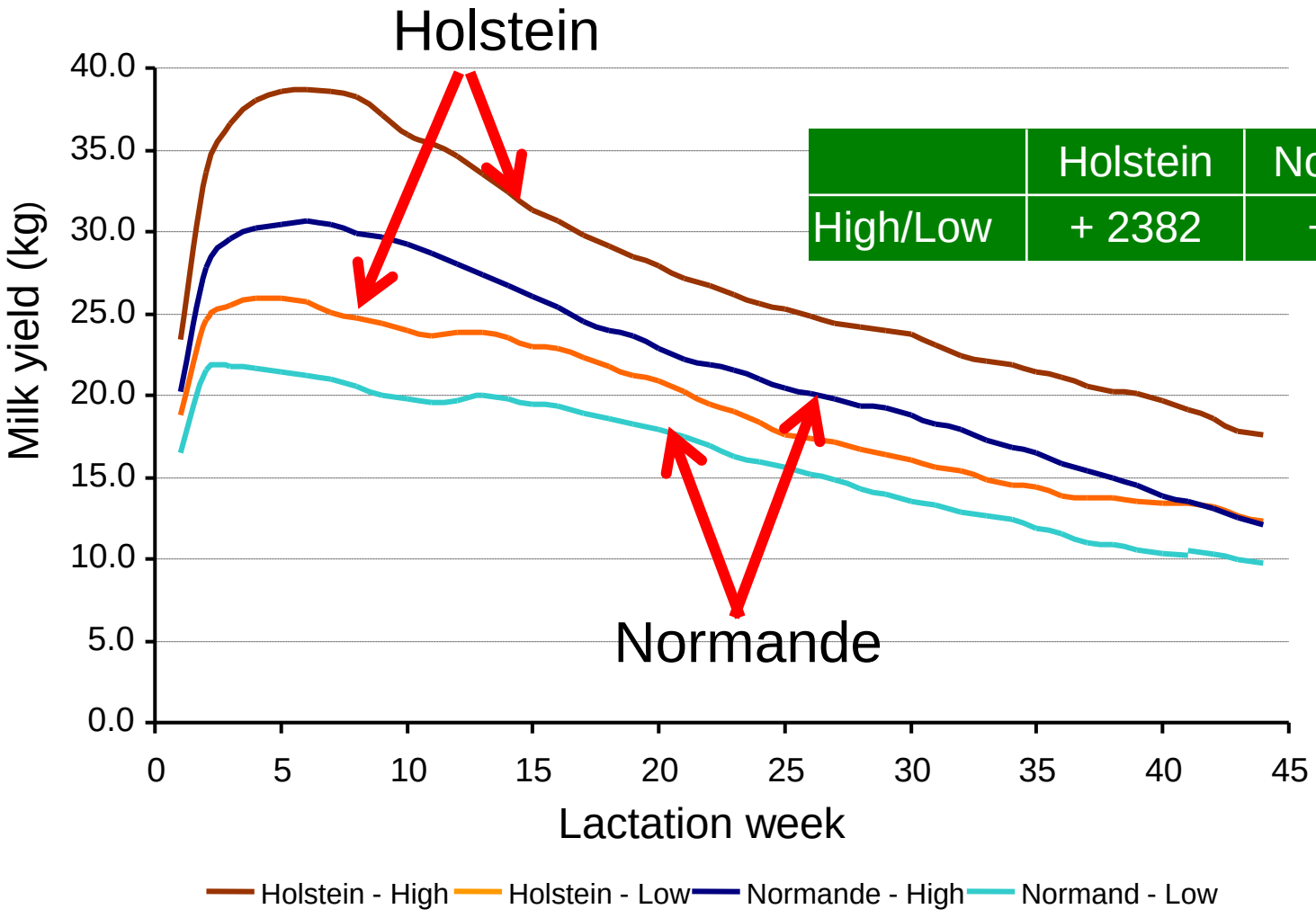
- Desirable cow traits for grass based systems
  - Robust, good confirmation for walking long distances
  - Easy care
  - High levels of performance from grass
  - Large intake of forage relative to potential milk yield
  - Fertile – calve every year, calve early in spring
  - Healthy
  - High survivability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

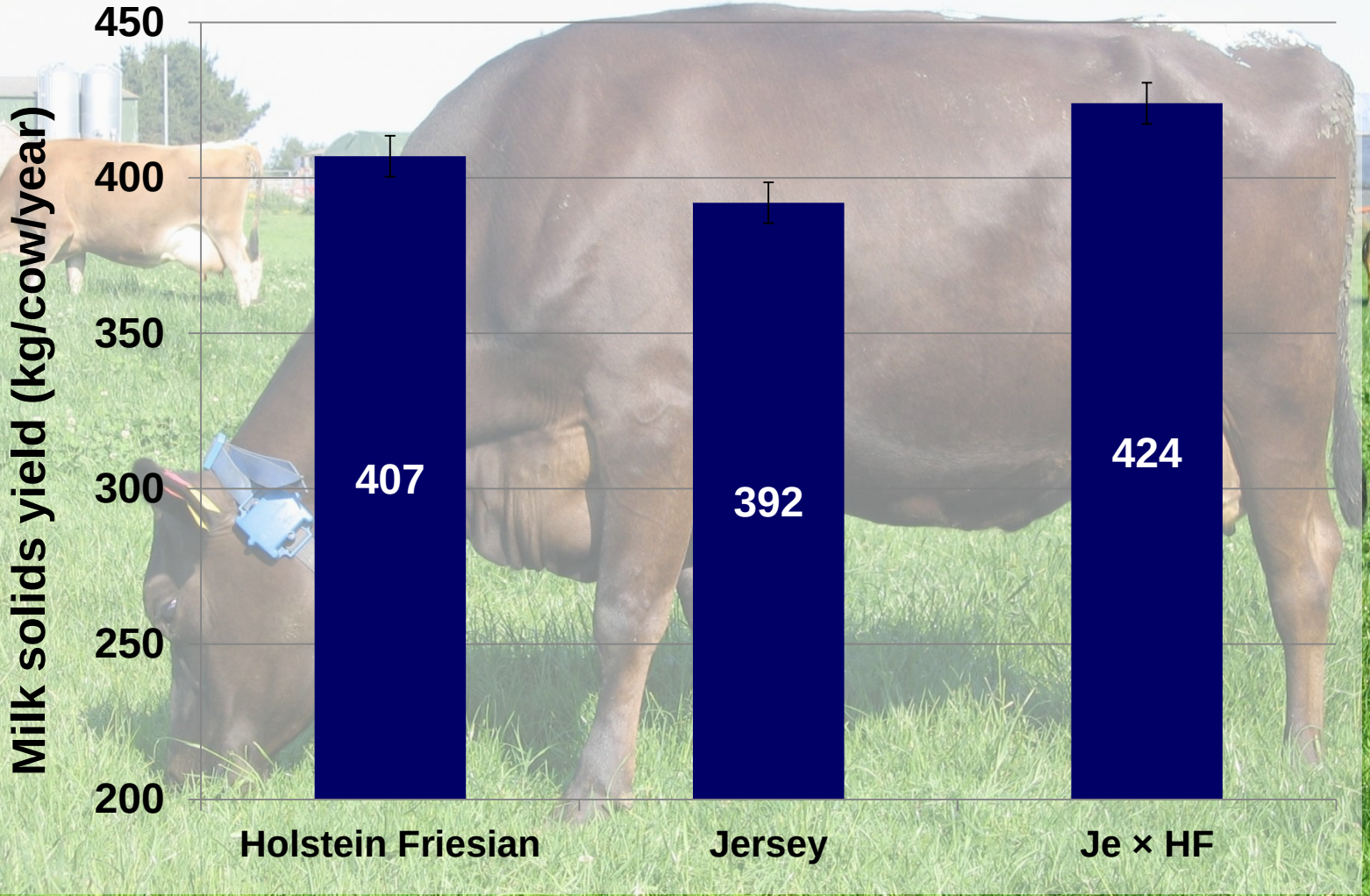
Interaction between breed and feeding system



	Holstein	Normande
High/Low	+ 2382	+ 1496

Source: L. Delaby, Le pin data

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

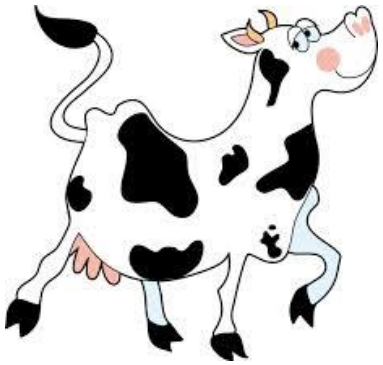
Stocking rate (cows/ha) on farms growing different amounts of pasture and feeding different amounts of concentrate/cow

Concentrate (t DM/cow)	Pasture grown (t DM/ha)			
	10	**12**	**14**	**16**
0.00	1.5	2.0	2.3	2.6
0.25	1.7	2.1	2.4	2.8
0.50	1.8	2.2	2.5	3.0
1.00	2.0	2.4	2.9	3.2
1.50	2.2	2.6	3.1	3.5
2.00	2.4	2.9	3.1	3.9

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

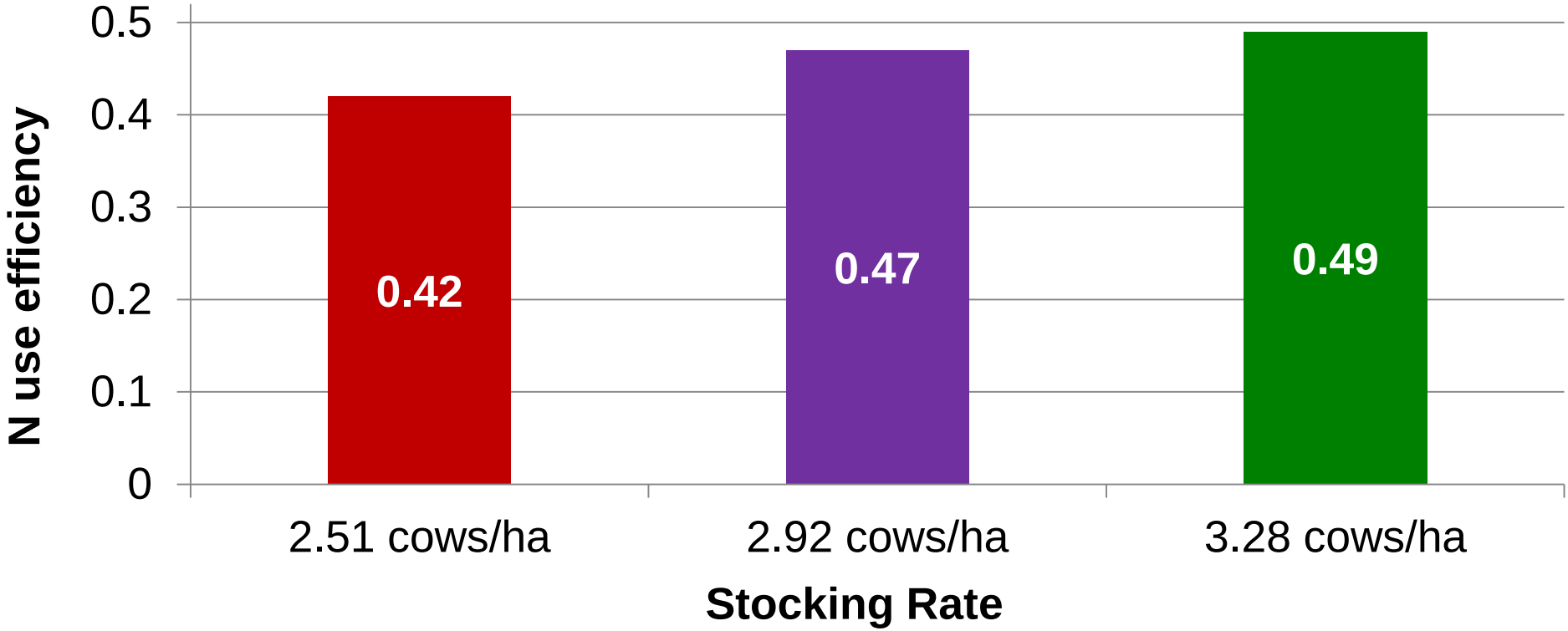
Environment

- 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)

Environment

- 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

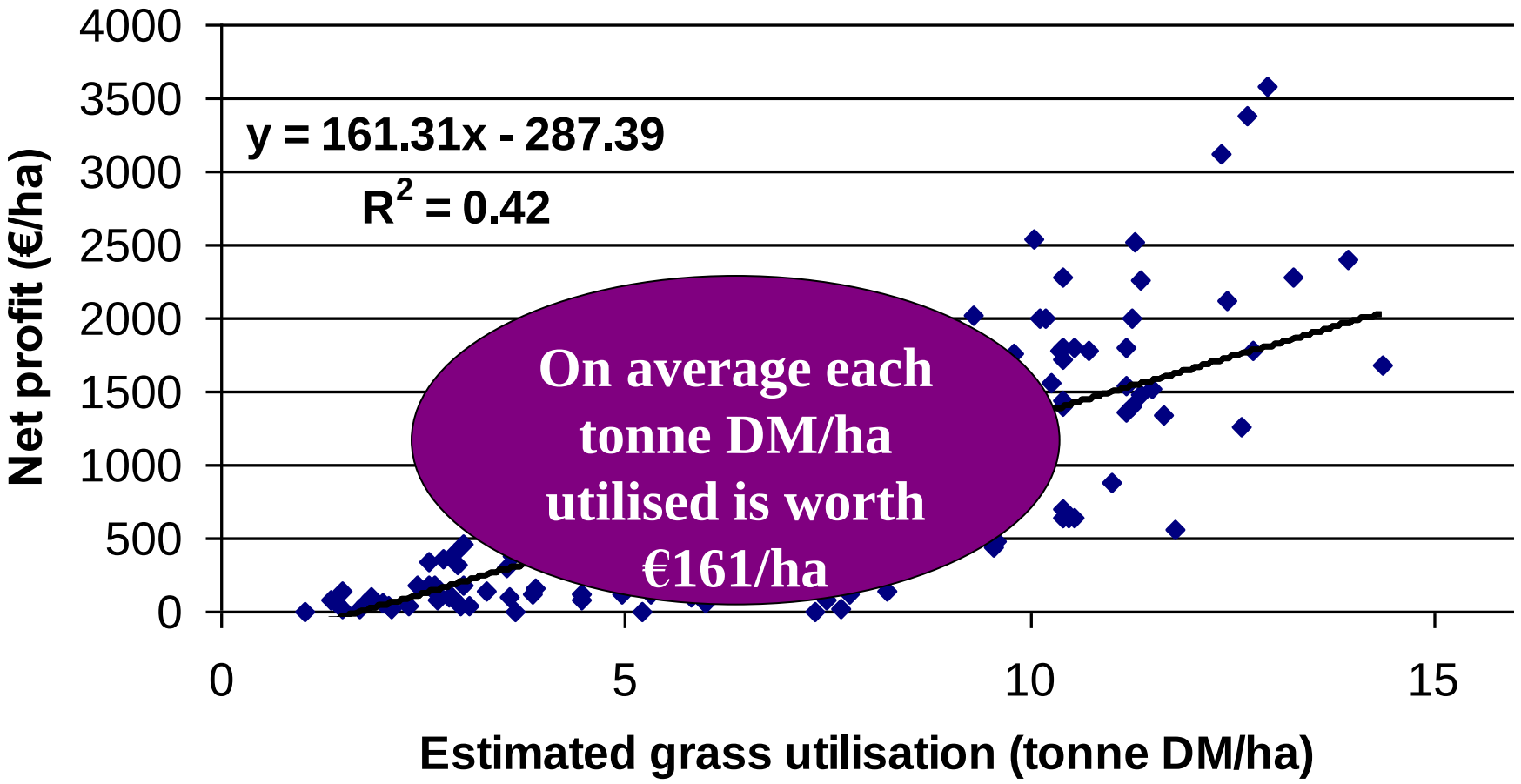


Economic efficiency

- 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)

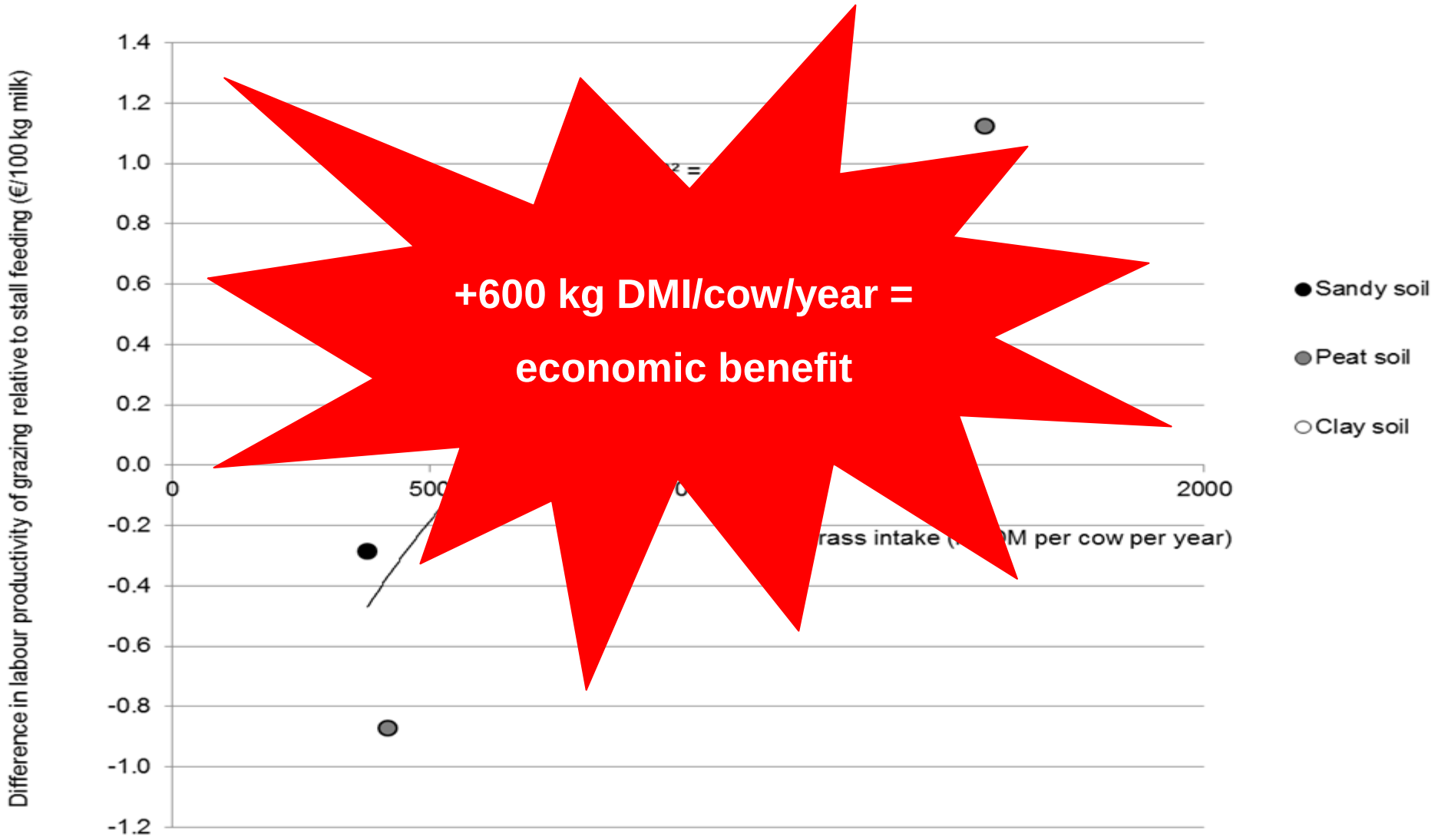
Economic efficiency

- 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)



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)



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