Research for competitive milk production systems

Conrad Ferris

20 March 2014

AFBI Dairy Conference – Growth through innovation

Moving forward – making use of research

- Dairying farming in NI has many advantages, including:
  - Ability to grow high quality forage
  - Family farm structure – attention to detail
  - Advisory service and local research capacity
- But we are now competing within a global market - must be at least as efficient as our competitors
- Innovation and the adoption of new technologies and best practice is essential
- This paper will seek to demonstrate the contribution that local research can make to improve the competitiveness of the NI dairy sector
- Focus on three main areas:
  - Dairy cow genetics
  - Winter feeding
  - Grazing management

afbi Agri-Food and Biosciences Institute

Optimising cow genetics

afbi Agri-Food and Biosciences Institute

The biological basis of higher milk yields

- Rapid increase in the genetic merit for milk yield of the UK dairy herd in the 90's
- What was the biological basis of these higher milk yields?

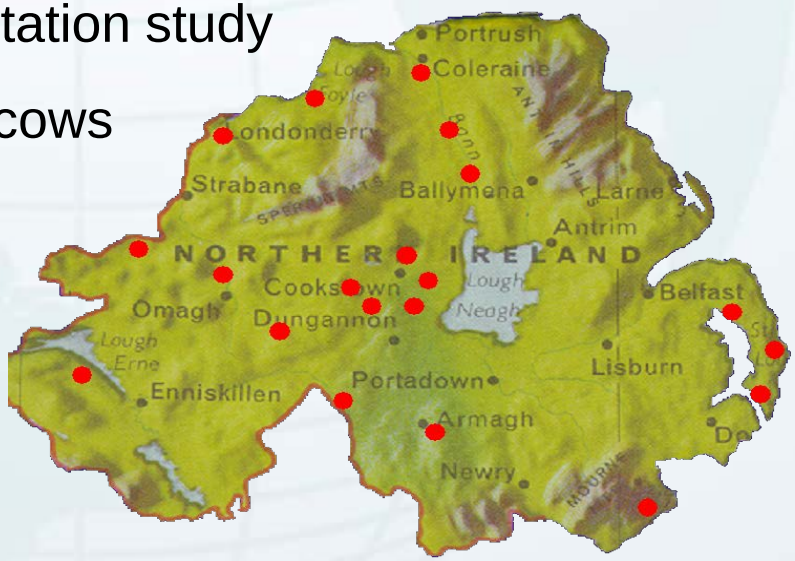
Genetic merit	*Milk yield (kg/day)*	*Dry matter intake (kg/day)*	*Gross energetic efficiency*	*Biological efficiency (kl)*	*Condition score change*
Low (traditional cow)	29.0	19.0	0.36	0.67	+0.5
High (imported cow)	37.2	20.2	0.45	0.66	-0.2

- Selection programmes with a primary focus on milk yield resulted in a Holstein cow with a high efficiency for milk production
- But a cow that produced milk at the expense of her own body tissue reserves – excessive negative energy balance and a decline in fertility, health and longevity
- Options to tackle the problem?

afbi Agri-Food and Biosciences Institute

Alternative breeds?

- There are many alternatives to the Holstein – but do they offer real potential to improve profitability of NI dairy systems?
- Scandinavian countries have made real progress within their cattle populations by selecting for functional traits for over 40 years
- Controlled comparison of Norwegian Red and Holstein cows on 20 local dairy farms
- 5 lactation study
- 440 cows



Norwegian Red vs Holsteins

Positives	Fewer calving difficulties
	Fewer calves born dead (4% vs13% at first calving)
	Similar yield of milk solids
	40% reduction in somatic cell count
	Improved fertility
	Improved survival (4.2 vs 3.5 lactations)
	Increased profit (£78/cow/year)
Negatives	Poorer temperament (especially as heifers)
	Poorer type traits (especially udder quality)

- NR breed outperformed the Holstein in traits included within its breeding programmes
- Study provided clear evidence of benefits arising from ‘multi-trait’ selection programmes!

Crossbreeding?

- Why crossbreeding? Desirable traits from another breed and Heterosis

	Holstein	Jersey crossbred
Milk Yield (litres/cow/lactation)	6070	5463
Fat (%)	4.20	4.78
Protein (%)	3.30	3.59
Fat + Protein yield (kg/cow/lactation)	467	471
Average live weight (kg)	510	470

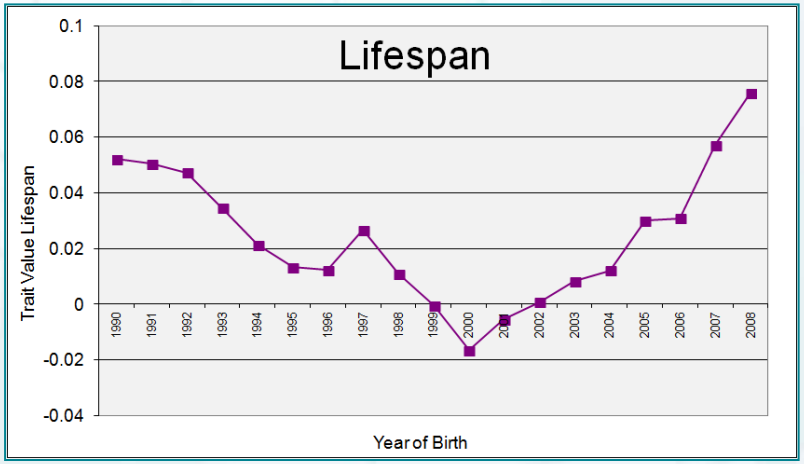
- Crossbred cows grazed for an extra 50 minutes each day - well suited to grass based systems
- Functional traits:
  - Reduced incidence of still births, mastitis and lameness
  - Improved fertility,
  - Increased longevity (4.8 vs 3.6 lactations)
  - Increased profitability (£27/cow/year)

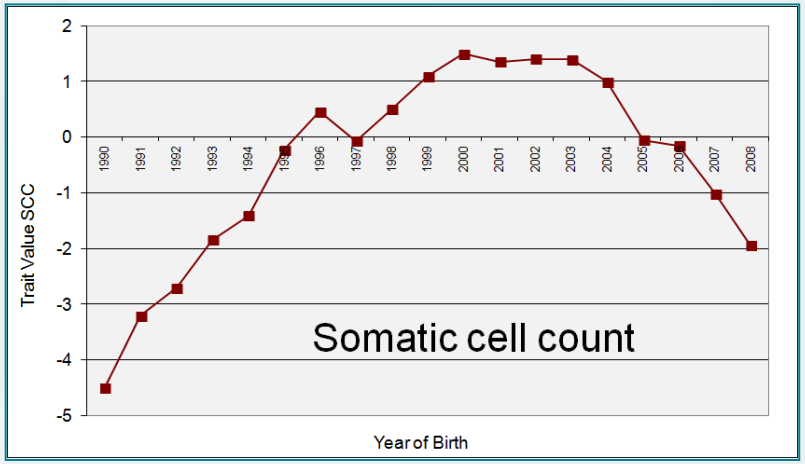
Crossbreeding should not be adopted to solve problems associated with poor management

afbi Agri-Food and Biosciences Institute

Re-defining genetic merit

- Breeding goals within the Holstein breed have changed dramatically
- 'High genetic merit' now means 'high genetic merit for profitability'
- Within the UK defined by PLI (Profitable Lifetime Index)
  - Information on a large number of traits, each weighted for appropriate economic value
  - Ranks animals on economic merit
- Adoption has resulted in the reversal of some negative trends





- PLI continues to be developed and updated - AFBI is involved in ensuring index is appropriate for NI
- Low uptake of milk recording, AI and adoption of PLI all limit the potential gains that could be made by NI producers

afbi Agri-Food and Biosciences Institute

Improving efficiency within winter feeding systems

afbi Agri-Food and Biosciences Institute

The challenges

- Dramatic increase in milk yield during the last 2 decades
- Increased nutrient demand – requires a higher quality diet
- Grass silage quality relatively unchanged during the last 20 years – increased nutrient requirements largely met through an increased reliance on concentrates
- Concentrate feed represent 60-70% of variable costs on NI dairy farms
  - Huge range in concentrate use efficiency on farms
- We live on a planet with finite resources - global challenge of food security (9 billion people by 2050)
  - Livestock consume approximately one third of world's cereal grains
  - Need to produce more from less
- Farming within increasing environmental constraints (N, P and GHG's)
  - Each litre of milk needs to be produced with a smaller environmental footprint
- Research has addressed a number of these issues

afbi Agri-Food and Biosciences Institute

Making more efficient use of dietary N?

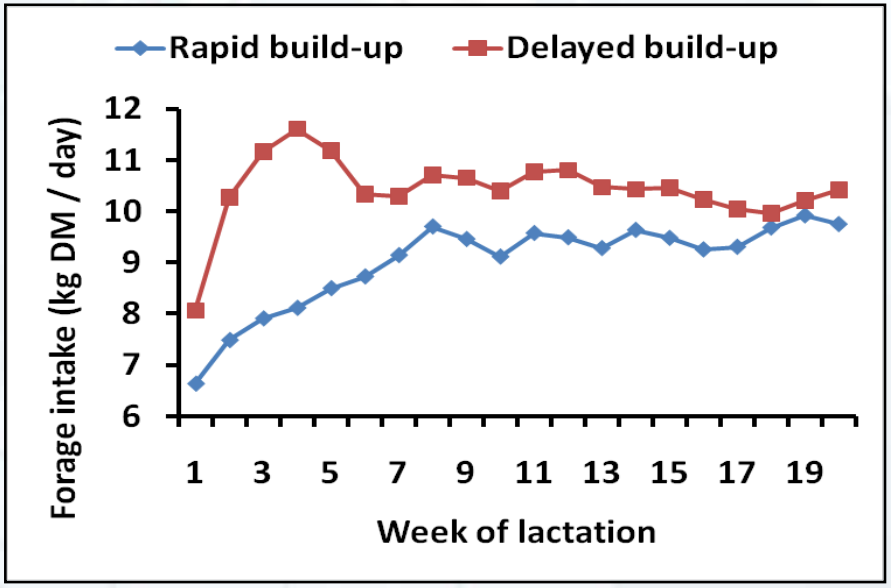
- N (protein) is expensive and inefficiently used – pollution risk
- Can the level of protein in the diet be reduced?

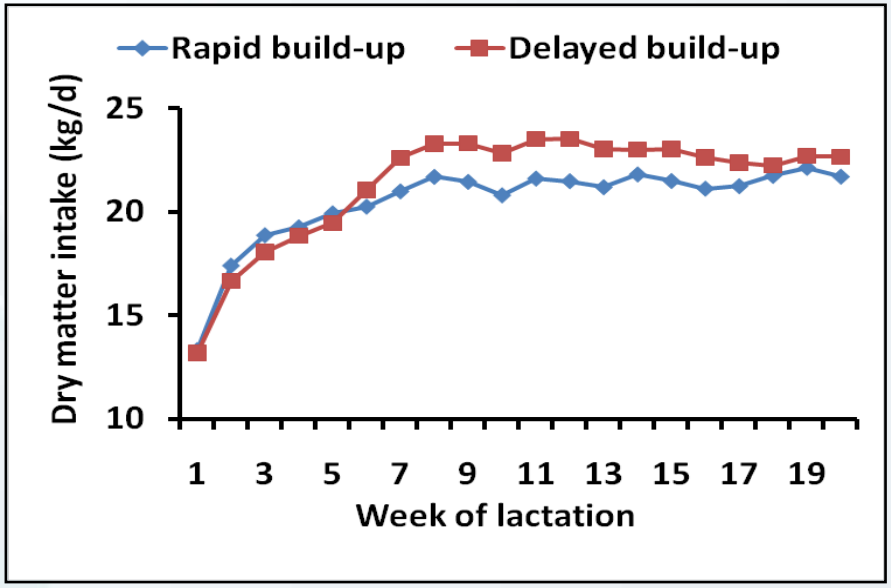
	Crude protein content of diet (% DM)		
	11.5	14.5	17.5
Dry matter intake (kg/day)	16.5	18.0	18.6
Milk yield (kg/day)	25.4	31.8	35.4
Week post calving when cow returned to +ve energy balance	3	6	12

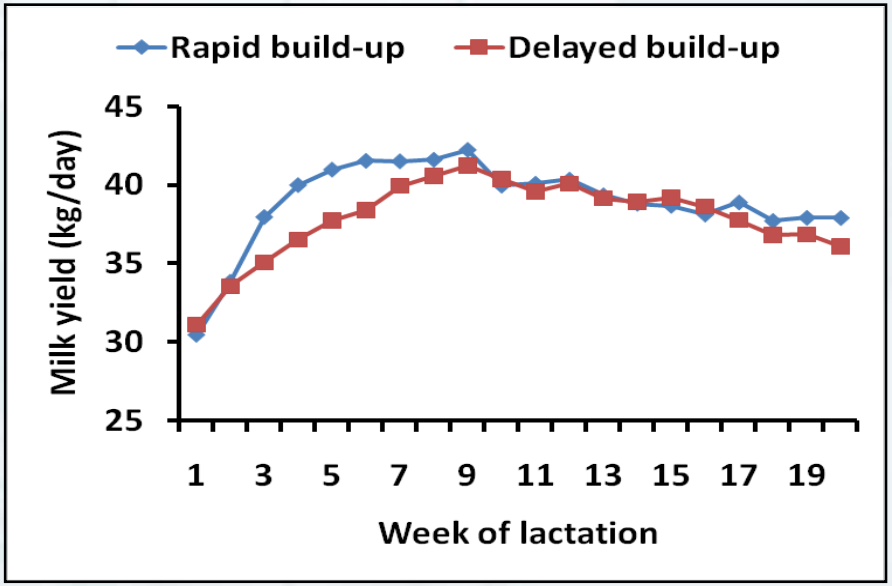
- Unacceptable loss in performance at 14.5% crude protein in the diet
- Can be overcome by supplementing with 'limiting' amino acids (methionine)
- Opportunities exist to reduce dietary protein levels to 14.5% in mid lactation without loss of performance
- Evidence that protein can be used as a short term tool to modify energy balance, without loss of performance?

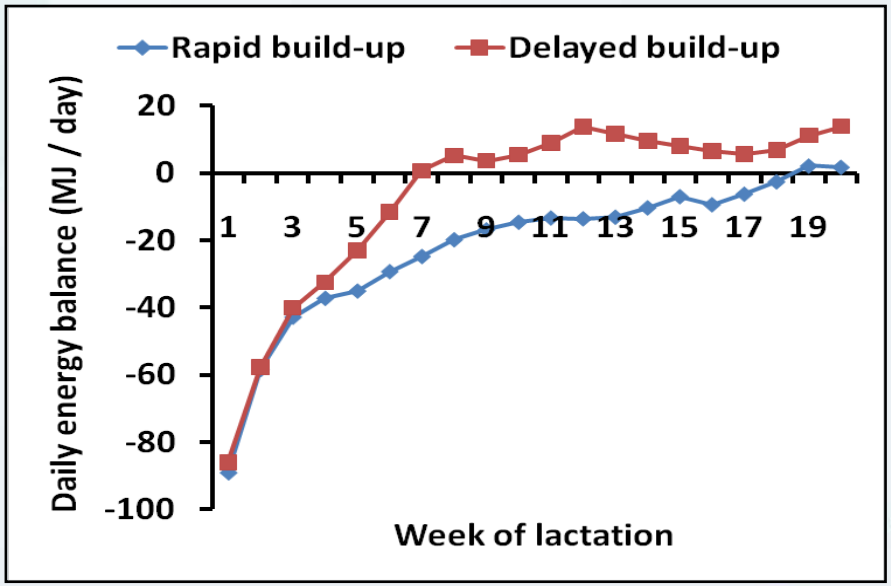
afbi Agri-Food and Biosciences Institute

Adopting a delayed concentrate build up strategy in early lactation









Effect of concentrate allocation strategy on milk production performance

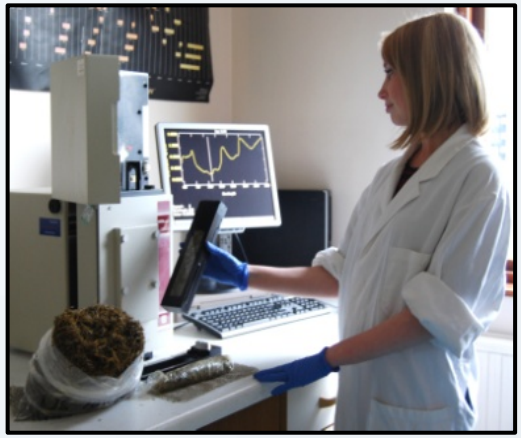
	Complete diet	***Feed-to-yield***
Total DM intake (kg/day)	22.6	21.9
Milk yield (kg/d)	41.9	42.8

- Cow performance largely unaffected by concentrate allocation strategy
  - Cows of similar genetic merit and similar calving date
- Unlikely to hold true in herds with spread calving patterns
- Developments in feeding technologies allow concentrates to be targeted at individual cows with a high level of precision
- Research ongoing to better understand the milk yield and immune response of individual cows within a feed-to-yield system

afbi Agri-Food and Biosciences Institute

Grass silage – an underused resource?

- AFBI - world leader in the development of systems to predict the chemical composition and nutritive value of forages (NIRS)



- Forage analysis available through the Hillsborough Feed and Information System (HFIS) – provides a fast, accurate and affordable service to the ruminant sector throughout Ireland
- System continues to be developed and improved:
  - Clover analysis
  - Methane?
- Little improvement in the quality of grass silage during the last 20 years
- The 'concentrate sparing' effect of quality silage has been consistently demonstrated – real scope to improve profitability by improving the quality of conserved forage

afbi Agri-Food and Biosciences Institute

Future challenge: Improving feed conversion efficiency

- Globally - conflicting demands for food for direct human consumption vs. as a feed for livestock
- Quality animal products will remain an important component of the human diet – but production efficiency must improve (more from less!)
- Can be achieved through:
  - Improved nutritional strategies
  - Improving feed conversion efficiency





? ? ? ? ?

- Breeding for more efficient cows – genomic markers!
- AFBI involved in EU projects: GplusE and GENiUS

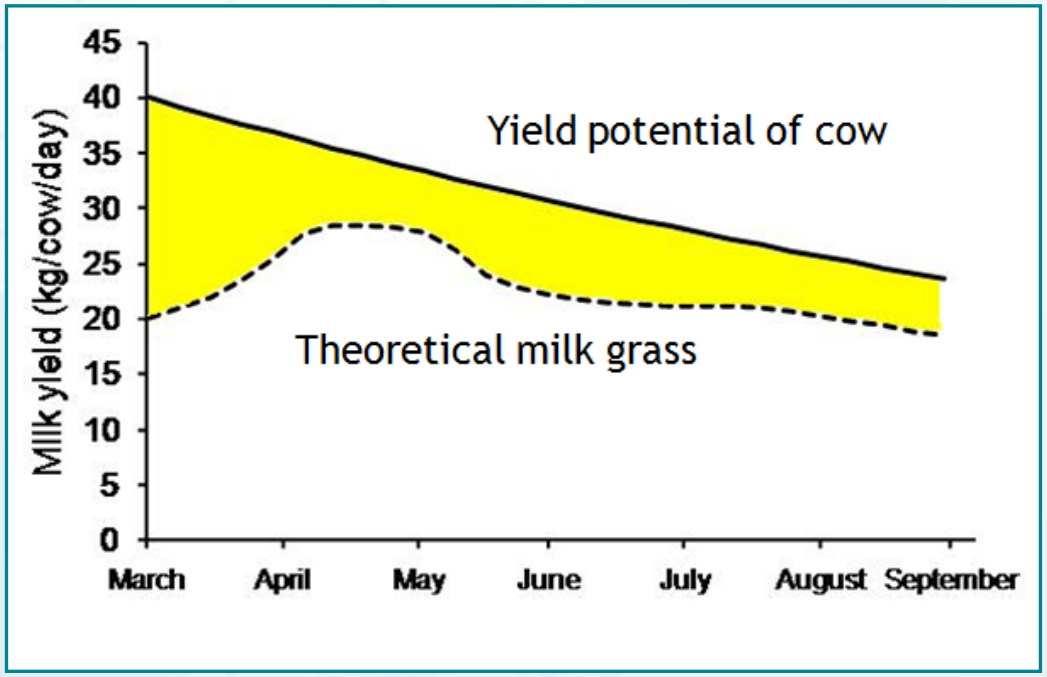
afbi Agri-Food and Biosciences Institute

Making more effective use of grazed grass

afbi Agri-Food and Biosciences Institute

The grazing dilemma!

- Grazing has many benefits.....
  - If well managed!
- There are lots of reasons not to graze!
- But are we at risk of losing one of our key advantages?



Research programme designed to identify key strategies for managing these high yielding cows during the summer

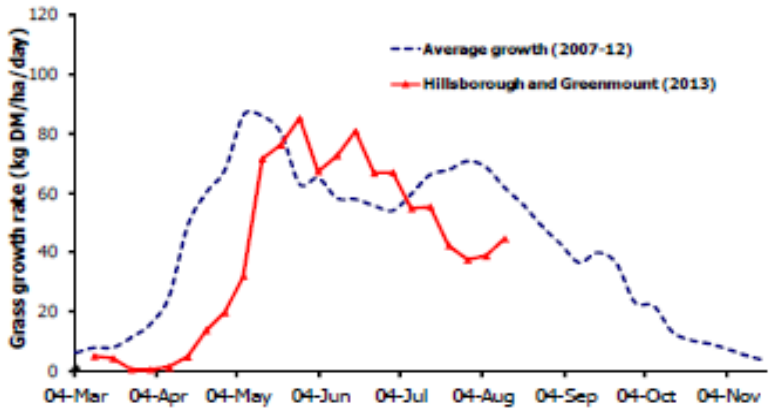
afbi Agri-Food and Biosciences Institute

Grass Check - weekly information on grass growth

GrassCheck

Week beginning 12 August 2013

Grass Growth and Quality

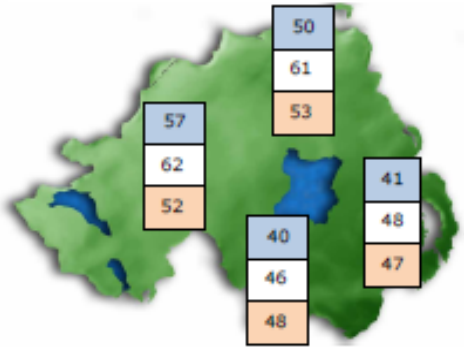


3-week Grass Growth (kg DM/ha/day)*	
Greenmount	58
Hillsborough	31
Average	45

* 270 kg N/ha/year applied

Grass Quality	
Dry matter (%)	19
ME (MJ/kg DM)	12.0
Crude protein (%)	20
Sugars (% DM)	14

Grass growth predictions represent the average daily growth over a 21 day period.



Grass Growth Predictions (kg DM/ha/day)

Current
1 week ahead
2 weeks ahead

Comment: Growth continues to improve, although it is still well below the seasonal average, particularly on the dryer sites.

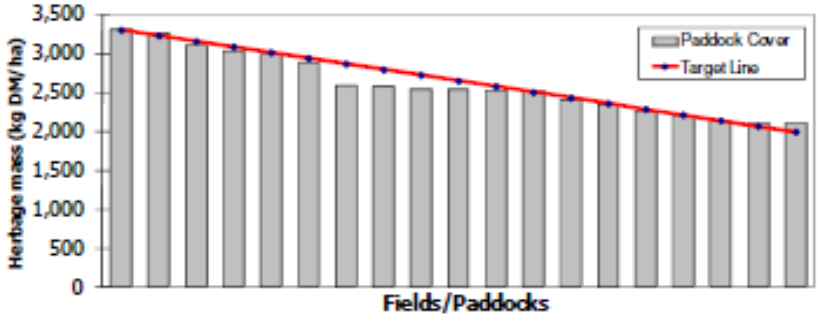
Grazing Management Focus

Pat Lavery manages 90 Holstein cows near Portadown. Pat's focus is to maximize milk yield per cow by utilising grass and grass silage. Rolling average performance figures are 7,600 litres from 1.8 tonnes of concentrate per cow with 3,600 litres of milk from forage per cow. There is no diet feeder on the farm and all concentrates are fed via a computerised "feed-to-yield" system in the milking parlour and out of parlour feeders.

Grass supply	
Average farm cover	2,590 kg DM/ha
Pre-grazing cover	3,300 kg DM/ha
7-day grass growth	59 kg DM/ha/day (based on farm cover)
Herd grass demand	52 kg DM/ha/day
Cow performance	
Milk yield and quality	26.3 litres/cow/day, 3.63% BF, 3.17% PR
Milk from forage	11.5 litres/cow/day
Concentrate feed level	6.7 kg/cow/day

Management issues

Growth rate on the farm has returned to the seasonal average following late July's rain. Paddocks too advanced for grazing were round baled in early August to control the grass wedge and provide additional silage for buffer feeding later in the season. Dry cows are following the milking herd to reduce residual covers to 2,000 kg DM/Ha. If this does not occur, paddocks are topped. Target residual covers have increased over the season with more rejection around the dung pats. The M+ on the computerised feeding system was reduced to 12 litres for cows and heifers at the beginning of August. One paddock has been identified for reseeding and will be burnt off next week.



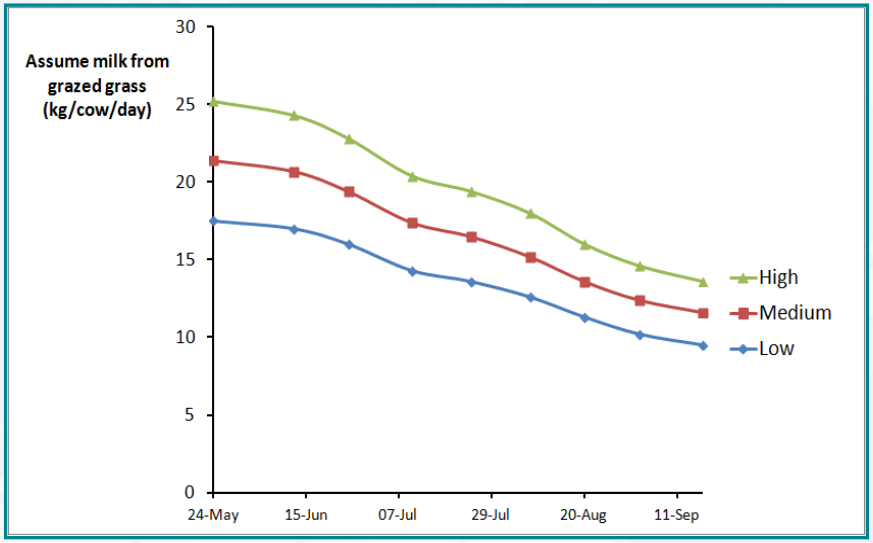
Target line in wedge reflects a pre-grazing target of 3,300 kg DM/ha and a post-grazing target 2,000 kg DM/ha. This is the quantity of grass required for a stocking rate of 3.5 cows/ha (86 cow equivalents grazing 24.7 ha) and a rotation length of 25 days, with cows eating 15 kg grass DM/day.

cafre College of Agriculture, Food & Rural Enterprise | afbi Agri-Food and Biosciences Institute | AgriSearch Farmer Funded Research | Department of Agriculture and Rural Development www.dardni.gov.uk

Also available on DARD Rural Portal http://www.ruralni.gov.uk/grasscheck

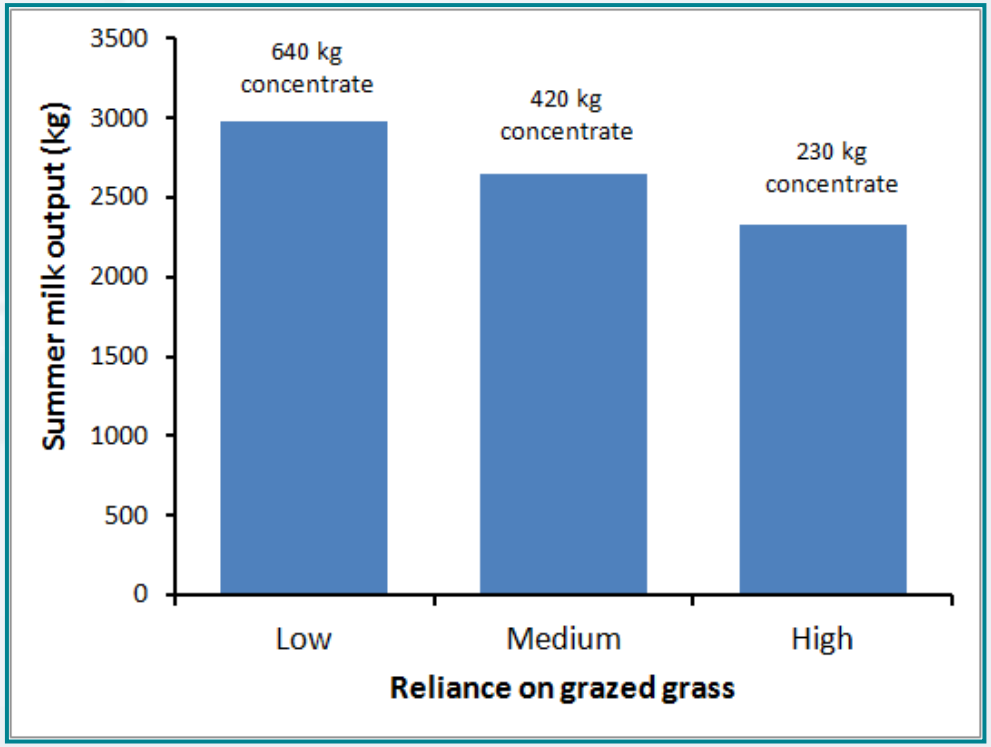
GrassCheck is part funded through producers' levy.

How much milk can grass really support?



- Study conducted to examine the impact of assuming either a High, Medium or Low level of milk sustained from grazed grass
- Concentrates offered on a 'feed-to-yield' basis

- 'Low' reliance on grazed grass resulted in more concentrates being fed, and more milk produced
- Need to develop improved concentrate supplementation strategies for higher yielding dairy cows while grazing



Confinement, partial confinement and zero grazing?

	Total confinement	*Low input grazing*
Total concentrate input (kg/cow)	3490	870
Milk yield (kg/cow)	9473	5974

- Increasing adoption of confinement, partial confinement and zero grazing systems
- Increasing public concern...
- The implications of these systems on cow health, welfare, performance, profitability and their environmental footprint need to be examined

Future opportunities - Harnessing technology for profit!

- Huge technological advances during the last decade... this will continue!
  - Automatic milking and feeding systems
  - Automatic data capture
  - Mid Infrared Reflectance Spectroscopy (MIR)
  - On-line biosensors and biomarkers
  - Real time monitoring systems
  - Genomic sequencing
  - PRECISION FARMING!

- Real scope, if the technology is utilised wisely

afbi Agri-Food and Biosciences Institute

Acknowledgements

- Work largely funded by DARD and AgriSearch
- Research teams involved in undertaking these studies

Thank you

afbi Agri-Food and Biosciences Institute