Effects of feeding intensity on milk production and animal health in different breed types

"Organic and low-input dairying – an option to Northern European Dairy Sector?"
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Auvo Sairanen[1], Marketta Rinne[1], Werner Zollitsch[2], Conrad Ferris[3]
Mogens Verstergaard[4] and Torben Larsen[4]

[1]Natural Resources Institute (Luke), Finland
[2]BOKU-University of Natural Resources and Life Sciences (BOKU), Austria
[3]Agri-Food and Biosciences Institute (AFBI), Northern Ireland
[4]Aarhus University, Denmark

SOLID | Sustainable Organic and Low Input Dairying

Introduction

- The milk yield potential of the Holstein breed has increased dramatically during the last 3 decades
  - Due to selection programmes with a primary focus on milk volume
- However, the health, fertility and longevity of the Holstein breed has declined
  - Functional traits were not included in breeding programmes until recently
- In addition, many ‘top’ Holstein sires have been bred, and their progeny tested within high concentrate input systems
- The suitability of the ‘modern’ Holstein for organic and low input systems is often questioned (as well as the role of some other ‘conventional’ breeds)

Introduction

- What are the requirements of cows for organic and low input systems:
  - Excellent health and fertility traits
  - Ability to produce high yields of milk solids from predominantly forage based diets
- Many breeds are perceived to be adapted to organic and low input systems – but for most, there is little evidence of how they performance within these systems
- Task 2.2 was designed to examine the performance of a number of breeds perceived to be adapted to these systems, with conventional breeds

To understand how contrasting genotypes adapt to a systematic restriction of nutrient and energy supply.

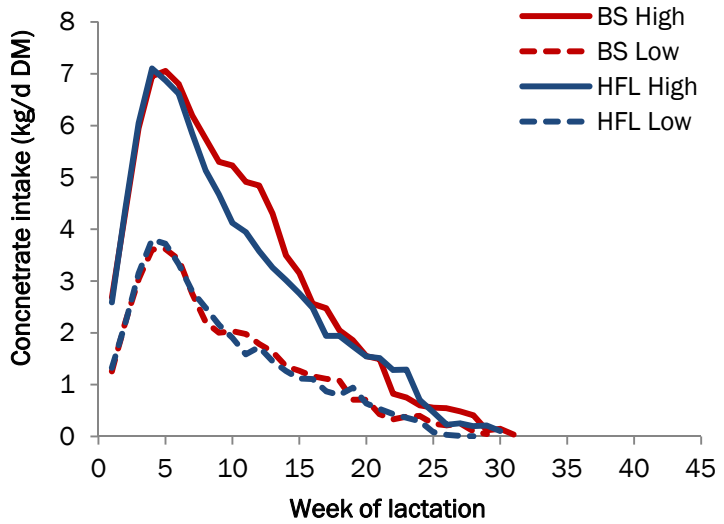
OVERVIEW

- Experiments undertaken in three ‘diverse’ regions
  - Conventional and ‘adapted’ genotypes examined in each region
  - Systems differing in concentrate inputs examined in each region

Country	Austria (BOKU)		Northern Ireland (AFBI)		Finland (Luke)	
Region	Alpine		Western European Grassland		North European Grassland/Confinement	
Genotype	Conventional	‘Adapted’	Conventional	‘Adapted’	Conventional	‘Adapted’
	Brown Swiss (n = 13)	Locally bred Holstein (n = 20)	Holstein (n = 36)	Three-way crossbred (SR x J x Hol) (n = 36)	Holstein (n = 32)	Nordic Red (n = 14)
Systems examined	Low and Moderate input systems		Low and Moderate input systems		Moderate and High input systems	

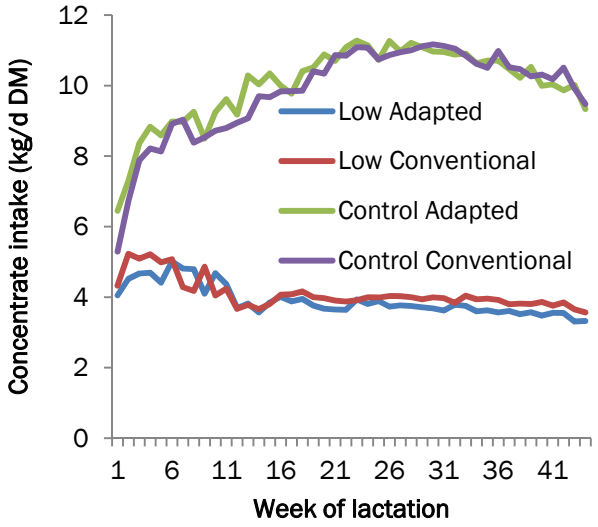
Experiment & methods, Austria

- n = 50 lactations (21 Conventional & 29 Adapted)
- Concentrate supplementation:
  - Control **618 kg** DM/cow & lact.
  - Low **279 kg** DM/cow & lact.
- Duration of grazing season: 210 d
- Turn out to pasture at 115 DIM in both experimental years

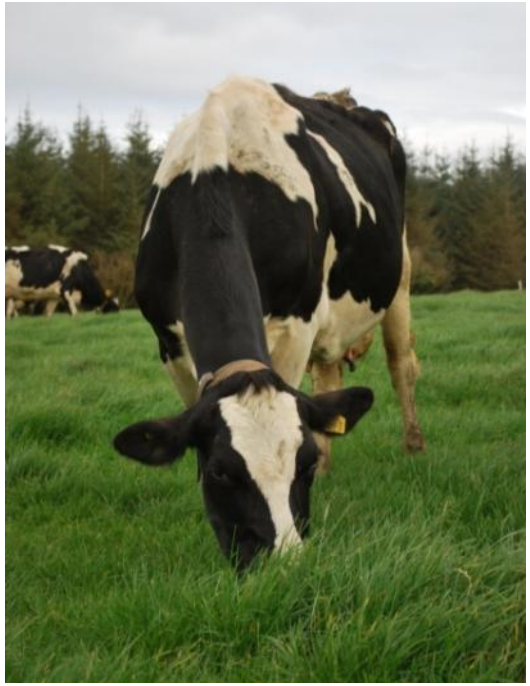


Experiment & methods, Finland

- n = 46 lactations (32 Conventional & 14 Adapted)
- Concentrate supplementation:
  - Control **3020 kg** DM/cow & lact.
  - Low **1220 kg** DM/cow & lact.
- Grass silage, barley grain, rapeseed meal
- Zero grazing
- Mainly TMR feeding
- Constant 305 d lactation

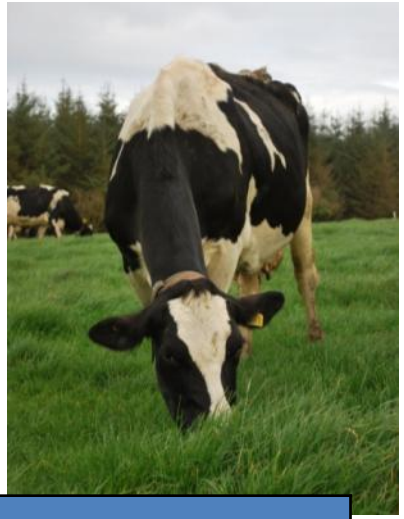


Experiment & methods, Northern Ireland



- 2 x 2 factorial design experiment
- 68 Spring calving dairy cows
  - 34 Holstein-Friesian (HF)
  - 34 '3-breed crossbreds)
    - Swedish Red x Jersey x Holstein-Friesian (SRx)
      - mean lactation number, 2.8
      - mean calving date, 15 February
- 2 production systems:
  - Low concentrate input (Low)
  - Moderate concentrate input (Control)

Experiment & methods, Northern Ireland



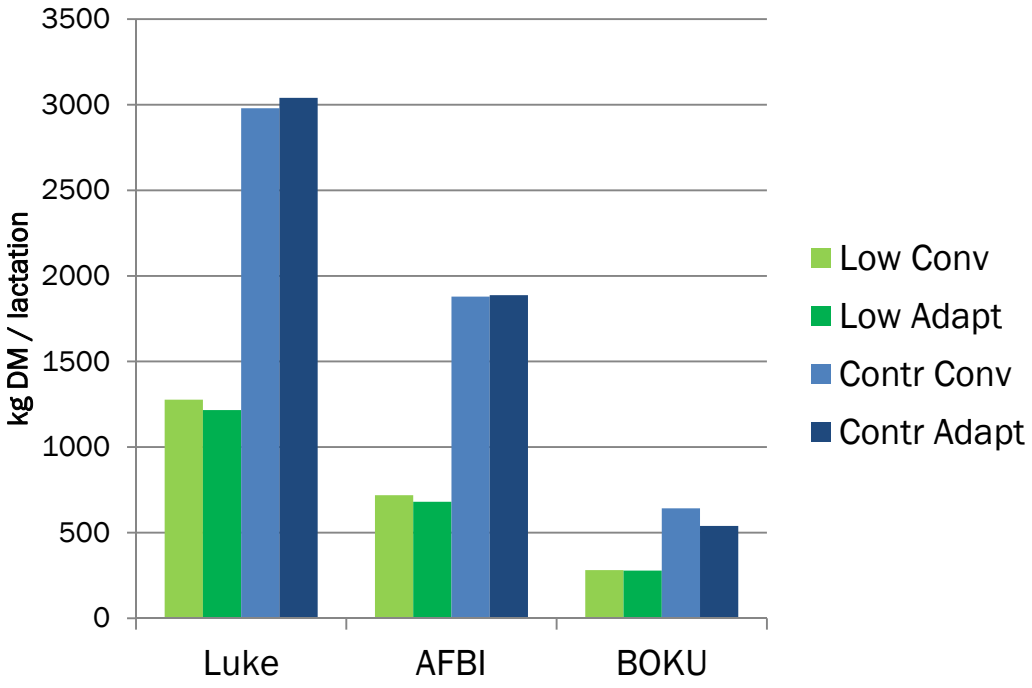
	Low input	Moderate input
Early lactation (calving until turnout)	Grass silage + concentrates (mixed in 70 : 30 DM ratio)	Grass silage + concentrates (mixed in a 40 : 60 DM ratio)
Mid lactation	Grazed grass plus 1.0 kg concentrate	Grazed grass plus 4.0 kg concentrate
Late lactation (re-housing until drying off)	Grass silage + concentrates (85 : 15 DM ratio)	Grass silage + concentrates (70 : 30 DM ratio)

Feed intake, interactions

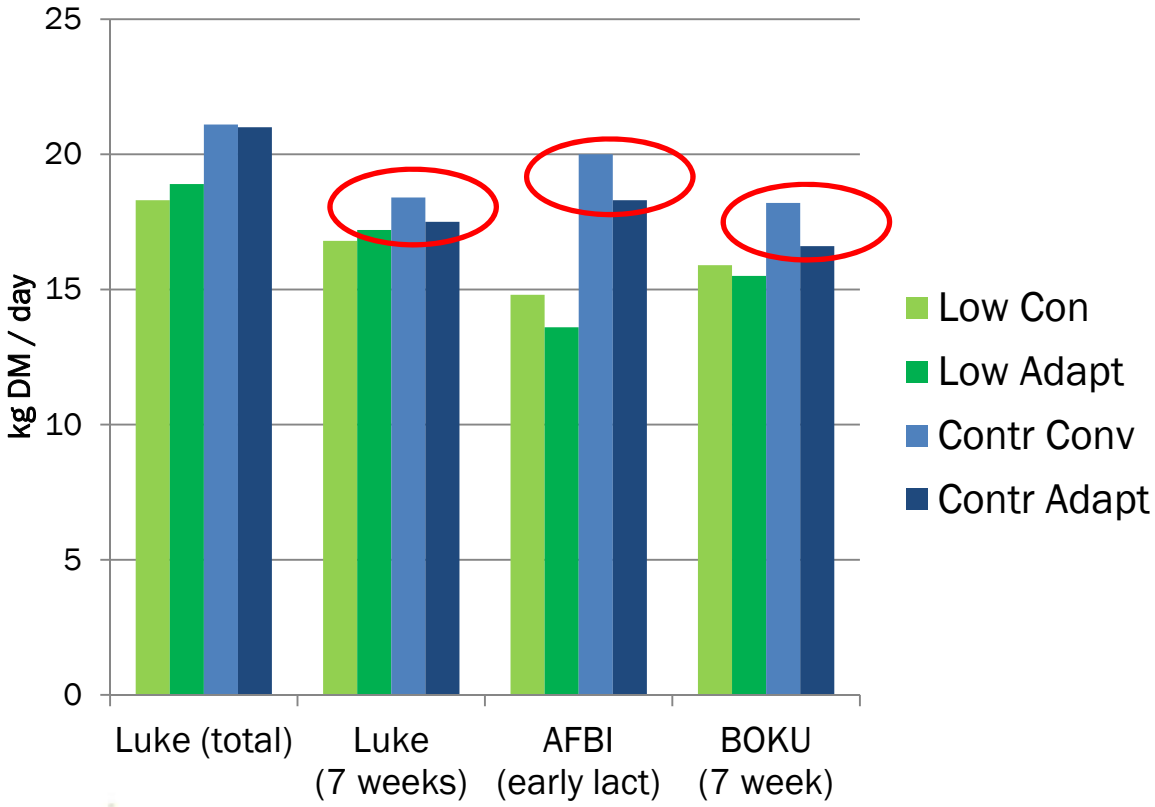
Concentrate	Low		Control			Significance		
Breed	Conv	Adapt	Conv	Adapt		Breed	Conc	B x C
Concentrate kg DM /lactation								
Luke	1277	1216	2979	3040		NS	<0.001	NS
AFBI	719	680	1879	1887		NS	<0.001	NS
BOKU	281	278	642	539		NS	<0.001	NS
Total intake, kg DM / d								
Luke (total)	18.3	18.9	21.1	21.0		NS	<0.001	NS
Luke (7 week)	16.8	17.2	18.4	17.5		NS	NS	NS
AFBI (Early lact)	14.8	13.6	20.0	18.3		NS	<0.001	NS
BOKU (7 week)	15.9	15.5	18.2	16.6		NS	<0.04	NS

Concentrate supplementation increased DMI regardless of the breed
High substitution rate between concentrate and roughage

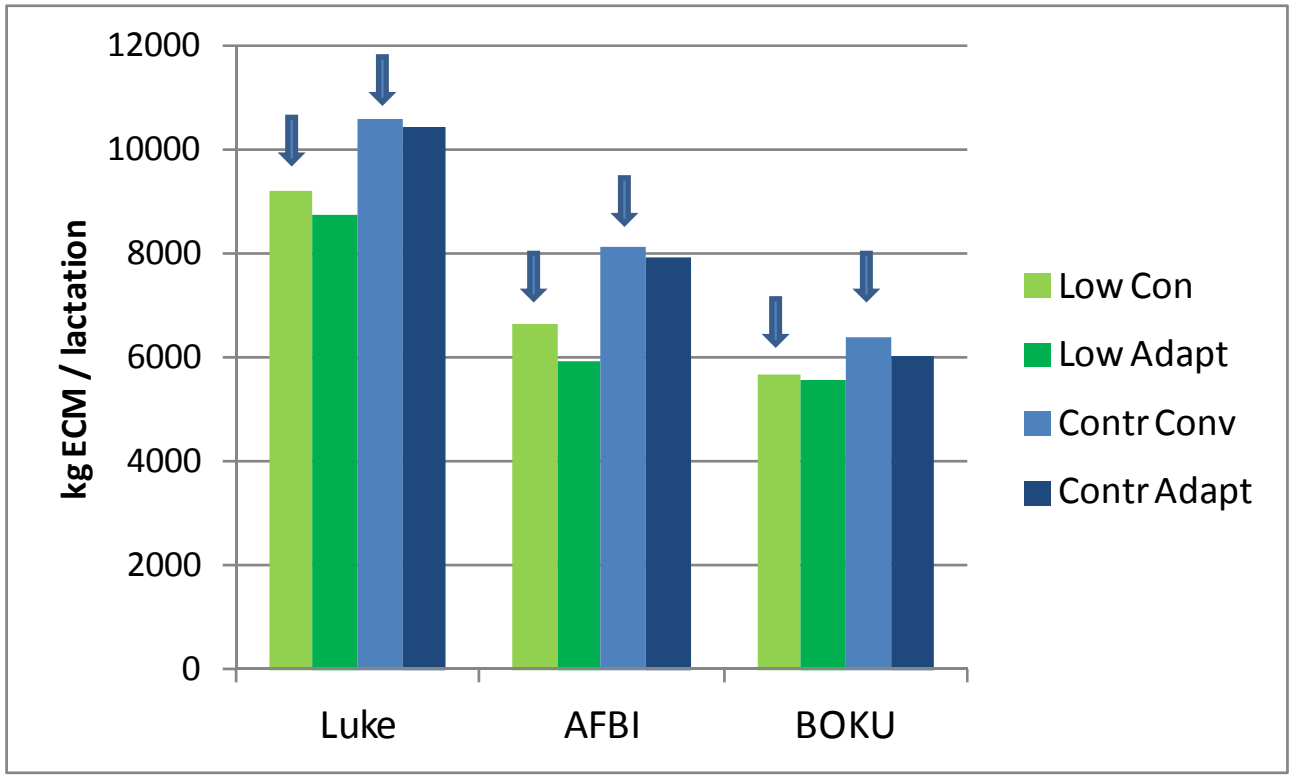
Concentrate intake



Total DM intake



ECM yield


12000
10000
8000
6000
4000
2000
0
kg ECM / lactation
Luke
AFBI
BOKU
Low Con
Low Adapt
Contr Conv
Contr Adapt

Milk and ECM production, kg/lactation

Concentrate	Low		Control			Significance		
Breed	Conv	Adapt	Conv	Adapt		Breed	Conc	B x C
Milk production								
Luke	8510	8052	9791	9028		0.15	<0.001	NS
AFBI	6636	5451	7984	7306		<0.001	<0.001	NS
Energy corrected milk production								
Luke	9180	8723	10553	10431		NS	<0.001	NS
AFBI	6642	5916	8098	7911		0.1	<0.001	NS
BOKU	5643	5570	6363	6021		NS	<0.001	NS

Concentrate supplementation increased procuction regardless of the breed
The amount of concentrates was low in BOKU => no breed effect

Body tissue reserves

Concentrate	Low		Control			Significance		
Breed	Conv	Adapt	Conv	Adapt		Breed	Conc	B x C
Live weight								
Luke	614	617	624	664		NS	0.1	NS
AFBI	555	518	563	542		<0.001	<0.01	NS
BOKU	593	537	585	533		<0.01	NS	NS
Body condition score								
Luke (mean)	2.8	3.2	2.9	3.2		<0.001	0.08	NS
AFBI (mean)	2.12	2.41	2.2	2.42		<0.001	NS	NS
BOKU (end lact)	2.7	2.6	2.7	2.6		NS	0.1	NS

Cows in Finland were the most heavy, supplementation increased weight
Adapted cows in Luke and AFBI have higher BCS

Fertility

Concentrate	Low		Control			Significance		
Breed	Conv	Adapt	Conv	Adapt		Breed	Conc	B x C
1st service conception rate (%)								
Luke	50	31	50	44		-	-	-
AFBI	43	60	31	13		NS	0.1	NS
BOKU	60	53	45	57		NS	NS	NS
Pregnancy (%)								
Luke	67	75	88	94		-	-	-
AFBI	71	100	85	85		NS	NS	0.03
BOKU	100	87	82	86		NS	NS	NS
Services per conception (n)								
BOKU	1.4	1.6	1.6	1.4		NS	NS	NS

Luke had problems in pregnancy in Low
ABI had problems in Low with Conventional breed

Health, Finland

	Low		Control	
	Convent	Adapted	Convent	Adapted
% of cows treated for				
Mastitis	**31**	**17**	**19**	**25**
Metab Disease	**31**	**0**	**25**	**13**
Ovarian Disorders	**6**	**0**	**13**	**38**
Lameness	**44**	**0**	**31**	**25**
Other Infectious	**13**	**0**	**19**	**0**

The number of Adapted cows is low => not superior health

Economy Finland

	Low		Control	
	Conv	Adapt	Conv	Adapt
Value of milk produced, €/cow	3149	3060	3720	3611
Margin over feed costs, €/cow	2297	2241	2695	2577
Margin over feed costs, €/litre	0.27	0.28	0.28	0.29

The production in Finland is not as profitable as presented

Economy Northern Ireland

	Grazing		Concentrate	
	Hol	H x J	Hol	H x J
Northern Ireland				
Value of milk produced, £/cow	1643	1644	2382	2089
Margin over feed costs, £/cow	1041	1043	1184	941
Margin over feed costs, £/litre	0.17	0.17	0.13	0.13

This is an example based on the study of Holstein *vs* Jersey x Holstein

Conclusions, Finland

- The breeds responded similarly to a reduced supplementation level
- Low concentrate feeding was a biologically applicable strategy
  - Acceptable body tissue mobilization also with low supplemented level
  - Reproductive performance in Low ?
- The high use of concentrate supplementation increased milk production and margin over feed costs

Conclusions, Austria

- The different **selection focuses** are only partially reflected in the response pattern of cows to a reduced supplementation level
- **Similar milk yield, body tissue mobilisation** and **reproductive performance** for both breeds
- **Dietary treatment** mainly influenced **milk production** while **reproductive performance** was relatively insensitive to concentrate supplementation
- Feed challenge did not exceed **metabolic adaptation:** response in milk yield, but not in reproduction

Conclusions, Northern Ireland

- Crossbred cows had lower intakes in early lactation
- Lower milk with crossbred cows but milk fat and protein content improved with crossbred cows – no effect on milk solids yield
- No interaction between genotype and production system for milk production
- Crossbred cows were lighter than Holstein cows
- Fertility not improved with crossbred cows, but less mastitis


Thank you !