



Producing milk from grazing to reconcile economic and environmental performances

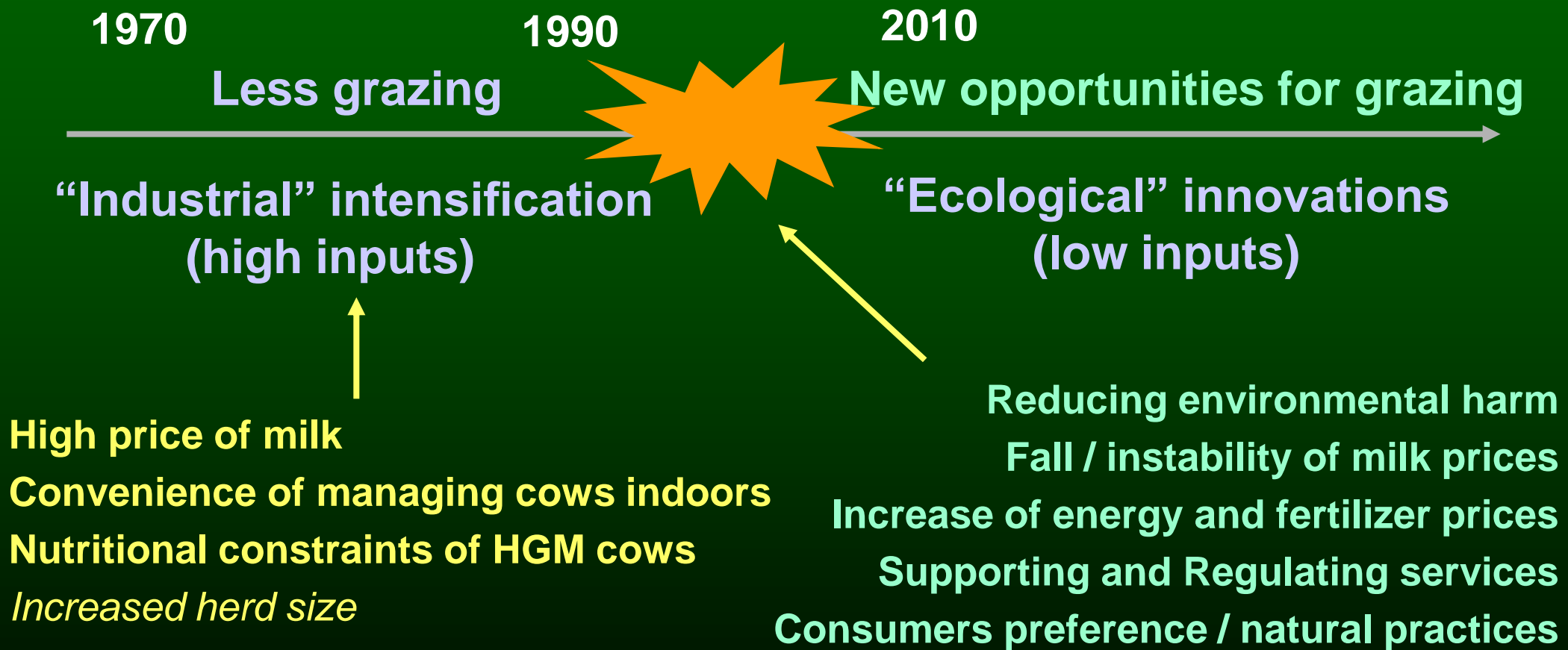
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New challenges for the dairy sector are also new opportunities for grassland based systems



Introduction

Benefits and risks of grassland based systems

How to combine farm profit and low environmental impact for successful grassland based systems ?

Forage production

Appropriate cows

Grazing management

Conclusion

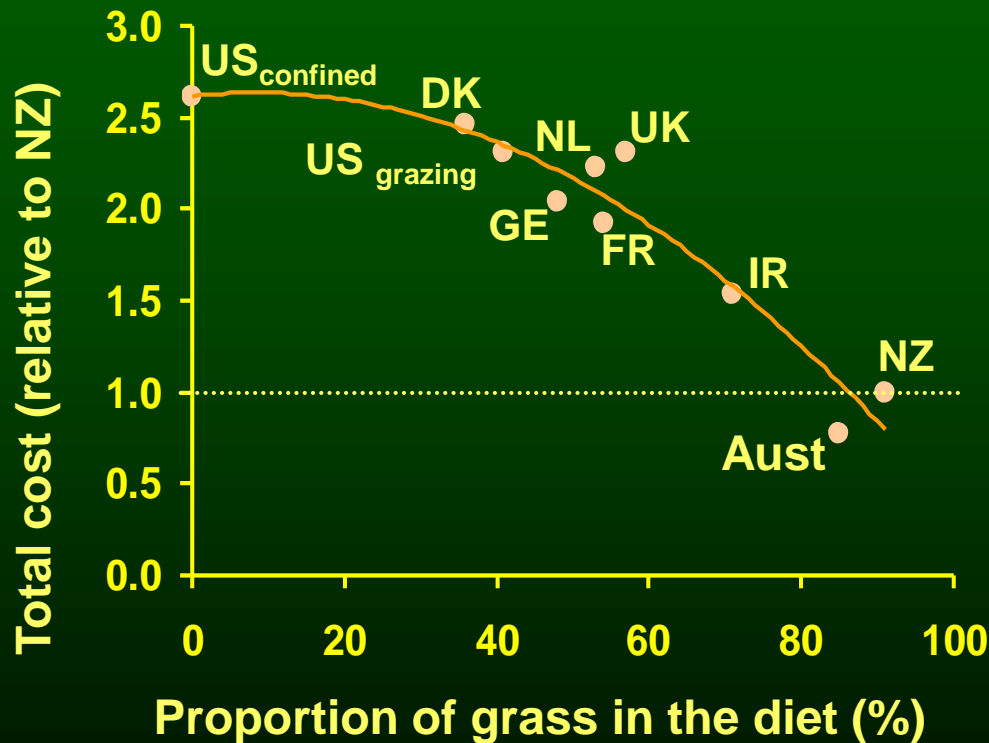
Benefits and risks of grassland based dairy systems

Grassland based systems have many assets
to combine economic and environmental performances
but... technical innovations are required



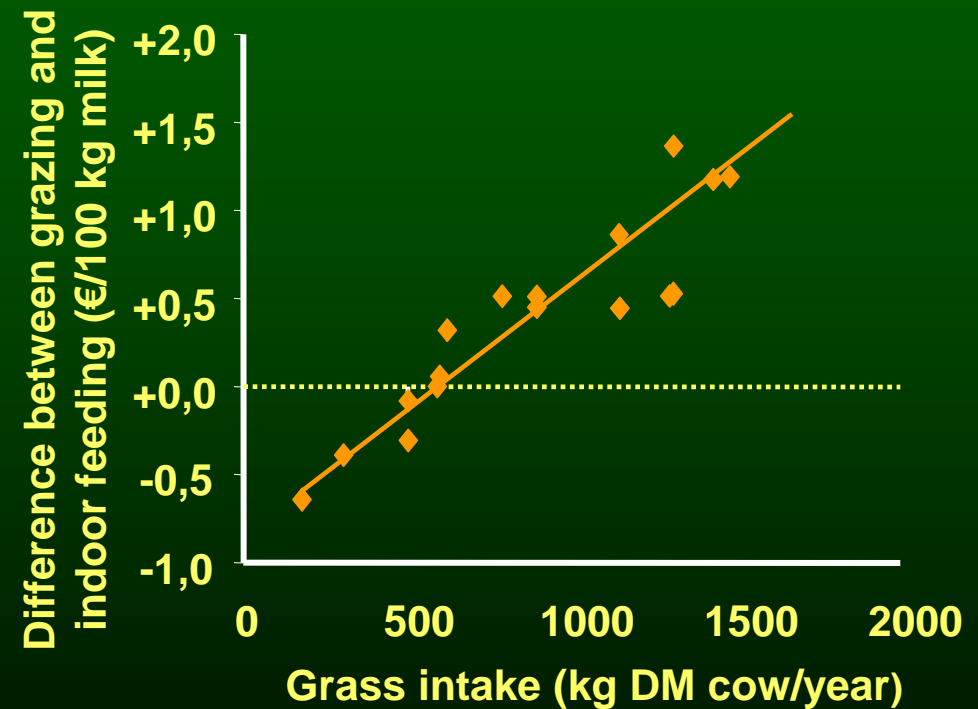
Dairy systems based on grazing are highly competitive

At world level



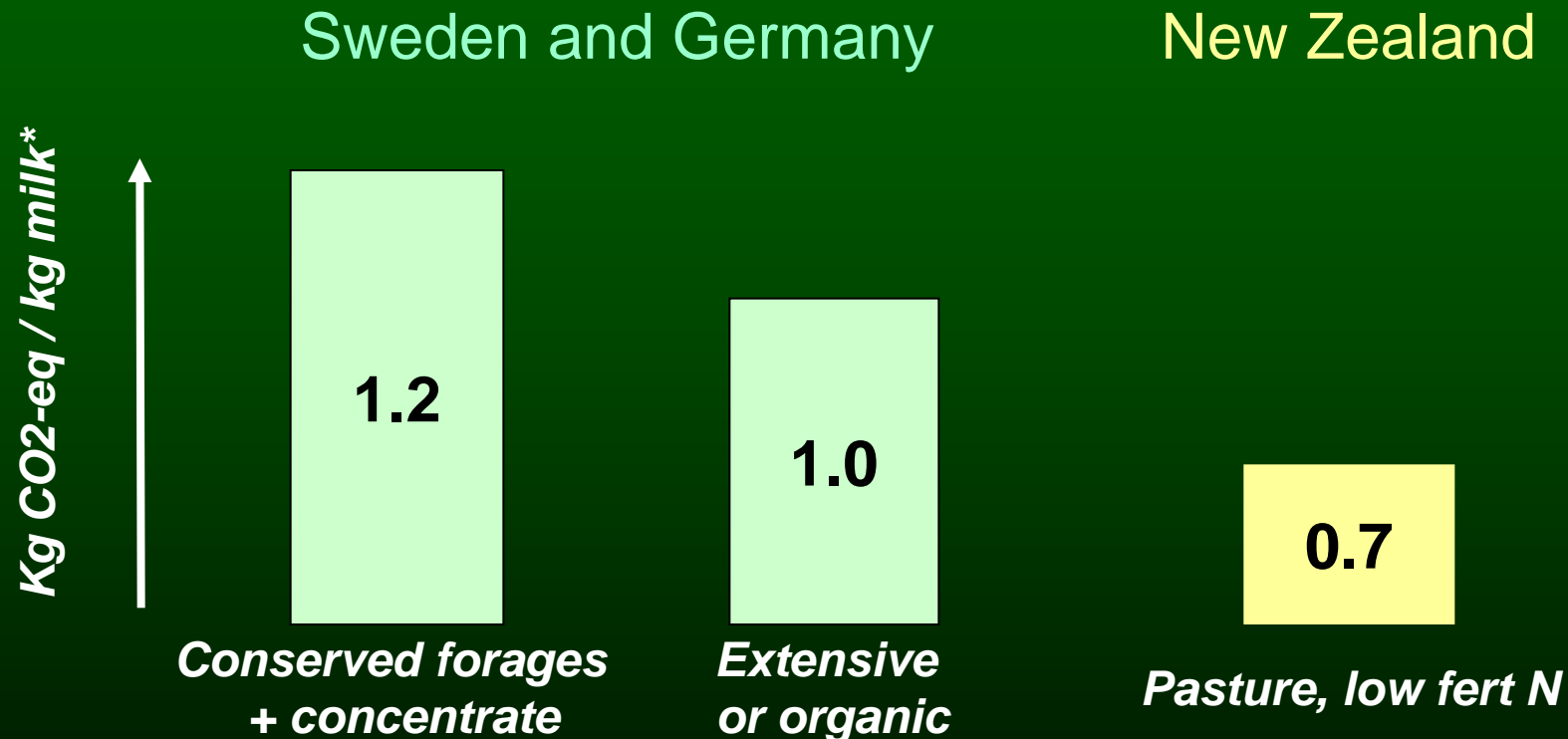
(Dillon et al., 2005)

For similar climatic conditions



(Van den Pol-van Dasselaar, EGF 2010)

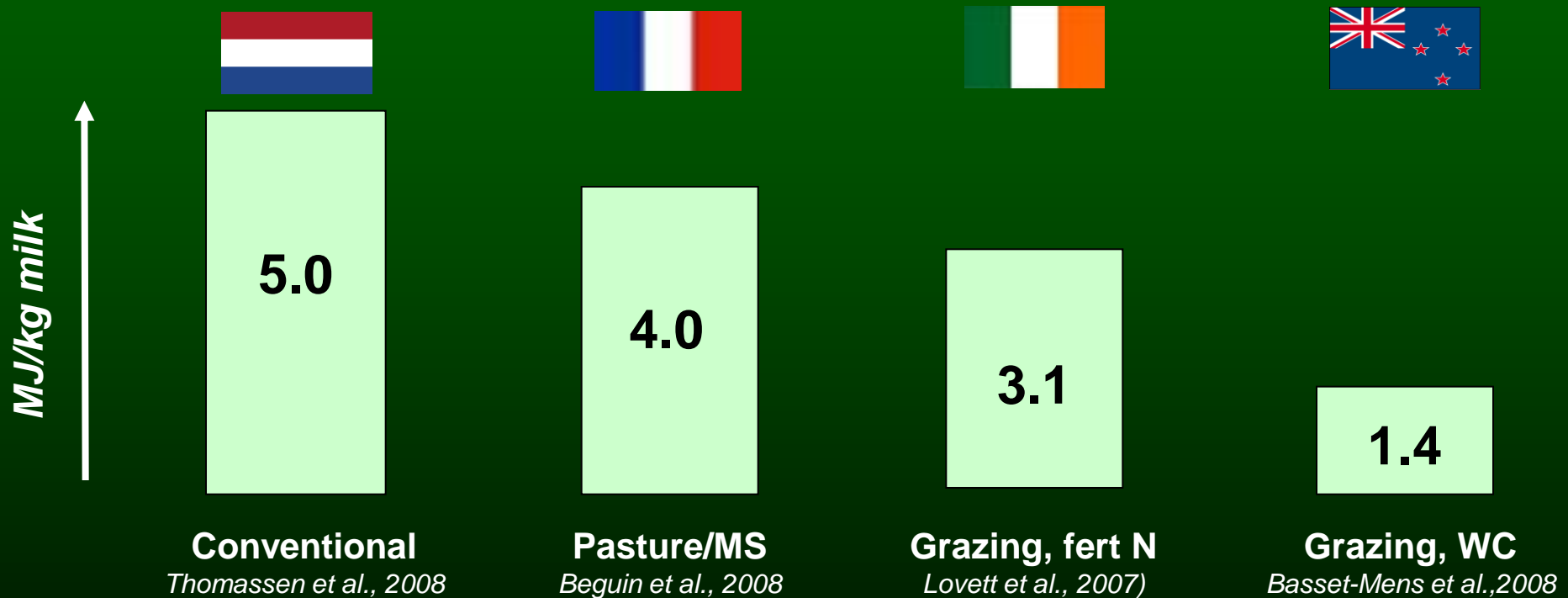
Grassland based systems offer opportunities for reducing the C-footprint of milk production



(adapted from Basset-Mens, Ledgard and Carran, 2006)

* C sequestration from grassland is not included

Grassland based systems consume less non renewable energy



Le Gall et al (2009)

***But...*the delivery of ecosystem services varies with grassland management and localisation**

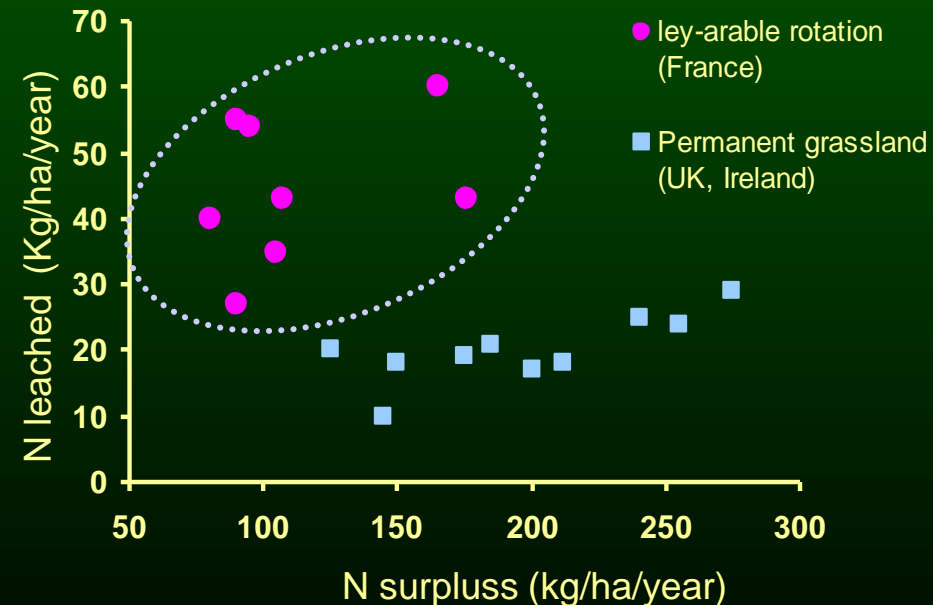
The role of grassland on water quality is questionable

Losses of N-NO₃ vary with the level of N fertilisation *(Vertes et al., 2010)*

High losses of N-N₂O have been reported *(Hyde et al. (2006))*

The ley-arable rotations present more important risks of Nitrate leaching than permanent grassland.

(Greendairy 2008)



***But...* grazing suffers of the difficulties of management**

Uncertainty of yield and quality of the resources

Dilemma between high animal performances and high utilisation of the forage that have been produced

Grass growth potential differs between and within countries

The importance of grazing in annual cow diet is variable

Different solutions should be investigated and proposed

Forage production for successful grassland based systems

Multi species swards with forage legumes have potential to match in a positive way the stakes of dairy systems



***Agronomical issue* : Potential of grass-clover mixtures in different soils and climatic conditions**

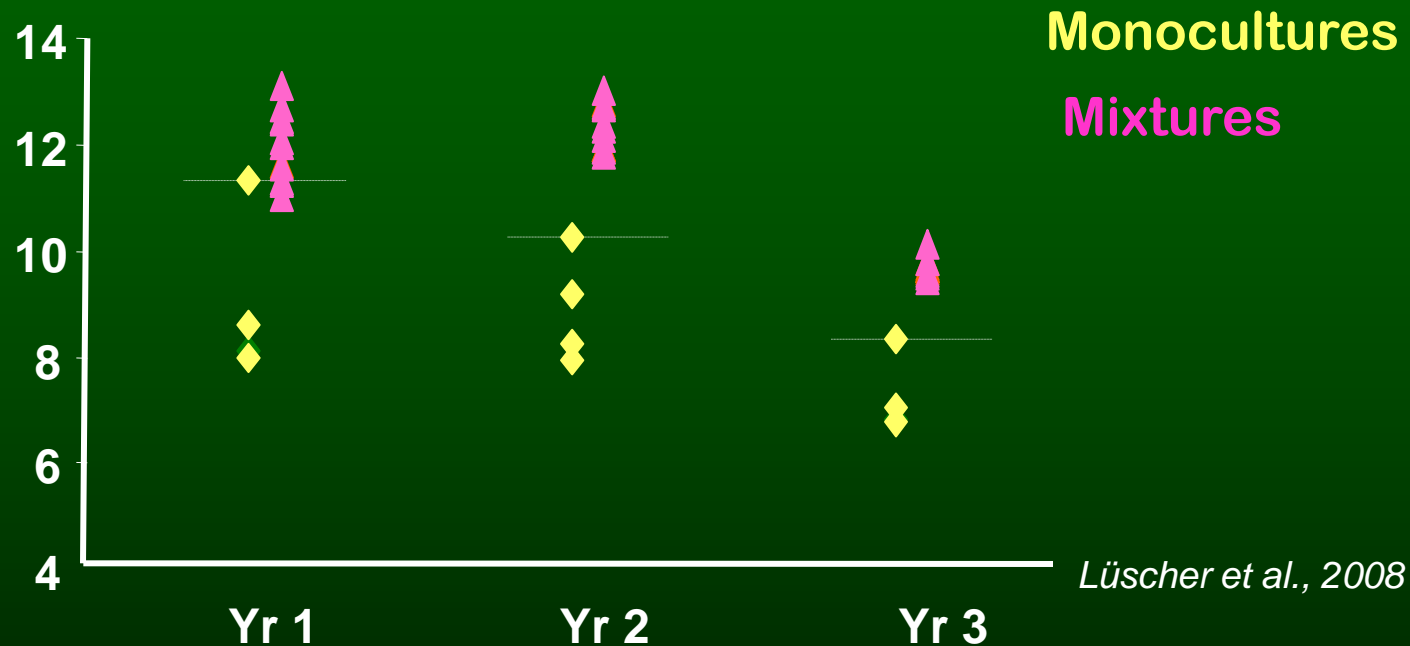
Productivity of mixed swards is related to the contribution of WC
(+0.5 t DM / 10 % clover)

On good/deep soils: mixed sward \cong PRG with 250 kg N/ha

On more difficult conditions: WC : - 0.5 to -1 t DM/ha

(Institut de l'Élevage, 2004)

Agronomical issue : Multi species swards have potential for increasing DM yield



Forage legumes have a strong and consistent over yielding effect

Strong: up to 20% better than best monoculture

Persistent: over all three experimental years

***Nutritional issue* : Forage legumes can sustain high animal performances**

Grass clover mixtures

+ 1 to + 3 kg/d DM Intake (3 trials) and + 2 to + 3 kg milk/d (7 trials)

The difference increases with increasing age of regrowth
(greater flexibility and easiness of management)

Multi species swards have high nutritional values

6.6 MJ NE/kg DM and 14.5 g MP / MJ of NE (\cong TMR)

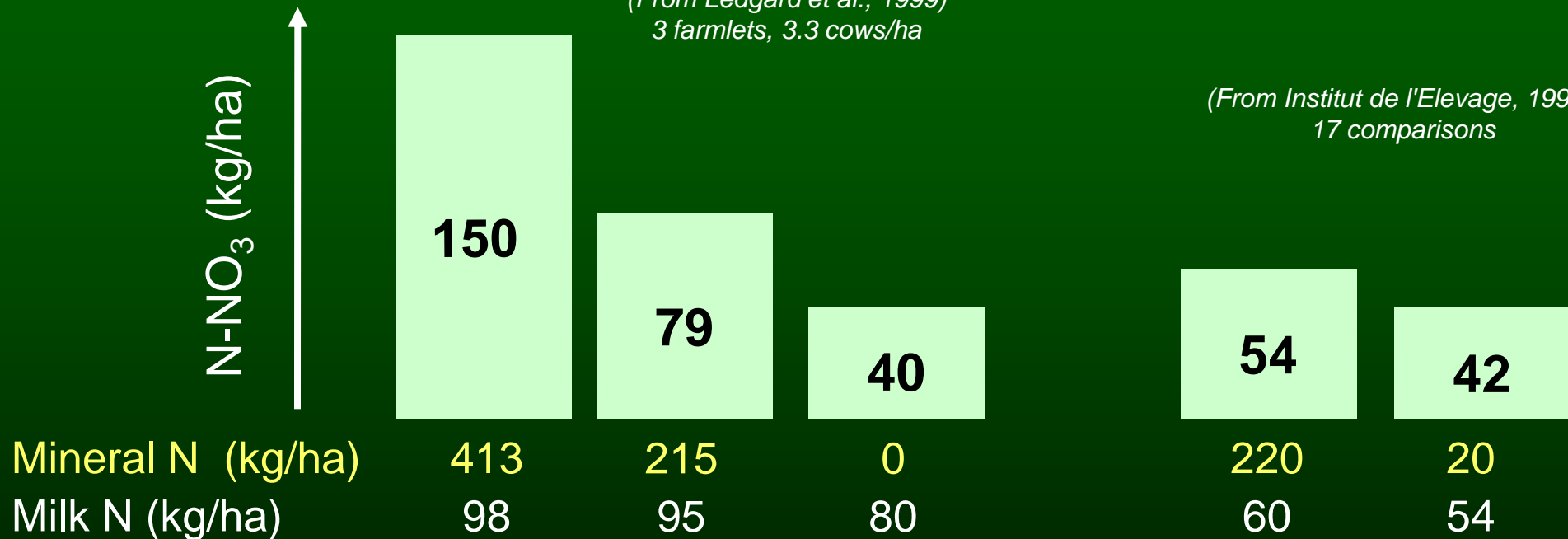
Higher values in spring and autumn

Delaby et al (EGF 2010)

Environmental issue : Multi species swards have potential for reducing the risk of N-NO₃ leaching

(From Ledgard et al., 1999)
3 farmlets, 3.3 cows/ha

(From Institut de l'Elevage, 1999)
17 comparisons



But risks of N leaching rise for WC content exceeding 50%

***Environmental issue* : Multi species swards reduce energy use and C-footprint of dairy systems**

	200 N	0 N + WC
Fossil fuel (MJ / kg milk)	1.25	0.50
GHG emission (kg CO ₂ -eq / Kg milk)	1.15	1.00

* 55 MJ are required to produce, transport and spread 1 kg of mineral N

Ledgard et al (2010)

The potential of MSS swards for reducing C-footprint and eutrophication potential of dairy systems will be further investigated with FP7 funded MULTISWARD project

Multi species swards will constitute one of the pillars of more sustainable dairy system

Associate high productivity and high forage quality

Reduce C-footprint of dairy systems

Increase protein self sufficiency and reduce risk of nitrate leaching

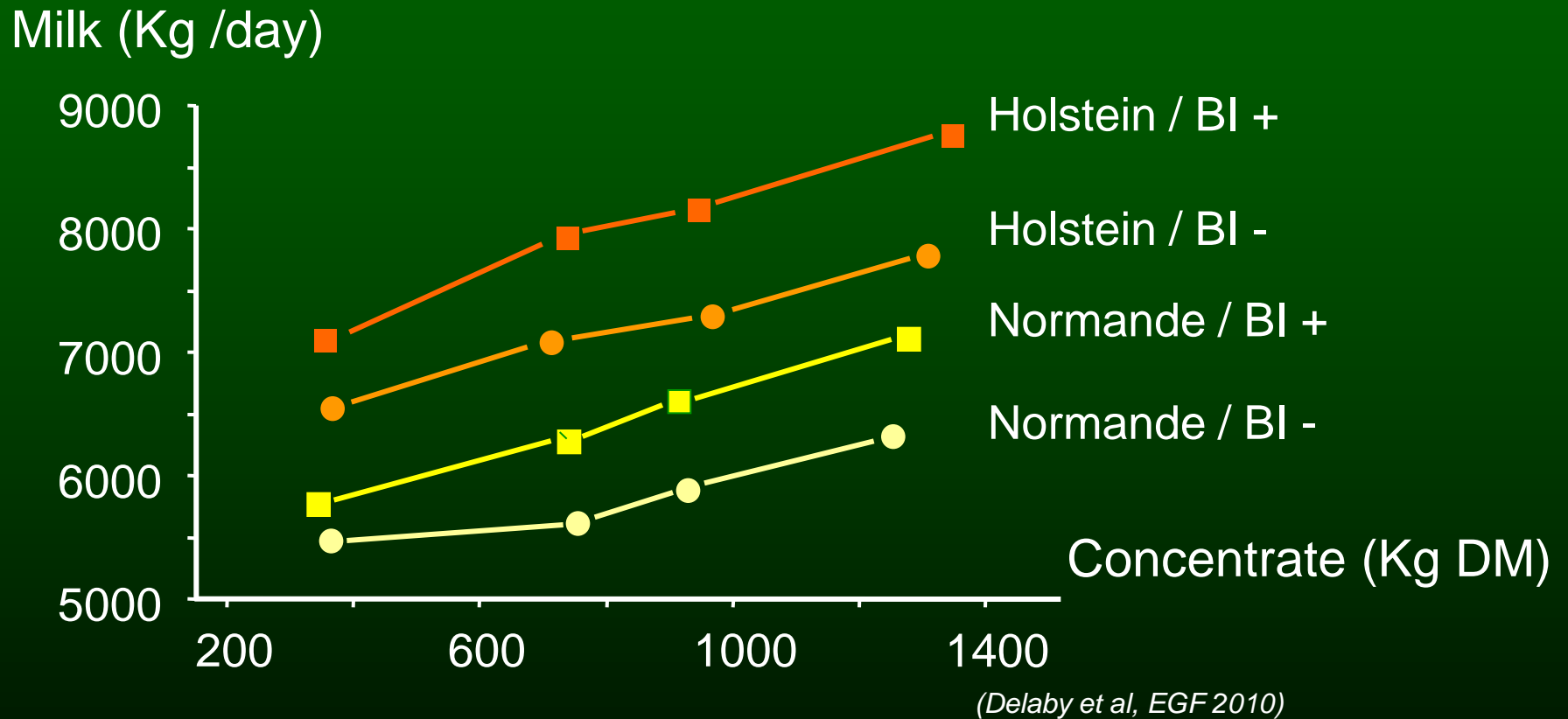
**Provide others supporting and regulating services:
pollination, pest control drought resistance,....**

Appropriate cow for successful grassland based system

Which type (s) of cow and lactation
management are required for developing efficient
grassland based dairy systems



High genetic merit cows produce more milk even on low inputs grassland based systems



Cows intensively selected on milk are not well suited for seasonal grassland based systems

	HGM vs more durable strains
Milk yield per lactation	++
Loss BCS (early lactation)	++
Reproduction performance	--
Survival	--

Adapted from Kennedy et al. (2003); Horan et al (2004), Mc Carthy et al (2007), Delaby et al. (2009)

Undesirable side effect on reproduction and survival which can not be counteracted by adjustment of feeding strategy

Increased replacement rate reduces profitability and environmental performances

Increasing replacement rate from 20 to 35%

+ 4 cows for a herd of 100 cows (+ replacement heifers)

More GHG emission and more N excreted

More forage is needed to feed the herd

Younger cows are also less efficient than adult cows

Lengthening the lactation of Ho cows to overcome the low fertility

Calving interval	12 months	18 months
Milk per year (kg)	7946	7843*
Protein (g/kg)	31.1	32.5
Pregnancy rate (1 st + 2 nd AI)	59	77

Broccard and Portier (unpublished)

Limits and advantages

Less calving periods per cow

Less non productive periods during the life of the cow
but ... required cows with high lactation persistency

not adapted for seasonal grassland based system

Increasing fertility does not remove the need for having cow with a high genetic merit for milk

	Ho NA	Ho NZ
Milk (Kg)	7205	6350
BCS (end of lactation)	2.82	3.15
Pregnancy rate	74	93
Milk response	+1075 kg (1.1)	+ 400 kg (0.4)
<hr/>		
+ 940 kg concentrate	<i>Horan et al (2005) and McCarthy et la (2007)</i>	

Using dual purpose cows ?

	Ho (++)	Mont	Nor
Milk (kg/lactation)	5994	5119	4561
Loss BCS (w1-w12)	- 0.54	- 0.26	- 0.23
Pregnancy rate (%)	73.7	91.2	91.9
% Survival after 5 years	20	49	56

Dillon et al. (2003)

Dual purpose cows

Are able to produce milk from grass with low supplementation

Similar net margin per worker:

Higher price of milk (fat and protein content) + meat product

Delaby and Pavie (2008)

Portrait of the ideal cows for successful grassland based systems

High reproductive performances (high fertility when AI are planned, low embryo mortality)

Longevity + others functional traits (mastitis, lameness,...)

High genetic merit for milk (for efficient responses to concentrate when required)

Good persistency of the lactation and moderate peak (for limiting energy deficit and associated troubles)

Appropriate grazing management for successful grassland based system

Innovative grazing management will help for combining farm profit and low environmental impact



Increasing stocking rate for producing more milk/ha and using grassland efficiently

Stocking rate strongly influences milk yield per ha

+ 1 cow/ha : + 1700 kg milk/ha and - 1.0 kg milk/cow (McCarthy et al, 2010)

High SR associated with a moderate supply of concentrate enables an efficient utilisation of grassland and high milk yield per cow

The milk response to concentrate is high (1 kg milk/kg conc)

(Peyraud and Delaby, 2001)

The risk of increasing N-NO₃ leaching is practically null (when mineral N application is not increased)

(Peyraud and Delaby, 2006)

Extending the grazing season (early turnout or late grazing) to consume more grass

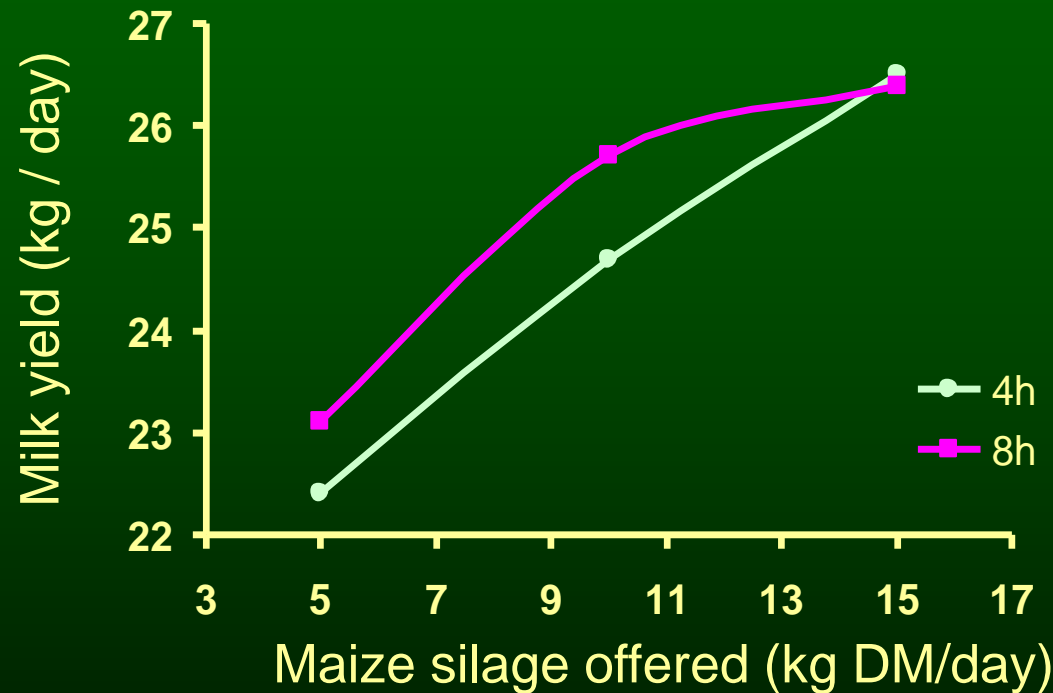
Extending the grazing season offer the opportunity to reduce the costs associated with indoor feeding systems

Intake of conserved forages : - 3 to - 5 kg / day (7 trials)

Milk yield: + 1 to 3 kg / day (spring and autumn, early or late lactation)
Similar milk yield while sparing 4 kg/day concentrate

The risks of increasing N-NO₃ leaching associated with late grazing should be investigated

On/off grazing combined with **restricted** indoor feeding could be an interesting alternative when grassland area is not sufficient to feed the herd



(Delaby et al., 2009)

The amount of supplementary forage must be adjusted to the access time to maximise yield while ensuring an efficient utilisation of pasture

Conclusion

Which conclusion can be drawn out of these data?



Conclusions

Grassland (and grazing) offers many opportunities for developing more sustainable dairy systems

There is considerable scope to improve the performances of grassland based dairy systems

- Forages legumes will undoubtedly constitute one of the pillar of more sustainable dairy systems
- Selection of more 'robust' cows and adaptation of animal management offer many possibilities
- Development of Innovative grazing management is the third pillar

A corpus of solutions should be proposed according to the local situations and farmers objectives

However grazing still remains not well accepted by many farmers and stakeholders!



**Thank you for
your attention**

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Early spring grazing to consume the full of the grass that have been produced

Grazing	Early	Late
Sward height (March 30 th)	5.5	10.0
Herbage growth (kg/ha/day)	60	60
Forage digestibility	0.80	0.76
Post grazing height (cm)	4.8	6.7
Grass utilisation (% allowance)	1.00	0.83

O'Donovan et al (2004)

Early turnout increases the ease of grazing management and the efficiency of utilisation of the forage that have been produced

Are small cows more efficient to convert grassland to milk ?

Production efficiency is higher for Jersey than for Holstein cows (milk solids per kg DM intake)

+ 6 % (*Grainger et Goddard, 2004*)

+ 11 % (*Prendiville et al., 2009*)

But effect will be more marginal at herd level

Smaller cows (400 kg) generally produced less milk (solids) than HGM Holstein (700 kg)

Meat product will be dramatically reduced.

