

**Meeting of the EGF-working group grazing  
« Research methodology of grazing »  
Kiel, August 29**

**Modelling herbage intake for predicting  
performance: the example of INRAtion  
software**

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# History

- **From 30 years:** INRA Fill and Feed Unit systems  
All ruminants, all feeds  
Only indoors feeding  
INRAtion software
- **2000-2003:**  
Grazemore European project (Mayne et al.)  
Development of GrazeIn model (Peyraud et al.)
- **2007:** Inclusion of GrazeIn model in INRAtion 4.0
- **2011:** Full model published in Grass and Forage Science (Faverdin et al., Delagarde et al.)

# The principles of INRA Fill Unit system (voluntary intake prediction)

Cows characteristics

Intake Capacity =

( Pasture Intake × Fill Value P )

+ ( Forage Intake × Fill Value F )

+ ( Concentrate Intake × Fill Value C )

Chemical  
composition

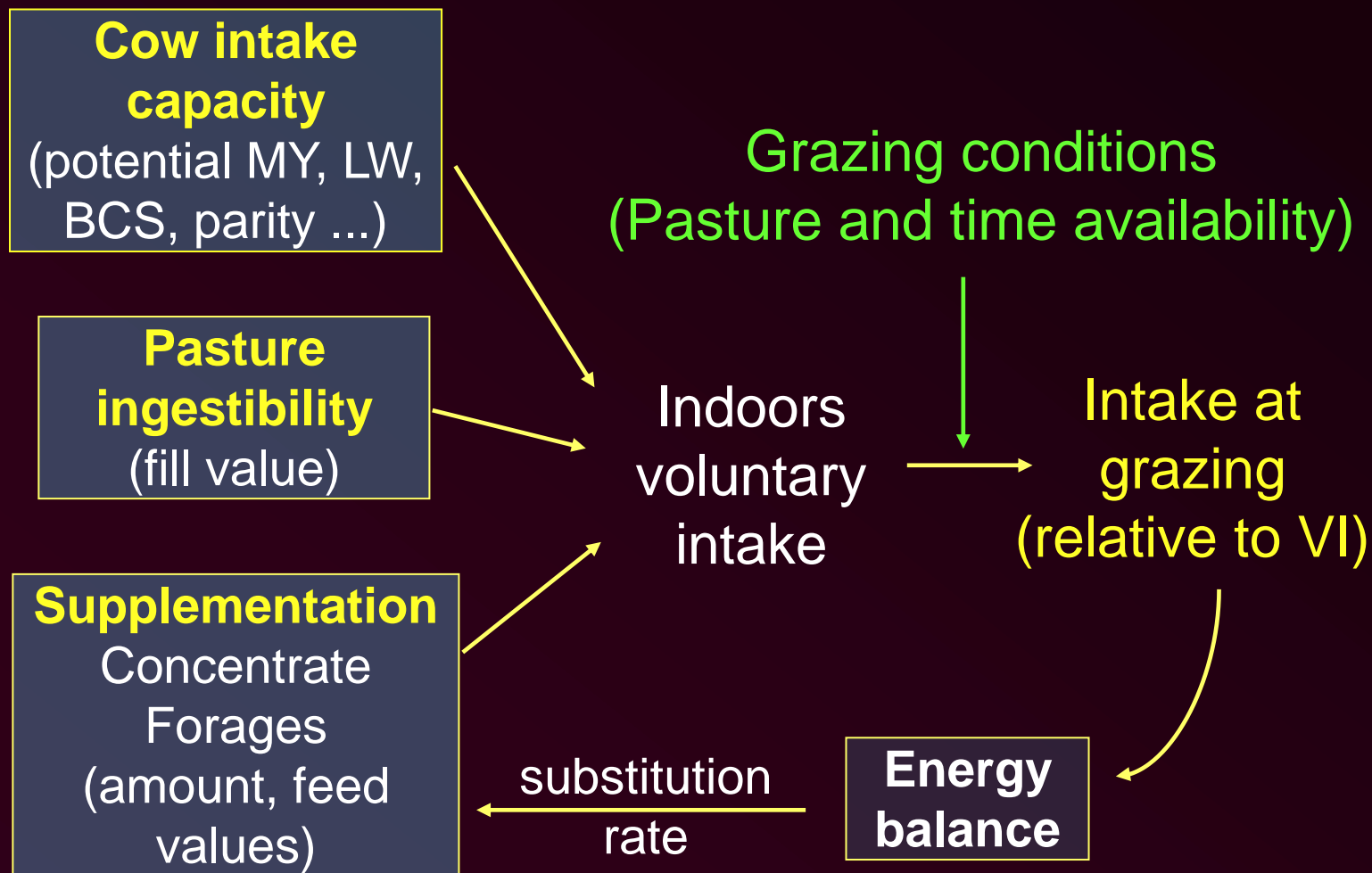
Inputs

Substitution rate  
(energy balance)

# Adaptation to grazing situations

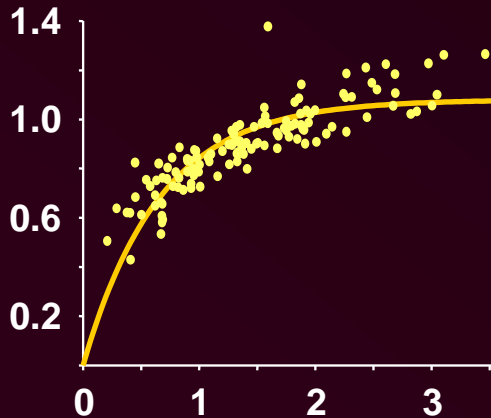
- **Principle:** grazing intake = relative to voluntary intake
- **2 grazing systems:** rotational and continuous
- For each grazing system, **2 sources of limitations:**
  - Pasture availability (allowance, mass)
  - Time availability (access time)

# General framework of the INRAtion pasture intake model



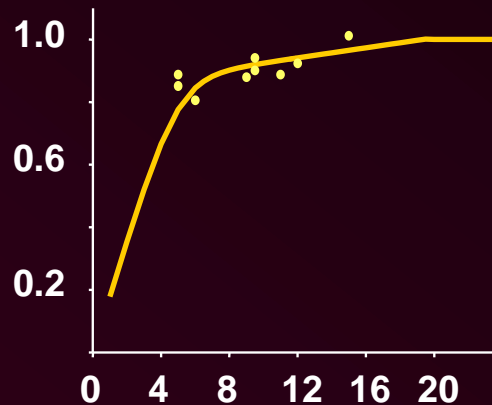
# Prediction of grazing conditions effects on herbage intake by grazing dairy cows

Relative herbage intake (% indoors voluntary herbage intake)



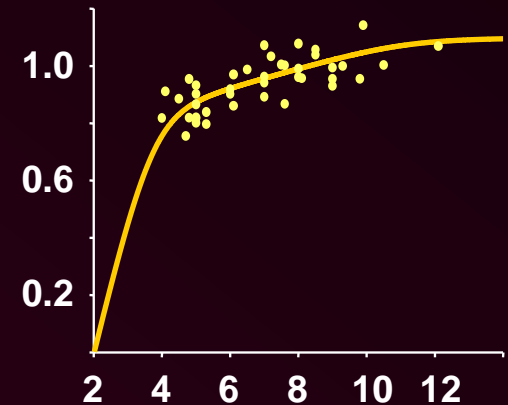
Relative HA > 2 cm  
(% VHI)

*Rotational*



Daily access time  
(h)

*Rotational+  
Set-stocking*



Sward surface height  
(cm stick)

*Set-stocking*

# Factors affecting herbage intake at grazing

## Animal

## Sward

## Grazing management

## Supplements

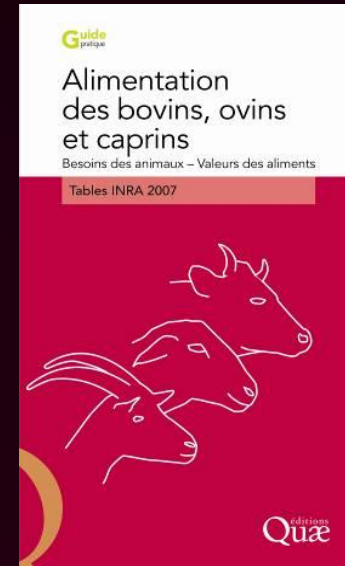
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Age	Botanical comp	Grazing system	Forages
Parity	Species	Stocking rate	Concentrates
LW	OMD	H. Allowance	(amount, nutritive values)
BCS	Fibre	Residence time	
Growth	CP	Time of access	
Peak milk	DM		
DIM	Sward height		
Breed	Herbage mass		
Strain	Bulk density		
	% dead		
	% lamina		
		<b>Weather</b>	
		Season, Temperature, Rain, Wind	

# Other INRA grazing intake models for dairy cows

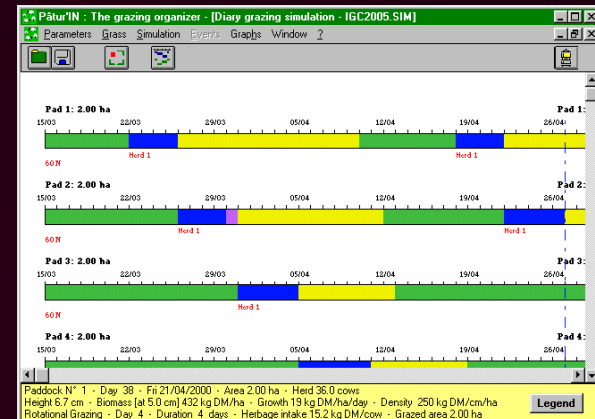
## INRA Feed Tables 2007:

Simplified equations from INRAtion model based on pre- and post-grazing sward height  
*(english version in 2010-2011)*



## Pâtur'In (Delaby et al.):

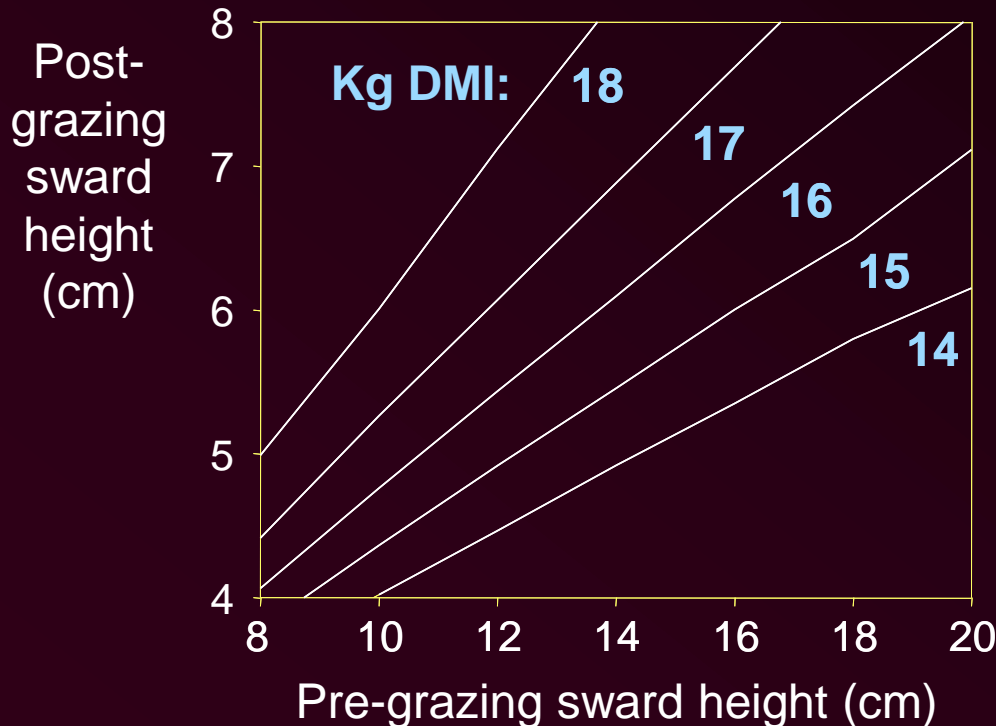
Software to assist grazing management of dairy cows  
*(herd, paddocks, pasture growth, decision rules)*





# Prediction of dairy cows pasture intake according to pre- and post-grazing sward height

$$PI = \frac{IC}{17} \times \left( 38,78 + 16,83 FV + \frac{39,7}{PoH^2} + \frac{631}{PrH^2} - \frac{2,1 PrH}{PoH} - \frac{459}{PrH \times PoH} \right)$$



# Discussion: Validation



- **Objectives:** Precision, robustness  
Time-consuming, but necessary (improvements)
- **Internal validation**  
Simulations (virtual experiments)  
⇒ Response laws to inputs and interactions
- **External validation**  
Predicted vs. actual values (independent data)  
Global precision  
(INRAtion : 304 herds, TEAGASC and INRA,  
actual DMI 10-22 kg  
MPE: 11% MPE, 1.6 kg DM)

# Discussion:

## What we need to predict ?



- **Objective of the model:**

Grazing processes, grazing management

Scale of approach (possible integration ?)

minute ◀ ▶ day ◀ ▶ year

Need for different input variables

(research model, practical tool ?)

- **Milk production:**

Responses law from energy and protein supply  
(relative to potential production)

Not yet included in INRAtion



**Thank you for your attention**