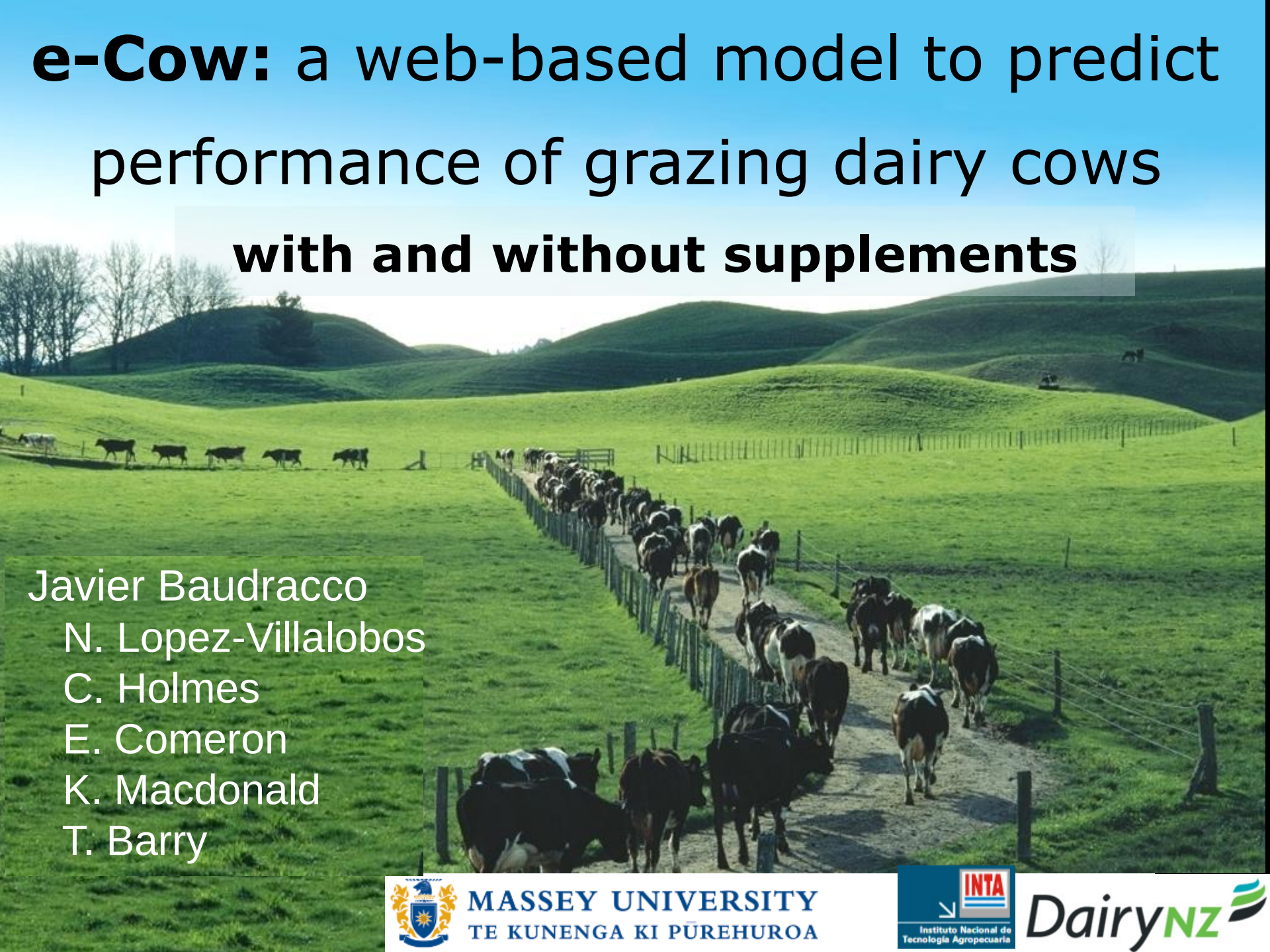
e-Cow: a web-based model to predict performance of grazing dairy cows

with and without supplements



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DairyNZ

e-Cow: a **web-based** model to predict the performance of grazing dairy cows

Availa
onlin

e-Cow: a web-based model to predict the performance of **grazing dairy cows**

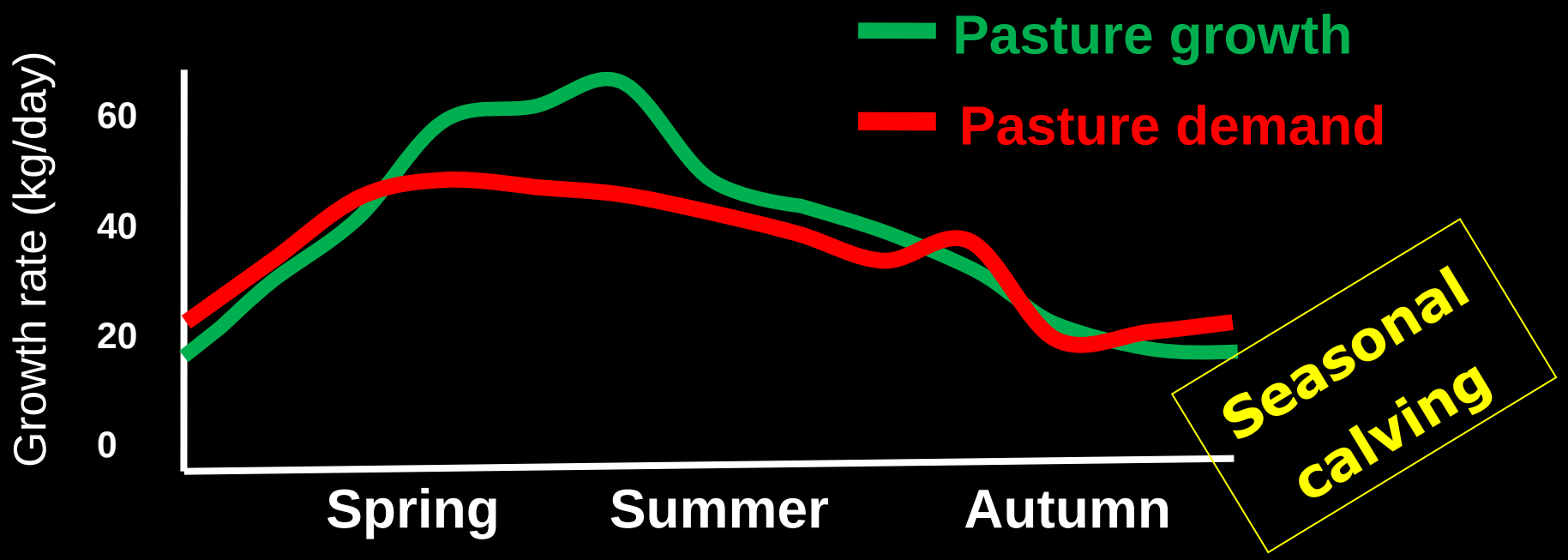
Grazed pasture cheapest source of feed

Conversion of non-human feed (pastures) into milk and beef

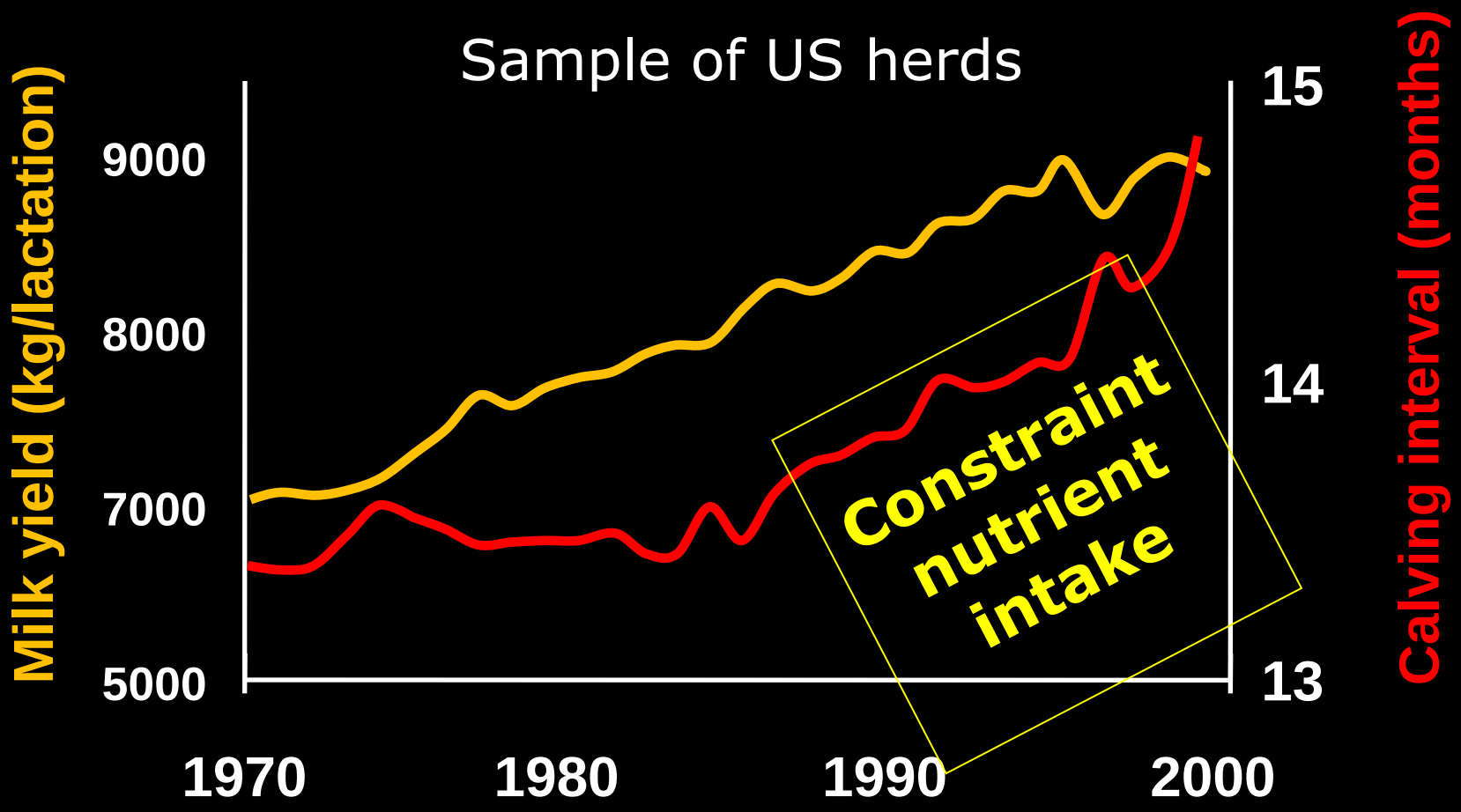
e-Cow: a web-based model to predict the performance of **grazing dairy cows**

BUT

Synchronisation between pasture growth and cow's demand is required



e-Cow: a web-based model to predict the **performance** of grazing dairy **cows**



(Lucy et al., 2001)

Modern dairy cow at grazing

Grazing systems, low cost but

Require seasonal calving

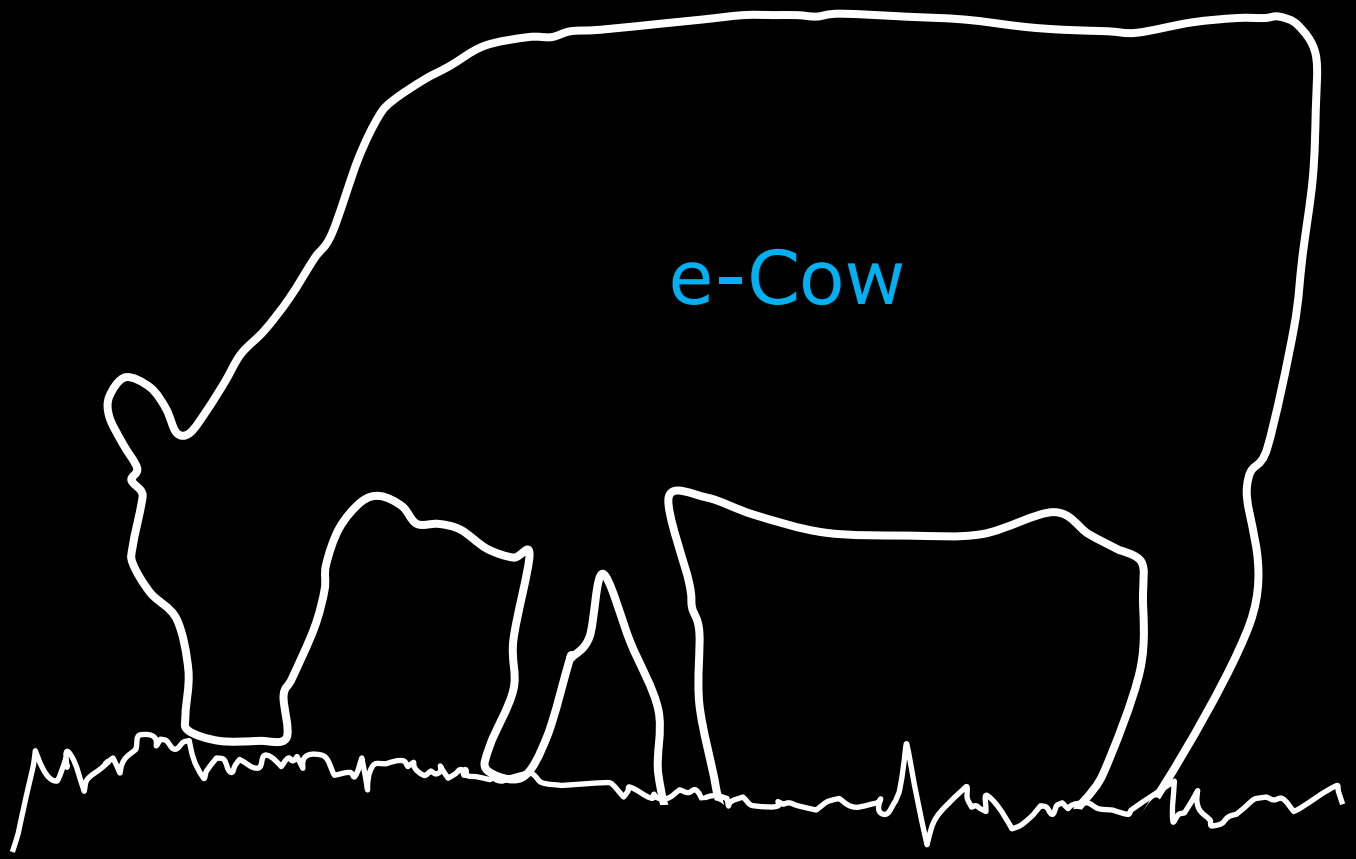
Set constraints to modern cows

Supplements crucial

body condition score and reproductive efficiency

Genotype x environment interactions

objectives



Objectives

To develop an animal model

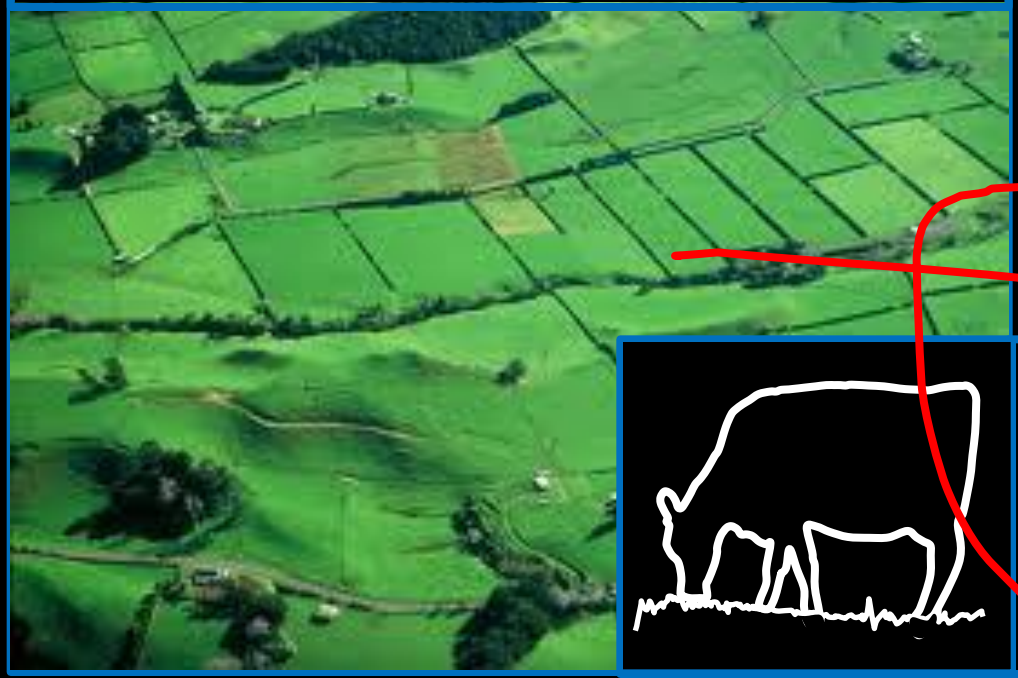
What for?

- Simulate cow responses to changes in feed supply
- Explore genotype x environment interactions

How?

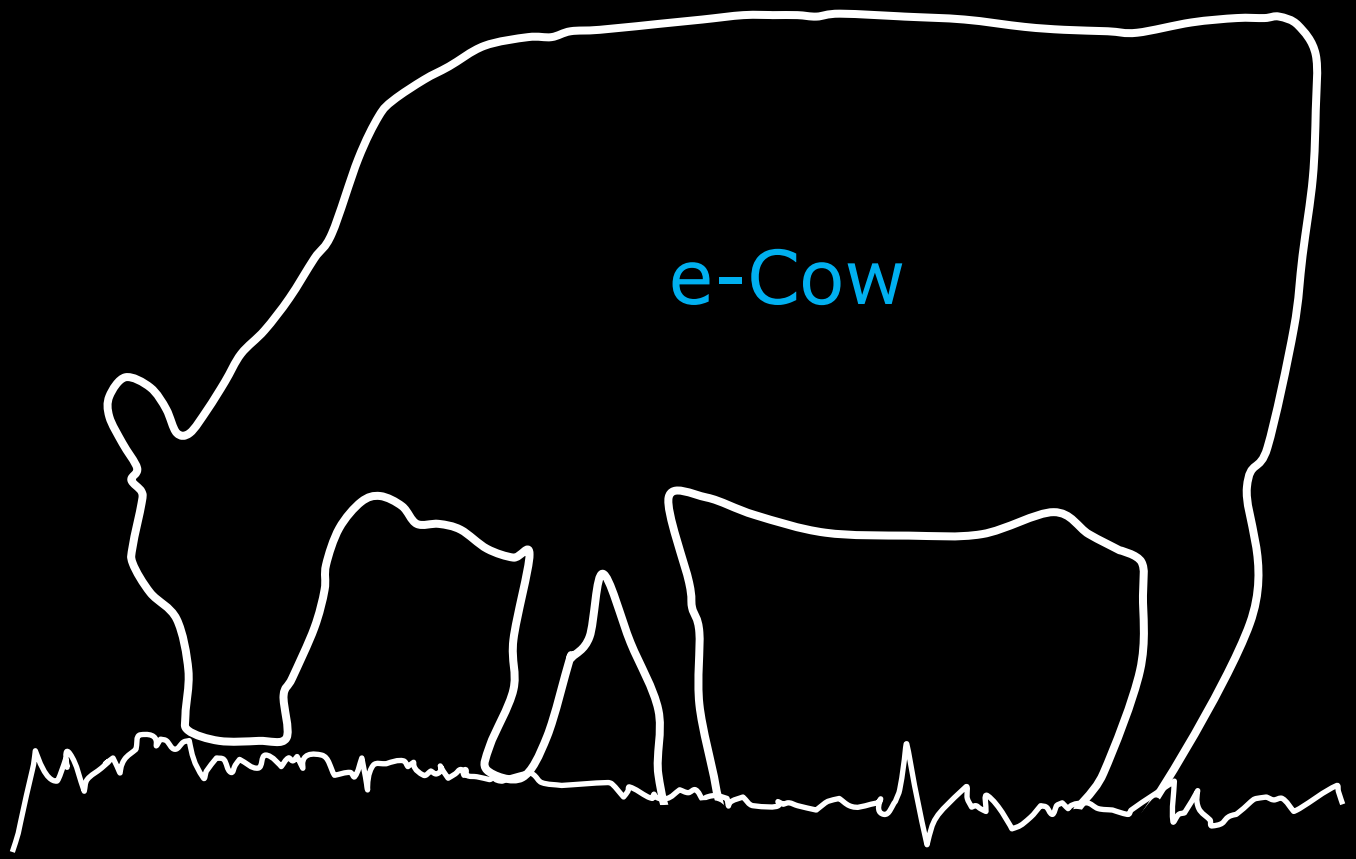
- Strong scientific base
- Genetic & nutritional drives
- User-friendly
- Web-based

e-Dairy: Whole farm model



e-Cow:
Animal model

methodology



e-Cow – Model classification

- Mechanistic model: Represents biology
- Empirical model: mathematical/ statistical equations

- Dynamic model: over one year (daily simulation)
- Level: animal
- Stochastic - Pasture allowance

e-Cow: a web-based model that **predicts** the performance for grazing dairy cows

PREDICTION

- Herbage intake
- Milk, fat and protein yields
- Live weight and body condition score

- Daily basis
- Whole-lactation
- Holstein-Friesian

e-Cow – Model description

Integrates 3 models to predict:

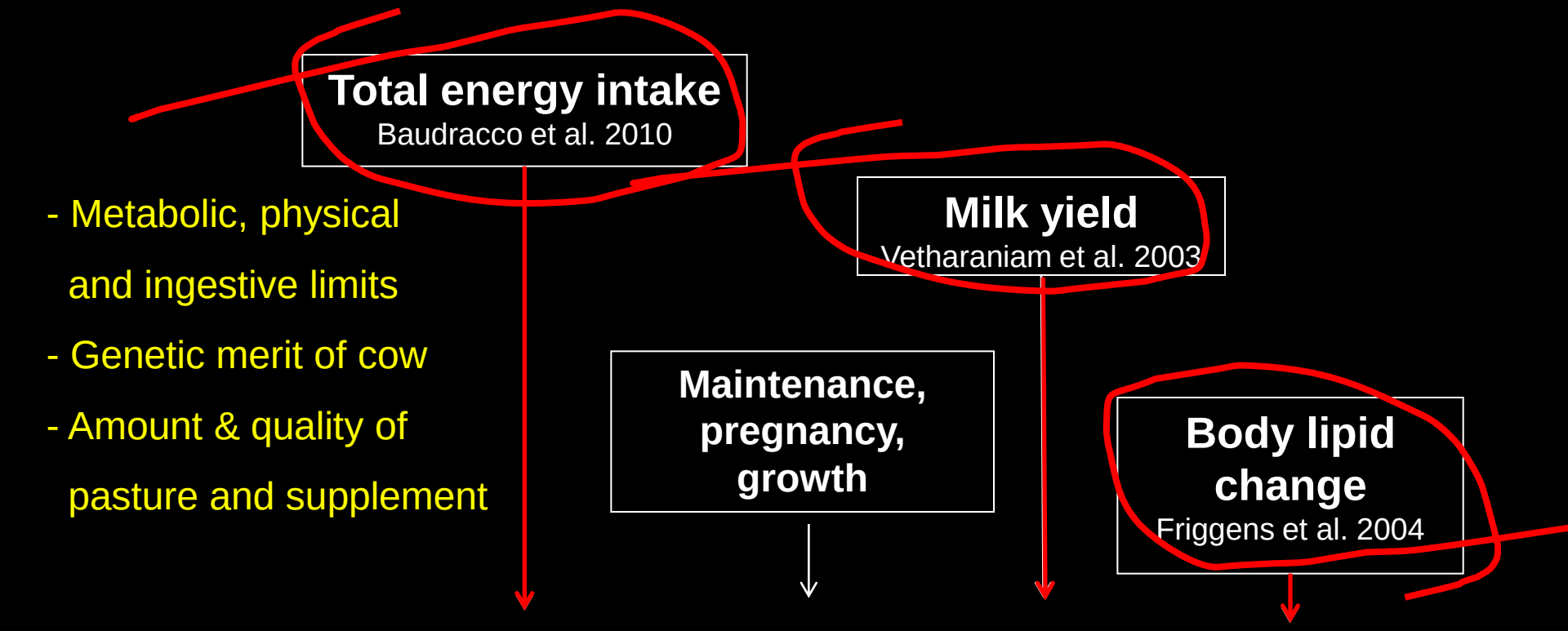
1. Dry matter and energy intake model (Baudracco *et al.*, 2010)

2. Milk yield - Mammary gland model (Vetharaniam *et al.,* 2003)

3. Body lipid change model (Friggens *et al.,* 2004)

e-Cow

e-Cow – Rationale

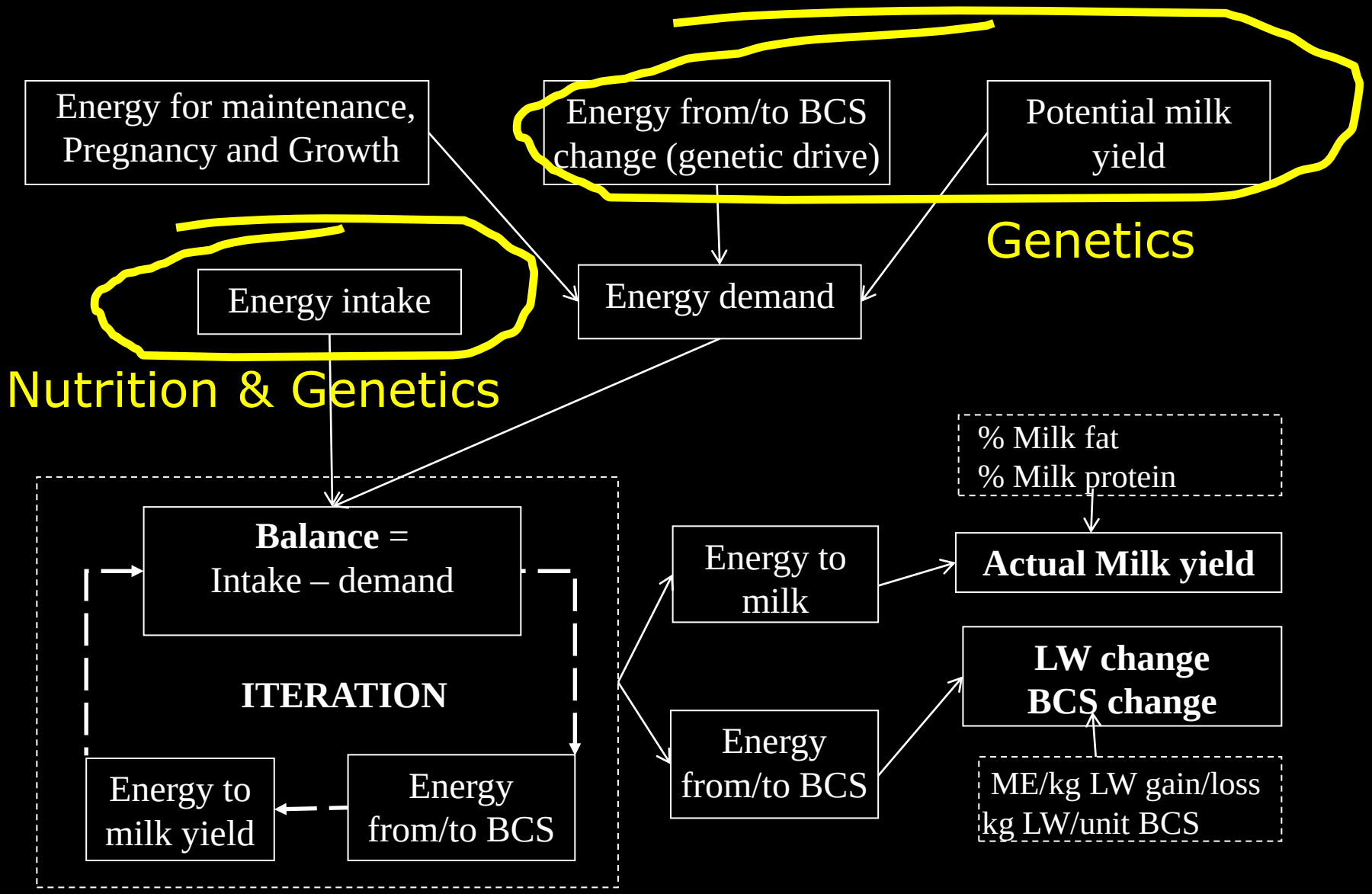


If intake is different to demand

Milk yield and body lipid change are reduced/increased

Iteration: loop until intake = demand

e-Cow – Model description



How to use the e-Cow model online?

Simple

5 minute training

Inputs screen

http://e-cow.net/ — baudracco cow milk

pasture — Search

Simulation of dairy cow's response | Contact us

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e-Cow

Developed by
Javier Baudracco
Nicolas Lopez-Villalobos
Marcelo Zamateo

Cow inputs

Genotype : New Zealand HF

Lactation number : 2

Change genetic merit <=

Potential milk yield (kg/cow/y)	6970
Pot. milk fat yield (kg/cow/y)	321
Pot. milk prot. yield (kg/cow/y)	258

Feed inputs

Start feeding	Finish feeding	Unit	Pasture	Conc	Silage	Hay
1	100	Amount Kg DM	35	2	0	0
		Energy (MJ/kg)	**11**	**12**	**10.4**	**10.3**
		NDF (%)	0.44	0.44	0.52	0.55
101	305	Amount Kg DM	35	2	0	0
		Energy (MJ/kg)	11	12	10.4	10.3
		NDF (%)	0.44	0.44	0.52	0.55
306	365	Amount Kg DM	35	2	0	0
		Energy (MJ/kg)	11	12	10.4	10.3
		NDF (%)	0.44	0.44	0.52	0.55

Add feeding period<=

Simulate using: Computer

Simulate response

Does e-Cow formulate rations?

What does e-Cow do?

What type of pasture?

Only pasture?

What type of cow?

How does e-Cow work?

Outputs screen

http://e-cow.net/e-Cow-example.php

Simulation of dairy cow's response | Contact us

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e-Cow

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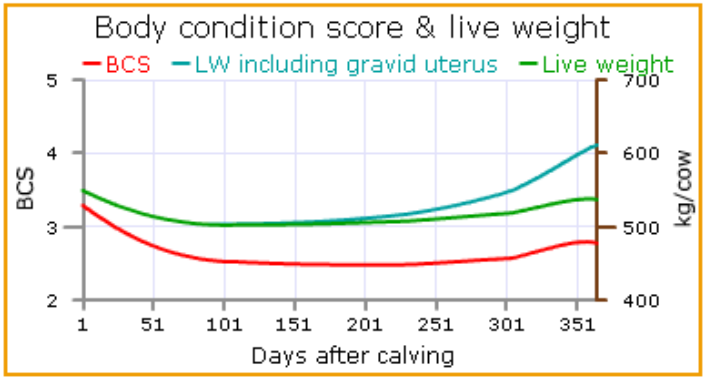
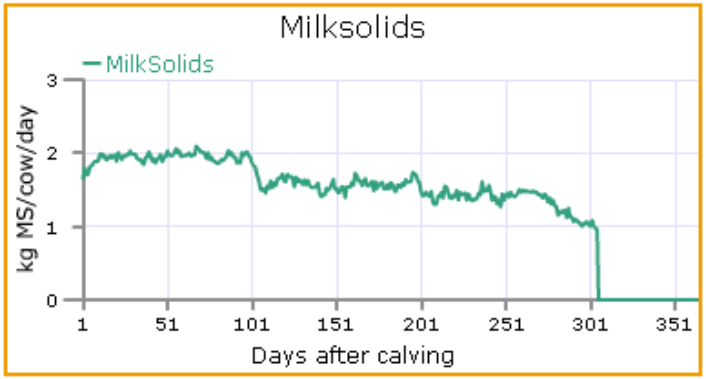
Inputs used
(click to show)

Export daily outputs to spreadsheet

Daily outputs (run 9)





Annual outputs
(click to show)

Outputs screen

http://e-cow.net/e-Cow-example.php

Annual outputs
(click to hide)

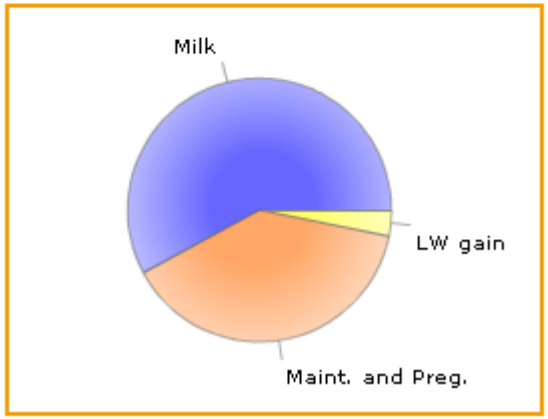
Cow

Pot. yield (kg/cow/y): **9812**
Milk yield (kg/cow/y): **6986**
Milk fat (kg/cow/y): **247**
Milk protein (kg/cow/y): **246**
Milk fat (%): **3.53**
Milk protein (%): **3.53**
Milksolids (kg/cow/y): **493**

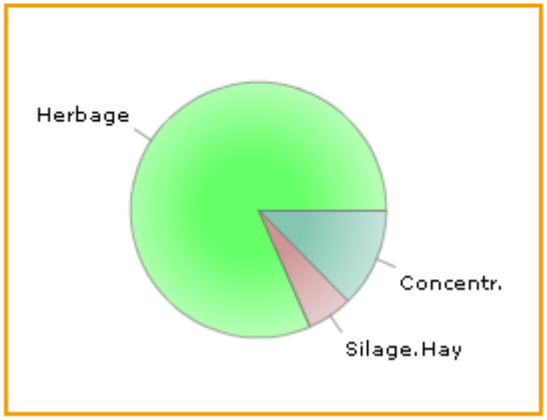
Feeds and intake

DM Concent. (kg/cow/y): **768**
DM Silage (kg/cow/y): **351**
DM Hay (kg/cow/y): **0**
DM Herbage (kg/cow/y): **4961**
Total DM (kg/cow/y): **6081**
Grazing efficiency lactating(%) : **32**
Grazing efficiency dry(%) : **35**

Use of energy consumed



Diet composition (DM basis)



e-Cow – Inputs

Cow

Genotype of Holstein Friesian (NA or NZ)

Live weight at calving

Potential yields of milk, fat and protein

Body condition score (BCS) at calving

Conception date (days after calving)

Dry-off date (milk yield or BCS limit)

Feeds

Feeding periods

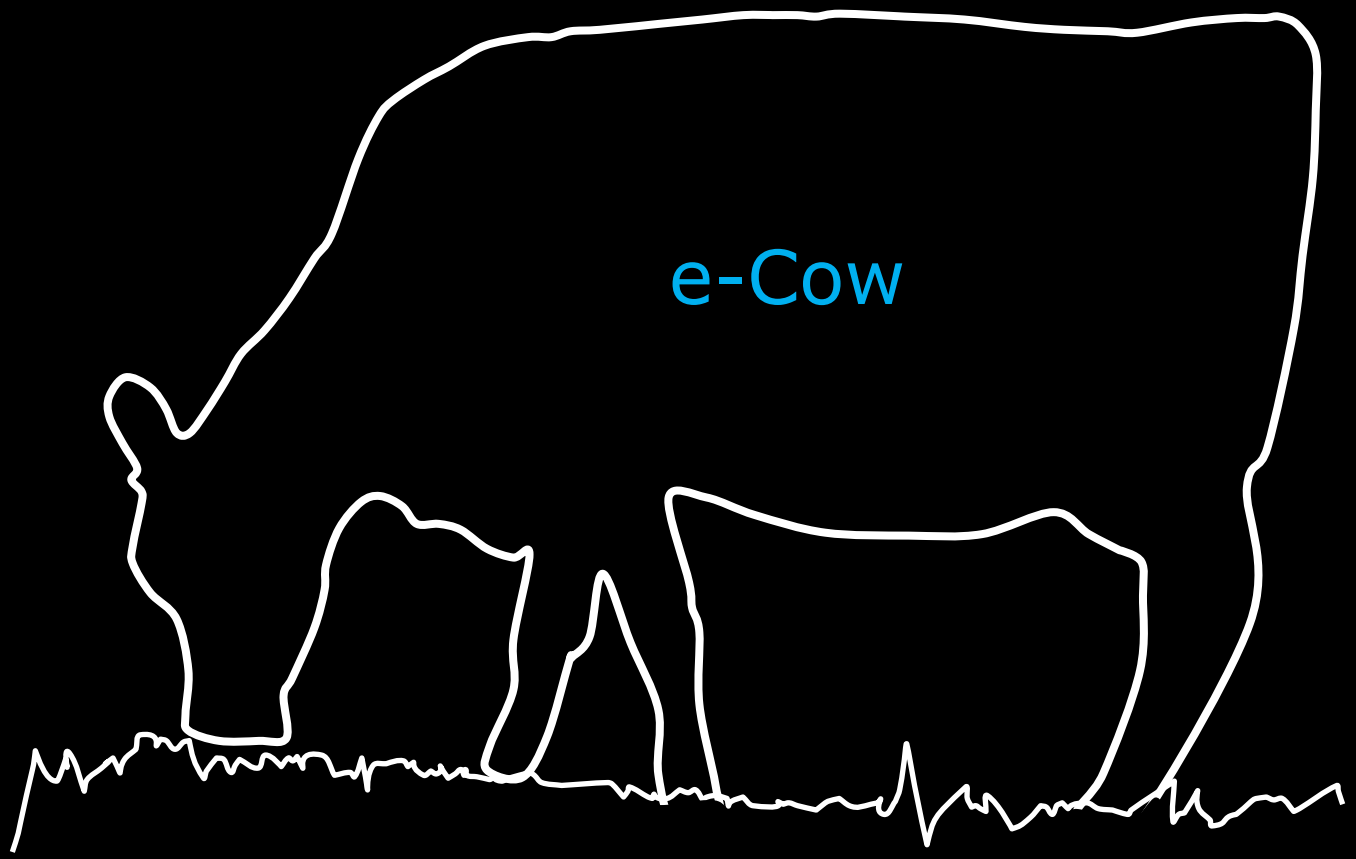
Herbage allowance (mean and SD - stochastic)

Neutral detergent fibre of feeds

Metabolisable energy of feeds

Supplements offered (amount and utilisation)

validation



Validation dataset

NZ strain trial dataset (Macdonald et al., 2008)

Data from 3 years (3 parities)

Two strains

- North American (NA) > 90% NA genetics
- New Zealand (NZ) ≤ 13% NA genetics

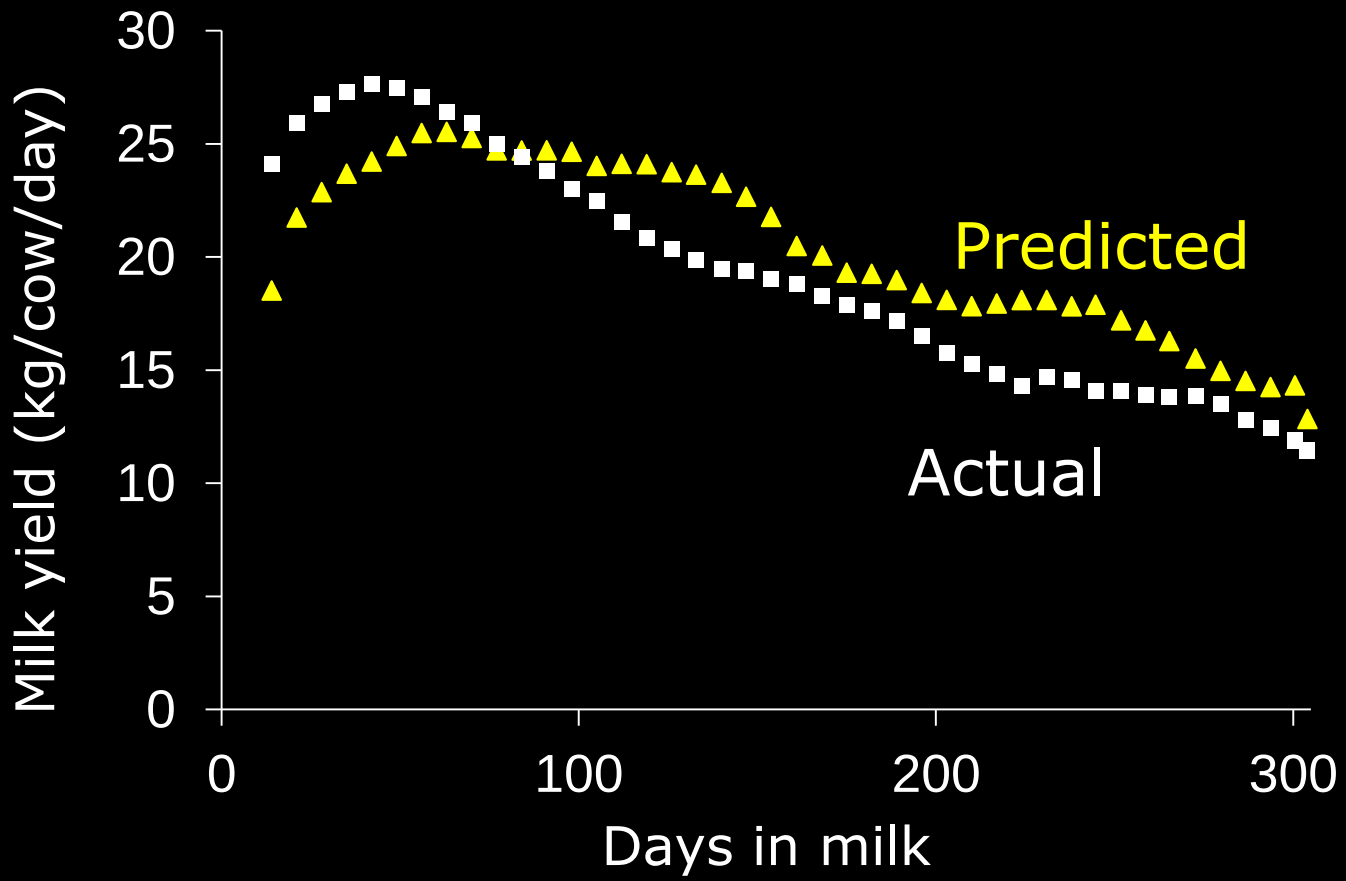
Validation

	Milk yield		Pasture intake		LW change	
	NA	NZ	NA	NZ	NA	NZ
R	0.88	0.82	0.89	0.81	0.63	0.68
CCC	0.74	0.77	0.81	0.80	0.61	0.63

CCC= Concordance correlation coefficient reflects both:

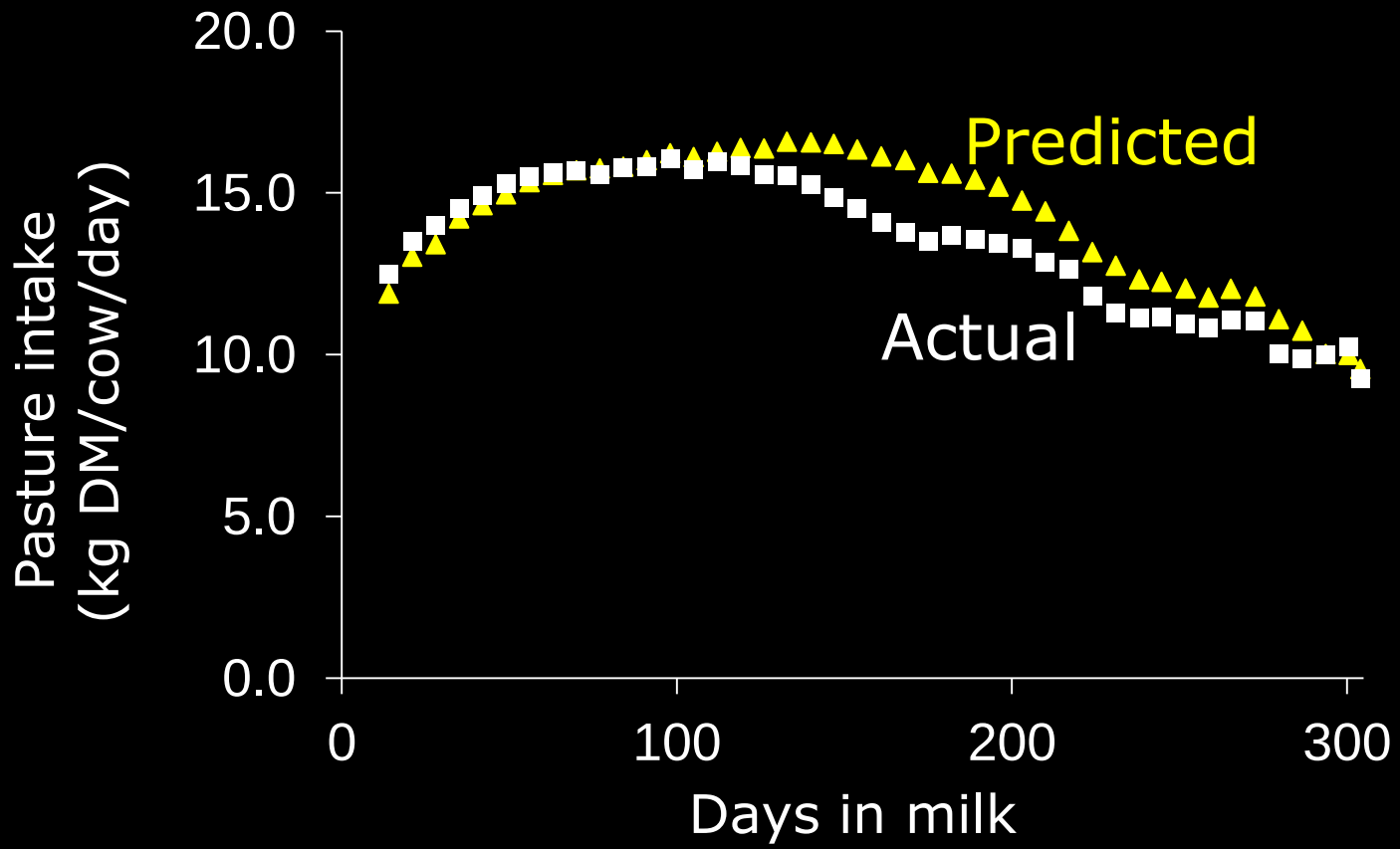
- Degree to which predicted Vs actual values cluster about regression line
- Degree to which the regression line adheres to the 45° line through origin

Milk yield



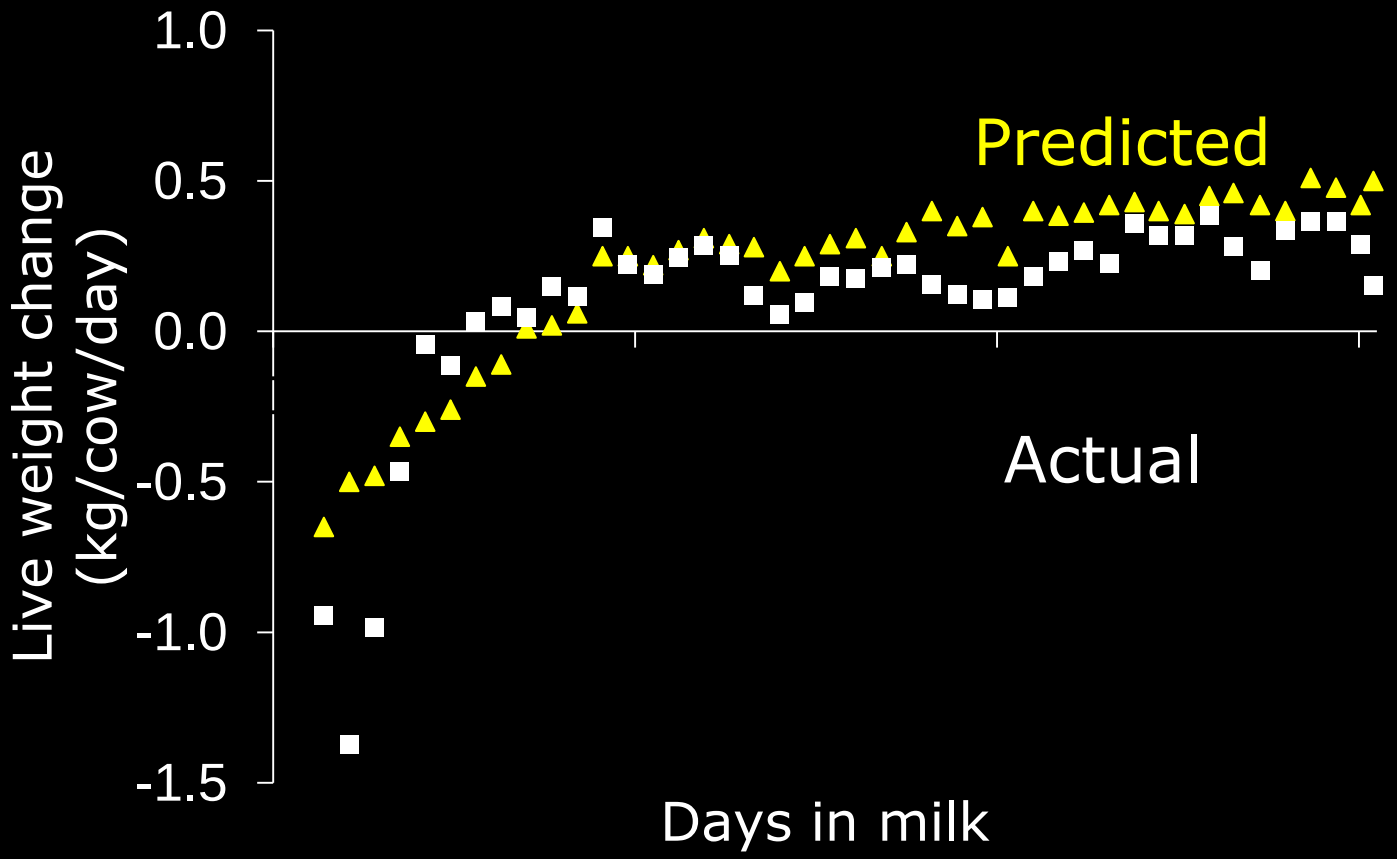
CCC = 0.76

Pasture dry matter intake



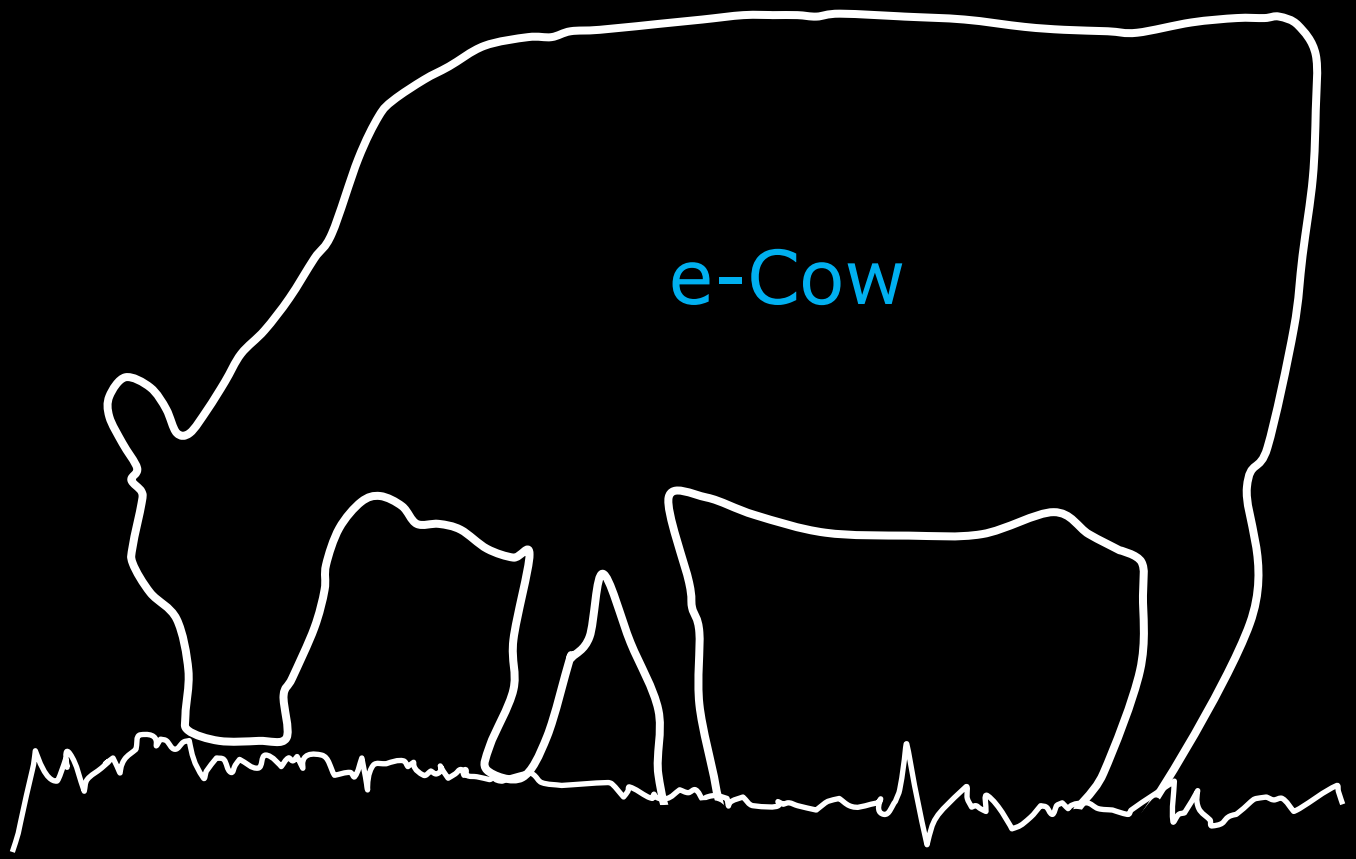
CCC= 0.80

Live weight change



CCC= 0.62

simulations

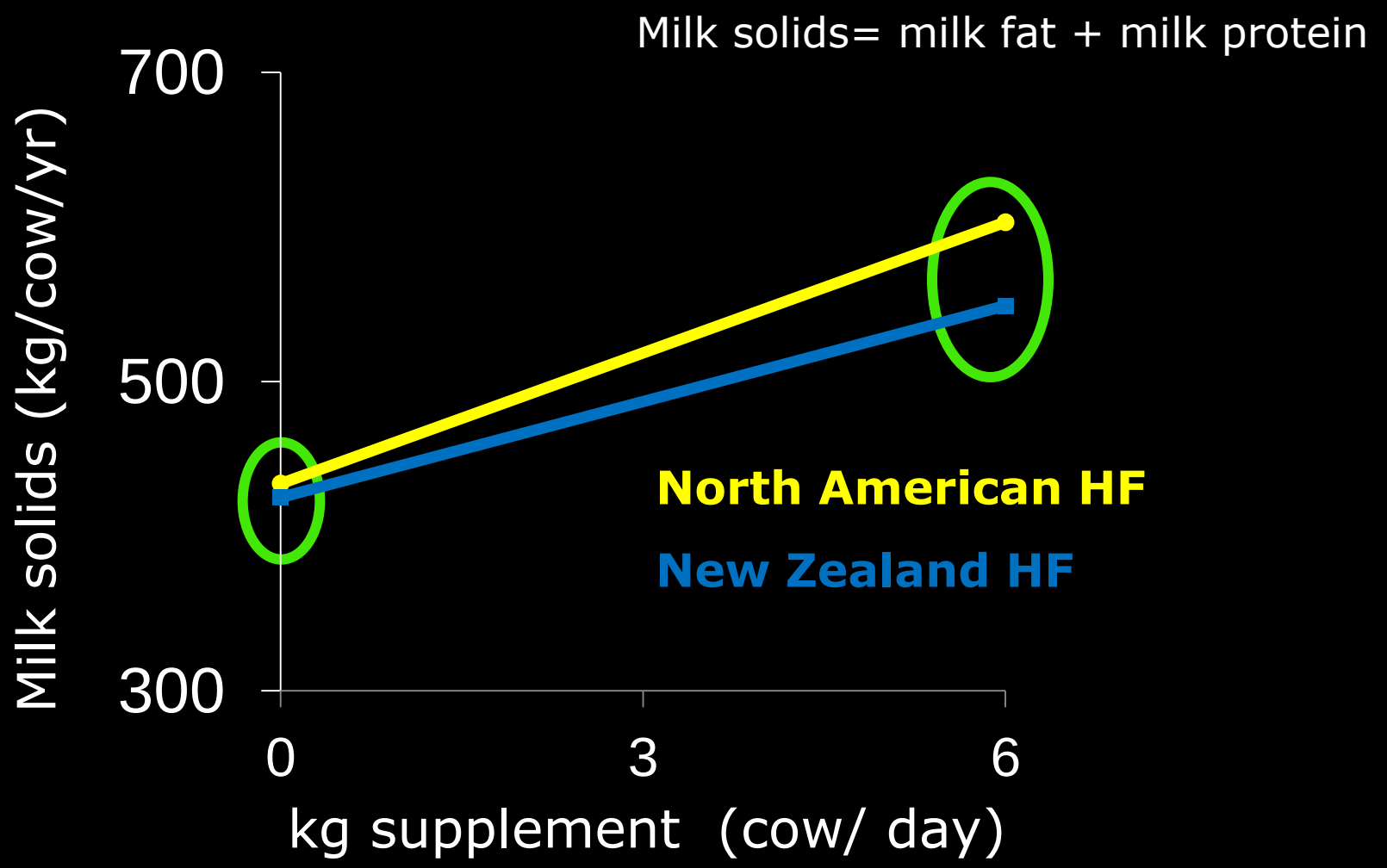


e-Cow - Simulations

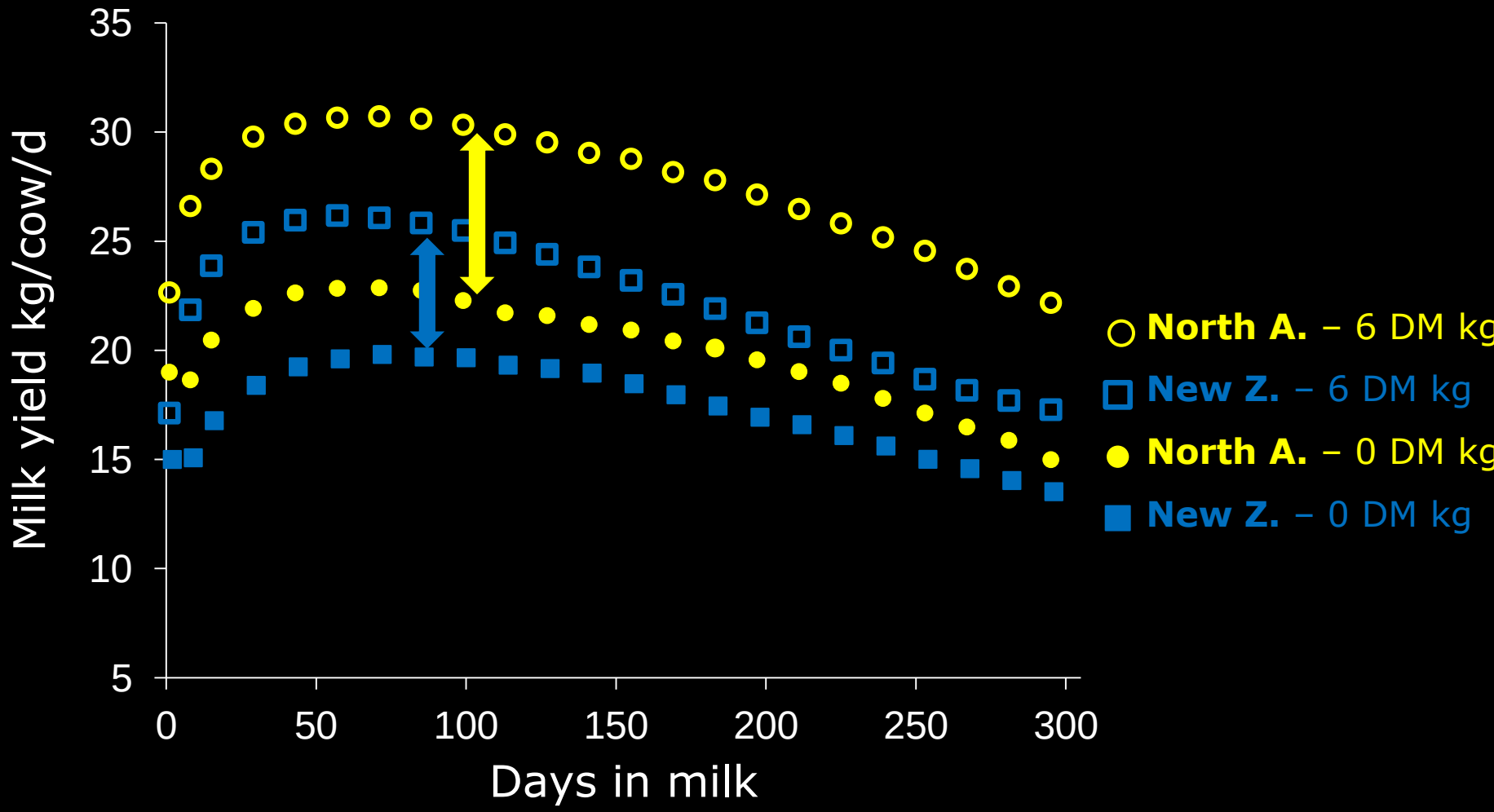
Example using:

- High pasture allowance (25 kg/cow/day)
- High pasture quality (11 MJ ME/kg)
- 2 Holstein-Friesian strains
  - North American HF
  - New Zealand HF

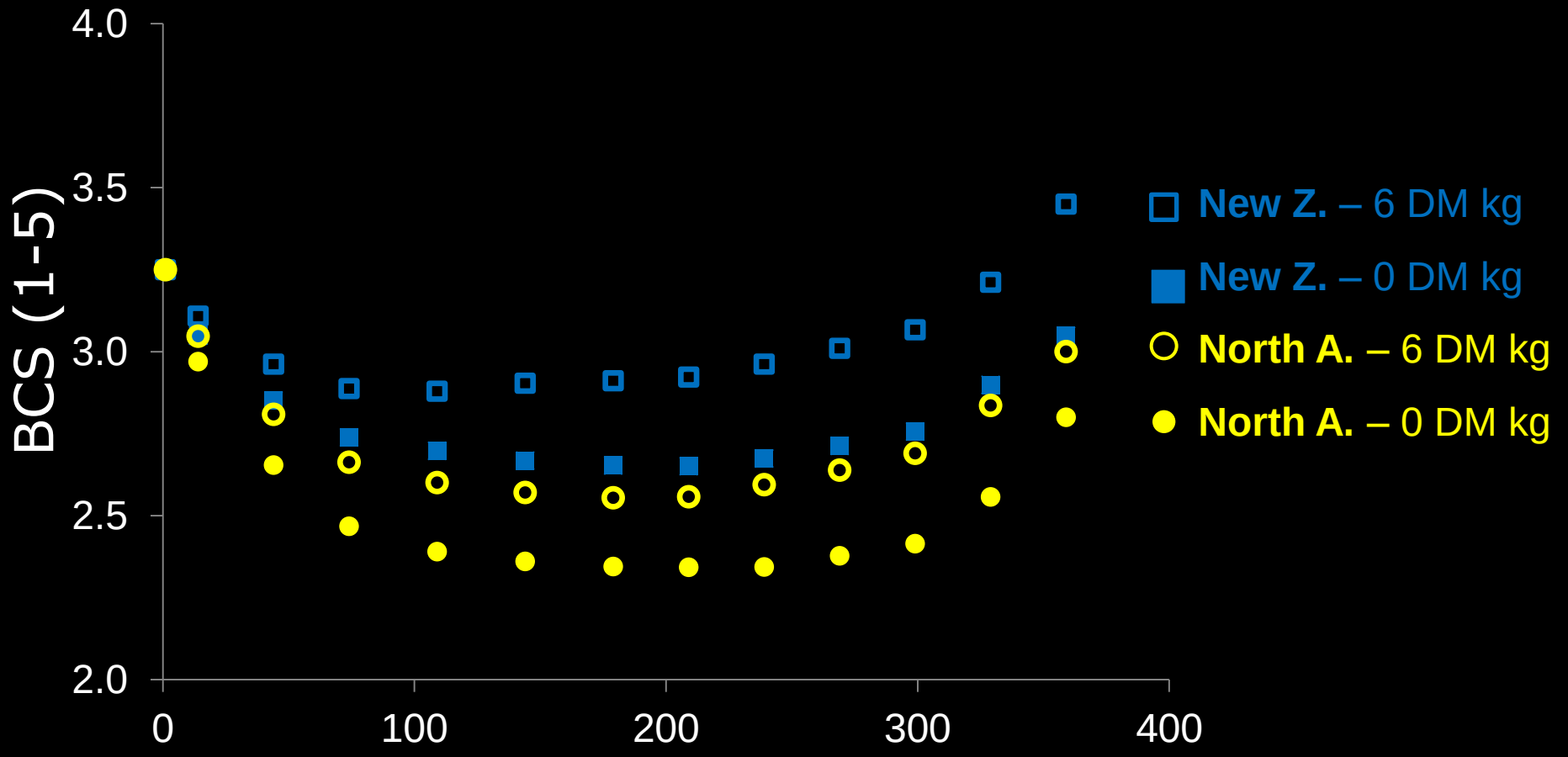
e-Cow - Simulations



e-Cow - Simulations



e-Cow - Simulations



Practical use of the e-cow model

Teaching

University students

Perform simulations to understand:

- Effects of amount of feed offered
- Effects of feed intake
- Effects of feed quality
- Effect of cow's genetic merit

on: Milk yield, Live weight, BCS

Practical use of the e-cow model

Applied research

- Effects of feeding level on estimated breeding values

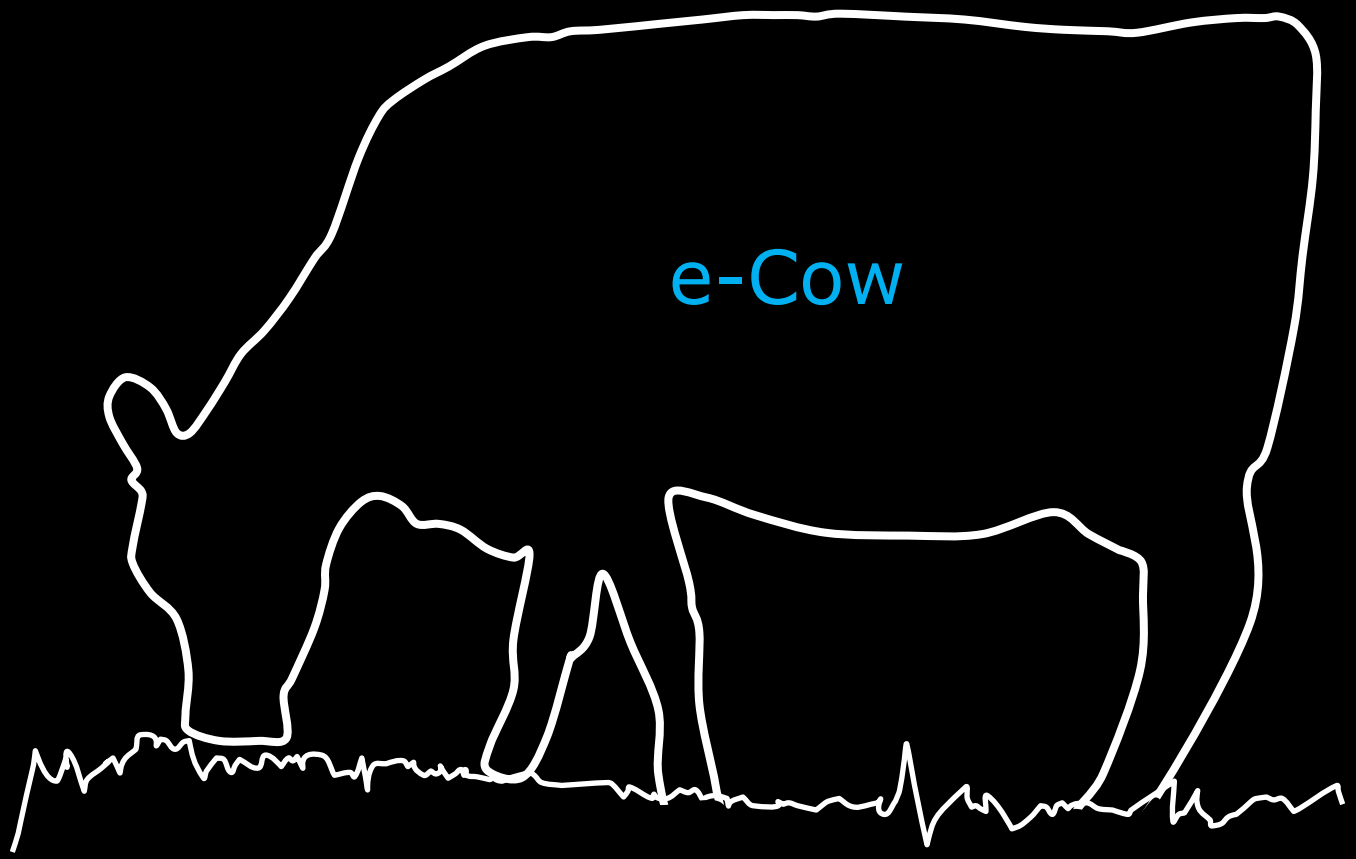
- 5,000 cows with known breeding values

- Predict performance of individual cows at 4 feeding levels

- Genetic evaluation to recalculate breeding values & to estimate breeding values for feed intake and FCE

- Estimation of G x E (reaction norms)

conclusions



Conclusions

Quick simulation of

Response of cows

of

different genetic potential

under

different feeding systems

Conclusions

Useful for

Teaching

Applied research

Extension

Acknowledgements

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Questions?