Calves that are divergent for residual feed intake as also divergent as cows

Jennie Pryce

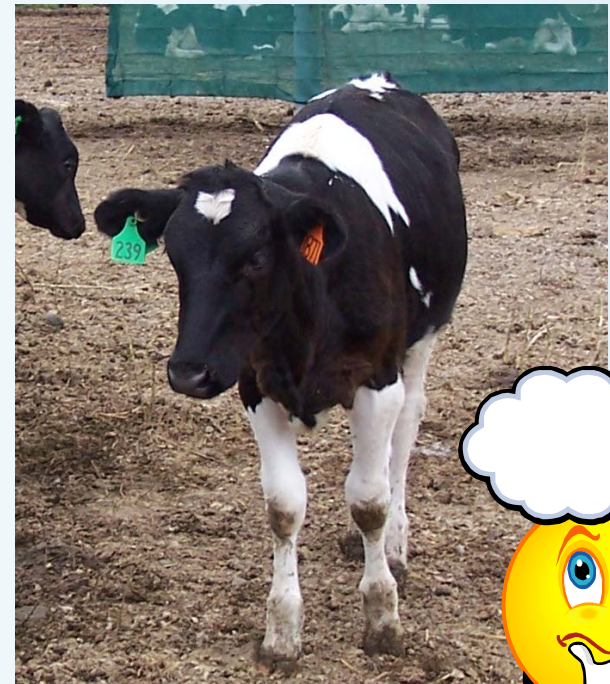DairyFutures CRC

Does an efficient calf become an efficient cow?

–A calf uses feed to grow

–A cow uses feed to lactate

Residual Feed Intake is
Actual – predicted DM intake

Same growth for less feed

EID reader

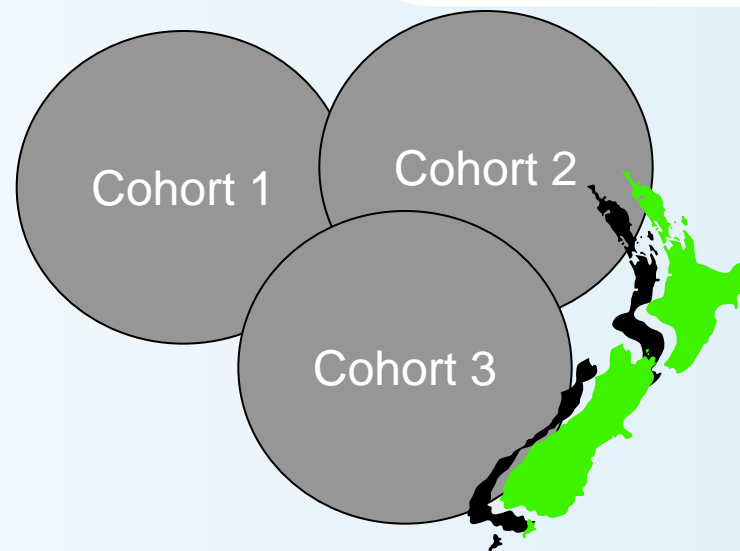Feed bin

Load cells
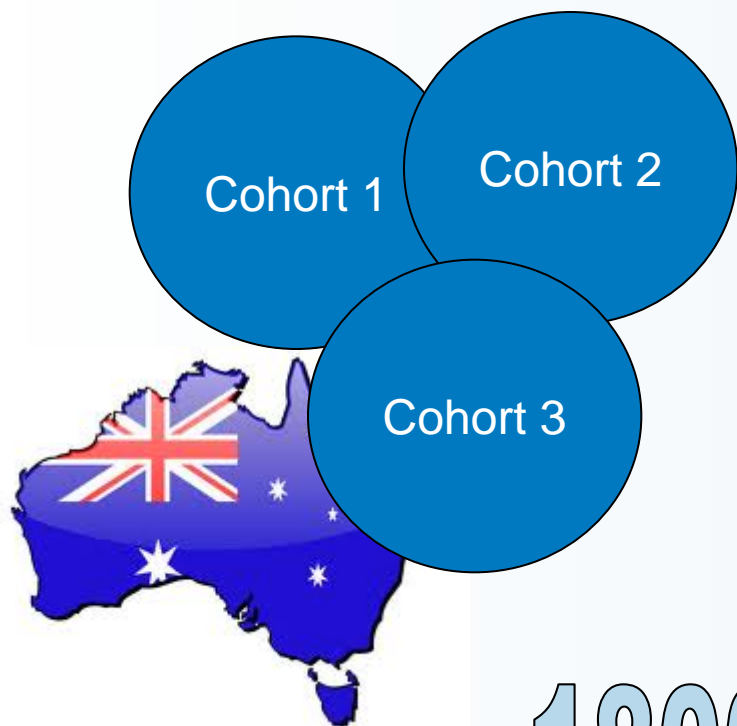
Feed intake unit

Trans-Tasman collaboration

- Started in 2007
- Involved 1000 heifers from Australia and 1000 from NZ
- Measured feed intake, growth and weight over 56 day period
- Kept the best and worst for feed efficiency to study in lactation

Dairy Futures CRC

Cohort 1
Cohort 2
Cohort 3

Cohort 1
Cohort 2
Cohort 3

1800 CALVES

Cohort 2

Cohort 3

Cohort 1

Cohort 2

Cohort 3

Prediction Equation
RFIg = x1+x2+x3+x4…+x625,000

Cohort 1

r(RFI,RFIg)
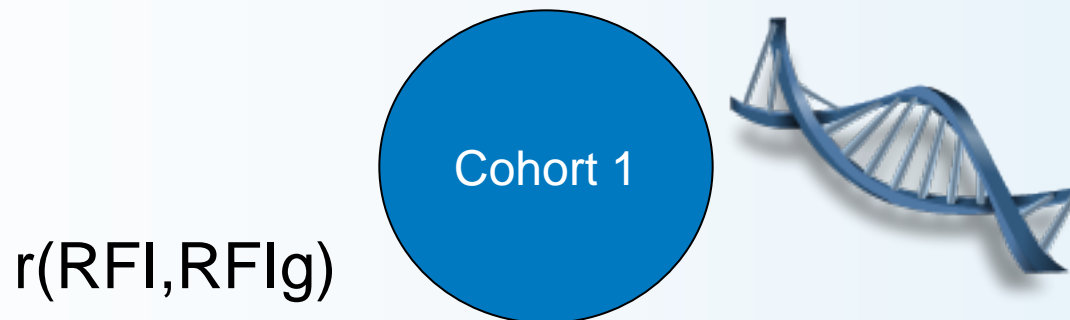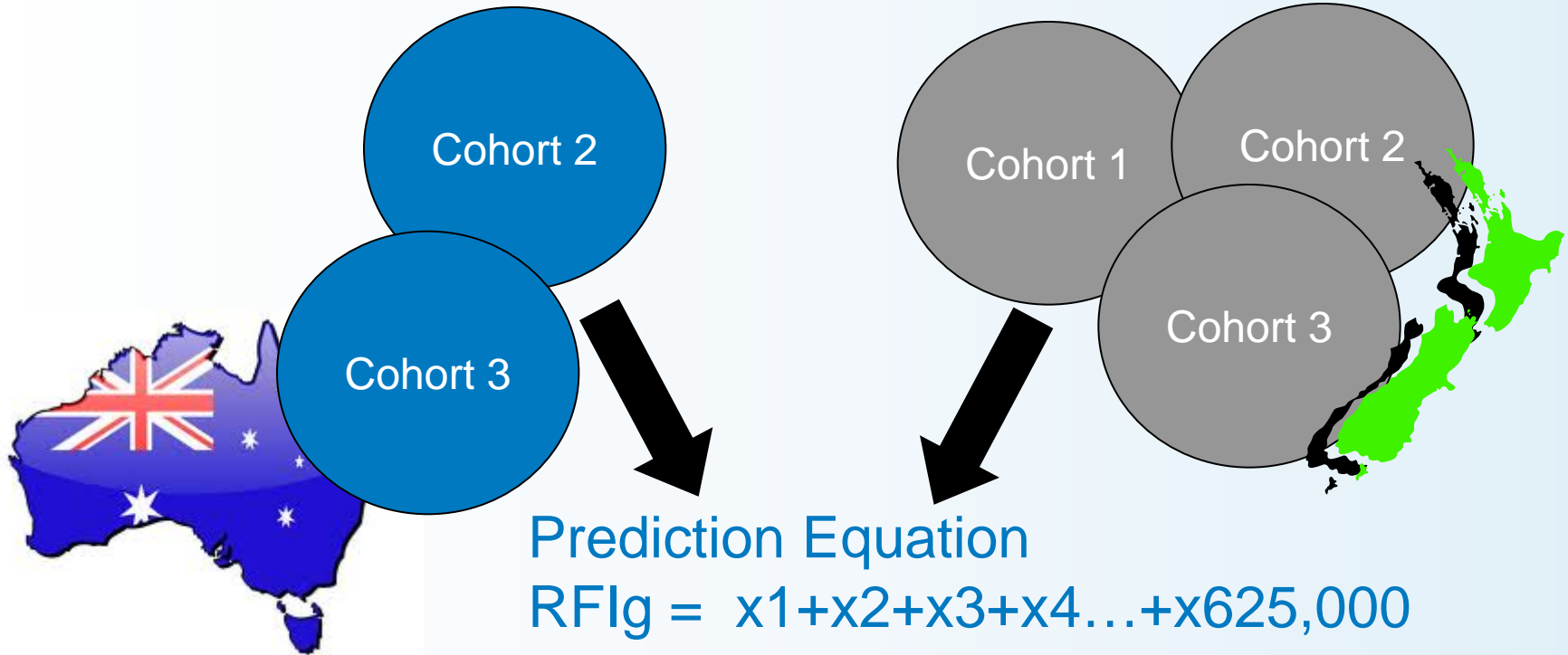
Results: Accuracy of genomic predictions

Validation	GBLUP	BayesMulti
AU trial 1	0.28	0.41
AU trial 2	0.31	0.39
AU trial 3	0.29	0.42
Average	**0.29**	**0.41**

Accuracy of genomic predictions of residual feed intake and 250-day body weight in growing heifers using 625,000 single nucleotide polymorphism markers
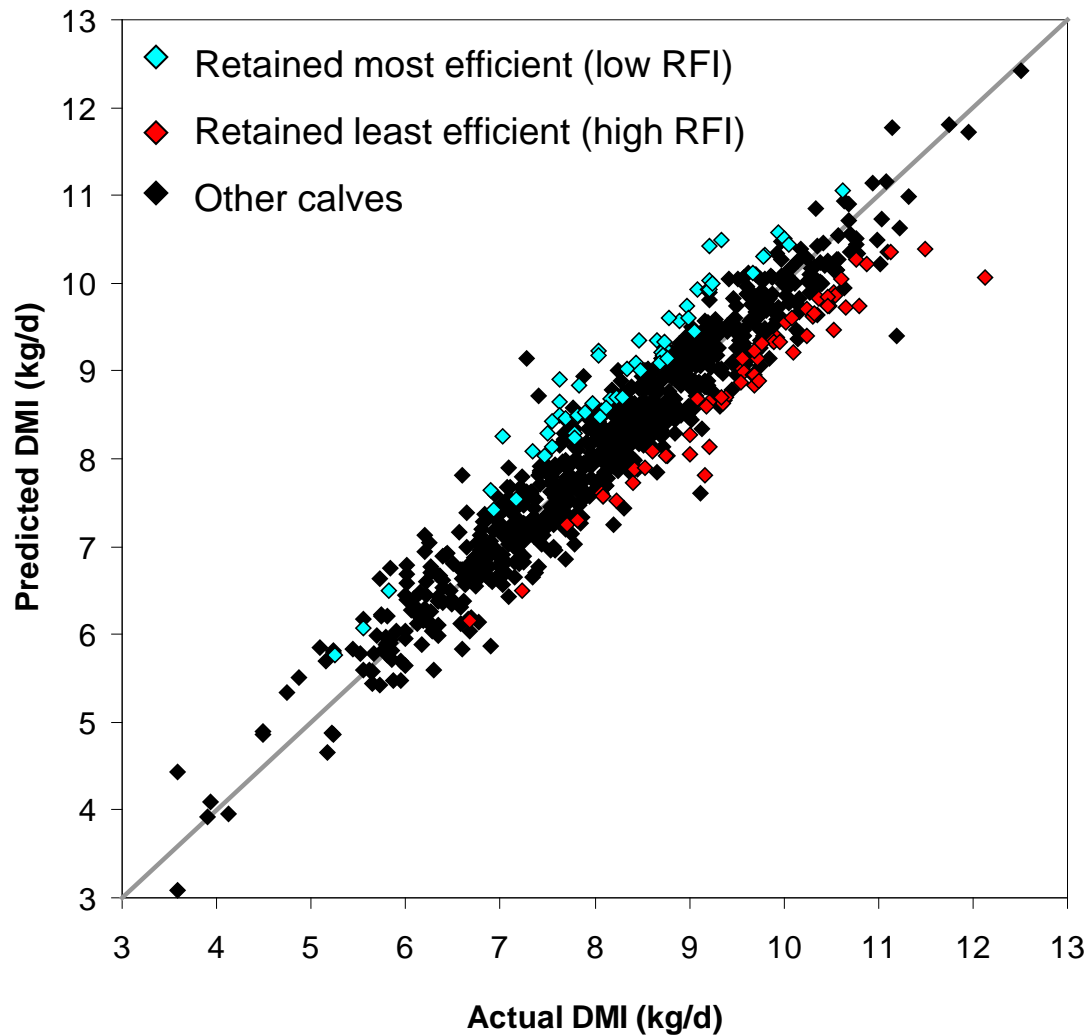
J. E. Pryce,*[1] J. Arias,‡ P. J. Bowman,*† S. R. Davis,§ K. A. Macdonald,# G. C. Waghorn,# W. J. Wales,‖ Y. J. Williams,¶ R. J. Spelman,‡ and B. J. Hayes*†
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Divergent groups

Legend:
- ◇ Retained most efficient (low RFI)
- ◆ Retained least efficient (high RFI)
- ◆ Other calves

X-axis: Actual DMI (kg/d)
Y-axis: Predicted DMI (kg/d)

Residual Feed intake is Actual – predicted DM intake

Average DMI difference = **1.39 kgDM/d** NZ (18% of daily mean DMI of 7.61 kg/d)

1.35 kgDM/d Australia (16% of daily mean of DMI of 8.3 kg/d)
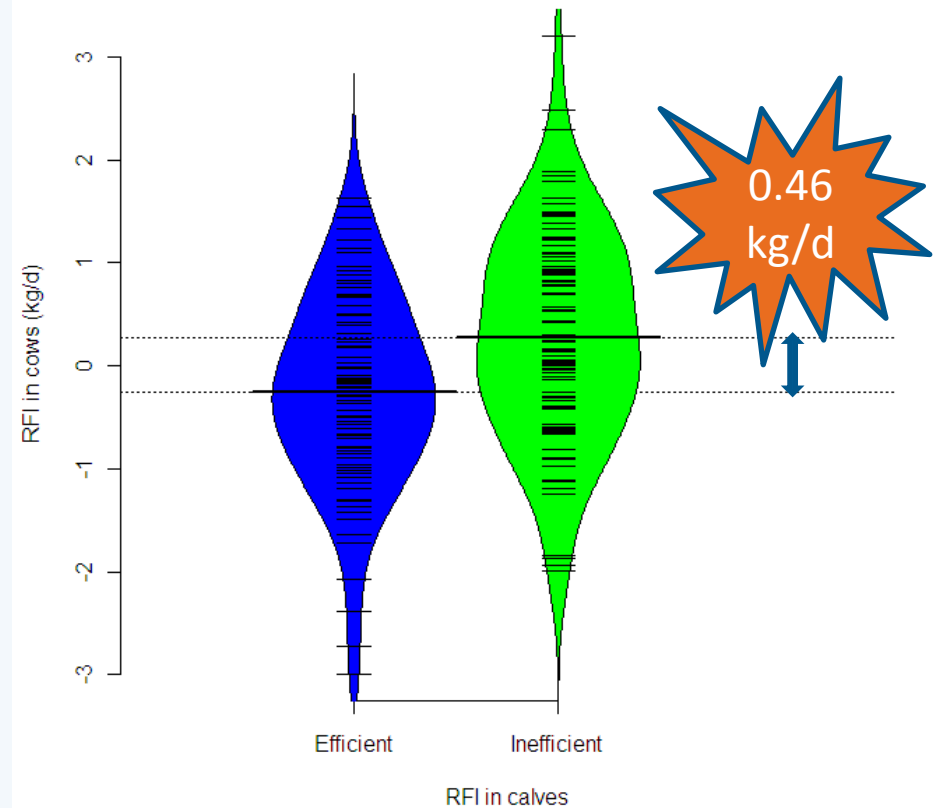
Divergent groups tested in lactation

- 1st lactation, *n*=183 from Australia and NZ
- 14 day adjustment, 30 day trial

Dry matter intake = days in milk + milk + fat + protein + lactose + liveweight + body condition score + RFI

- Efficient calves…..
  become efficient cows
- P<0.002
- Divergence (0.46kgDM/d)
  ~3% of DMI
- Correlation ~ 0.42

0.46 kg/d

Feed efficiency markers validated

- Genomic breeding values for residual feed intake (RFI) calculated for whole Ellinbank herd, 79 "validation" cows chosen at random
  - balanced across parities

- Realised accuracy of 0.27 using heifer genomic prediction equation (i.e. 68% of our accuracy in growing heifers)

Dry matter intake = days in milk + parity + milk + fat + protein + lactose + liveweight + body condition score + RFI

Summary

– We have a genomic prediction tool for efficiency of growth in calves

– Growing heifer efficiency is correlated to lactating cow efficiency

– Working towards including RFI in the Australian national breeding objective

Acknowledgements

- DEPI staff: Bundoora, Ellinbank, Rutherglen
- DairyNZ and LIC (New Zealand)
- Gardiner Foundation
- Dairy Future's Co-operative Research Council
- ADHIS
- gDMI collaborators

Questions?

Jennie Pryce

www.dairyfuturescrc.com.au

Implementation

- – Need estimates of genetic correlations of RFI with traits of importance (Gonzalez-Recio et al., 2013)

- – Economic value of RFI is $102.67 (Bell et al., 2013)

- – Calculate responses to selection

Means of posterior distribution of genomic correlations (SDs)

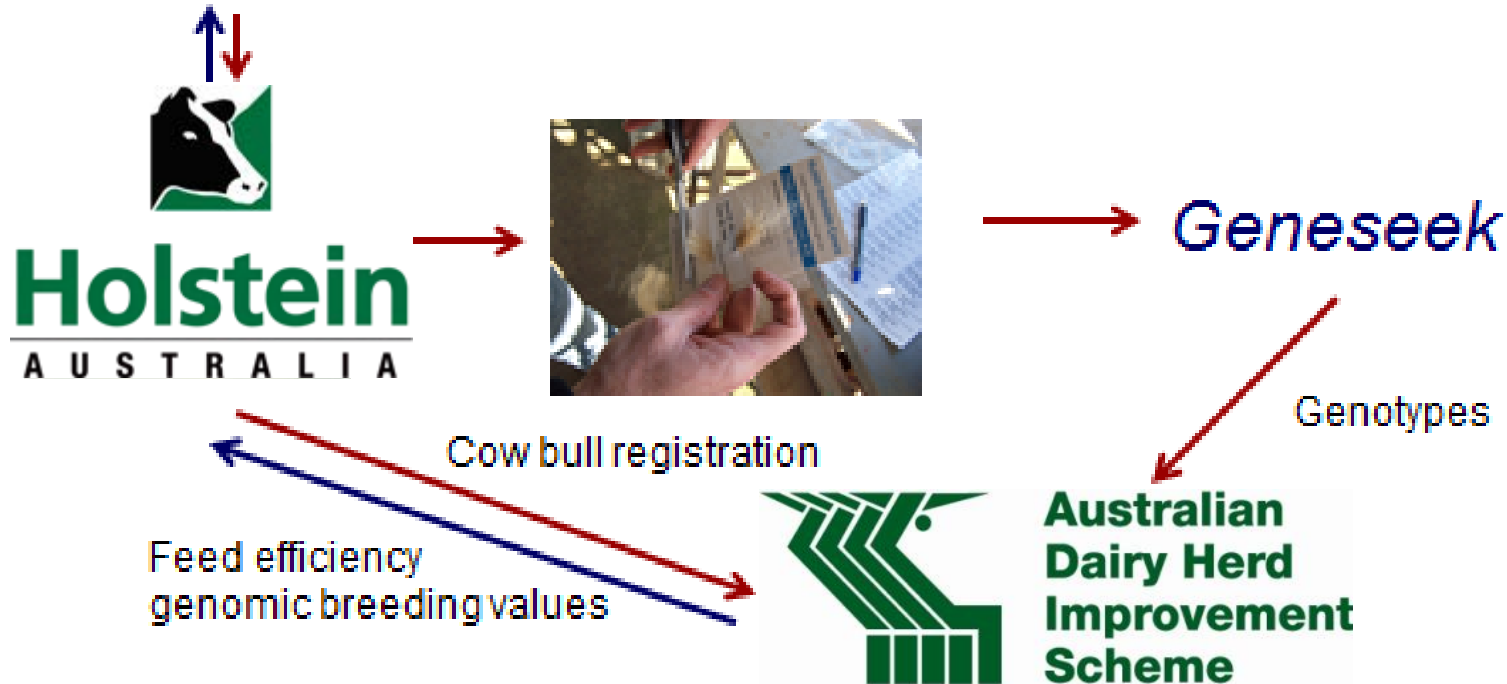| Trait	RFI
Milk yield	0.07 (0.08)
Fat yield	0.02 (0.07)
Protein yield	0.03 (0.07)
Calving interval	-0.13 (0.25)
Body condition score	0.71 (0.32)

Gonzalez-Recio et al, (2013)

Responses to selection

Trait	APR			FPI	
	Units	$		Units	$
Milk yield (l)	54.3	-2.86		49.08	-2.59
Protein yield (kg)	2.05	12.25		1.99	11.92
Fat yield (kg)	2.44	3.62		2.38	3.54
Survival (%)	1.1	7.72		1.04	7.34
Fertility (d)	-0.46	1.39		-0.53	1.61
SCC (%)	-2.92	0.76		-2.49	0.65
Liveweight (kg)	1.23	-1.04		0.51	-0.44
Milking speed (1-5)	-0.17	0.3		-0.13	0.23
Temperament (1-5)	-0.35	0.96		-0.36	0.96
RFI (kg/year)	**3.41**	**-0.96**		**0.49**	**-0.14**
Total Profit (AU$)		22.14			23.09

Implementation

Farmer, Breeders, Bull companies

Cow bull registration

Feed efficiency genomic breeding values

Geneseek

Genotypes

Australian Dairy Herd Improvement Scheme

	4.1 %		
l Longevity	Somatic Cell	Calving Difficulty	Body Condition
88 days	-0.11	. 6.7 %	0.11

TRAITS

	BV	-0.5	0	0.5	1	
tability to milking	.53					quickly
temperament	.57					placid
ng speed	.16					fast
all opinion	.59					desirable
re	.86					tall
city	.58					capacious
angle	.01					sloping
width	.42					wide
	-.24					curved
support	.23					strong
udder	.21					strong
udder	.10					high
teat placement	.29					close
teat placement	.46					close
overall	.22					desirable
conformation	.78					desirable

ughters TOP inspected   New Zealand Genetics **41%**

NITIATIVES

	4225	Gestation Length	2.8 days
Input	2202	% Black	95 %
otein	A1A2	RFI	$8 / 10%

nvestaMate discount applies (see page 111)