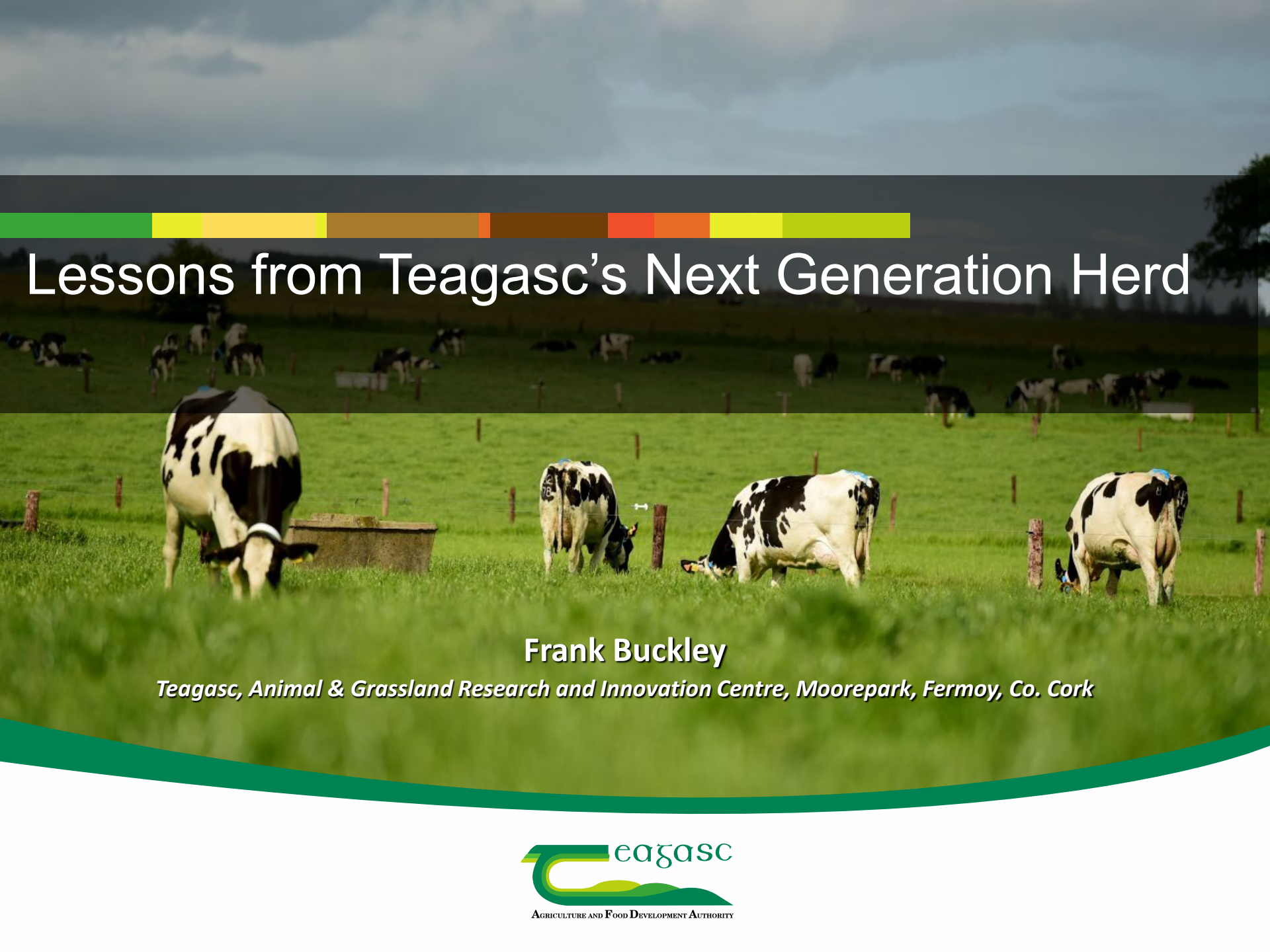




Lessons from Teagasc's Next Generation Herd

Frank Buckley

Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

What is NGH?



- Sentinel research herd providing a futuristic view of the phenotypic performance of dairy cows selected for extremely high genetic merit based on the Irelands dairy breeding objective, the EBI
 - Future Proofing EBI and our National Breeding Programme
- Precisely identify the drivers of improved performance in animals selected EBI
- Industry point of reference
- Nucleus of superior genetics contributing directly our national breeding programme

Study Design

- Dairygold Farm
- 3 Genotypes
 - 72 Elite
 - 36 NatAv
 - 72 Jersey
- 3 Pasture-based FTs
- 9 individual farmlets



EBI Profile of Cows

2014 Economic values and % emphasis for traits in the EBI

Sub-Index	Trait	Economic Weight	Trait Emphasis	Overall Emphasis
Production	Milk	+0.09	10.0%	33%
	Fat	+1.04	3.4%	
	Protein	+6.54	18.9%	
Fertility	Calving Interval	-12.43	24.0%	35%
	Survival	+22.01	10.9%	
Calving	Direct Calving Difficulty	-3.52	2.8%	9%
	Maternal Calving Difficulty	-1.73	1.3%	
	Gestation Length	-7.40	4.1%	
	Calf Mortality	-2.58	1.0%	
Beef	Cull Cow Weight	+0.35	0.7%	9%
	Carcass Weight	+1.38	5.1%	
	Carcass Conformation	+30.32	1.7%	
	Carcass Fat	-11.71	1.1%	
Maintenance	Cull Cow Weight	-1.65	7.2%	7%
Management	Milking Time	-0.25	2.1%	4%
	Milking Temperament	+33.69	1.9%	
Health	Lameness	-54.26	0.6%	3%
	SCC	-43.49	1.8%	
	Mastitis	-77.30	0.8%	

EBI



Genotype	EBI	Sub-Indices						
		Milk	Fert	Calving	Beef	Maint	Health	Manag
Elite	214	62	102	42	-15	15	4	3.2
NA	110	38	39	36	-11	7	1.6	1.5
NZJ	180	72	59	40	-52	53	2	8
DKJ	109	15	74	-1	-54	63	6	6

National Rankings on EBI

	Top 1%	Top 5%	Top 10%	Top 25%	Ave.
Herd	€160	€143	€134	€118	€98
Animal	€202	€175	€161	€133	€97



Published!

- Milk Production characteristics
- Intake, FCE and grazing behaviour
- Reproductive efficiency and Survival
- Economic impact
- Environmental implications

– Peer reviewed articles and two Phds completed and more...



J. Dairy Sci. 102:2560–2577
<https://doi.org/10.3168/jds.2018-15559>
© 2019, The Authors. Published by FASS Inc. and Elsevier Inc. on behalf of the American Dairy Science Association.
This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Milk production of Holstein-Friesian cows of divergent Economic Breeding Index evaluated under seasonal pasture-based management

M. O'Sullivan,^{1,2} B. Horgan,¹ K. M. Pierce,³ S. McParland,¹ K. O'Sullivan,² and F. Buckley^{1,2*}
¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C987, Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2E5, Ireland
³School of Mathematical Sciences, University College Cork, Cork, T12 XPG2, Ireland

J. Dairy Sci. 102:8234–8246
<https://doi.org/10.3168/jds.2019-16371>
© 2019, The Authors. Published by FASS Inc. and Elsevier Inc. on behalf of the American Dairy Science Association.
This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Intake, efficiency, and feeding behavior characteristics of Holstein-Friesian cows of divergent Economic Breeding Index evaluated under contrasting pasture-based feeding treatments

M. O'Sullivan,^{1,2*} P. Dillon,¹ K. O'Sullivan,² K. M. Pierce,³ N. Galvin,³ M. Egan,¹ and F. Buckley^{1,2}
¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C987, Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2E5, Ireland
³School of Mathematical Sciences, University College Cork, Cork, T12 XPG2, Ireland

J. Dairy Sci. 103:1665–1700
<https://doi.org/10.3168/jds.2019-17374>
© 2020, The Authors. Published by FASS Inc. and Elsevier Inc. on behalf of the American Dairy Science Association.
This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Reproductive efficiency and survival of Holstein-Friesian cows of divergent Economic Breeding Index, evaluated under seasonal calving pasture-based management

M. O'Sullivan,^{1,2*} S. T. Butler,¹ K. M. Pierce,³ M. A. Croane,² K. O'Sullivan,⁴ R. Fitzgerald,¹ and F. Buckley^{1,2*}
¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C987, Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2E5, Ireland
³School of Veterinary Medicine, University College Dublin, Belfield, Dublin, D04 N2E5, Ireland
⁴School of Mathematical Sciences, University College Cork, Cork, T12 XPG2, Ireland

1. Economic assessment of Holstein-Friesian dairy cows of divergent Economic Breeding Index
2. evaluated under seasonal calving pasture-based management
3. M. O'Sullivan,^{1,2} L. Shalloo,¹ K. M. Pierce,¹ and F. Buckley^{1,2}
4.
5. ¹Animal & Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co.
6. Cork, Ireland
7. ²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin,
8. Ireland

Modelling greenhouse gas emissions and nitrogen efficiency of Holstein-Friesian dairy cows of divergent economic breeding index under seasonal pasture-based management

B. Lalor,¹ L. Shalloo,¹ J. Hennessy,¹ R. Fitzgerald,¹ T.M. Boland,¹ F. Buckley¹

¹Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2E5, Ireland

Corresponding author: Ben Lalor, Email: ben.lalor@teagasc.ie

Production 2013-2016



	Elite	NatAv	Diff	Sig
Milk yield (kg)	5,613	5,818	-205	***
Fat (%)	4.48	4.20	+0.28	***
Protein (%)	3.72	3.54	+0.18	***
Fat yield (kg)	251	244	+7	*
Protein yield (kg)	209	206	+3	NS
SCC (1000 cells/ml)	116	130	-14	NS



J. Dairy Sci. 102:2560-2577
<https://doi.org/10.3168/jds.2018-15559>

© 2019, The Authors. Published by FASS Inc. and Elsevier Inc. on behalf of the American Dairy Science Association®.
 This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Milk production of Holstein-Friesian cows of divergent Economic Breeding Index evaluated under seasonal pasture-based management

M. O'Sullivan,^{1,2} B. Horan,¹ K. M. Pierce,² S. McParland,¹ K. O'Sullivan,³ and F. Buckley^{1,2*}
¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C967 Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2E5 Ireland
³School of Mathematical Sciences, University College Cork, Cork, T12 XF62 Ireland



AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

Fertility Performance

2013-2016



	Elite	NatAv	Sig
Submission rate (%)	92	86	*
Pregnancy rate first service (%)	61	46	*
Pregnancy rate first 6 weeks (%)	73	58	***
Final pregnancy rate - 12 wks (%)	92	81	***
Calving to conception (days)	93	97	*
No. of services	1.57	1.77	**



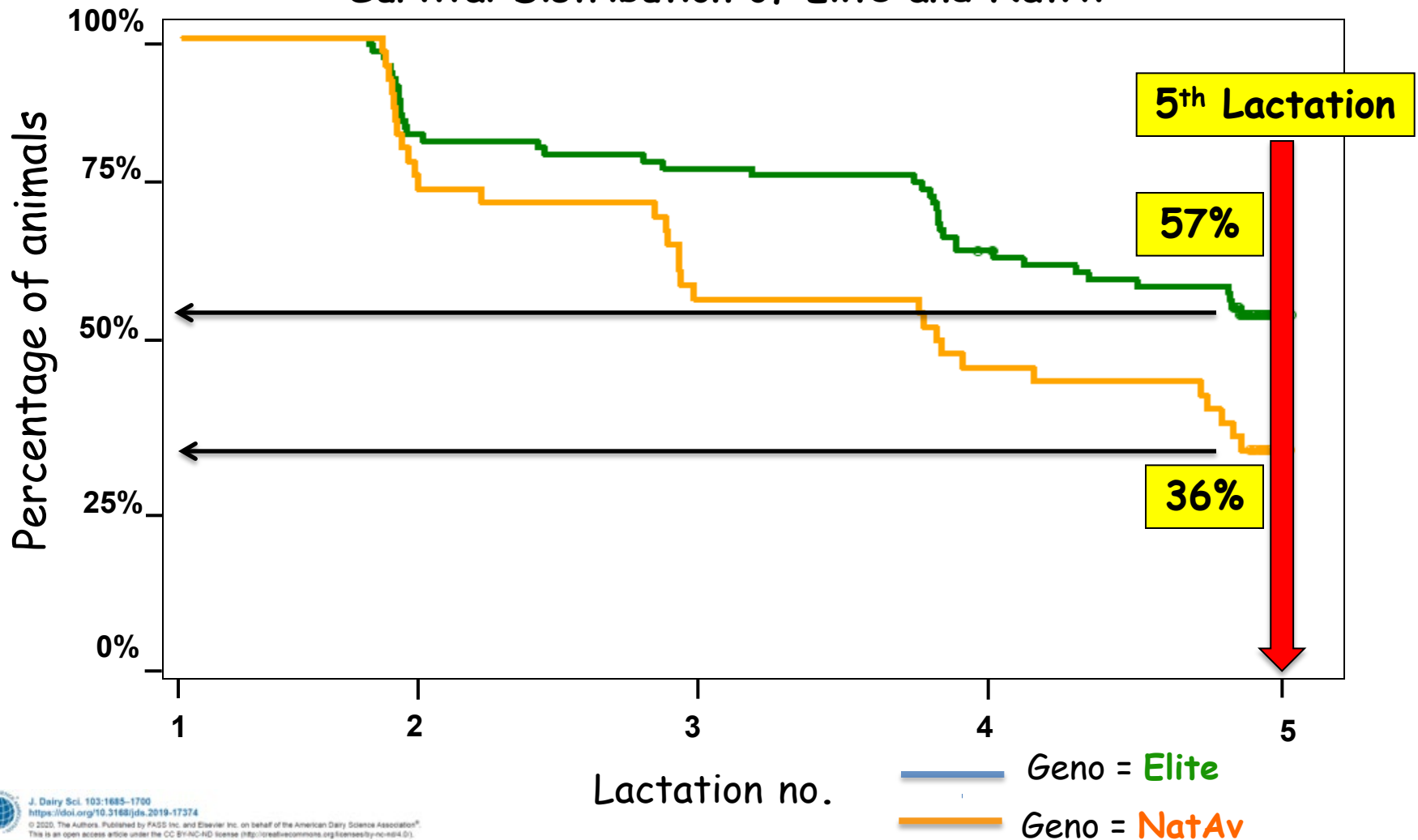
J. Dairy Sci. 103:1685-1700
<https://doi.org/10.3168/jds.2019-17374>
 © 2020 The Authors. Published by FASS Inc. and Elsevier Inc. on behalf of the American Dairy Science Association®.
 This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Reproductive efficiency and survival of Holstein-Friesian
 cows of divergent Economic Breeding Index, evaluated
 under seasonal calving pasture-based management

M. O'Sullivan,^{1,2} S. T. Butler,¹ K. M. Pierce,³ M. A. Crowe,¹ K. O'Sullivan,⁴ R. Fitzgerald,¹
 and P. Buckley^{1,5}
¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C957, Ireland
²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N025, Ireland
³School of Veterinary Medicine, University College Dublin, Belfield, Dublin, D04 N025, Ireland
⁴School of Mathematical Sciences, University College Cork, Cork, T12 XFS2, Ireland

Survival Analysis

Survival Distribution of Elite and NatAv



J. Dairy Sci. 103:1685–1700
<https://doi.org/10.3168/jds.2019-17374>
 © 2020, The Authors. Published by FASS Inc. on behalf of the American Dairy Science Association®.
 This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Reproductive efficiency and survival of Holstein-Friesian cows of divergent Economic Breeding Index, evaluated under seasonal calving pasture-based management

M. O'Sullivan,^{1,2} S. T. Butler,¹ K. M. Pierce,² M. A. Crowe,² K. O'Sullivan,⁴ R. Fitzgerald,¹ and F. Buckley^{1,3*}

¹Animal and Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co. Cork, P61 C937, Ireland

²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, D04 N2ES, Ireland

³School of Veterinary Medicine, University College Dublin, Belfield, Dublin, D04 N2ES, Ireland

⁴School of Mathematical Sciences, University College Cork, Cork, T12 XPS2, Ireland



AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

1 Economic assessment of Holstein-Friesian dairy cows of divergent Economic Breeding Index
2 evaluated under seasonal calving pasture-based management

3 M. O'Sullivan,¹ L. Shalloo,² K.M. Pierce,¹ and F. Buckley¹

4

5 ¹Animal & Grassland Research and Innovation Centre, Teagasc Moorepark, Fermoy, Co.

6 Cork, Ireland

7 ²School of Agriculture, and Food Science University College Dublin, Belfield, Dublin,

8 Ireland



Farm Profit

Elite

NatAv

Labour cost (€)

+ 41kg
MS

32,485

31,808

Replacement costs (€)

28,160

42,827

Total costs (€)

164,627

177,951

Livestock sales (€)

+ >€200/cow

31,126

35,841

Profit Farm (€)

94,691

64,339

Environmental footprint

	Elite	NatAv
<i>GHG Emissions</i>		
CO ₂ -eq, tonnes / ha	16.2	16.3
CO ₂ -eq, kg / kg FPCM	0.96	1.06
<i>Nitrogen efficiency</i>		
N input	307.9	309.4
N output	103.3	99.5
N surplus	204.6	209.9
N use efficiency	0.336	0.322

Lahart et al. (2020)



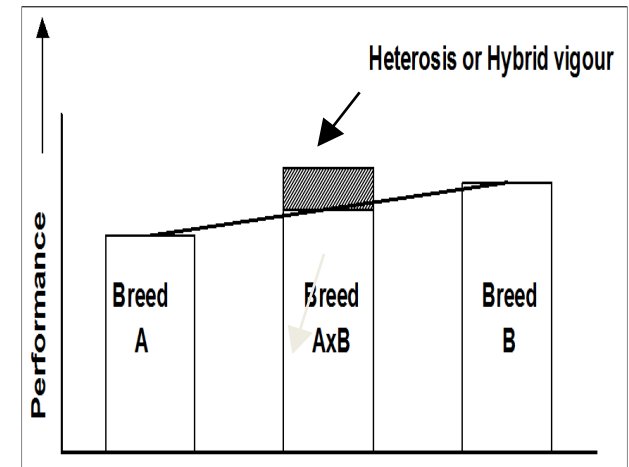
Crossbreeding with
Jersey

Fundamentally

- Remove the negative effects associated with

INBREEDING

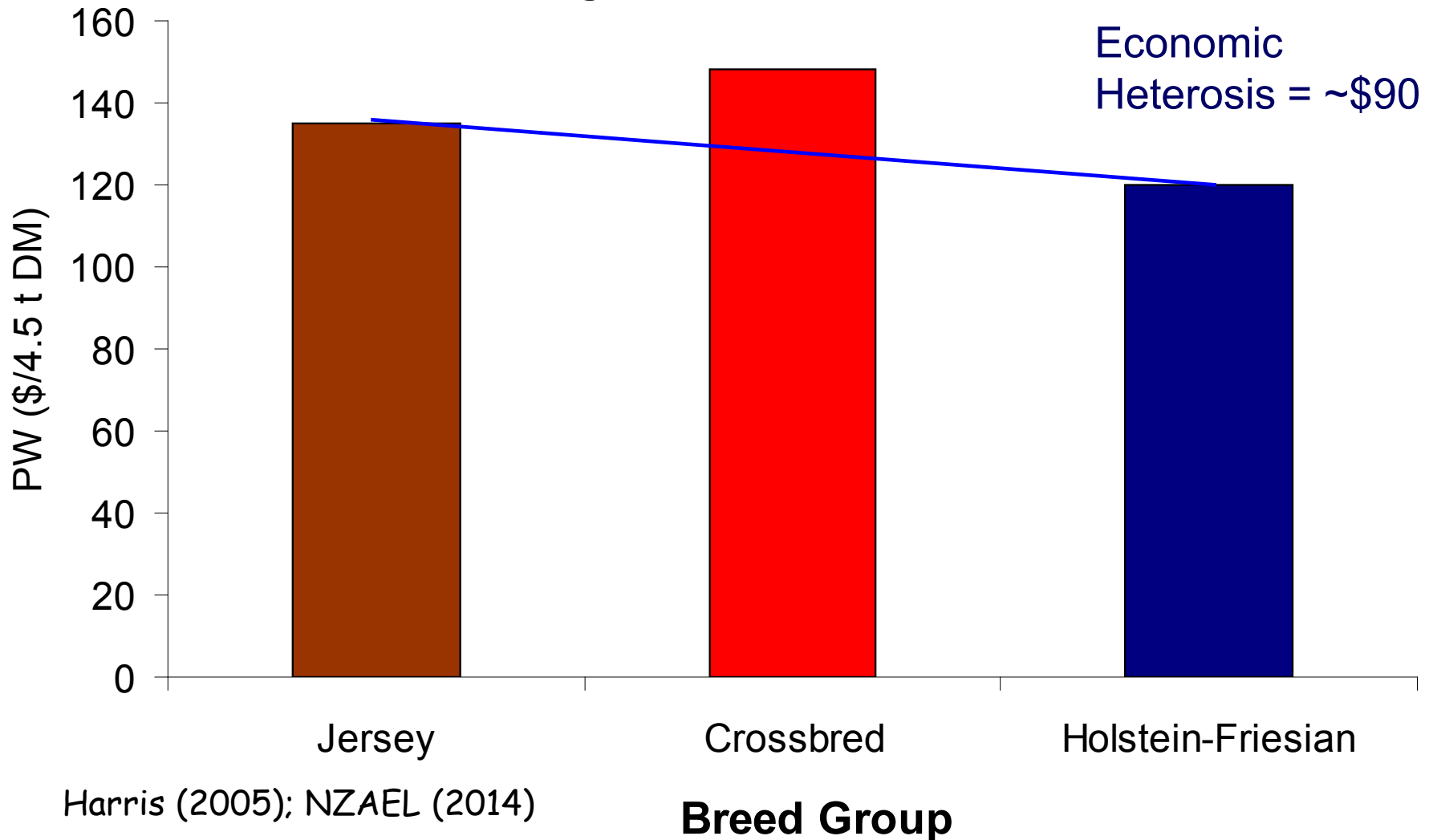
- Breed Complementarity
- Heterosis or Hybrid Vigour



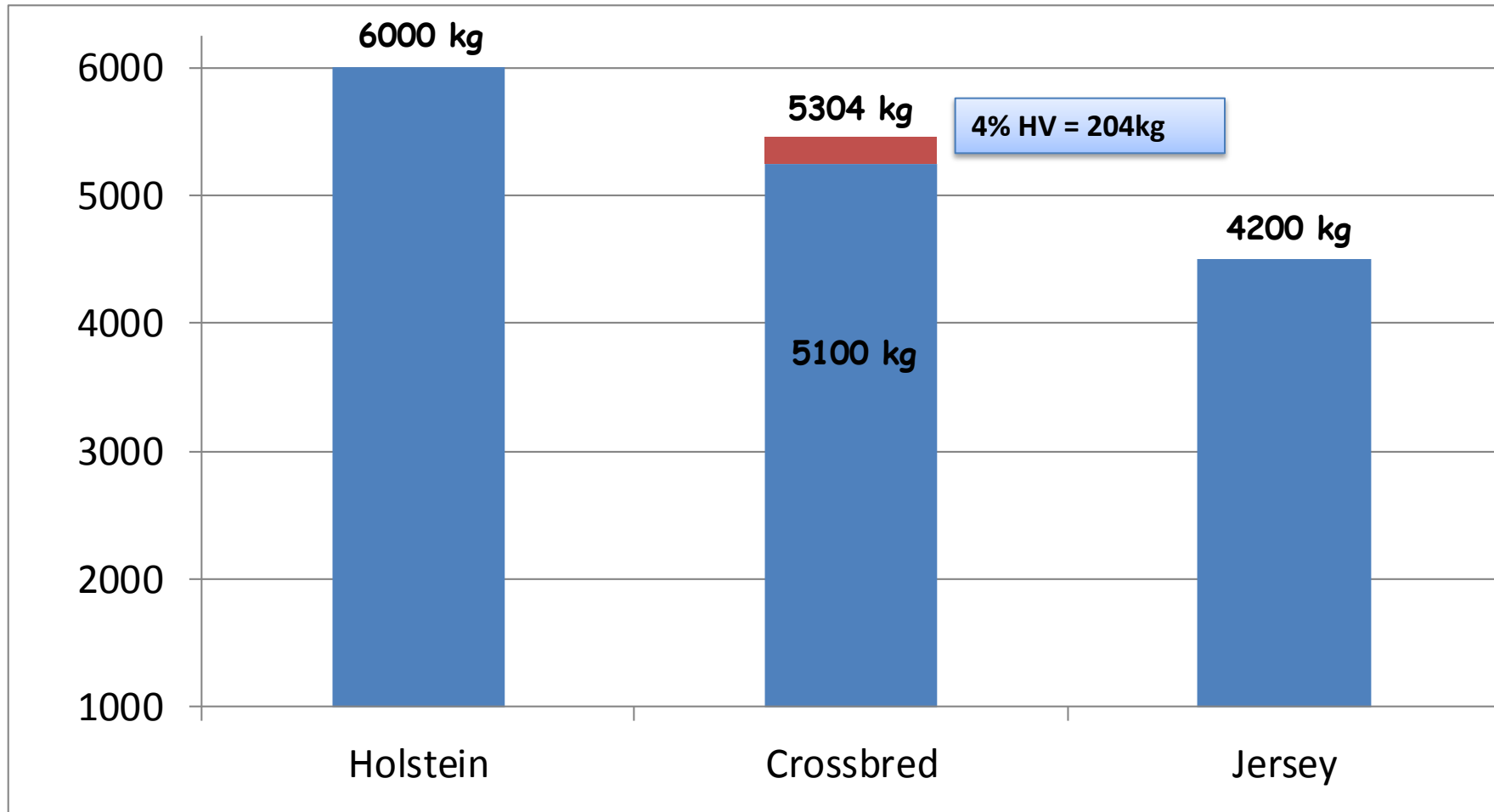
- Additional performance vs the mid-parent mean

Economic Heterosis

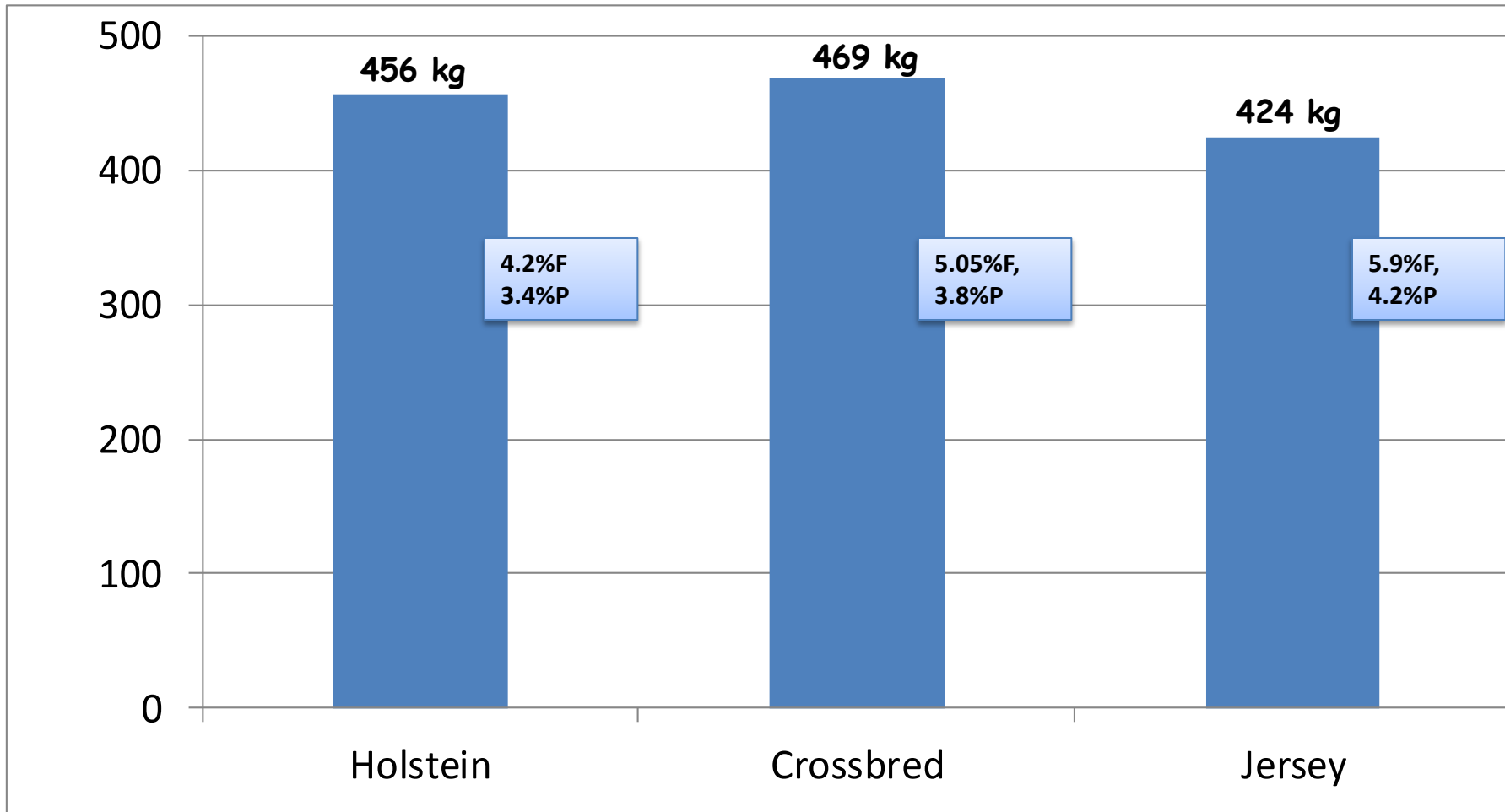
Kinghorn (1982)



Heterosis & breed Complementarity explained....



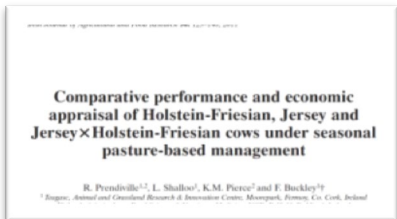
Heterosis & breed Complementarity explained....



Dispelling the Myth

JX = Lower MS yield/Cow!



	HF	JX
Ballydague - Prendiville et al., 2011, IJAFR		
		
MS/cow (kg)	422	446
Weight (kg)	523	466
Ratio	0.81	0.96

Commercial data - Coffey et al., 2016, J Dairy Sci		
		
MS/cow (kg)	402	422

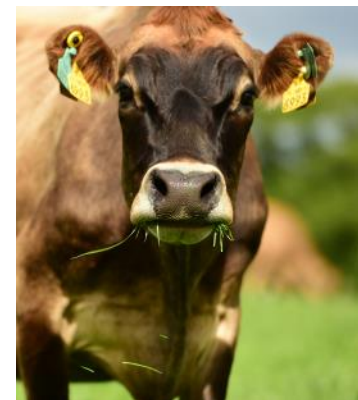
Clonakilty - McClearn et al., 2020, J Dairy Sci		
		
MS/cow (kg)	435	443
Weight (kg)	527	476
Ratio	0.83	0.93

Nextgen Jersey 2018-19



	ELITE	NA	NZJ	DKJ
Milk Yield (kg)	5424	5546	4498	4276
Fat (%)	4.64	4.38	5.75	5.40
Protein (%)	3.71	3.61	4.18	3.90
F+P Yield (kg)	457	444	445	394
Weight (kg)	514	522	406	383
BCS	2.90	2.77	2.96	2.78
MS kg/kg BW	0.88	0.85	1.08	1.02
6 week PR	79	58	73	61
12 week PR	91	85	92	92

Intake Capacity



	Elite	NA	NZJ
TDMI (kg)	15.7	15.7	14.2
TDMI/100kgBW (kg)	3.1	3.0	3.8
MS/100kgBW (kg)	0.33	0.31	0.39

Quigley et al. (unpublished)

Extrapolation using MDSM.....JX

	NA	Elite	J	NAxJ*	ELITExJ*
SR (cow/ha)	2.63	2.68	3.18	2.73	2.76
Milk solids/kg body weight	0.84	0.90	1.06	1.01	1.03
Milk solids (kg/ha)	1141	1254	1317	1297	1322
Milk price (c/l)	33.9	36.6	44.8	39.6	40.1
Net profit/cow (€)	622	844	564	829	873
Net profit/ha (€)	1709	2322	1868	2365	2479

*Based on NGH data 2018 & Prendiville et al. 2011

JEX v CH₄

Methane (g/d)
Brd

P = 0.4292

	lsmean	SE	df	lower.CL	upper.CL
FR	376	16.2	41	343	409
JeX	384	17.3	41	349	419

Methane (g/d)
Parity

P = 0.0211

	lsmean	SE	df	lower.CL	upper.CL
One	354	16.2	41	321	387
Two	387	16.1	41	354	420
Three	399	11.5	41	376	422

Milk solids (kg/d)

Milk solids

P = 0.4292

	lsmean	SE	df	lower.CL	upper.CL
FR	1.95	0.0813	41	1.79	2.12
JeX	2.1	0.0869	41	1.93	2.28

Milk solids (kg/d)

Parity

P = <.0001

	lsmean	SE	df	lower.CL	upper.CL
One	1.77	0.0813	41	1.61	1.94
Two	2.03	0.0807	41	1.87	2.19
Three	2.28	0.0563	41	2.17	2.4

Methane / Milk Solids(g)

Brd

P = 0.0465

	lsmean	SE	df	lower.CL	upper.CL
FR	197	8.35	41	180	214
JeX	186	8.88	41	168	204

Methane / Milk Solids(g)

Parity

P = 0.0031

	lsmean	SE	df	lower.CL	upper.CL
One	203	8.35	41	187	220
Two	193	8.42	41	176	210
Three	177	6.19	41	165	190

Lahart et al. (unpublished)

Selecting for Increased Feed/Nitrogen efficiency

- Strong positive correlation (+0.62) between Energy and Nitrogen efficiency



J. Dairy Sci. 96:7245–7259

<http://dx.doi.org/10.3168/jds.2013-6977>

© American Dairy Science Association®, 2013.

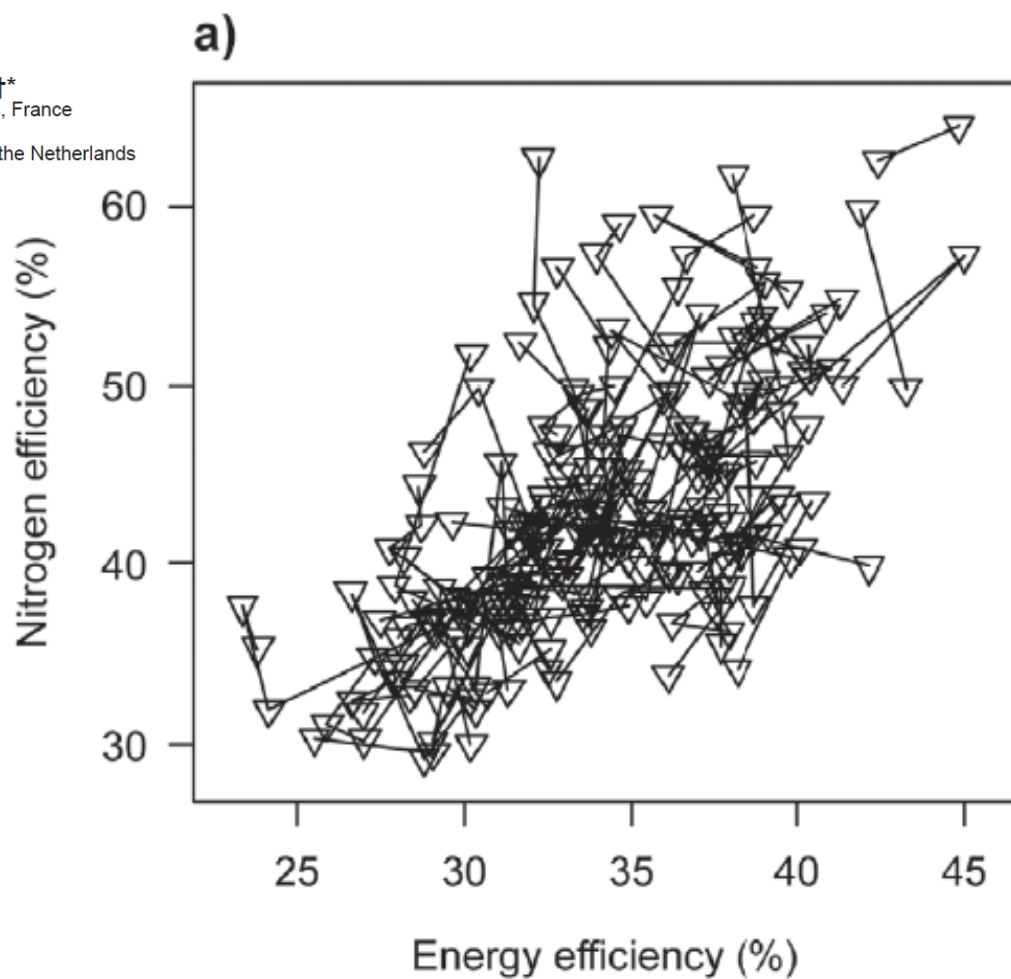
Factors affecting energy and nitrogen efficiency of dairy cows: A meta-analysis

H. N. Phuong,*†¹ N. C. Friggens,*† I. J. M. de Boer,‡ and P. Schmidely†*

*AgroParisTech, UMR791 Modélisation Systémique Appliquée aux Ruminants, F-75005 Paris, France

†INRA, UMR791 Modélisation Systémique Appliquée aux Ruminants, F-75005 Paris, France

‡Animal Production Systems group, Wageningen University, PO 338, 6700 AH Wageningen, the Netherlands



JEX v Beef

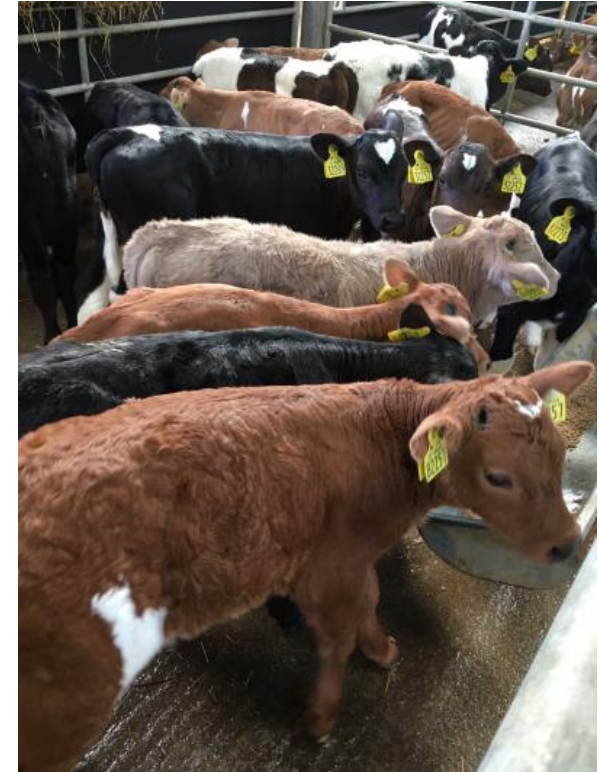


J. Dairy Sci. 101:11052–11060
<https://doi.org/10.3168/jds.2018-14992>
© American Dairy Science Association®, 2018.

Carcass characteristics of cattle differing in Jersey proportion

D. P. Berry,^{*,†} M. J. Judge,^{*} R. D. Evans,[†] F. Buckley,^{*} and A. R. Cromie[†]
^{*}Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy P61 P302, Co. Cork, Ireland
[†]Irish Cattle Breeding Federation, Highfield House, Shinagh, Bandon P72 X050, Co. Cork, Ireland

- Over played??
- Responsible use of Jersey genetics
- Minimise or eliminate low value male calves
 - Sexed semen
 - Maximise proportion mated to beef
- Dairy Beef Index/calf to beef integration initiatives/outlets
- Increase weighting on beef within EBI....???



Positive Trends

Table 1. Analysis of MALE calves from the dairy herd.

Year	Sire Breed	Dam Breed	Total Births	Num_dead_ytd	Num_slau	Num_dead at birth	Num_exported
2019	AA	FR	136463	7563	270	3498	26858
2019	AA	JE	3310	277	102	95	987
2019	FR	FR	320416	19120	10800	7132	108975
2019	FR	JE	14374	1397	5586	582	3075
2019	HE	FR	99815	4739	157	2095	7505
2019	HE	JE	2437	163	57	58	414
2019	JE	FR	14123	1500	8492	737	1322
2019	JE	JE	4771	968	2744	536	220
2019	OTHER BEEF	FR	58093	2988	27	1110	4193
2019	OTHER BEEF	JE	1457	88	65	26	160
Total			655,259	38,723	28,300	15,869	153,709
2020	AA	FR	144280	8061	223	4009	18725
2020	AA	JE	3775	284	119	105	853
2020	FR	FR	323148	19164	9845	7941	85006
2020	FR	JE	16135	1310	5394	448	2834
2020	HE	FR	104112	4714	111	2306	2124
2020	HE	JE	2993	226	76	84	171
2020	JE	FR	11305	1090	5832	462	923
2020	JE	JE	4453	748	2295	312	132
2020	OTHER BEEF	FR	66093	3147	22	1242	1601
2020	OTHER BEEF	JE	1823	132	42	53	90
Total			678,117	38,876	23,969	16,962	112,459

Table 2. Some stats of interest.

Change in dairy calvings	3.4%
Change in calves slaughtered	-15.3%
Change in calf mortality (dead_ytd)	0.4%
Change in JE calf mortality (dead_ytd)	-18.6%
Change in beef usage on dairy cows	7.1%
Change in JE sire usage on dairy cows (i.e., JE bred calves from dairy cows)	-16.6%
Change in JE calf mortality (dead_birth)	-34.1%

- Very positive trend re: all key metrics.
- Direct impact of approaches applied in Spring 2019 (i.e., DAFM farm visits, letters to suppliers, media....).



Summary...



- Delivering production performance consistent with the national breeding objective
- Combined cows expressing high DMI capacity, strong inherent grazing aptitude, positive energy balance, and the ability to maintain high BCS
- Slight reduction in the utilisation of ingested energy for milk production BUT.....
- Delivering fertility and longevity consistent with industry targets
- Considerable Economic benefit and favourable Environmental metrics
- Borne out of genetic improvement based on balanced selection for traits of economic importance to seasonal pasture-based systems of milk production
- NextGen Jersey provides evidence of the continuing presence of significant additive genetic gain in the Jersey breed
- These results support the continued development of the National Breeding Programme (including the delivery of high EBI sires to industry) and continue to underpin farmer confidence in the direction of dairy cattle breeding

QUESTIONS?

