Breeding for resilience in the Netherlands and Flanders

Niek Meijer | 20 May 2024

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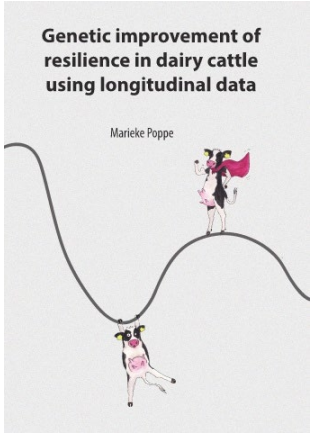
Resilience

How can the overall health of cows be improved?

Based on PhD of Marieke Poppe at Wageningen University (2022)



News

Milk yield resilience indicators and sensor features for a more diverse and sustainable dairy production landscape

August 29, 2023

Milking robot helps breed 'trouble-free' cows

22 January 2020 | by FarmingUK Team | Dairy, Machinery, News

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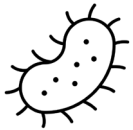
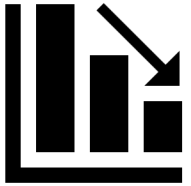
Resilience



Environmental disturbances



Reduced functioning

The ability to be minimally affected by disturbances
AND / OR
to recover quickly when affected
Colditz & Hine, 2016

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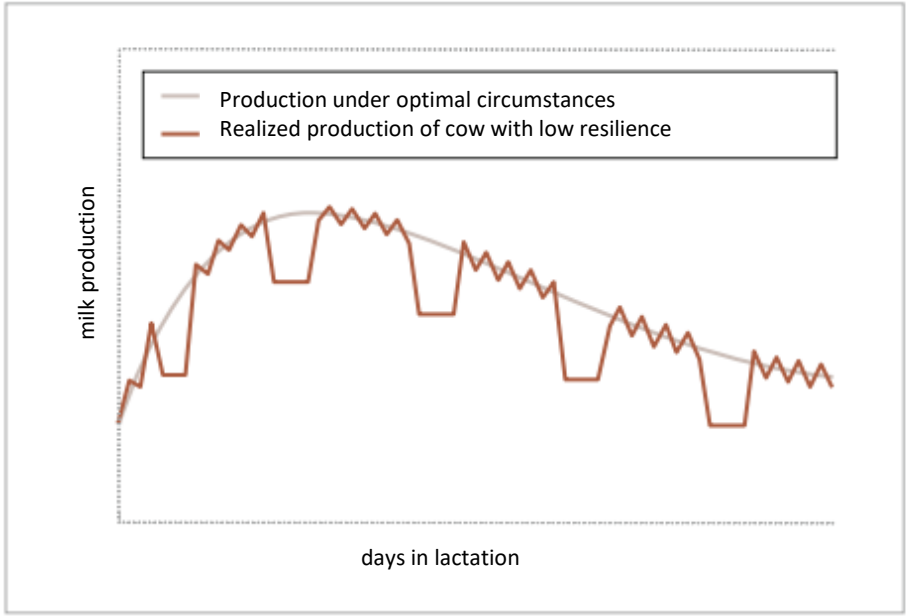
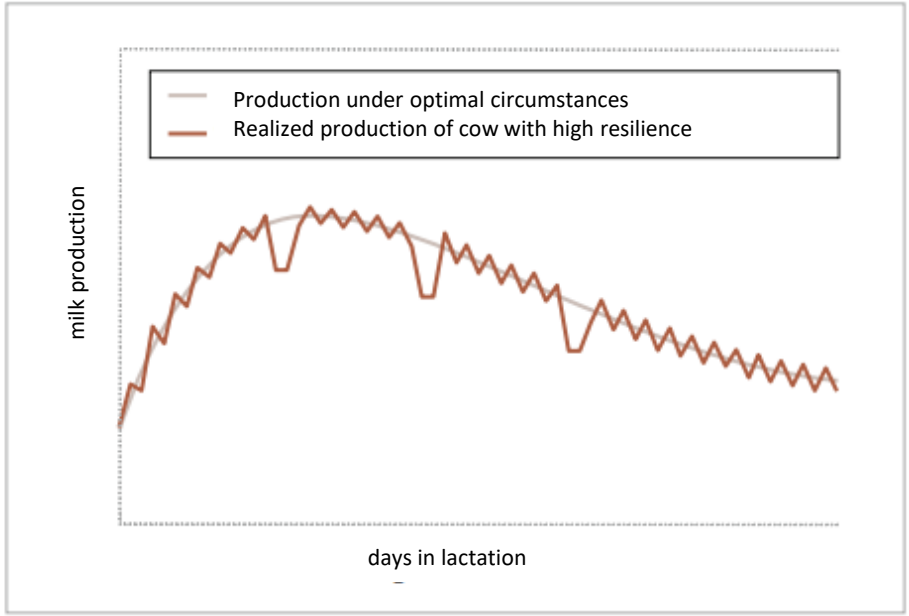
Resilience





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How to measure resilience?

Dataset with information with individual milk records since 2010 (> 5 billion)

Automatic milk systems (AMS) and milking parlour with electronic milk devices

Calculate daily milk yield

Predict optimal production curve for each cow, each lactation

Calculate for each cow how much the cow has produces less / more than predicted

large difference → low resilience

low difference → high resilience

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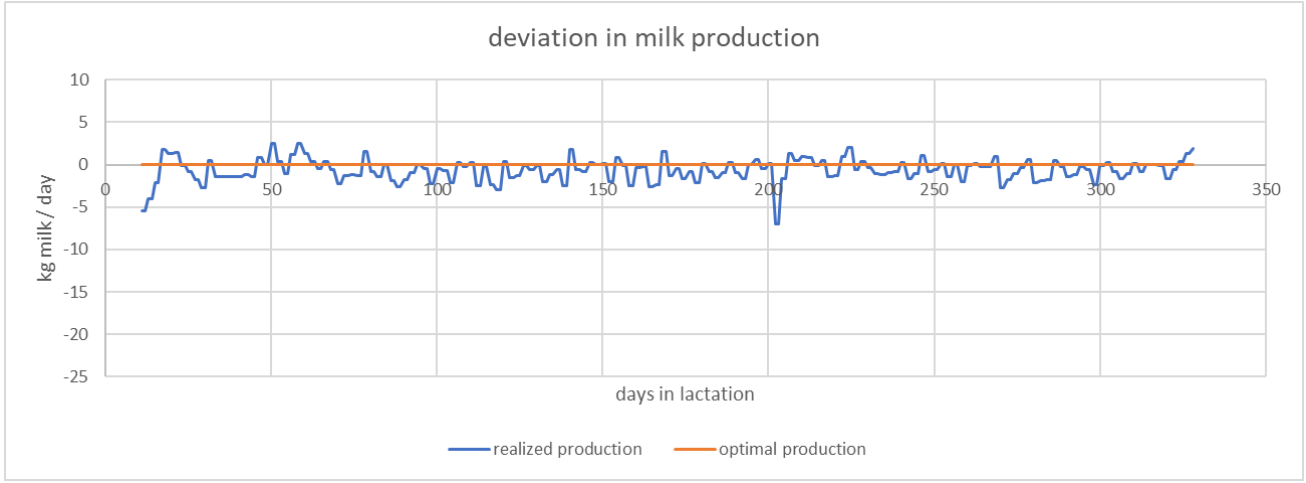
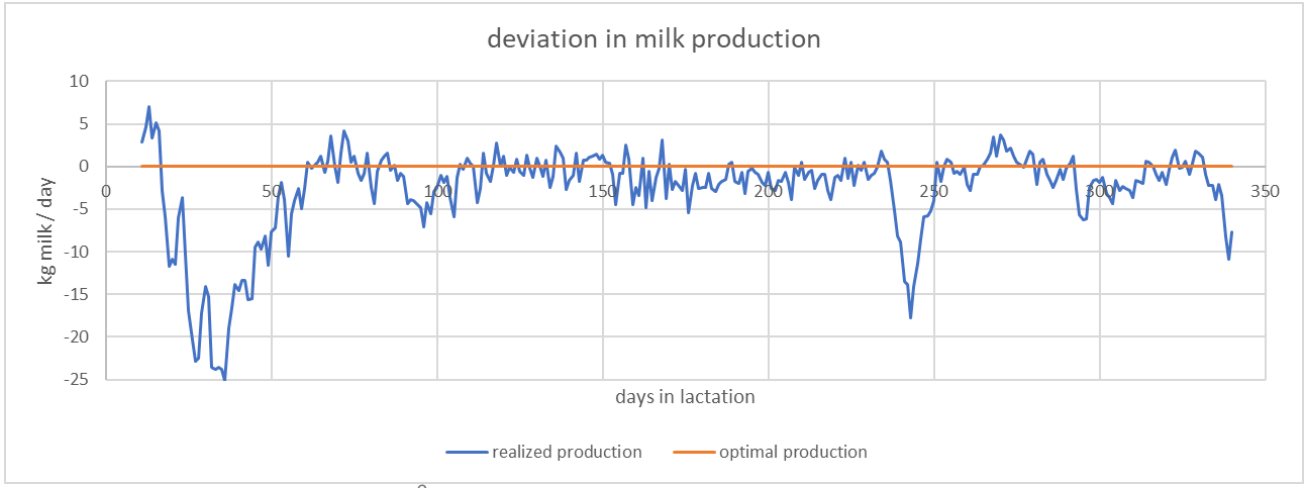
Example

high resilience



low resilience



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Resilience – trait definition

Recovery
the time it takes to recover from a disturbance

Stability
the amount of disturbances that were met during a lactation

Recovery

Autocorrelation between deviation from the current day and previous day over the whole lactation

Correlation → observations between -1.0 and +1.0

Low correlation is desirable

parity	mean	sd	min	max
1	0.56	0.20	-0.21	0.98
2	0.56	0.19	-0.26	0.99
3+	0.56	0.19	-0.32	0.98

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Stability

Natural logarithm of the variance based on all deviations during a lactation

Lower variance is desirable

parity	mean	sd	min	max
1	1.57	0.67	-1.01	3.95
2	1.85	0.69	-0.74	4.30
3+	2.06	0.70	-0.98	4.64

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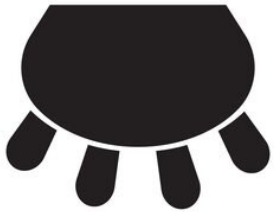
Traits

2 characteristics	3 parities	2 milking systems
		
• Recovery • Stability	• Parity 1 • Parity 2 • Parity 3+	• Automatic milking system (AMS) • Electronic milking measurement (EMM)

12 traits in total

Traits based on AMS are the breeding goal trait

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Genetic parameters - heritability

	AMS	EMM
Recovery 1	0.07	0.04
Recovery 2	0.04	0.03
Recovery 3+	0.04	0.02
Stability 1	0.09	0.05
Stability 2	0.06	0.05
Stability 3+	0.09	0.04

AMS higher heritability

Stability higher heritability

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Genetic parameters – genetic correlations

AMS vs EMM

	Recovery	Stability
Parity 1	0.76	0.90
Parity 2	0.63	0.88
Parity 3+	0.35	0.91

Between parities

	Recovery	Stability
Parity 1 – 2	0.98	0.98
Parity 1 – 3+	0.84	0.91
Parity 2 – 3+	1.00	0.98

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Genetic correlations with other traits

	Recovery	Stability
Milk production	-0.14	-0.36
Fertility	0.08	0.31
Ketosis	0.16	0.49
Longevity	-0.06	0.33
Metabolic disorders	0.14	0.48
Claw health	-0.03	0.14
Reproduction disorders	0.06	0.15
Udder health	0.22	0.50

55% of the variance in resilience can be explained by other health traits and longevity

45% not explained → added value

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Resilience on farm

Netherlands and Flanders:
- mean EBV = 100
- sd. EBV = 4

	EBV 92	EBV 100	EBV 108
Recovery – time to recover	14.0 days	10.9 days	7.0 days
Stability – number of disturbances	4.8	3.8	2.4

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Publication

1. Total breeding value recovery (*recovery*)
2. Total breeding value stability (*stability*)
3. Index resilience (*resilience*)

Galileo

Highest bull for resilience

Perspublicatie Veerkracht NVI is berekend op ZB basis en veerkracht op eigen basis — **April 2024**

Ki / Ai	Stiernummer / Bull number	Stiernaam / Bull name	Erf-fact / Her-fact	Vader / Sire	M-vader / MGS	B / S	N / N	Bt / Rel	NVI / NVI	+/- / +/-	Basis / Base	dtrs / daus	Bt / Rel	Veerkracht / Resilience	Herstel / Recovery	Stabiliteit / Stability
									pnt					Veerkracht		
CRV	CZ 563882032	**Galileo**		Osmium	Levier	Nat		94	**-91**	*+31*	*roodbont*	300	93	113	112	110
CRV	BE 914488171	**Delta Nominator-Red**		Jacuzzi	Finder	Gna		88	**+155**	*+14*	*roodbont*	448	89	112	110	109
	NL 657465003	**Bloemplaat Hoeve Cash**		Lord 108	Thierry	Nat		49	**-232**	*+1*	*dubbeldoel*	43	65	112	108	110
CRV	NL 743430180	**Delta Bonjour**		Sidekick	Guard	Gna		94	**+208**	*+2*	*zwartbont*	806	94	111	106	110
CRV	US 118313241	**Jx Wilsonview M/z Stormy**		Marvel	Pr Oomsdale J	Nat		92	**-4**	*+78*	*roodbont*	172	88	111	108	109
Alt	US 3131664037	**Peak Altadepot**		Hotshot	Montross	Gna		89	**+234**	*+10*	*zwartbont*	58	83	111	107	110
CRV	NL 684982926	**Lowlands Goldline-Red**		Listrotto	Rosebud	Gfw		75	**+255**	*+38*	*roodbont*	0	72	111	99	112
CRV	NL 926807954	**Delta Buttercup P-Red**	PO	Nominator	Jim P	Gfw		74	**+156**	*+28*	*roodbont*	0	71	111	110	108
	DK 04363901784	**Vj Birkelygaard Lure Libero**		Vj Lure	Dj Hibe	Nat		78	**-22**	*+43*	*roodbont*	6	55	111	106	109
K&L	DK 04098602840	**Vj Tester**		Topholm	Hirse	Nat		80	**-39**	*+62*	*roodbont*	9	50	111	105	110
K&L	DK 03740801689	**Vj Hoeholt Hjort Hjorri**		Vj Hjorvangs H	Dj Holmer	Int		77	**-35**	*+88*	*roodbont*	4	39	111	104	110
CRV	NL 938401263	**Buisweerd Mobile**		G-Force	Bertil	Gna		98	**+111**	*-12*	*zwartbont*	6360	99	110	102	110
CRV	NL 882810490	**Lowlands Monopoly**		Aswin	Mascol	Gna		97	**+41**	*-2*	*zwartbont*	1070	98	110	102	110
Alt	US 3129128763	**Peak Altatrueshot**		Supershot	Mccutchen	Nat		95	**+142**	*-16*	*zwartbont*	804	96	110	103	110
CRV	NL 615059167	**Delta Popcorn-Red**		Carnival	Riverboy Rf	Gna		95	**+63**	*-27*	*roodbont*	488	94	110	106	108
CRV	NL 894076439	**Delta Janko-Red**		Meteor	Aikman	Gna		95	**+62**	*-9*	*roodbont*	339	94	110	107	108
CRV	NL 598753212	**Lowlands Blessing**		Jethro	Final	Gna		90	**+110**	*+7*	*zwartbont*	866	92	110	99	111
Kam	NL 656965812	**Gansey's Antartica**		Stellando Rf	Dakker	Gna		92	**+20**	*+19*	*roodbont*	387	90	110	112	106

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Breeding for resilience

Healthy cows (positive correlations with health traits)

Increased longevity (positive correlations with longevity)

Captures health that is not in the current health traits NEW

Easy managable cows NO PROBLEM

Animal welfare

Introduced since April 2024

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