Overview of all bases for breeding values

▪ Introduction

This document describes the situation since April 2025, which bases are used, which base differences do exist, and which animals are published on which base.

▪ Definition of the four bases

On which base the breeding values of an animal are presented depends on the breed and colour of the animal. Starting April 2015, the name Black & White base has been replaced by Milk goal Black. The Red & White base is now called Milk goal Red, and local base was changed to Dual Purpose. Besides that, a new base has been added to the existing bases, this is the Belgian Blue base.

For traits like milk production, somatic cell count, conformation, milking speed, temperament, fertility, calving ease, beef traits, udder health, urea, persistency, rate of maturity, automatic milking traits, calf survival, claw health and longevity, breeding values are estimated simultaneously for cows and bulls using an animal model. For breeding values estimated with an animal model the following base definitions are used:

Milk goal Black (Z)
Herd book-registered cows born in 2020 with at least 87.5% HF-blood and up to 12.5% FH-blood and hair colour black pied, with at least one observation in the genetic evaluation.

Milk goal Red (R)
Herd book-registered cows born in 2020 with at least 87.5% HF-blood and up to 12.5% MRY-blood and hair colour red pied, with at least one observation in the genetic evaluation.

Dual purpose (D)
Herd book-registered cows born in 2018, 2019 and 2020 with at least 87.5% MRIJ-blood and 12.5% or less HF blood, with at least one observation in the genetic evaluation.

Belgian Blue (B)
For most traits, the base Belgian White Blue is determined by cows defining the base Dual Purpose. For fertility, birth traits and meat index, the base Belgian White Blue is determined by pedigree-registered cows born in 2020 with at least 87.5% Belgian White Blue blood, with at least one observation in the breeding value estimate..

An observation in the genetic evaluation can be:

Milk production:	test day record
Somatic cell count:	test day record
Urea:	test day record
Conformation:	classification
Milking speed:	a score
Temperament:	a score
Claw health:	a score for a claw disorder
Fertility:	an observation for one of the fertility traits
Beef index:	slaughter record

Udder health: an observation for one of the udder health traits
Automatic Milking: an observation for one of the automatic milking traits
Calf survival: an observation
Methane sniffer A measurement for methane, based on a Greenfeed or a

The Belgian Blue base is only determined by Belgian Blue animals for fertility, calving ease traits and beef index. For all other traits, the base formed by the Dual-purpose animals is used as reference.

The animals forming the Milk goal Black base determine the standard deviation for all bases, for all traits where cows determine the base and the breeding value of a trait is expressed as a relative breeding value. The advantage is that only a difference in level exists between bases and no difference in standard deviation.

Table 1. Overview of bases used for different traits.

Trait	Cow base prodgoal black	Cow base prodgoal red	Cow base Dual purpose	Cow base BBL
NVI	*	*	*	
Milk production	*	*	*	
Conformation	*	*	*	
Longevity	*	*	*	
Calving traits	*	*	*	*
Liveability	*	*	*	
Fertility	*	*	*	*
Somatic cell count	*	*	*	
Udder health	*	*	*	
Milking speed	*	*	*	
Temperament	*	*	*	
Beef index	*	*	*	*
Bodyweight	*	*	*	
Urea	*	*	*	
Calf survival	*	*	*	
AMS traits	*	*	*	
Claw health	*	*	*	
Lifetime production-index	*	*	*	
Feed intake	*	*	*	
Reproduction disorders	*	*	*	
Metabolic disorders	*	*	*	
Resilience	*	*	*	
Methane	*	*	*	

▪ Base differences per April 2025

For all traits for which breeding values are published, differences in bases exist. In Table 2 the differences between the four bases are shown.
Note. The NVI is not in this Table. This is because of the differences in the formulas used to calculate these traits between different bases. The differences are therefore only to be calculated using the underlying formulas of the traits per base (see relevant E-chapter). Unknown base differences are indicated with '-'.

Table 2. Base differences between Milk goal Black (B), Milk goal Red (R), Dual purpose (D) and Belgian blue (B).

Trait	kind base [1]	Base difference [2]					
		Z=>R	**Z=>D**	**Z=>B**	**R=>D**	**R=>B**	**D=>B**
Milk production							
Overall							
Kg milk	C	542	2275	2275	1733	1733	0
Kg fat	C	23	81	81	70	70	0
Kg protein	C	12	68	68	56	56	0
Kg lactose	C	25	101	101	76	76	0
% fat [4]	C	-0.12	-0.25	-0.25	-0.13	-0.13	0
% protein [4]	C	-0.08	-0.18	-0.18	-0.10	-0.10	0
% lactose [4]	C	0.00	-0.05	-0.05	-0.02	-0.02	0
INET [4]	C	84	439	439	355	355	0
Lactation 1							
Kg milk	C	506	1937	1937	1431	1431	0
Kg fat	C	10	65	65	55	55	0
Kg protein	C	11	56	56	45	45	0
Kg lactose	C	24	86	86	62	62	0
% fat [4]	C	-0.24	-0.23	-0.23	0.01	0.01	0
% protein [4]	C	-0.09	-0.14	-0.14	-0.05	-0.05	0
% lactose [4]	C	-0.04	-0.07	-0.07	-0.03	-0.03	0
INET [4]	C	84	364	364	280	280	0
Lactation 2							
Kg milk	C	582	2410	2410	1828	1828	0
Kg fat	C	12	84	84	72	72	0
Kg protein	C	13	74	74	61	61	0
Kg lactose	C	27	107	107	80	80	0
% fat [4]	C	-0.22	-0.20	-0.20	0.02	0.02	0
% protein [4]	C	-0.07	-0.13	-0.13	-0.06	-0.06	0
% lactose [4]	C	-0.05	-0.07	-0.07	-0.02	-0.02	0
INET [4]	C	91	474	474	383	383	0
Lactation 3							
Kg milk	C	583	2533	2533	1950	1950	0
Kg fat	C	12	92	92	80	80	0
Kg protein	C	13	76	76	63	63	0
Kg lactose	C	27	113	113	86	86	0
% fat [4]	C	-0.23	-0.22	-0.22	0.03	-0.03	0
% protein [4]	C	-0.08	-0.13	-0.13	-0.05	-0.05	0
% lactose [4]	C	-0.05	-0.07	-0.07	-0.02	-0.02	0
INET [4]	C	89	474	474	383	383	0
Lactation 4							
Kg milk	C	527	2426	2426	1899	1899	0
Kg fat	C	10	91	91	81	81	0
Kg protein	C	11	72	72	61	61	0
Kg lactose	C	24	109	109	85	85	0
% fat [4]	C	-0.25	-0.22	-0.22	0.03	0.03	0
% protein [4]	C	-0.08	-0.12	-0.12	-0.04	-0.04	0
% lactose [4]	C	0.05	-0.06	-0.06	-0.01	-0.01	0
INET [4]	C	82	474	474	392	392	0
Lactation 5							
Kg milk	C	490	2297	2297	1807	1807	0
Kg fat	C	9	88	88	79	79	0
Kg protein	C	10	68	68	58	58	0
Kg lactose	C	23	103	103	80	80	0
% fat [4]	C	-0.24	-0.20	-0.20	0.04	0.04	0
% protein [4]	C	-0.07	-0.11	-0.11	-0.04	-0.04	0
% lactose [4]	C	-0.06	-0.05	-0.05	0.01	0.01	0

INET [4]	C	69	439	439	370	370	0
Maturity	C	0	0	0	0	0	0
Persistency	C	1	0	0	-1	-1	0
Persistency, lactation 1	C	1	2	2	1	1	0
Persistency, lactation 2	C	1	2	2	1	1	0
Persistency, lactation 3	C	1	2	2	1	1	0
Persistency, lactation 4	C	1	2	2	1	1	0
Persistency, lactation 5	C	1	2	2	1	1	0
Conformation							
Stature	C	3	14	14	11	11	0
Chest width	C	1	-6	-6	-7	-7	0
Body depth	C	3	12	12	9	9	0
Rib structure	C	3	17	17	14	14	0
Condition score	C	-2	-11	-11	-9	-9	0
Rump angle	C	0	-7	-7	-7	-7	0
Rump width	C	1	2	2	1	1	0
Rear legs rear view	C	0	3	3	3	3	0
Rear legs side view	C	0	-1	-1	-1	-1	0
Foot angle	C	0	1	1	1	1	0
Front feet orientation	C	0	-3	-3	-3	-3	0
Locomotion	C	1	4	4	3	3	0
Fore udder attachment	C	1	13	13	12	12	0
Front teat placement	C	2	11	11	9	9	0
Teat length	C	1	-1	-1	-2	-2	0
Udder depth	C	1	12	12	11	11	0
Rear udder height	C	2	17	17	15	15	0
Central ligament	C	2	10	10	8	8	0
Rear teat placement	C	1	8	8	7	7	0
Udder balance	C	1	10	10	9	9	0
Frame [4]	C	2	-	-	-	-	0
Dairy strength [4]	C	1	-	-	-	-	0
Udder [4]	C	1	-	-	-	-	0
Feet and legs [4]	C	1	-	-	-	-	0
Muscularity [3] [4]	C	-	-	-	-	-	0
Overall conformation [4]	C	2	-	-	-	-	0
Longevity							
Longevity	C	70	520	520	450	450	0
Calving traits							
Overall index							
Calving index	C	0	1	6	1	6	5
Calving ease	C	0	1	65	1	65	64
Maternal calving ease	C	1	3	-2	2	-3	-5
Gestation length	C	-1	-1	-6	0	-5	-5
Gestation length maternal	C	1	2	10	1	12	8
Birth weight	C	0	0	-61	0	-61	-61
Birth weight maternal	C	1	3	13	2	12	10
Vitality	C	-2	2	2	4	4	0
Vitality maternal	C	1	0	0	-1	-1	0
Heifers – parity =1							
Calving ease	C	0	1	65	1	65	64
Maternal calving ease	C	1	3	-2	2	-3	-5
Gestation length	C	-1	-1	-6	0	-5	-5
Gestation length maternal	C	1	2	10	1	12	8
Birth weight	C	0	0	-61	0	-61	-61
Birth weight maternal	C	1	3	13	2	12	10
Vitality	C	-2	2	2	4	4	0
Vitality maternal	C	1	0	0	-1	-1	0
Cows – parity >1							

Calving ease	C	0	1	52	1	52	51
Maternal calving ease	C	1	3	55	1	54	52
Gestation length	C	-1	-1	-8	0	-7	-7
Gestation length maternal	C	1	1	9	0	8	8
Birth weight	C	0	-2	-42	-1	-42	-40
Birth weight maternal	C	0	1	-12	1	-12	-13
Vitality	C	-1	4	4	5	5	0
Vitality maternal	C	0	0	0	0	0	0
Fertility							
Overall							
FERT index (4)	C	0	0	6	0	6	6
Non return	C	-1	-4	1	-3	2	5
Interval calving-1st insemination	C	0	-2	1	-2	1	3
Calving interval	C	0	-3	3	-3	3	6
Interval 1st-last insemination	C	0	-2	4	-2	4	6
Open days	C	0	-3	3	-3	3	6
Conception rate	C	0	0	7	0	7	7
Conception rate heifers	C	1	3	9	3	8	6
Age at 1st insemination heifers	C	1	12	43	11	42	31
Lactation 1							
Non return	C	-1	-3	0	-2	1	3
Interval calving-1st insemination	C	-1	-3	3	-2	4	6
Calving interval	C	0	-3	5	-3	5	8
Interval 1st-last insemination	C	0	-2	4	-2	4	6
Conception rate	C	0	1	6	1	6	5
Lactation 2							
Non return	C	-1	-4	1	-3	2	5
Interval calving-1st insemination	C	0	-2	0	-2	0	2
Calving interval	C	0	-3	2	-3	2	5
Interval 1st-last insemination	C	0	-3	4	-3	4	7
Conception rate	C	0	0	6	0	6	6
Lactation 3							
Non return	C	-1	-4	3	-3	4	7
Interval calving-1st insemination	C	0	-2	-2	-2	-2	0
Calving interval	C	0	-3	3	-3	3	6
Interval 1st-last insemination	C	0	-3	5	-3	5	8
Conception rate	C	0	-1	7	-1	7	8
Somatic cell count							
Somatic cell count	C	1	3	3	2	2	0
Somatic cell count, lactation 1	C	1	3	3	2	2	0
Somatic cell count, lactation 2	C	1	3	3	2	2	0
Somatic cell count, lactation 3	C	0	3	3	3	3	0
Somatic cell count, lactation 4	C	0	3	3	3	3	0
Somatic cell count, lactation 5	C	0	3	3	3	3	0
Udder health							
Udder health (4)	C	-1	1	1	2	2	0
Clinical mastitis	C	0	4	4	4	4	0
Sub-clinical mastitis	C	-1	-1	-1	0	0	0
Milking speed							
Milking speed	C	0	0	0	0	0	0
Temperament							
Temperament	C	-1	0	0	1	1	0
Beef index							
Beef index	C	0	-7	-33	-7	-33	-26
Fleshiness cows	C	-3	-21	-119	-18	-116	-98
Fat covering cows	C	3	7	-2	4	-5	-9
Carcass weight cows	C	0	-4	-53	-4	-53	-49
Fleshiness veal calves	C	-1	-16	-65	-15	-64	-49

Fat covering veal calves	C	1	3	-11	2	-12	-14
Growth veal calves	C	0	-4	-14	-4	-14	-10
Meat colour veal calves	C	0	1	-4	1	-4	-5
Fleshiness beef bulls	C	-1	-15	-70	-14	-69	-55
Fat covering beef bulls	C	1	1	-15	0	-16	-16
Growth beef bulls	C	0	-5	-30	-5	-30	-25
Body weight							
Body weight	C	1	-2	-2	-3	-3	0
Urea							
Urea	C	1	-6	-6	-7	-7	0
Urea, lactation 1	C	1	-6	-6	-7	-7	0
Urea, lactation 2	C	1	-6	-6	-7	-7	0
Urea, lactation 3	C	1	-6	-6	-7	-7	0
Urea, lactation 4	C	0	-6	-6	-6	-6	0
Urea, lactation 5	C	0	-5	-5	-5	-5	0
Calf survival							
Calf survival 3-365	C	-1	1	1	2	2	0
Calf survival 3-14	C	-2	-1	-1	1	1	0
Calf survival 15-180	C	0	3	3	3	3	0
AMS traits							
Efficiency	C	0	0	0	0	0	0
Milking interval	C	0	7	7	7	7	0
Habituation of heifers	C	0	-3	-3	-3	-3	0
Claw health							
Claw health	C	0	0	0	0	0	0
Sole haemorrhage	C	1	-1	-1	-2	-2	0
Digital Dermatitis	C	0	-1	-1	-1	-1	0
Interdigital Dermatitis	C	-1	-2	-2	-1	-1	0
Sole ulcer	C	0	1	1	1	1	0
Interdigital Hyperplasia	C	0	4	4	4	4	0
White line defect	C	0	2	2	2	2	0
Life production-index							
Kg milk	C	3629	25080	25080	21451	21451	0
Kg fat	C	131	1029	1029	898	898	0
Kg protein	C	100	848	848	748	748	0
INET	C	828	6733	6733	5905	5905	0
Dry matter intake							
DMI, lactation 1	C	0.38	2.56	2.56	2.18	2.18	0
DMI, lactation 2	C	0.44	2.85	2.85	2.41	2.41	0
DMI, lactation 3	C	0.48	3.12	3.12	2.64	2.64	0
DMI with predictors	C	0.43	2.80	2.80	2.37	2.37	0
Saved feed for maintenance [4]	C	0.17	0.29	0.29	0.12	0.12	0
Saved feed cost for maintenance [4]	C	10	17	17	7	7	0
Reproduction disorders							
Retained placenta	C	0	1	1	1	1	0
Endometritis	C	0	2	2	2	2	0
Metritis	C	0	0	0	0	0	0
Cystic ovaries	C	1	1	1	0	0	0
Anoestrum	C	0	3	3	3	3	0
Index reproduction disorders	C	0	1	1	1	1	0
Metabolic disorders							
Milk fever	C	0	-3	-3	-3	-3	0
Clinical ketosis	C	-1	-2	-3	-1	-1	0
Subclinical ketosis	C	0	-4	-4	-4	-4	0
Resilience							
Resilience index	C	-2	-8	-8	-6	-6	0
Recovery	C	1	-1	-1	-2	-2	0
Stability	C	-3	-8	-8	-5	-5	0

Methane							
Methane index	C	-1	-1	-1	-1	0	0
Methane, lactation 1	C	-1	-1	-1	-1	0	0
Methane, lactation 2	C	-1	-1	-1	-1	0	0
Methane, lactation 3	C	-1	-1	-1	-1	0	0
Trait	kind base (1)	**Z=>R**	**Z=>D**	**Z=>B**	**R=>D**	**R=>B**	**D=>B**

(1) C=cow base, B=bull base
(2) Z=Milk goal Black, R=Milk goal Red, D=Dual purpose, B=Belgian Blue
(3) Muscularity is only published on Dual purpose and Belgian Blue base.
(4) For the conversion of this trait first the underlying traits are converted, then the formula to derive the trait must be applied. The given base differences are an indication and only hold for the total population (not for an individual animal).

When converting indexes like INET, overall conformation traits, fertility index, calving index, and udder health index, first the underlying traits are converted before applying the formula for the index.

For the conversion of fat, protein, and lactose percentage, first the breeding values for milk yield, fat yield, protein yield and lactose yield are converted before applying the formula:

$$F_{\%fat} = \frac{F_{kgf} * 100 - F_{kgm} * P_{\%fat}}{F_{kgm} + P_{kgm}}$$

$$F_{\%protein} = \frac{F_{kgp} * 100 - F_{kgm} * P_{\%protein}}{F_{kgm} + P_{kgm}}$$

$$F_{\%lactose} = \frac{F_{kgl} * 100 - F_{kgm} * P_{\%lactose}}{F_{kgm} + P_{kgm}}$$

in which:
P = average production of the base animals for the given traits;
F = breeding value: kg milk, kg fat, kg protein or kg lactose, % fat, % protein or % lactose.

Values for P and F can be found in Table 6 in e-chapter ‘Milk production’.

Base differences mentioned in Table 2 for INET, overall conformation traits, fertility index, calving index, udder health index, fat and protein percentage are an indication and should not be used to convert breeding values of animals from one base to the other.

▪ Which breeds on which base?

On which base breeding values of an animal are published depends on its breed composition and with some breeds also on the hair colour. When determining the base for an animal the following rules are used:

An animal is published on the Milk goal Black base:
- Black & White Holstein possessing at least 5/8 Holstein genes.

An animal is published on the Milk goal Red base:

- An animal belongs to a dairy breed and has a minimum of 62.5% genes of the following breeds: Red HF (If HF, coat colour red), RDC (=ZRB, NRB, DR, GUS, AYS, ANG), BSW, Jersey, Milking Shorthorn, Normande, Montbeliarde.

An animal is published on the Belgian Blue base:
- Animals with 5/8 Belgian Blue and/or West Flemish Beef breed and/or Verbeterd Roodbont.

All other animals are published on the dual-purpose base.

Table 3 shows which breed is published on which base. For a dairy breed it is possible that an animal is published on Milk goal Black base or on Milk goal Red base. This depends on the hair colour of the animal.

Table 4 describes the phenotypic mean of milk goal Black cows. This shows the average values for Milk goal Black cows born in 2020. For lifetime, the discharge age of all animals disposed in 2023 was taken as the base.

Table 3. Bases for publication of breeding values for different breeds. B= Milk goal Black, R= Milk goal Red, D= Dual Purpose, B= Belgian Blue.

Nr		Breed code	Basis
10	Dutch Friesian	FH	D
11	Holstein Friesian	HF	Z,R
12	British Friesian	BF	D
13	New Zealand Friesian	NF	D
14	Friesian Red Pied	FR	D
19	Friesian Other	OF	D
20	Witrik	WR	D
21	Lakenvelder (Belted)	LV	D
22	Brand rood	BRR	D
24	Other dairy type	OM	D
25	Maas Rijn IJssel	MRY	D
26	Fleck Vieh	FLV	D
27	Brown Swiss	BS	R
28	Ayrshire	AYS	R
29	Guernsey	GUS	R
30	Swedish Red Pied	ZRB	R
31	Norwegian Red Pied	NRB	R
32	Danish Red Pied	DR	R
33	Belgian Red Pied	BR	D
35	Other Red Pied	OD	D
36	Glan Donnersberg	GDB	D
40	Blaarkop (Groninger)	G	D
41	Angler	ANG	R
42	Jersey	JER	R
43	Montbeliard	MON	R
44	Abondance	ABO	D
45	Tarentaise	TAR	D
46	Dexter	DEX	D
47	Salers	SAL	D
48	Milking Shorthorn	MSH	R
50	Pinzgauer	PIN	D
52	East Flemish White Red	BWR	D
53	West Flemish Red	BRD	D
54	Western Flanders Beef	BRV	B
55	Belgisch Blauw Mixed	WBD	D

Nr		Breed code	Basis
56	Wagyu	WAG	D
57	Swedish lowlands	SLB	D
58	Kerry	KER	D
59	Garonnaise	GAR	D
60	Piemontese	PIM	D
61	Chianina	CHI	D
62	Charolais	CHL	D
63	Limousin	LIM	D
64	Belgian Blue	BBL	B
65	Aberdeen Angus	AA	D
66	Blonde d'Áquitaine	BA	D
67	Maine Anjou	MA	D
68	Romagnola	ROM	D
69	Normande	NOR	R
70	Marchigiana	MAR	D
71	Hereford	HER	D
72	Aubrac	AUB	D
73	Gasconne	GAS	D
74	Galloway	GAL	D
75	Welsh Black	WBL	D
76	Highland	HI	D
77	Devon	DEV	D
78	Dikbil	DIK	D
79	Verbeterd Roodbont	VRB	B
80	Beef Shorthorn	BSH	D
81	Bazandaise	BAZ	D
82	Brahman	BRA	D
83	Belted Galloway	BGW	D
84	Buffelo	BUF	D
85	Simmental	SIM	D
86	Longhorn	LHO	D
87	Maraichine	MI	D
88	Parthenaise	PTN	D
89	Other beef types	OV	D
90	Unknown	ONB	D

Tabel 4 Phenotypic average of black Holstein cows born in 2020

KG Milk (305 days), lactation 1-5	9557
KG Fat (305 days), lactation 1-5	412
KG Protein (days), lactation 1-5	336
% Fat	4.31
% Protein	3.52
Longevity	2250 days (6 years 2 months)
Milkingspeed	2,6 kg/min
Character	5 pnt
Clinical mastitis	12%
Calving interval	402 days
Conception rate cows, first lactation	65%
Calving interval - first insemination	89 days
Claw health (healthy)	59%
Birthing ease	95.70%
Liveability	91.50%
Stature	149 cm
Conformation mean linear traits	5 days
Conformation mean overall traits	80 days