



AIPL RESEARCH REPORT  
BASE2 (8-09)

## Genetic base changes for January 2010

*P.M. VanRaden, J.B. Cole, M.E. Tooker, and T.A. Cooper*

Animal Improvement Programs Laboratory, ARS-USDA, Beltsville, MD 20705-2350

301-504-8334 (voice) ~ 301-504-8092 (fax) ~ [inquiry@aipl.arsusda.gov](mailto:inquiry@aipl.arsusda.gov) ~ <http://aipl.arsusda.gov>

[Genetic \(PTA\) progress](#) || [Standard deviations](#) || [Phenotypic progress](#)

Genetic bases were updated previously in the United States in 1965, 1974, 1984, 1989, 1995, 2000, and 2005, and the next base change is scheduled for January 2010. Base changes for yield, health, fertility, and type traits in January 2010 are reported below. Stepwise genetic bases allow predicted transmitting abilities (PTA's) from new evaluations to be easily compared with previous evaluations except at base changes, when accumulated genetic gain is subtracted so that all animals are compared with a more recent cow population. A particular animal's PTA is supposed to decrease when the base is changed and remain fairly constant between base changes.

### Genetic (PTA) progress (base change)

For most traits, genetic trend comparing PTA of cows born in 2005 with those of cows born in 2000 is equal to or slightly less than the trend for the preceding 5 years reported at the [previous base change](#) in February 2005. For the January 2010 base change, the differences in PTA's are provided for Holstein, Jersey, Brown Swiss, Guernsey, Ayrshire, and Milking Shorthorn cows, and those changes are also applied to bulls:

Trait	Unit	PTA progress (2005 – 2000 birth year)					
		Holstein	Jersey	Brown Swiss	Guernsey	Ayrshire	Milking Shorthorn
Net merit	Lifetime \$	132	119	60	50	37	71
Protein	Pounds	14	12	10	6	3	6
Fat	Pounds	15	17	10	12	3	8
Milk	Pounds	417	323	267	231	53	199
Productive life	Months	0.6	0.8	0.3	0.1	0.3	0.8
Somatic cell score	Log (base 2)	-0.01	0.00	0.01	0.02	-0.02	0.01
Daughter pregnancy rate	%	0.0	-0.1	-0.5	-0.4	0.1	-0.1
Service sire calving difficulty	%	0.4	...	0.4	...	...	...
Daughter calving difficulty	%	-1.0	...	-0.5	...	...	...
Service sire stillbirth rate	%	0.2	...	...	...	...	...
Daughter stillbirth rate	%	-0.4	...	...	...	...	...
Udder composite		0.85	0.40	0.25	0.30	0.35	0.25
Feet and legs composite		0.65	0.20	0.10	0.30	0.15	0.15
Body size composite		0.60	0.15	0.30	0.35	0.30	0.10
Dairy composite		0.75	...	...	...	...	...
Stature		0.70	0.30	0.51	0.72	0.75	0.81
Strength		0.45	0.09	0.08	0.34	0.13	0.06
Dairy form		0.72	0.55	0.49	0.54	0.28	0.24
Foot angle		0.65	0.19	0.07	0.15	0.19	0.08
Rear legs (side view)		-0.11	0.02	-0.10	-0.20	0.04	-0.08
Rear legs (rear view)		0.70	...	0.17	0.24	...	...
Body depth		0.57	...	...	0.34	0.13	0.07
Rump angle		-0.09	-0.08	-0.04	0.10	-0.02	0.21
Thurl width		0.53	0.10	0.11	0.39	0.32	0.14

Fore udder attachment		0.88	0.46	0.29	0.46	0.26	0.28
Rear udder height		1.10	0.72	0.42	0.67	0.38	0.25
Rear udder width		1.16	0.53	0.41	0.59	0.20	0.25
Udder depth		0.57	0.30	0.20	0.30	0.33	0.18
Udder cleft		0.70	0.31	0.36	0.27	0.17	0.15
Front teat placement		0.64	0.49	0.26	0.39	0.15	0.20
Rear teat placement		0.59	...	...	...	...	...
Teat length		-0.02	-0.02	-0.10	-0.08	0.08	-0.14
Final score		0.87	0.62	0.30	0.54	0.25	0.20

Progress for Holstein PTA service sire calving difficulty and stillbirth is the change between bulls born in 2005 and those born in 2000; progress for Holstein PTA daughter calving difficulty and stillbirth rate is the change between bulls born in 2000 and those born in 1995. For Brown Swiss, PTA progress for service sire calving difficulty is calculated as the change between bulls born from 2001 through 2005 and those born from 1996 through 2000; PTA progress for Brown Swiss daughter calving ease is the change between bulls born from 1996 through 2000 and those born from 1991 through 1995. Brown Swiss bulls had to be grouped because of their limited numbers.

## Standard deviations (SD's)

As a result of updating the base year, the SD of PTA for each breed is adjusted along with the mean. Yield and daughter pregnancy rate data are adjusted for variance within herd and year to have the same SD as the base year using an SD ratio based on calving year:

Herd variance adjustment	SD ratio (2007/2002 calving year)					
	Holstein	Jersey	Brown Swiss	Guernsey	Ayrshire	Milking Shorthorn
Yield (milk, fat, and protein)	1.03	1.03	.99	1.09	1.12	1.05
Daughter pregnancy rate	0.99	0.99	1.01	1.00	0.98	1.01

A PTA from before the base change ( $PTA_{old}$ ) can be converted to a PTA after the base change ( $PTA_{new}$ ) by using the formula

$$PTA_{new} = SD \text{ ratio} \times (PTA_{old} - \text{base change}),$$

where the base change is the appropriate breed PTA progress in the table above. For example, a Holstein bull with a PTA protein of +50 pounds before the base change is expected to have a PTA protein of  $1.03(50 - 14) = +37$  pounds after the base change.

## Phenotypic progress

Phenotypic trends comparing cows born in 2005 with cows born in 2000 are equal to or slightly less than the trends for the preceding 5 years reported at the [previous base change](#) in February 2005. For the January 2010 base change, the phenotypic differences for standardized first-lactation traits are provided for Holstein, Jersey, Brown Swiss, Guernsey, Ayrshire, and Milking Shorthorn cows.

Trait	Unit	Progress	Progress (2005 – 2000 birth year)					
			Holstein	Jersey	Brown Swiss	Guernsey	Ayrshire	Milking Shorthorn
Protein	Pounds	Phenotypic (total)	31	31	32	21	15	2
		Genetic (BV) <sup>1</sup>	28	24	20	12	6	12
		Environmental	3	7	12	9	9	-10
Fat	Pounds	Phenotypic (total)	32	36	31	21	15	18
		Genetic (BV)	30	34	20	24	6	16
		Environmental	2	2	11	-3	9	2
Milk	Pounds	Phenotypic (total)	779	682	795	597	219	-40
		Genetic (BV)	834	646	534	462	106	398
		Environmental	-55	36	261	135	113	-438
Productive life	Months	Phenotypic (total)	1.8	-2.4	-2.0	0.3	-3.3	-1.0

		Genetic (BV)	1.2	1.6	0.6	0.2	0.6	1.6
		Environmental	0.6	-4.0	-2.6	0.1	-3.9	-2.6
Somatic cell score	Log (base 2)	Phenotypic (total)	-0.28	-0.25	-0.18	0.01	-0.25	-0.02
		Genetic (BV)	-0.02	0.00	0.02	0.04	-0.04	0.02
		Environmental	-0.26	-0.25	-0.20	-0.03	-0.21	-0.04
Daughter pregnancy rate	%	Phenotypic (total)	1.9	0.9	-0.5	-0.2	1.3	1.8
		Genetic (BV)	0.0	-0.2	-1.0	-0.8	0.2	-0.2
		Environmental	1.9	1.1	0.5	0.6	1.1	2.0
Service sire calving difficulty	%	Phenotypic (total)	-0.4	...	0.0	...	...	...
		Genetic (BV)	0.8	...	0.8	...	...	...
		Environmental	-1.2	...	-0.8	...	...	...
Daughter calving difficulty	%	Phenotypic (total)	0.2	...	0.3	...	...	...
		Genetic (BV)	-2.0	...	-1.0	...	...	...
		Environmental	2.2	...	1.3	...	...	...
Service sire stillbirth rate	%	Phenotypic (total)	-1.5	...	...	...	...	...
		Genetic (BV)	0.4	...	...	...	...	...
		Environmental	-1.9	...	...	...	...	...
Daughter stillbirth rate	%	Phenotypic (total)	0.4	...	...	...	...	...
		Genetic (BV)	-0.8	...	...	...	...	...
		Environmental	1.2	...	...	...	...	...

<sup>1</sup>Genetic progress based on breeding value (BV) is twice PTA progress.

Phenotypic progress due to environmental factors such as management is the difference between genotypic and total phenotypic progress. For Holsteins, genetic improvement is responsible for 90% of the increase in protein yield, 94% of the increase in fat yield, and 107% of the increase in milk yield during the past 5 years; the negative effect of environmental factors on milk yield caused the phenotypic change to be less than the genetic change. Phenotypic progress in yield traits for other breeds also was predominantly the result of genetic improvement. In general, positive progress has been made for most traits through management practices and genetics since the 2005 base change.