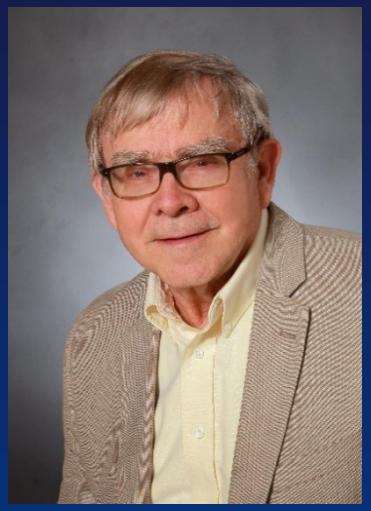
Genetic and Environmental Changes in Reproductive Traits over 5 Years Revealed in the Genetic Base Update



H.D. Norman[1] and P.M. VanRaden[2]

[1]Technical Advisor and Industry Liaison,
Council on Dairy Cattle Breeding, Bowie, MD 20716
[2] Research Geneticist,
USDA, Animal Genomics and Improvement Laboratory, Beltsville, MD 20705

Introduction:

- In the US, genetic prediction for most dairy traits are presented on a deviation basis.
- Every 5 years since 1975, the genetic bases for dairy traits have been updated.
- The purpose for the update is to remind breeders the standards they set five years earlier may need to be raised if they want to remain competitive.
- In April 2020, the average Predicted Transmitting Abilities (PTA) of cows born in 2015 was defined as zero for most traits; all PTA are comparable to them.

Objective:

- Document the phenotypic and genetic performance for each dairy breeds for the reproductive traits having genetic evaluations.
- Document the genetic changes that have occurred in 5 years for each dairy breeds for these fertility traits.
- Examine the size of the phenotypic changes in performance attributed to the genetic changes.

Change in phenotypic yields over 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Milk (kg.)	316	197	56	489	696
Fat (kg.)	22	12	11	32	42
Protein (kg.)	12	11	6	22	32
Somatic cell score (log^2 units)	.04	-.01	.00	-.03	.06

Gains in yield ETAs over 5 years by breed

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Milk (kg.)	165	201	137	446	476
Fat (kg.)	6	8	6	21	23
Protein (kg.)	5	7	4	16	18
Somatic cell score (log base 2 units)	-.02	.00	-.01	-.17	.00

Summary for yield traits:

- All 5 breeds showed gains in phenotypic and genetic estimates for milk, fat and protein.
- Gains were impressive for Holsteins and Jerseys.
- Genetic reduction in SCS was substantial for Holsteins. Other breeds were inconsistent.

Change in repro. phenotypes over 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Heifer Conception Rate (%)	1.0	-0.1	0.9	-0.7	-4.3
Cow Conception Rate (%)	1.5	-0.4	1.3	4.4	-1.3
Daughter Pregnancy Rate (%)	1.3	0.3	-0.2	2.9	-0.6

Change in reproductive ETAs over 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Heifer Conception Rate (%)	-0.9	-0.5	0.1	1.0	0.9
Cow Conception Rate (%)	-1.0	-1.5	-0.3	0.8	-1.8
Daughter Pregnancy Rate (%)	-0.9	-1.2	-0.2	0.5	-2.0

Summary for fertility traits:

- **The ETAs for Heifer Conception Rates improved for Holsteins and Jerseys.**
- **The ETA for Cow Conception Rates improved only for Holsteins.**
- **The ETA for Daughter Pregnancy Rate improved only for Holsteins.**

Changes in fitness phenotypes over 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Early First Calving (days)	26	18	11	27	27
Gestation Length (days)	0.2	0.8	0.1	-1.2	-0.8
Cow Livability (%)	0.6	-0.2	-0.4	0.2	-0.5
Productive Life (months)	-2.2	-0.8	-0.1	2.7	-0.7

Changes in fitness ETAs over 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Early First Calving (days)	2.2	1.0	0.9	3.0	2.8
Gestation Length (days)	-0.6	-0.1	-0.1	-0.7	0.6
Cow Livability (%)	-0.6	-0.6	0.0	1.5	0.2
Productive Life (months)	0.2	0.5	1.8	3.7	3.1

Summary for fitness traits:

- Cow are nearly 1 month younger at first calving than 5 years earlier. The genetic change is about 3 days.
- Holstein gestation length has decreased by 1 day. About half of this reduction is due to genetics.
- There was phenotypic improvement in Cow Livability in Ayrshires and Holsteins. Genetic gains were made in Holsteins and Jerseys.
- There was an actual increase in Productive Life in Holsteins. Genetic gains in Productive Life was present in all breeds (3 to 4 months in Holsteins and Jerseys).

Change in economic merit ETAs in 5 years

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Lifetime Net Merit ($)	242	120	154	462	382
Lifetime Cheese Merit ($)	246	126	154	478	392
Lifetime Fluid Merit ($)	234	112	156	438	358
Lifetime Grazing Merit ($)	216	76	124	414	284

Summary of lifetime merit traits:

- **Lifetime merit indexes which represent a composite of many traits were all positive for all five breeds.**
- **Within each breed, all four merit indexes were fairly similar.**

Gain in ETAs compare to previous change

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Lifetime Net Merit ($)	43	92	145	164	152
Lifetime Cheese Merit ($)	43	94	140	166	153
Lifetime Fluid Merit ($)	43	94	140	166	153
Lifetime Grazing Merit ($)	40	73	200	174	143

Comparison of change to previous gains

- **The base changes for merit indexes in 2020 for Guernseys, Holsteins and Jerseys exceeded those in 2015 by 40 to 100%**
- **These accelerated gains are due to the genomic revolution initiated in 2009.**
- **Although not shown, 52 to 100% of the change in phenotype for traits were attributed to genetics in the Brown Swiss, Guernsey, Holstein and Jersey breeds.**

Pheno. Comparison of Base Cows by Breed

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Heifer Conception Rate (%)	44.8%	45.9	40.9	55.5	49.9
Cow Conception Rate (%)	40.5	30.7	29.4	38.6	39.2
Daughter Pregnancy Rate (%)	26.8	24.7	23.6	31.4	34.7

Genetic Comparison of Base Cows by Breed

Breed	Ayrshire	Brown Swiss	Guernsey	Holstein	Jersey
Heifer Conception Rate (%)	-8.7	-9.8	-11.1	Zero	-0.7
Cow Conception Rate (%)	0.0	-6.1	-7.5	Zero	3.1
Daughter Pregnancy Rate (%)	1.6	-1.8	-0.3	Zero	4.0

Breed Comparisons for Fertility

- The Holsteins show a slight advantage (0.7%) over Jerseys in Heifer Conception Rate.
- The Jerseys show a to 3 to 4% advantage over Holsteins in Cow Conception Rate and Daughter Pregnancy Rate.

And the best news is …

- **Any negative impact of the dairy industry on the environment is reduced each year because the overall gains in many traits means the resources required to produce a unit of milk is decreasing.**

- **Genomics is providing the opportunity to improve gains in numerous traits so emphasis could be shifted easily in the future if needed.**

Acknowledgments

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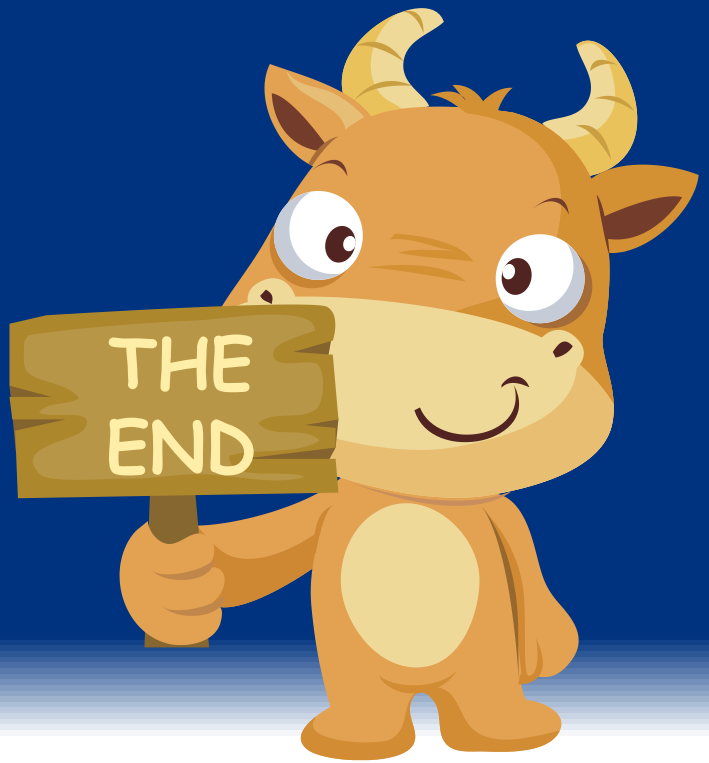
Thank you!



H. Duane Norman
Technical Advisor and Industry Liaison

Council on Dairy Cattle Breeding
Beltsville, MD 20705 -2350

301-525-2006 (voice) • duane.norman@cdcb.us