

Importance of Health and Fertility Traits - A Producer's Perspective

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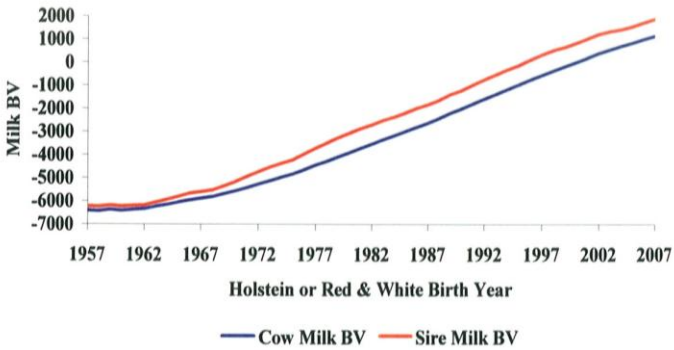
■ Take Home Messages

- Past practices in breeding dairy cattle have not always resulted in more profitable animals.
- The problem of evaluating whether various practices were helpful or harmful was largely due to the unavailability of ways to measure performance.
- Today we have measures and data that evaluate the factors involved in improving herd life and animal health. Using these measures in a dairy herd breeding program gives a dairyman considerable opportunity to increase the profitability of his herd.

For the better part of a century, the rural dairy youth of the United States have been taught that the path to the most profitable dairy cow is to combine type with production. The type was to be the source of longevity. Long-lived high producing dairy cows are universally accepted as the most profitable.

The young people have been and are given a picture of the "Model Cow". From this they first learn the various parts of the cow; then they are told how each of these individual parts should look. This allows them to evaluate how any individual cow compares to the model. Much verbiage is given as to how these parts should fit together and how this affects the performance and longevity of the cow.

As the attached graph shows, the increase in the breeding values for milk production for both sires and cows has been significant.

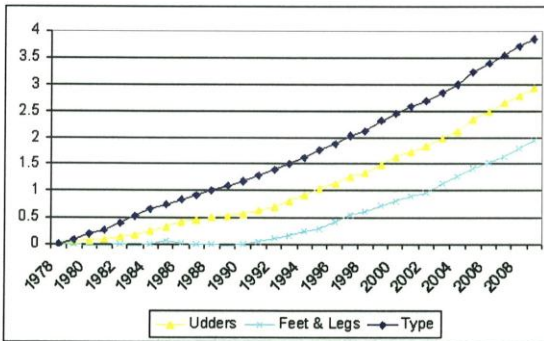


Source: <http://aipl.arsusda.gov/eval/summary/trend.cfm>

Figure 1. Cow and sire milk breeding values (BV) for Holstein or Red & White cattle by birth year

Notice how the breeding value of the sire population was higher than that of the cow population and how the use of these high breeding value sires through artificial insemination pulled up the cow breeding value over time.

Figure 2 shows a substantial increase in cow type scores with time. Obviously the goal of type change was met.



Source : Dr. T. Lawlor Holstein Association

Figure 2. Conformation improvement in Holstein cows over 30 years.

So we met our goal of increasing production per 305 day lactation and showing substantial increases in type scores.

But what happened as a consequence?

Herd Life (longevity) went down (Figure 3).

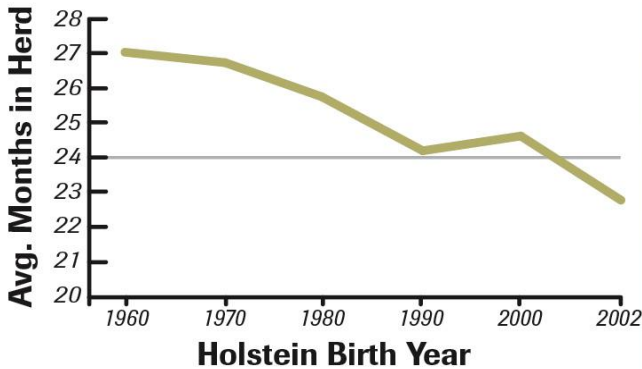
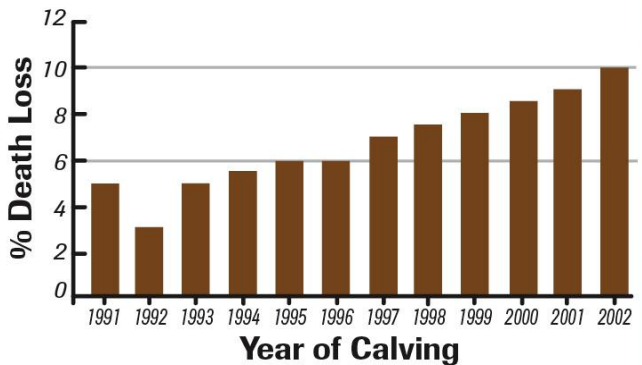


Figure 3. Herd life decline in Holstein cows over 40 years.

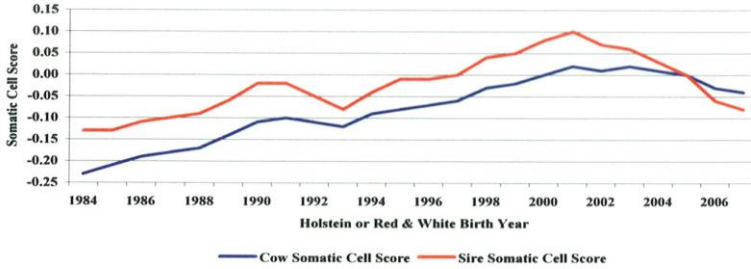
Death rate (mortality) increased (Figure 4).



Source: DHI Provo data, Tripp, 2004

Figure 4. Cow mortality rate in DHI herds from 1991 to 2002.

Somatic cells increased until we started measuring them in bull proofs (Figure 5).



Source: http://aipl.arsusda.gov/eval/summary/trend.cfm?R_Menu=HO.s#StartBody

Figure 5. Changes in cow and sire somatic cell scores for Holstein or Red & White cattle (1994 – 2006)

Daughter pregnancy rate dropped drastically (Figure 6).

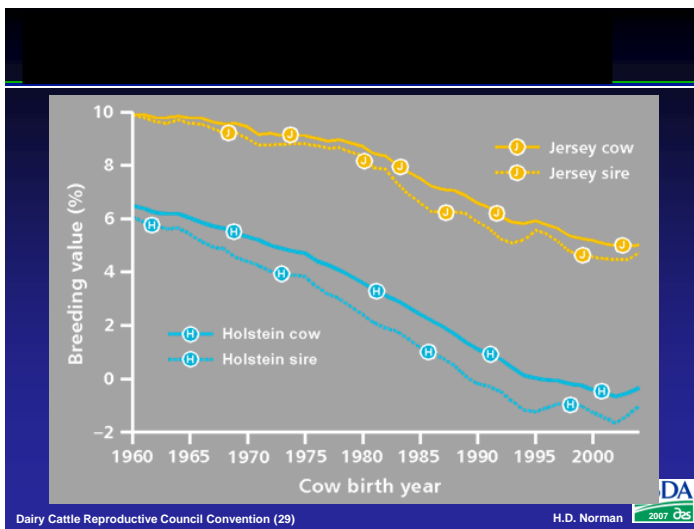


Figure 6. Daughter pregnancy trend (August 2007 base).

Stillbirths went up (Table 1).

Table 1. The number of calves born alive as a percentage of cow inventory decreased from 93.4% in 1996 to 86.0% in 2007.

Number of calves born and alive*, as a % of January 1 cow inventory					
Dairy 1996		Dairy 2002		Dairy 2007	
Pct	Std. Error	Pct	Std. Error	Pct	Std. Error
93.4	0.5	88.8	0.5	86.0	0.6

*In Dairy 2007, included "alive at 48 hours"

Source: Management, NAHMS Population Estimates – D. Heifer Health

Typical comments from large herd operators were as follows. We need:

- ▶ more pregnant cows and heifers
- ▶ Heifers and cows that have live calves without problems
- ▶ More live calves, less stillbirths, especially in heifers
- ▶ Cows that maintain body weight in early lactation while producing at a profitable level
- ▶ Fewer dead cows; cows with more vigor - fire in the belly
- ▶ Healthy udders, low SCS
- ▶ Mobile cows
- ▶ Trouble-free cows

Now we can measure the factors that actually affect herd life, lifetime production, and profitability. Health traits such as:

- ▶ P.L. – Productive Life
- ▶ SCS – Somatic Cell Score
- ▶ Fertility – DPR (Daughter Pregnancy Rate)
- ▶ Calving Ease – Sire CE & Daughter CE
- ▶ Still Births

The typical push for type and classification has been for "bigger, taller, sharper". Let's look at how we are led astray by the emphasis on stature.

“When this is all evaluated and compared on an apples to apples basis, it becomes clear that the primary difference between TPI and NM is that PTAT (and therefore stature) gets a heavy positive weight in TPI, and Body Size (and therefore PTAT) gets a negative weight in NM\$.

Therefore biggest problem I see with the TPI index is the high correlation of Stature with PTAT. Among the 871 active daughter proven bulls in the industry, PTAT has a correlation of 0.74 with stature!! I've included these correlations below for reference. Some of them are quite appalling. For example that Foot Angle has a correlation of .44 with Stature! The .51 correlation between stature and UDC, and .36 between stature and FLC, means that simple selection for these traits, without negative selection on Stature, will make our cows bigger – fast!

PTAP:	-.09 (this means the larger the cow, the less protein she produces)
PTAF:	-.09
PL:	-.29
DPR:	-.21
SCS:	.04
CE	.29 (taller cows are linked with bigger calves)
DCE	.00
SB:	.19
DSB:	.09
PTAT:	.74
UDC:	.51
FLC:	.36
Strength:	.66
Body Depth:	.78
Foot Angle:	.44
RLRV:	.28
Fore Udder:	.41
Rear Udder:	.41
Udder Cleft:	.35
Udder Depth:	.42
Teat Placement	.22
Teat Length	.18

That brings me to my biggest problem with the Holstein cow today – stature, and more specifically its high correlation with other traits, which has led to indirect selection for bigger cows. A bigger cow has led to more injury problems, more fertility issues, more calving problems, less productive life and generally higher maintenance animals.”

Nate Zwald
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CE = calving ease; DCE = daughter calving ease; DPR = daughter pregnancy rate; DSB = daughter still birth; FLC = foot & leg composite; NM = net merit; PL = productive life; PTA = predicted transmitting ability; PTAF = PTA for fat; PTAP = PTA for protein; PTAT = predicted transmitting ability of type; SCS = somatic cell score; SB = still birth; TPI = type production index; UDC = udder composite.

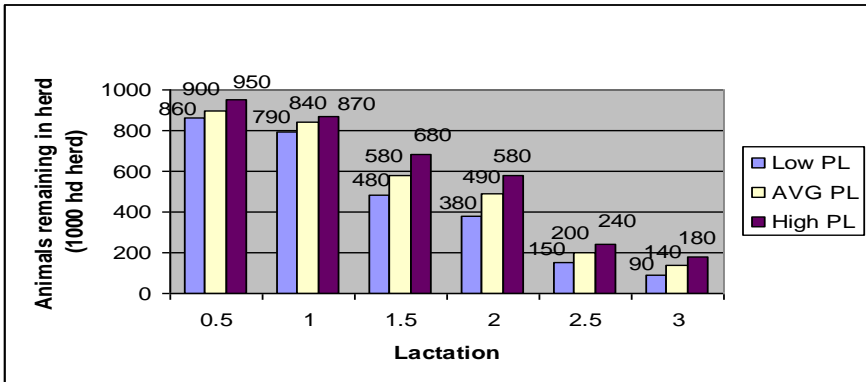
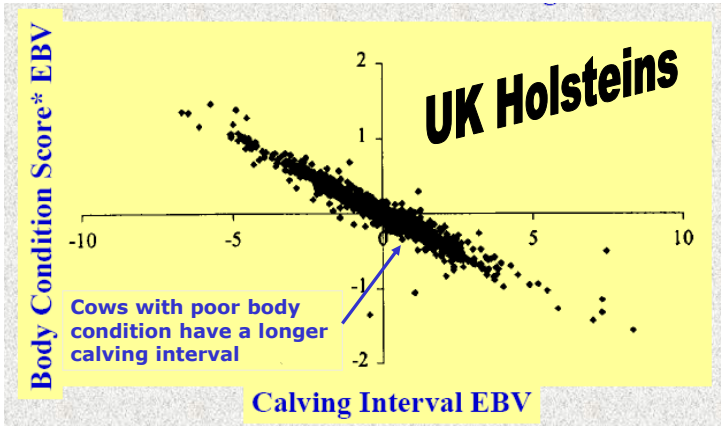


Figure 7. What does increased productive life (PL) mean? Data based on Low = -2.7 PL bulls, Average = 0.0 PL bulls, High = +2.7 PL bulls (Nov 2004 evaluation run). Data source: Nate Zwald, Alta Genetics.

The Pregnancy Rate for the average herd in the U.S. is about 15. A bull's DPR is the amount his daughters exceed or fall below the average. In a herd with a Pregnancy Rate of 15, a bull with a 3 DPR should have 18 percent pregnant in the 21 day period and a bull with a minus 3 DPR would have 12 percent pregnant. That means that when you do preg checks the plus 3 bull would have 50% more pregnant than the minus 3 bull.

Numerous studies have shown that sharp, lean (i.e. thin) cows are much less fertile and don't show heats as well as cows in medium body condition.



Body condition scores were measured on a 1-9 scale
Source: Dr. Kent Wiegel, U of Wisconsin –Cow mobility and fertility.

Figure 8. Body condition score (BCS) vs. Cow Fertility

The Holstein Association’s own classification system gives extra points to the real sharp, lean cows, but those that carry moderate condition stay in the herd longer (Figure 9).

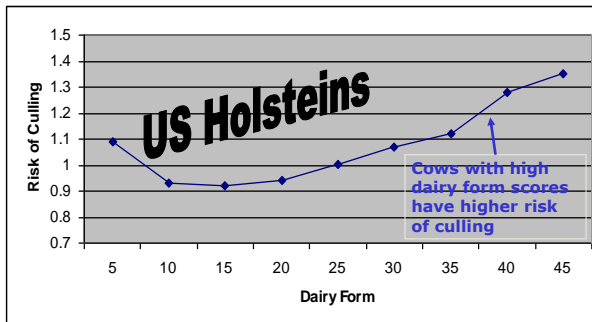


Figure 9. Dairy form vs. risk of culling in US Holstein cows

Because of the very strict record keeping that dairy farmers have to bear in Scandinavian countries, the Swedes were able to put together some very interesting hoof data. They set up a system where the health of each claw

was rated by hoof trimmers. The various lesions were rated on a 1 to 5 basis. This allows a computer to come up with a Hoof Health Index for each cow.

Because 20,000 cows are done per month, there is plenty of data to compare bulls on their ability to sire healthy feet that could compete under modern conditions. The very best bulls score around the 120 mark and the worst around 70. This list was published in Holstein International a couple years ago (Table 2).

Table 2. International bulls used in Sweden with their Swedish breeding values for hoof health (HH) and feet & legs (F&L)

NAME	PEDIGREE	HH	F&L
Aaron	Luke x Mascot	94	116
Addison	Mountain x Elton	106	71
Bojer	Juror x Acres	98	93
Calano	Juror x Cleitus	93	107
Cash	Sunny Boy x Cleitus	111	86
Champion	Rudolph x Horton	93	94
Dutch Boy	Bellwood x Laser	99	92
Ersgard	Lukas x Mascot	96	98
Forbidden	Emory x Mascot	108	109
Ford	Juror x Southwind	96	102
Heldostar	Aerostar x Baba	98	110
Iron	Bookie x Mark	71	89
Lancelot	Lukas x Tonic	99	102
Laudan	Lukas x Raider	85	117
Lee	Raider x Blackstar	98	129
Lord Lily	Blackstar x Rotate	100	108
Merdrignac	Labelle x Aerostar	104	100
Mtoto	Prelude x Blackstar	100	101
O-Man	Manfred x Elton	113	96
Outside	Storm x Blackstar	101	103
Ramos	Rudolph x Ambition	120	118
Roy	Juror x Aerostar	101	117
Skywalker	Leadman x Cleitus	101	121
Stormatic	Storm x Blackstar	100	128
Winchester	Aerostar x Cleitus	89	107
Wizard	Formation x Benchmark	118	87

Source: “Holstein International”

Upon viewing the list, the bulls with the best Hoof Health Scores were the highest Productive Life sires in the U.S. at the time. Also I didn’t know anything about Swedish Foot and Leg composite. Below you will see the list that I compiled by ranking the bulls in order of their Swedish Hoof Health. You can see that there is no correlation between Hoof Health and Foot and Leg composite as compiled by the U.S. Holstein Association (Table 3). Many people are misled by this.

Table 3. Productive life of bulls ranked in order of hoof health

Productive Life of Bulls Ranked in order of Hoof Health

Bull	Hoof Health	Productive Life	Foot and Leg Composition Score
Ramos	120	8.2	2.22
Wizard	118	6.7	0.07
Oman	113	6.1	1.58
Cash	111	1.1	-1.65
Forbidden	108	-1.3	0.21
Addison	106	-2.2	2.61
Roy	101	-1.3	0.75
Outside	101	5.1	1.64
Lord Lily	100	0.8	0.38
Stormatic	100	2.2	3.25
Mtoto	100	3.6	1.45
Dutch Boy	99	2.6	0.79
Lancelot	99	2.1	0.94
Lee	98	0.9	1.35
Ford [Juror Ford]	96	1.4	0.98
Aaron	94	-2.2	2.61
Champion	93	1.5	0.51
Winchester	89	-0.6	-0.54
Laudan	85	7.2	1.82
Iron	71	3.5	1.08

(Based on “Holstein International” and US Holstein Association data for the Productive Life and Foot & Leg Composite numbers)

What I feel is the most insightful and revealing research on foot health and lameness was done by Bichalo and coworkers (2009). By ultrasound, they measured the thickness of the digital cushion in individual cows. They found that digital cushion thickness was highly correlated to all kinds of foot health issues. As there reaches a point where this cushion becomes very thin, there is little or no protection for the corium at the bottom of the foot from the impact of the pedal bone or third phalanx when the cow walks.

What is very interesting is that this digital cushion is adipose or fat tissue. As the cow’s body condition comes and goes, so does the thickness of the digital cushion. We always thought that lame cows are thin but maybe the more accurate statement is that thin cows tend to be lame. Figure 10 shows the relative differences of digital cushion thickness measured on hundreds of cows relative to their body condition score.

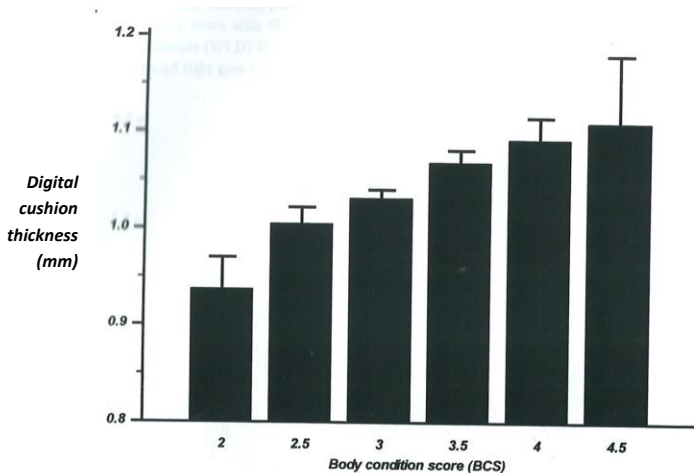


Figure 10. Body Condition Scores and Digital Cushion Thickness (Bicahlo et al., 2009).

When one goes to a show or listens to classifiers, even though the terminology they use quacks like a duck, they never give the advantage to an animal because she is thin or emaciated. Instead they use terminology like:

- ▶ Sharpness
- ▶ Angularity
- ▶ Cleaner
- ▶ Leaner
- ▶ Dairyness

A cow with a practical 3.5 body score is not clean enough or angular enough for them.

Let's look at how body condition score affects the proportion of cows detected in estrus. As the graph below shows, cows with a 3.3 to 3.5 body condition score are detected about 85% of the time versus 30% of the time for the typical show winner with a BCS of 2.5.

We continue to select and breed for sharper, leaner, more angular cattle even though it:

- ▶ Reduces herd life
- ▶ Reduces fertility

- ▶ Increases lameness
 - ▶ Makes it harder to catch cows in heat
 - ▶ Increases somatic cell count according to data from Israel
- Isn't it time we got in the real world?

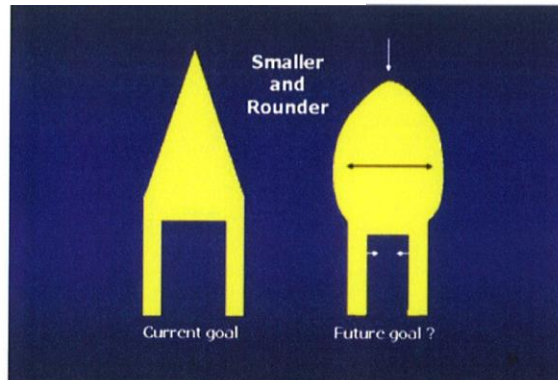
The various genetic correlations of traits to longevity are shown below (Table 4).

Table 4. Genetic Correlations of Traits with Longevity

Genetic Correlations of Traits with Longevity	
Daughter Preg. Rate	.59
Somatic Cell Score	-.35
Udder	.30
Daughter Calving Ease	-.24
Sire Calving Ease	-.19
Feet and Legs	.19
Size	-.04

Source: Aipl Web Site

Les Hansen and others at the University of Minnesota worked on a computer model of the ideal dairy cow from an efficiency, productivity, and longevity standpoint. This was from numerous studies that involved many animals from many different circumstances. Below you see two cow models as viewed from the front (Figure 11). The one on the left is the model Holstein cow and the one on the right is the long lived, productive, profitable cow from their computer model.



Source: <http://www.milkproduction.com/Library/Articles/default.htm>

Figure 11. A return to the original prototype.

■ Conclusions

- ▶ 40 years of selection on production and type has led to higher culling and lower fertility in today's cows
- ▶ We have tools available to fix the problem within our breed
- ▶ Selection on PL, DPR, SCS, DCE should achieve the same goals as crossbreeding in the short term and more progress in the long term.

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