Correlation of Longevity Evaluation with Other Trait Evaluations from 14 Countries

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Introduction

Longevity evaluations from 11 countries (Van der Linde and de Jong, 2002) were previously examined (VanRaden and Powell, 2002) according to correlations with other traits on each country's scale. Correlations of direct longevity with somatic cell score (SCS) and conformation traits were fairly uniform across countries. Correlations with yield traits varied for countries that reported functional longevity and for those that reported true longevity. Some correlations of yield with functional longevity were higher than correlations of yield with true longevity.

Objectives were to extend the previous analysis to new countries and additional data and to compute correlations within birth year. Of particular interest was comparison of trends, effectiveness of adjustment for yield in determining functional longevity, and examination of any changes in national methods.

Materials and Methods

International longevity evaluations from the research of Van der Linde and de Jong (2003) were examined for Australia, Canada, Denmark, France, Germany, Ireland, Israel, Italy, New Zealand, Sweden, Switzerland, The Netherlands, the United Kingdom, and the United States. Those longevity evaluations were generally from August 2002 national evaluations. Bulls born from 1985 through 1994 were included in our study. Only evaluations on the scale of the country that reported the most daughter records for protein yield (home country) for a bull were used.

New countries in this analysis were Australia, Ireland, and the United Kingdom. Trait definitions differ across countries; most adjust longevity for yield traits but Australia, Israel, New Zealand, and the United States do not. Differences among trait definitions may be quantified by examining correlations of evaluations for longevity with those for yield, SCS, and conformation within each country.

November 2002 Interbull yield (milk, fat, and protein), SCS, and conformation evaluations on the home country scale were matched with the longevity evaluations. Home country was defined as the country of most daughters in the yield evaluations. Simple product-moment correlations among those trait EBVs were obtained on each country's scale. No attempt was made to estimate genetic correlations. To allow correlations of the same sign to have the same interpretation, direct longevity evaluations from Italy were reversed to make positive values desirable, and SCS evaluations from France, Italy, Sweden, and The Netherlands were reversed to make positive values undesirable. Correlations of longevity evaluations with birth year provided a unitless measure of genetic trend. Correlations with other traits were computed overall as in our 2002 report, and also within birth year.

Results and Discussion

Correlations for direct and combined longevity are in Table 1 and 2, respectively. The results are essentially the same in both tables for Denmark, Ireland, Israel, New Zealand, Sweden, Switzerland, and the United Kingdom because they provided only one measure of longevity, which was used in both analyses.

Rates of genetic trend are expected to be higher for countries reporting true rather than functional (i.e. yield-adjusted) longevity. Thus, the positive trends for Israel and the US are expected but are especially high for Australia where the correlations with birth year were above 0.5. In New Zealand, trend is about zero, rather than benefiting from the inclusion of yield. Perhaps in that system, bulls that transmit high

yield produce cows that cannot conceive in a timely fashion to fit the seasonal pattern. Surprisingly, the French trend is substantial even though their longevity has been adjusted for yield. We know that there has been progress for yield and the high correlations overall suggest improvement also for functional longevity. This seems unlikely because French longevity evaluations are too new to have had any impact on bulls born 1985-1994. Italy has a negative trend, perhaps from over-adjusting for yield. Trends were slightly more different from zero for combined than for direct longevity.

Granted that neither country adjusts for yield, correlations of longevity with yield traits were especially high for Australia and Israel. Other true longevity countries, New Zealand and the US had mixed results; moderate for both countries for fat, but for New Zealand, correlations were near zero for protein and solidly negative for milk. The correlations with yield for France and Sweden were unexpectedly high.

Correlation of longevity with somatic cell score and conformation traits are fairly uniform except for the strong negative correlations for udder and stature in New Zealand. Correlations with US productive life were generally moderate except for New Zealand where it was essentially zero. Productive life evaluations of foreign bulls on the US scale are calculated from US parent averages and regressions on published Interbull traits.

Tables 3 and 4 include the same variables as Tables 1 and 2, but correlations, except with birth year, are after removal of birth year. Accounting for birth year did not alter correlations between direct and combined longevity except for Australia. Correlations with other traits were impacted marginally except for yield traits for Australia and for France, where correlations were reduced to essentially the expected zero value for fat and protein. Otherwise, comments from Tables 1 and 2 apply to Tables 3 and 4 as well.

Allowing the upper birth year limit to range from 1993 to 1996 affected most correlations only modestly, but some markedly. The changes for Denmark were substantial but are not discussed as they have moved on to an improved procedure since the data in this study. Trend for Ireland changed from .10 to -.10. Volatility may be due to scarce data especially in the early years. Correlation of longevity in France increased by .10 for birth year and by .06 to .09 for the yield traits.

Table 1. Correlations of direct longevity[1] with birth year and other traits[2] on the scale of bull's home country[3].

			Yield Traits			Somatic	Conformation traits				US
Country	Birth year	Combined longevity	Milk	Fat	Protein	cell score	Overall udder	Udder depth	Foot Angle	Stature	Productive Life
Australia	0.57	0.75	0.40	0.23	0.46	-0.23	0.17	0.24	0.12	0.04	0.41
Canada	0.07	0.88	0.06	-0.04	0.00	-0.27	0.28	0.28	0.15	0.01	0.57
Denmark	0.02	1.00	-0.13	-0.05	-0.11	-0.36	0.37	0.43	0.07	0.00	0.51
France	0.26	0.96	0.27	0.11	0.18	-0.35	0.40	0.39	0.09	0.09	0.42
Germany	0.03	0.99	0.02	0.02	0.03	-0.38	0.18	0.29	0.08	-0.08	0.46
Ireland	-0.02	1.00	-0.08	-0.05	-0.07	...	...	...	...	...	0.34
Israel	0.26	1.00	0.52	0.33	0.53	-0.27	...	...	...	...	0.34
Italy	-0.13	0.98	-0.24	-0.15	-0.29	-0.17	0.14	0.28	0.07	-0.09	0.38
New Zealand	-0.02	1.00	-0.18	0.28	0.02	...	-0.27	...	...	-0.47	-0.02
Sweden	0.08	1.00	0.20	0.14	0.17	-0.26	0.23	0.32	0.04	0.03	0.39
Switzerland	0.09	1.00	-0.04	-0.08	-0.05	-0.46	0.36	0.37	0.07	0.13	0.48
The Netherlands	0.11	0.99	0.08	-0.18	0.00	-0.30	0.33	0.36	0.11	-0.01	0.50
United Kingdom	0.04	1.00	-0.03	-0.05	-0.02	-0.28	0.33	0.49	0.31	0.12	0.52
United States	0.17	0.98	0.24	0.18	0.25	-0.30	0.24	0.29	0.13	-0.08	0.97

[1]Evaluations on home country scale from van der Linde and de Jong (2003).
[2]November 2002 Interbull evaluations on home country scale.
[3]Country that reported the most daughter records for protein yield as of November 2002.

Table 2. Correlations of combined longevity[1] with birth year and other traits[2] on the scale of bull's home country[3].

Country	Birth year	Direct longevity	Yield Traits			Somatic cell score	Conformation traits				US Productive Life
			Milk	Fat	Protein		Overall udder	Udder depth	Foot Angle	Stature	
Australia	0.53	0.75	0.33	0.19	0.33	-0.19	0.50	0.55	0.12	0.28	0.41
Canada	0.09	0.88	0.03	-0.01	0.00	-0.48	0.47	0.41	0.22	-0.04	0.71
Denmark	0.02	1.00	-0.13	-0.05	-0.11	-0.36	0.37	0.43	0.07	0.01	0.51
France	0.31	0.96	0.27	0.12	0.20	-0.41	0.49	0.48	0.12	0.11	0.48
Germany	0.04	0.99	0.02	0.02	0.03	-0.46	0.23	0.35	0.11	-0.06	0.51
Ireland	-0.02	1.00	-0.09	-0.05	-0.08	...	...	...	...	...	0.33
Israel	0.26	1.00	0.52	0.33	0.53	-0.27	...	...	...	...	0.35
Italy	-0.16	0.98	-0.27	-0.17	-0.31	-0.20	0.26	0.41	0.09	-0.06	0.46
New Zealand	-0.02	1.00	-0.18	0.28	0.02	...	-0.26	...	...	-0.47	-0.02
Sweden	0.08	1.00	0.19	0.14	0.17	-0.26	0.23	0.32	0.04	0.03	0.39
Switzerland	0.09	1.00	-0.04	-0.07	-0.05	-0.46	0.36	0.37	0.07	0.13	0.48
The Netherlands	0.13	0.99	0.07	-0.18	-0.01	-0.36	0.38	0.43	0.14	0.04	0.55
United Kingdom	0.04	1.00	-0.03	-0.05	-0.03	-0.29	0.33	0.49	0.31	0.11	0.52
United States	0.18	0.98	0.24	0.21	0.26	-0.38	0.35	0.36	0.17	-0.09	0.99

[1]Evaluations on home country scale from van der Linde and de Jong (2003).
[2]November 2002 Interbull evaluations on home country scale.
[3]Country that reported the most daughter records for protein yield as of November 2002.

Table 3. Correlations of direct longevity[1] with birth year, and with other traits[2] within birth year, on the scale of bull's home country[3].

Country	Birth year	Combined longevity	Yield Traits			Somatic cell score	Conformation traits				US Productive Life
			Milk	Fat	Protein		Overall udder	Udder depth	Foot Angle	Stature	
Australia	0.57	0.63	0.23	0.17	0.28	-0.21	0.13	0.22	0.02	0.03	0.33
Canada	0.07	0.88	0.03	-0.08	-0.05	-0.27	0.27	0.28	0.15	-0.01	0.57
Denmark	0.02	1.00	-0.18	-0.07	-0.15	-0.37	0.37	0.42	0.07	0.00	0.51
France	0.26	0.96	0.16	0.02	0.03	-0.38	0.36	0.38	0.07	0.05	0.42
Germany	0.03	0.99	0.01	0.01	0.02	-0.38	0.19	0.28	0.08	-0.09	0.45
Ireland	-0.02	1.00	-0.10	-0.07	-0.07	...	...	...	...	...	0.33
Israel	0.26	1.00	0.50	0.28	0.49	-0.27	...	...	...	...	0.29
Italy	-0.13	0.98	-0.20	-0.10	-0.26	-0.22	0.19	0.28	0.10	-0.05	0.38
New Zealand	-0.02	1.00	-0.19	0.30	0.06	...	-0.27	...	...	-0.48	-0.02
Sweden	0.08	1.00	0.19	0.11	0.15	-0.26	0.22	0.31	0.03	0.00	0.40
Switzerland	0.09	1.00	-0.10	-0.11	-0.10	-0.44	0.38	0.37	0.04	0.14	0.47
The Netherlands	0.11	0.99	0.03	-0.22	-0.07	-0.30	0.30	0.35	0.11	-0.05	0.50
United Kingdom	0.04	1.00	-0.09	-0.10	-0.09	-0.29	0.33	0.49	0.31	0.11	0.52
United States	0.17	0.98	0.19	0.13	0.20	-0.31	0.20	0.26	0.10	-0.12	0.97

[1]Evaluations on home country scale from van der Linde and de Jong (2003).
[2]November 2002 Interbull evaluations on home country scale.
[3]Country that reported the most daughter records for protein yield as of November 2002.

Table 4. Correlations of combined longevity[1] with birth year, and with other traits[2] within birth year, on the scale of bull's home country[3].

Country	Birth year	Direct longevity	Yield Traits			Somatic cell score	Conformation traits				US Productive Life
			Milk	Fat	Protein		Overall udder	Udder depth	Foot Angle	Stature	
Australia	0.53	0.63	0.16	0.13	0.13	-0.16	0.49	0.56	0.04	0.29	0.33
Canada	0.09	0.88	-0.01	-0.05	-0.06	-0.49	0.48	0.40	0.22	-0.06	0.71
Denmark	0.02	1.00	-0.18	-0.07	-0.15	-0.37	0.37	0.42	0.07	0.00	0.51
France	0.31	0.96	0.14	0.01	0.01	-0.46	0.45	0.48	0.10	0.08	0.49
Germany	0.04	0.99	0.01	0.01	0.01	-0.46	0.23	0.34	0.11	-0.08	0.51
Ireland	-0.02	1.00	-0.10	-0.07	-0.07	· · ·	· · ·	· · ·	· · ·	· · ·	0.33
Israel	0.26	1.00	0.50	0.28	0.49	-0.27	· · ·	· · ·	· · ·	· · ·	0.30
Italy	-0.16	0.98	-0.22	-0.11	-0.27	-0.25	0.33	0.42	0.13	-0.01	0.46
New Zealand	-0.02	1.00	-0.19	0.30	0.05	· · ·	-0.27	· · ·	· · ·	-0.48	-0.02
Sweden	0.08	1.00	0.18	0.11	0.15	-0.26	0.22	0.31	0.03	0.00	0.39
Switzerland	0.09	1.00	-0.10	-0.11	-0.10	-0.44	0.38	0.37	0.04	0.14	0.47
The Netherlands	0.13	0.99	0.01	-0.22	-0.09	-0.36	0.35	0.42	0.14	0.00	0.55
United Kingdom	0.04	1.00	-0.09	-0.10	-0.09	-0.29	0.33	0.49	0.31	0.11	0.52
United States	0.18	0.98	0.19	0.15	0.20	-0.39	0.32	0.34	0.15	-0.13	0.99

[1]Evaluations on home country scale from van der Linde and de Jong (2003).
[2]November 2002 Interbull evaluations on home country scale.
[3]Country that reported the most daughter records for protein yield as of November 2002.

Longevity is an overall indicator of the suitability of a cow relative to a given environment. The correlations between yield and longevity in Table 5 suggest that the traits influencing owner satisfaction change over time. In the earlier years, culling was more for yield whereas improvement for yield has been sufficient that other traits are now more important. Similarly, even at a given time, importance of different traits will vary across countries.

Table 5. Correlations between milk yield and true longevity estimated at different times.

Correlation	Publication Year and Reference	
.67 - .92	1966	Robertson and Baker
.54 - .77	1967	Miller et al.
.46	1993	VanRaden and Klaaskate
.13	2002	VanRaden
f(time)	2002	Lawlor et al.

Conclusions

Correlations of longevity with other traits were similar to those reported previously, but three countries were added. Trends were high for Australia, Israel, and France with the former two benefiting from inclusion of the impact of yield in their measure of longevity. Correlations with yield were high for Australia and Israel. Some countries that have adjusted for yield (e.g. France and Sweden) have correlations between longevity and yield similar to other countries that have not adjusted for yield (e.g. New Zealand and the US). Italy adjusts for yield, but seems to have done so to excess. Correlations computed within birth year tended to be lower by .02 to .05 but decreased much more for Australia and France. Fitness is determined by a different function of traits in different countries and across time. Correlations are generally high enough to warrant combination of data, though some situations deserve further investigation.

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