Poster Presentation Session CG2.28
Commission on Cattle Production,
05-jun-2005 (14.00-18.00 h.)
European Association for Animal Production
Uppsala, Sweden,

corresponding author: Marco.Pool@wur.nl
internet address: http://www.asg.wur.nl

Multiple breed evaluation for Cow Survival and Fertility in Irish Beef cattle

M.H. Pool[1]*, V.E. Olori[2], A.R. Cromie[2], B.W. Wickham[2], R.F. Veerkamp[1],

[1]ASG WUR, Division Animal Resources Development, P.O. Box 65, 8200 AB Lelystad, The Netherlands
[2]Irish Cattle Breeding Federation, Highfield House, Bandon, Co. Cork, Republic of Ireland

Abstract:
Cow survival and fertility are together with calving difficulty, gestation length, calf mortality, weaning weight and cull cow carcass weight proposed in a maternal beef cattle index. Beef breeding values for cow survival and fertility are predicted with one multiple trait sire model for reappearance, lifespan and calving interval including beef, dairy and crossbred information. Since information on cow survival or reappearance is scarcely available in historical beef data, reappearance curves are proposed as survival indicators for animals that did not reappear within 300-450 days. Different breed effects were accounted for with a regression on the sire and dam breed percentage.
Average lifespan for beef was with almost 3 years and survival with 0.73 to 0.79 in lact1 to 3 slightly lower than for dairy with the difficulty of having more missing and censored records. Reappearance fractions as survival indicator were included in 8.3% to 2.4% of the censored in lactation 1 to 4. Heritability, first lactations only, was 2% for cow survival and calving interval and 7% for lifespan; correlations were 0.37 and -0.47 for reappearance and lifespan with calving interval and 0.91 for reappearance with lifespan.
Using reappearance fractions and multiple breed data, including dairy and crossbreds, allowed multiple breed evaluation for cow survival and fertility in Irish beef cattle.

References:

Brotherstone, S., Veerkamp, R.F., Hill, W.G., 1997, Genetic parameters for a simple predictor of lifespan of Holstein-Friesian dairy cattle and its relationship to production. Animal Science. (65) 31-37.
Gilmour, A.R., B.R. Cullis, S.J. Welham and R. Thompson. (2000). ASREML Reference Manual. NSW Agriculture, Orange Agric. Inst. Orange, Australia.
Hickey, J.M., Amer P.R., Cromie, A.R., Grogan, A., Calus, M. P. L., Wickham, B.W., Veerkamp R.F., 2005, Utilizing Multibreed Commercial Slaughter Information in Beef Selection Indices in Ireland. To be published in Interbull proceedings Uppsala, Sweden.
Olori, V.E., Pool, M.H., Calus, M.P.L., Cromie, A.R., Veerkamp, R.F., 2003, Joint evaluation of survival and fertility in dairy cattle with a linear model. . Interbull bulletin 30, 20-24. Beltsville, MaryLand, USA.
Pool M. H., Olori, V. E. , Cromie A. R., Wickham, B.W. , Veerkamp R. F., 2005 To one cow survival and fertility evaluation for Irish dairy and beef cattle. To be published in Interbull proceedings Uppsala, Sweden.
Pool, M.H., Meuwissen, T.H.E., Olori, V.E., Cromie, A.R., Calus, M.P.L., Veerkamp, R.F., 2002. Breeding for survival and calving interval in Ireland. 7th World Congress Genet. Appl. Livest. Prod., Montpellier, France, S01. Comm N°01-23.
Veerkamp, R.F., Dillon, P., Cromie, A.R., Groen, A.F., 2002. Dairy cattle breeding objectives combining yield survival and calving interval for pasture-based systems in Ireland. Livestock Production Science 76:137-151

Multiple breed evaluation for Cow Survival and Fertility in Irish Beef cattle

M. H. Pool[a], V. E. Olori[b], A. R. Cromie[b], B.W. Wickham[b] and R. F. Veerkamp[a]

[a]Animal Sciences Group (ASG-WUR), P.O. Box 65, 8200 AB Lelystad, The Netherlands.
[b]Irish Cattle Breeding Federation (ICBF), Highfield House, Shinagh, Bandon, Co. Cork, Republic of Ireland

Introduction

Cow survival and fertility is of major importance in countries with a seasonal calving pattern for both beef and dairy cattle. For beef, **Cow survival** and **Fertility** have been proposed in a maternal beef cattle index together with *calving difficulty*, *gestation length*, *calf mortality*, *weaning weight* and *cull cow carcass weight* (project team 2005). Since the number of records and amount information available on cow survival and fertility is limited in beef - we proposed one model for all breeds (see list).

Angus
Friesian
Hereford
Charolais
Limousin
Belgian Blue
Blonde d'Aquitaine
Red and White
Montbeliarde
Brown Swiss
Simmental
Shorthorn
Holstein
Jersey
others

Model: survival and fertility

Beef: A MT sire model with 1st lactation reappearance, lifespan and calving interval. Including information from all beef breeds, dairy and crossbred as well. Breed was accounted for by a regression coefficient on both sire and dam breed.

Dairy: A MT animal model is applied as routine evaluation since 2003. Including 13 traits: fertility (calving interval), survival (cow reappearance), milk production (lactation 1- 3) and 4 conformation traits.

Beef Survival: Reappearance rates

Since information on cow survival or reappearance is scarcely available in historical beef data, reappearance curves were proposed as survival indicators for censored animals within the interval 300 - 450 days (see Figure). Indicators were inserted in 8.3 - 2.4% of the censored records (for respectively lactations 1 - 4).

Beef Lifespan: Herd life

Average lifespan (Table 2) was calculated according Brotherstone et al. (1997) using historical survival rates (Table 3)

Reappearance chances for beef cattle based on historical data

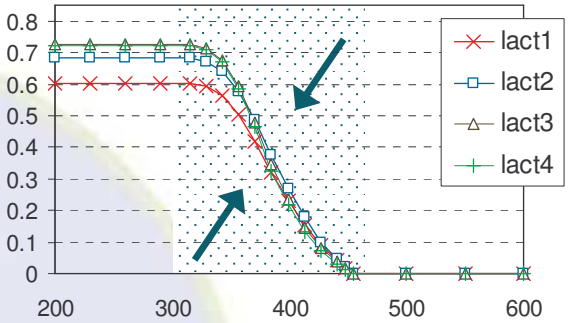

Table 1: Survival rates from historical data

Parity	1	2	3	4
Beef	0.73	0.80	0.84	0.80
Dairy	0.82	0.80	0.78	0.75

Table 2: Expected additional Lifespan

Parity	1	2	3	4	5
Beef	3.05	3.17	2.98	2.56	2.21
Dairy	3.06	2.73	2.41	2.09	1.8

Table 3: Parameters (diagonal: sire variance, genetic correlations below and residual correlations above)

	CIV1	SU1	LSP
CIV1	31.129	0.00	-0.06
SU1	-0.37	0.001	0.63
LSP	-0.47	0.91	0.082
h2	0.02	0.02	0.07

Summary

Reappearance (for beef index) and lifespan (considering herd life) provide useful information, although correlated. For beef the difficulty was to handle all the missing and censored records (up to 28%). Using reappearance fractions, lifespan and multiple beef breed data, including dairy and crossbred records, allowed one multiple breed evaluation for 1st lactation cow survival and fertility in Irish beef cattle.

Animal Sciences Group (ASG-WUR)
P.O.Box 65, 8200 AB Lelystad, The Netherlands
tel +31 320 23 82 33
e-mail: Marco.Pool@wur.nl
http:/www.asg.wur.nl

To one cow survival and fertility evaluation for Irish dairy and beef cattle

M. H. Pool[a], V. E. Olori[b], A. R. Cromie[b], B.W. Wickham[b], R. F. Veerkamp[a]
[a] Animal Sciences Group (ASG-WUR), Division Animal Resources Development, PO Box 65, 8200 AB Lelystad, The Netherlands.
[b]Irish Cattle Breeding Federation (ICBF), Highfield House, Shinagh, Bandon, Co. Cork, Republic of Ireland

Webpage : http://www.asg.wur.nl E-mail: marco.pool@wur.nl

Abstract

Cow survival and fertility are together with calving difficulty, gestation length, calf mortality, weaning weight and cull cow carcass weight proposed in a maternal beef cattle index. Beef breeding values for cow survival and fertility are predicted with one multiple trait sire model for reappearance, lifespan and calving interval including beef, dairy and crossbred information. Since information on cow survival or reappearance is scarcely available in historical beef data, reappearance curves are proposed as survival indicators for animals that did not reappear within 300-450 days. Different breed effects were accounted for with a regression on the sire and dam breed percentage.

Average lifespan for beef breeds was almost 3 years and survival ranged from 0.73 to 0.79 in parities 1 to 3. This was slightly lower than for dairy breeds with the difficulty of having more missing and censored records. Reappearance fractions as survival indicator were included in 8.3% to 2.4% of the censored records in parities 1 to 4. Heritability (first parities only) was 2% for cow survival and calving interval respectively and 7% for lifespan; correlations were -0.37 and -0.47 for reappearance and lifespan with calving interval and 0.91 for reappearance with lifespan.

Using lifespan, reappearance fractions and multiple breed data, including dairy and crossbreds, allowed multiple breed evaluation for cow survival and fertility in Irish beef cattle.

Introduction

Cow survival and fertility is of major importance in countries with a seasonal calving pattern (Veerkamp et al, 2002). Selection for cow survival and fertility in Ireland has been implemented in the dairy cattle evaluation for a while (Olori et al., 2003) but is as important in beef cattle – since the beef farmers income is directly influenced by the number of calves born during the seasonal calving period and replacement costs of dams.

The dairy model for the genetic evaluation of cow survival and fertility in Ireland is a 13 trait MT model (Pool et al., 2002). This model includes calving interval for fertility, cow reappearance for survival, milk production (parities 1-3) and four conformation traits as predictors. Breeding values for cow survival and fertility in dairy cattle have thus been routinely available since 2003.

No similar evaluation is available for beef breeds even though the importance of these traits in beef breeding has been acknowledged. Hence the project team proposed to include cow survival and fertility in a maternal beef cattle index together with calving difficulty, gestation length, calf mortality, weaning weight and cull cow carcass weight as important beef traits (described by Hickey et al., 2005). In contrast to dairy, beef cattle have with regard to cow survival no information available along the parity period such as test day records and therefore have a larger fraction of censored records.

The issues presented in this paper to overcome the problem of limited number of records and the large fraction of censored records are: (i) inclusion of reappearance data for censored beef records since information on cow survival and fertility in beef cattle is limited in both the number of records and the time of availability of cow survival information, (ii) inclusion of Lifespan as a prediction for herd life which adds the information about the number of later lactations known or predicted for all animals and (iii) one beef analyses including all breeds.

Material and methods

Data records for cow survival and fertility were available from the IRIS cattle data base at the Irish Cattle Breeding Federation (ICBF). In total over 940,000 first parity records were available from which 138,792 were considered as beef animals, i.e. records with no milk production in the first five parities. The edits were for pedigree, number of daughters per sire (>4, i.e. 31% of the sires) and number of records per herd (>4). The optimized data set contained 20,434 first parity records for calving interval (CIV1), 48,940 for reappearance or survival (SU1) and 69,555 records for lifespan (LSP). Data used for the multiple trait analyses included all available records. Data for CIV1 originated from 1,172 sires up to 2,288 for LSP. The total pedigree included 10,889 entries from in total 2,288 sires.

Reappearance:

Reappearance as predictor for survival (SU1) was defined as the chance to reappear in the next parity - reappearance is 0 when the animal did not survive, 1 when the animal did survive, between 0-1 when animal's record is censored within the interval of 300-450 days after calving (Figure 1), and censored otherwise.

The chance to reappear after a certain number of days post calving was calculated

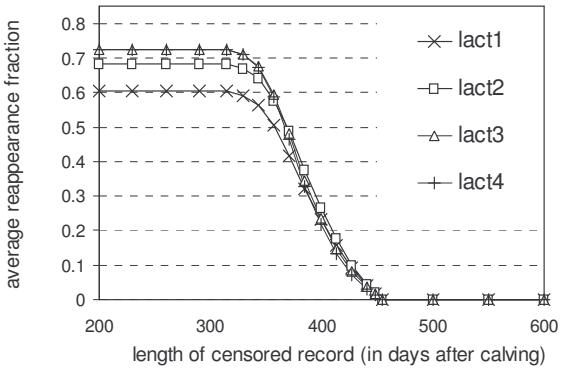

Figure 1: Reappearance chances for beef cattle based from historical data

from the historical data in which all animals had the chance to reappear within a period of 450 days after calving. To reduce the fraction of censored records the reappearance chance - which declines steadily from day 300 on (Figure 1) – was introduced as a prediction of survival for beef animals with censored records in the interval 300 – 450 days. The minimum of 300 days was considered as the minimum gestation period (i.e. becoming pregnant and carrying a calf) and 450 days was considered as the maximum gestation period allowed in a seasonal calving pattern. Percentage of reappearance chances included for the censored records varied from 8.3 to 2.4% in respectively parity 1 to 4.

Lifespan:

Lifespan is applied as a predictor for survival considering the complete animal's herd life. Compared to reappearance, lifespan takes account of later lactations. Although that true lifespan is only known at the end of life time, censored records can be predicted for all animals. Lifespan used in this study was calculated as the number of

Table 1: Reappearance fractions for Irish beef and dairy cattle.

Parity	1	2	3	4
Beef	0.73	0.80	0.84	0.80
Dairy	0.82	0.80	0.78	0.75

Table 2: Expected additional lifespan applied to censored records in Irish beef and dairy cattle, and calculated from historical data.

parity	beef	dairy
1	3.05	3.06
2	3.17	2.73
3	2.98	2.41
4	2.56	2.09
6	1.91	1.56
8	1.44	1.18
10	1.08	0.89
15	0.51	0.40
20	0.18	0.11

parities completed with known herd life and for the censored animals as $n + p_n + p_n p_{n+1} + \ldots$. (Brotherstone et al.1997). p_n is the reappearance fraction for parity n (Table 1) which were calculated from historical data up to parity 4 and assumed to decline for later parities at the rate of 4% per year. Expected additional lifespan for first parity censored records (Table 2) was little more than 3 lactations. Expected additional lifespan for second parity was in beef cattle higher than first parity but lower for dairy. For later parities expected additional lifespan decreased with the number of parities, with a tendency to be somewhat higher for beef compared to dairy cattle.

Model:

First parity records were analyzed using a MT sire model for Lifespan (LSP), calving interval (CIV1) and survival (SU1)

Regression coefficients were included for the dam and sire breed effects considering the following breeds: Angus, Blonde d'Aquitaine, Belgian Blue, Brown Swiss, Charolais, Friesian, Hereford, Holstein, Jersey, Limousin, Montbeliarde, Red and White, Shorthorn , Simmental and others.

Herd-Year-Seasons (HYS) were created according the procedure describe by Schmitz et al. (1991) and Crump et al.(1997); with restrictions set to a minimum of 3 records and lengths of 100 - 365 days for each HYS.

Result and discussion

Phenotypic means in the sire breeds varied for LSP from 2.7 in Belgian Blue up to 4.54 in Charolais; SU1 from 0.56 in Belgian Blue up to 0.84 in Montbeliarde and for CIV1 from 388 in Friesians to 422 in Blonde d'Aquitaine.

Multiple trait parameters for CIV1, SU1 and LSP (Table 3) were estimated using first parity beef cattle records only in Asreml® (Gilmour et al., 2000). Single trait and bi-variate analyses were necessary to get good starting values for the multiple trait analyses, since number of measures for especially CIV1 was limited.

Although there is no residual covariance between SU1 and CIV1 - only animals surviving the first parity have a measure for CIV1 – in a sire model ¾ of the genetic variance is going into the residual and by restricting the residual covariance on the genetic covariance, allows proper estimates by using the -cvv option with an unstructured model in Asreml.

Heritability for the traits are low but reasonable and comparable to those in dairy cattle (Olori et al, 2003 and Brotherstone et al., 1997). Correlations with CIV1 showed a negative relation with SU1 and LSP, as expected, and between LSP and SU1 the correlation was high (0.91) but not equal to 1. Including both survival traits is preferred since survival expressed by LSP accounts

Table 3: Multiple trait model parameter estimates for calving interval, survival and lifespan from first parities in beef cattle
(on the diagonal sire variance and genetic correlations blow)

	CIV1	SU1	LSP
CIV1	31.129	0.00	-0.06
SU1	-0.37	0.001	0.63
LSP	-0.47	0.91	0.082
h2	0.02	0.02	0.07

for later parity information and survival measured with SU1 is of interest for the maternal beef cattle index.

The current parameter estimation was extended to multiple parities but ran into the difficulty that data sets for later parities were smaller, especially the number of records for calving interval was limiting. Since the use of crossbreeding is a common practice in Ireland the amount of information on cow survival and fertility would increase considerably by including records of crossbreds as dairy cattle as well. The final goal is aiming for one large multiple breed genetic routine evaluation including all beef, dairy and crossbred information.

Conclusions

One all breed multiple trait model for CIV1, SU1 and LSP based on first parity records in beef cattle allowed us to estimate realistic parameters. Beef cattle records had more censored or missing records, but the use of average reappearance fractions in censored beef records within the interval of 300 - 450 days added valuable information.

Acknowledgement

The Irish Cattle Breeding Federation (ICBF) is acknowledged for funding this work.

References

Brotherstone, S., Veerkamp, R.F., Hill, W.G., 1997, Genetic parameters for a simple predictor of lifespan of Holstein-Friesian dairy cattle and its relationship to production. Animal Science. (65) 31-37.

Crump, R.E., Wray, N.R., Thompson, R., Simm, G., 1997, Assigning pedigree beef performance records to contemporary groups taking into account of within-herds calving patterns. Animal Science (65) 193-198

Gilmour, A.R., B.R. Cullis, S.J. Welham and R. Thompson. (2000). ASREML Reference Manual. NSW Agriculture, Orange Agric. Inst. Orange, Australia.

Hickey, J.M., Amer P.R., Cromie, A.R., Grogan, A., Calus, M. P. L., Wickham, B.W., Veerkamp R.F., 2005, Utilizing Multibreed Commercial Slaughter Information in Beef Selection Indices in Ireland. This Interbull proceedings

Olori, V.E., Pool, M.H., Calus, M.P.L., Cromie, A.R., Veerkamp, R.F., 2003, Joint evaluation of survival and fertility in dairy cattle with a linear model. . Interbull bulletin 30, 20-24. Beltsville, MaryLand, USA.

Pool, M.H., Meuwissen, T.H.E., Olori, V.E., Cromie, A.R., Calus, M.P.L., Veerkamp, R.F., 2002. Breeding for survival and calving interval in Ireland. 7th World Congress Genet. Appl. Livest. Prod., Montpellier, France, S01. Comm N°01-23.

Schmitz, F., Everett, R.W., Quaas, R.L., 1991, Herd-Year-Season Clustering. Journal of Dairy Science 74: 629-636.

Veerkamp, R.F., Dillon, P., Cromie, A.R., Groen, A.F., 2002. Dairy cattle breeding objectives combining yield survival and calving interval for pasture-based systems in Ireland. Livestock Production Science 76:137-151