## Supplementary materials S1

### Calculation of 95% confidence interval for predicted values

If $A = var(\hat{β)}$,

where $\hat{β}$ = the estimated values of β in the model $y=Xβ+e$,

and $y$ = observations and $e$ = errors, with $R=var(e)$.

Then $A = (X'R^{-1}X)$. The predicted values are $X\hat{β}$, and $var(X\hat{β}) = XA^{-1}X'$.

### Change in daughter fertility EBV over time for Jerseys



Figure S1. Genetic merit for fertility in 20,084 Jersey records from 26 dairy herds from Northern Victoria, Australia. Line plot comparing the mean daughter fertility EBV of lactating cows against heifers born per calendar year.

The following tables present predicted hazard ratios and odds ratios for a typical cow. The purpose of this section is to facilitate the interpretation of non-linear terms and interactions for each model.

### Submission results

##### Table S1. Adjusted hazard ratios and 95% confidence intervals for insemination events within the first 21 days of the mating period (Holstein-Friesians); predicted values for typical cow

|  |  |  |
| --- | --- | --- |
| **Explanatory variable** | **Adjusted hazard ratio** | **95% CI** |
| Daughter fertility EBV | 1.026 | 1.019 – 1.032 |
| Age at calving (for a cow with a 120-day milk yield of 3800 liters) 2 |
| 2 years | 1 | ref |
| 3 years4 years5 years7 years9+ years | 0.9800.9610.9420.9060.871 | 0.923 – 1.0410.907 – 1.0190.888 – 0.9990.846 – 0.9700.799 – 0.948  |
| Days calved at MSD 2 |
| 30 | 0.500 | 0.475 – 0.525 |
| 60 | 1 | ref |
| 90 | 1.100 | 1.044 – 1.159 |
| 120 | 1.286 | 0.968 – 1.286  |
| Milk yield (L) at 120 days (for a 5-year-old cow in the third quartile protein percentage group) 2 |
| 2000 | 1 | ref |
| 3500 | 1.054 | 0.998 – 1.114 |
| 5000 | 0.949 | 0.878 – 1.027  |
| 6500 | 0.922 | 0.634 – 1.341  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 3800 liters) 2 |
| < 3.02%3.02 – 3.17%3.17 – 3.33%> 3.33% | 11.0861.0971.145 | ref1.028 – 1.1481.039 – 1.1601.082 – 1.211  |
| System |  |  |
| Split | 1 | ref |
| Seasonal | 1.212 | 1.148 – 1.280 |

1 The model was also adjusted by season-year.

2 Age at calving, days calved at MSD and 120-day milk yield were fitted as natural splines to the model with an interaction term for age at calving and 120-day milk yield. To simplify interpretation of these variables, the predicted hazard ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only).

##### Table S2. Adjusted hazard ratios and 95% confidence intervals for insemination events within the first 21 days of the mating period (Jerseys)

|  |  |  |
| --- | --- | --- |
| **Explanatory variable** | **Adjusted hazard ratio** | **95% CI** |
| Daughter fertility EBV | 1.031 | 1.011 – 1.052 |
| Age at calving (for a cow with a 120-day milk yield of 2700 liters) 2 |
| 2 years | 1 | ref |
| 3 years4 years5 years7 years9+ years | 0.9840.9690.9530.9230.894 | 0.883 – 1.097 0.873 – 1.0740.860 – 1.0570.825 – 1.0340.781 – 1.024 |
| Days calved at MSD 2 |
| 30 | 0.516 | 0.478 – 0.557 |
| 55 | 1 | ref |
| 90 | 1.219 | 1.096 – 1.355  |
| 120 | 1.758 | 1.270 – 2.433  |
| Milk yield (L) at 120 days (for a 5-year-old cow in the third quartile protein percentage group) 2 |
| 1500 | 1 | ref |
| 2500 | 1.097 | 1.011 – 1.190 |
| 3500 | 1.203 | 1.033 – 1.401  |
| 4500 | 1.319 | 0.981 – 1.774  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 2700 liters) 2 |
| < 3.40%3.40 – 3.56%3.56 – 3.71%> 3.71 | 11.2801.3641.387 | ref1.162 – 1.4111.239 – 1.5021.251 – 1.537  |

1 The model was also adjusted by season-year.

2 Age at calving, days calved at MSD and 120-day milk yield were fitted as natural splines to the model with an interaction term for age at calving and 120-day milk yield. To simplify interpretation of these variables, the predicted hazard ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only).

### Conception results

##### Table S3. Adjusted odds ratios and 95% confidence intervals for conception to first service (Holstein-Friesians)1

|  |  |  |
| --- | --- | --- |
| **Explanatory variable** | **Odds ratio** | **95% CI** |
| Daughter fertility EBV |
|  Single unit | 1.056 | 1.042 – 1.071 |
| Age at calving (for a cow with a 120-day milk yield of 3800 liters) 2 |
| 2 years3 years4 years5 years7 years9+ years | 10.9650.9200.8590.7020.539 | ref0.802 – 1.1610.761 – 1.1120.708 – 1.0420.576 – 0.8570.425 – 0.683  |
| Days calved at insemination 2 |
| 306090120 | 0.63711.1171.163 | 0.504 – 0.806ref0.920 – 1.3550.948 – 1.427  |
| Milk yield (L) at 120 days (for a 5-year-old cow in the third quartile protein percentage group) 2 |
| 2000350050006500 | 10.8890.7820.682 | ref1.081 – 0.8890.978 – 0.782 0.491 – 0.948  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 3800 liters) 2 |
| < 3.02%3.02 – 3.17%3.17 – 3.33%>3.33% | 11.0371.0401.083 | ref0.854 – 1.2580.858 – 1.2610.892 – 1.314 |
| Temperature humidity index |
| Single unit | 0.988 | 0.983 – 0.993 |
| System  |
| SplitSeasonal | 11.175 | ref1.041 – 1.327 |

1 The model was also adjusted by year of insemination (see Supplementary Table 6a for results).

2 Age at calving and days calved at insemination were fitted as natural splines to the model, while age at calving, 120-day milk yield and protein percentage included interaction terms. To simplify interpretation of these variables, the predicted odds ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only; see Supplementary Materials S1 for details).

##### Table S4. Adjusted odds ratios and 95% confidence intervals for conception to first service (Jerseys) 1

|  |  |  |
| --- | --- | --- |
| Explanatory variable | Odds ratio | 95% CI |
| Daughter fertility EBV |
|  Single unit | 1.075 | 1.031 – 1.121 |
| Age at calving (for a cow with a 120-day milk yield of 2700 liters) 2 |
| 2 years | 1 | ref |
| 3 years4 years5 years7 years9+ years | 1.0030.9940.9630.8440.684 | 0.706 – 1.4240.669 – 1.4110.674 – 1.3750.588 – 1.2120.448 – 1.045 |
| Days calved at insemination 2 |
| 30 | 0.702 | 0.440 – 1.119 |
| 60 | 1 | ref |
| 90 | 1.085 | 0.757 – 1.555 |
| 120 | 1.107 | 0.746 – 1.643  |
| Milk yield (L) at 120 days (for a 5-year-old cow in the third quartile protein percentage group) 2 |
| 1500 | 1 | ref |
| 2500 | 0.872 | 0.604 – 1.258 |
| 3500 | 0.731 | 0.459 – 1.165 |
| 4500 | 0.589 | 0.271 – 1.277  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 2700 liters) 2 |
| < 3.40%3.40 – 3.54%3.54 – 3.69%> 3.69% | 11.1071.0301.032 | ref0.775 – 1.5800.721 – 1.4700.719 – 1.480  |

1 The model was also adjusted by year of insemination (see Supplementary Table 6b for results).

2 Age at calving and days calved at insemination were fitted as natural splines to the model, while age at calving, 120-day milk yield and protein percentage included interaction terms. To simplify interpretation of these variables, the predicted odds ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only; see Supplementary Materials S1 for details).

### In-calf results

##### Table S5. Adjusted hazard ratios and 95% confidence intervals for calving within the first 42 days after calving start date (Holstein-Friesians)

|  |  |  |
| --- | --- | --- |
| Explanatory variable | Odds ratio | 95% CI |
| Daughter fertility EBV |
|  Single unit | 1.054 | 1.044 – 1.065 |
| Age at calving (for a cow with a 120-day milk yield of 3800 liters) 2 |
| 2 years3 years4 years5 years7 years9+ years | 10.9650.9200.8560.6990.547 | ref0.907 – 1.0280.861 – 0.9820.798 – 0.9170.652 – 0.7490.499 – 0.599 |
| Days calved at MSD 2 |
| 306090120 | 0.56311.2621.682 | 0.524 – 0.605ref1.166 – 1.3651.347 – 2.100  |
| Milk yield (L) at 120 days (for a 5-year-old cow with 120-day protein percentage 3.16%) 2 |
| 2000350050006500 | 10.8720.7610.664 | ref0.806 – 0.9440.684 – 0.8470.547 – 0.806  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 3800 liters) 2 |
| 2.7%3.1%3.5%3.9% | 11.1981.3171.223 | ref1.112 – 1.2901.204 – 1.4391.051 – 1.422 |
| Temperature humidity index |
| 60 | 1 | ref |
| 7080 | 0.8230.510 | 0.772 – 0.8790.465 – 0.560 |
| System  |
| SplitSeasonal | 11.270 | ref1.161 – 1.389 |

1 The model was also adjusted by season-year.

2 Age at calving, days calved at MSD and 120-day milk yield were fitted as natural splines to the model with an interaction term for age at calving and 120-day milk yield. To simplify interpretation of these variables, the predicted hazard ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only).

##### Table S6. Adjusted hazard ratios and 95% confidence intervals for calving within the first 42 days after calving start date (Jerseys) 1

|  |  |  |
| --- | --- | --- |
| **Explanatory variable** | **Odds ratio** | **95% CI** |
| Daughter fertility EBV |
|  Single unit | 1.082 | 1.047 – 1.118 |
| Age at calving 2 |
| 2 years | 1 | ref |
| 3 years4 years5 years7 years9+ years | 1.0971.1561.1350.9180.653 | 0.999 – 1.2051.052 – 1.2701.022 – 1.2600.834 – 1.0090.568 – 0.750 |
| Days calved at MSD 2 |
| 30 | 0.497 | 0.434 – 0.568 |
| 60 | 1 | ref |
| 90 | 1.352 | 1.127 – 1.622 |
| 120 | 1.433 | 0.896 – 2.290 |
| Milk yield (L) at 120 days (for a 5-year-old cow with 120-day protein percentage 3.55%) 2 |
| 1500 | 1 | ref |
| 2500 | 0.904 | 0.805 – 1.017 |
| 3500 | 0.818 | 0.717 – 0.934 |
| 4500 | 0.740 | 0.570 – 0.961  |
| Protein percentage at 120 days (for a 5-year-old cow with a 120-day milk yield of 2700 liters) 2 |
| 3.2%3.5%3.8%4.1% | 10.9940.9870.981 | ref0.892 – 1.1070.869 – 1.1210.807 – 1.192 |
| Temperature humidity index |
| 607080 | 11.0420.497 | ref0.940 – 1.1560.425 – 0.582 |

1 The model was also adjusted by season-year.

2 Age at calving, days calved at MSD and 120-day milk yield were fitted as natural splines to the model with an interaction term for age at calving and 120-day milk yield. To simplify interpretation of these variables, the predicted hazard ratios and 95% confidence intervals for specific values are presented here (based on the fixed effects only).

## Supplementary materials S2

The following tables provide the raw model outputs of all terms.

### Submission results

##### Table S7. Adjusted hazard ratios and 95% confidence intervals for insemination events within the first 21 days of the mating period (Holstein-Friesians); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **HR (95% CI)** |
| Daughter fertility EBV | 0.0254 (0.00325) | < 0.001 | 1.03 (1.02 - 1.03) |
| Milk yield at 120 days (L; splines) |
| 1 | 0.916 (0.159) | < 0.001 | - |
| 2 | 2.8 (0.75) | < 0.001 | - |
| 3 | 0.4 (0.541) | 0.46 | - |
| Protein percentage at 120 days (quartiles) |
| 1 (< 3.02%) | ref |  | 1 |
| 2 (3.02 - 3.17%) | 0.27 (0.443) | 0.542 | 1.31 (0.549 - 3.12) |
| 3 (3.17 - 3.33%) | 0.979 (0.416) | < 0.05 | 2.66 (1.18 - 6.02) |
| 4 (> 3.33%) | 1.55 (0.364) | < 0.001 | 4.72 (2.31 - 9.63) |
| Age at calving | 0.127 (0.0773) | 0.0993 | 1.14 (0.976 - 1.32) |
| Days calved at MSD (splines) |
| 1 | 4.36 (0.13) | < 0.001 | - |
| 2 | 12.7 (0.528) | < 0.001 | - |
| 3 | 3.47 (0.16) | < 0.001 | - |
| System |
| Split | ref |  | 1 |
| Seasonal | 0.192 (0.0279) | < 0.001 | 1.21 (1.15 - 1.28) |
| Milk yield at 120 days (splines) x protein percentage at 120 days (quartiles) |
| Milk 1 x protein 2 | -0.138 (0.205) | < 0.001 | - |
| Milk 2 x protein 2 | -0.418 (1.04) | 0.688 | - |
| Milk 3 x protein 2 | -0.228 (0.747) | 0.76 | - |
| Milk 1 x protein 3 | -0.643 (0.195) | < 0.001 | - |
| Milk 2 x protein 3 | -1.65 (1.02) | 0.106 | - |
| Milk 3 x protein 3 | -0.46 (0.824) | 0.577 | - |
| Milk 1 x protein 4 | -0.818 (0.182) | < 0.001 | - |
| Milk 2 x protein 4 | -2.6 (0.901) | < 0.01 | - |
| Milk 3 x protein 4 | -0.576 (0.805) | 0.474 | - |
| Milk yield at 120 days (splines) x age |
| Milk 1 x age | -0.109 (0.0385) | < 0.01 | - |
| Milk 2 x age | -0.216 (0.197) | 0.272 | - |
| Milk 3 x age | 0.0285 (0.178) | 0.873 | - |

a Regression coefficients and their standard errors from a mixed effects Cox Proportional Hazards regression model of explanatory variables for submission in the first 21 days of the mating period.

##### Table S8. Adjusted hazard ratios and 95% confidence intervals for insemination events within the first 21 days of the mating period (Jerseys); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **HR (95% CI)** |
| Daughter fertility EBV | 0.0309 (0.01) | < 0.01 | 1.03 (1.01 - 1.05) |
| Milk yield at 120 days (L) b | 0.0344 (0.00794) | < 0.001 | 1.04 (1.02 - 1.05) |
| Protein percentage at 120 days (quartiles) |
| 1 (< 3.40%) | ref |  | 1 |
| 2 (3.40 - 3.56%) | 0.6 (0.263) | < 0.05 | 1.82 (1.09 - 3.05) |
| 3 (3.56 - 3.71%) | 0.704 (0.267) | < 0.01 | 2.02 (1.2 - 3.41) |
| 4 (> 3.73%) | 0.367 (0.262) | 0.161 | 1.44 (0.864 - 2.41) |
| Age at calving | 0.0795 (0.054) | 0.141 | 1.08 (0.974 - 1.2) |
| Days calved at MSD (splines) |
| 1 | 4.63 (0.288) | < 0.001 | - |
| 2 | 14.4 (1.14) | < 0.001 | - |
| 3 | 4.29 (0.337) | < 0.001 | - |
| Milk yield at 120 days x protein percentage at 120 days (quartiles) b |
| Milk x protein 2 b | -0.0131 (0.0095) | 0.169 | 0.987 (0.969 - 1.01) |
| Milk x protein 3 b | -0.0146 (0.00984) | 0.138 | 0.986 (0.967 - 1) |
| Milk x protein 4 b | -0.0015 (0.00985) | 0.879 | 0.999 (0.979 - 1.02) |
| Milk x age b | -0.00353 (0.00203) | 0.0813 | 0.996 (0.993 - 1) |

a Regression coefficients and their standard errors from a mixed effects Cox Proportional Hazards regression model of explanatory variables for submission in the first 21 days of the mating period.

b Coefficients presented for 100 litre increases in 120-day milk yield.

### Conception results

##### Table S9. Adjusted odds ratios and 95% confidence intervals for conception to the first insemination after calving (Holstein-Friesians); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **OR (95% CI)** |
| Daughter fertility EBV | 0.0548 (0.00685) | < 0.001 | 1.06 (1.04 - 1.07) |
| Age at calving (splines) |
| 1 | -0.00466 (0.366) | 0.99 | - |
| 2 | 0.0104 (0.353) | 0.977 | - |
| Days calved at insemination (splines) |
| 1 | 1.29 (0.157) | < 0.001 | - |
| 2 | 3.34 (0.438) | < 0.001 | - |
| 3 | 1.2 (0.445) | < 0.01 | - |
| Milk yield at 120 days (L) b | 0.0102 (0.00507) | < 0.05 | 1.01 (1 - 1.02) |
| Protein percentage at 120 days (quartiles) |
| 1 (< 3.02%) | ref |  | 1 |
| 2 (3.02 - 3.17%) | 0.864 (0.201) | < 0.001 | 2.37 (1.6 - 3.52) |
| 3 (3.17 - 3.33%) | 0.705 (0.203) | < 0.001 | 2.02 (1.36 - 3.01) |
| 4 (> 3.33%) | 1.28 (0.204) | < 0.001 | 3.59 (2.41 - 5.35) |
| Temperature humidity index | -0.0124 (0.00265) | < 0.001 | 0.988 (0.983 - 0.993) |
| Year |
| 2004 | ref |  | 1 |
| 2006 | -1.82 (0.581) | < 0.01 | 0.162 (0.0519 - 0.505) |
| 2007 | -1.74 (0.547) | < 0.01 | 0.176 (0.0601 - 0.513) |
| 2008 | -1.72 (0.547) | < 0.01 | 0.179 (0.0613 - 0.523) |
| 2009 | -1.76 (0.547) | < 0.01 | 0.172 (0.0589 - 0.502) |
| 2010 | -1.7 (0.545) | < 0.01 | 0.184 (0.0631 - 0.534) |
| 2011 | -1.74 (0.545) | < 0.01 | 0.176 (0.0605 - 0.513) |
| 2012 | -1.81 (0.545) | < 0.001 | 0.163 (0.0562 - 0.476) |
| 2013 | -1.77 (0.545) | < 0.01 | 0.171 (0.0587 - 0.497) |
| 2014 | -1.84 (0.545) | < 0.001 | 0.159 (0.0545 - 0.462) |
| 2015 | -1.9 (0.545) | < 0.001 | 0.15 (0.0516 - 0.438) |
| 2016 | -1.41 (0.57) | < 0.05 | 0.244 (0.08 - 0.746) |
| System |  |  |  |
| Split | ref |  | 1 |
| Seasonal | 0.162 (0.062) | < 0.01 | 1.18 (1.04 - 1.33) |
| Milk yield at 120 days x protein percentage at 120 days (quartiles) b |
| Milk x protein 2 | -0.0212 (0.00502) | < 0.001 | 0.979 (0.969 - 0.989) |
| Milk x protein 3 | -0.0169 (0.00514) | < 0.001 | 0.983 (0.973 - 0.993) |
| Milk x protein 4 | -0.0303 (0.00535) | < 0.001 | 0.97 (0.96 - 0.98) |
| Milk yield at 120 days x age at calving (splines) b |
| Milk x age 1 | -0.019 (0.00978) | 0.0519 | - |
| Milk x age 2 | -0.0229 (0.00906) | < 0.05 | - |

a Regression coefficients and their standard errors from a mixed effects logistic regression model of explanatory variables for conception to the first insemination after calving.

b Coefficients presented for 100 litre increases in 120-day milk yield.

##### Table S10. Adjusted odds ratios and 95% confidence intervals for conception to the first insemination after calving (Jerseys); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **OR (95% CI)** |
| Daughter fertility EBV | 0.0726 (0.0213) | < 0.001 | 1.08 (1.03 - 1.12) |
| Age at calving (splines) |
| 1 | 1.16 (0.944) | 0.218 | - |
| 2 | -0.155 (0.882) | 0.861 | - |
| Days calved at insemination (splines) |
| 1 | 1.19 (0.353) | < 0.001 | - |
| 2 | 2.34 (0.869) | < 0.01 | - |
| 3 | -0.121 (1.2) | 0.92 | - |
| Milk yield at 120 days (L) | 0.0105 (0.0169) | 0.533 | 1.01 (0.978 - 1.04) |
| Protein percentage at 120 days (quartiles) |
| 1 (< 3.4%) | ref |  | 1 |
| 2 (3.02 - 3.17%) | -0.176 (0.511) | 0.731 | 0.839 (0.308 - 2.28) |
| 3 (3.17 - 3.33%) | 0.679 (0.535) | 0.204 | 1.97 (0.691 - 5.63) |
| 4 (> 3.33%) | 1.4 (0.533) | < 0.01 | 4.04 (1.42 - 11.5) |
| Year |
| 2004 | ref |  | 1 |
| 2005 | 0.699 (0.58) | 0.228 | 2.01 (0.645 - 6.28) |
| 2006 | 0.357 (0.249) | 0.152 | 1.43 (0.877 - 2.33) |
| 2007 | -0.107 (0.241) | 0.656 | 0.898 (0.56 - 1.44) |
| 2008 | -0.0891 (0.248) | 0.719 | 0.915 (0.563 - 1.49) |
| 2009 | 0.189 (0.253) | 0.454 | 1.21 (0.736 - 1.98) |
| 2010 | -0.0577 (0.242) | 0.811 | 0.944 (0.588 - 1.52) |
| 2011 | -0.152 (0.237) | 0.522 | 0.859 (0.54 - 1.37) |
| 2012 | -0.119 (0.241) | 0.621 | 0.888 (0.554 - 1.42) |
| 2013 | -0.224 (0.239) | 0.35 | 0.8 (0.5 - 1.28) |
| 2014 | -0.471 (0.235) | < 0.05 | 0.624 (0.394 - 0.99) |
| 2015 | -0.398 (0.236) | 0.092 | 0.672 (0.423 - 1.07) |
| 2016 | 0.214 (0.528) | 0.685 | 1.24 (0.44 - 3.49) |
| Milk yield at 120 days x protein percentage at 120 days (quartiles) |
| Milk x protein 2 | 0.0162 (0.0182) | 0.375 | 1.02 (0.981 - 1.05) |
| Milk x protein 3 | -0.0225 (0.0196) | 0.249 | 0.978 (0.941 - 1.02) |
| Milk x protein 4 | -0.0489 (0.0198) | < 0.05 | 0.952 (0.916 - 0.99) |
| Milk yield at 120 days x age at calving (splines) |
| Milk x age 1 | -0.0588 (0.0357) | 0.0992 | - |
| Milk x age 2 | -0.0242 (0.0318) | 0.446 | - |

a Regression coefficients and their standard errors from a mixed effects logistic regression model of explanatory variables for conception to the first insemination after calving.

b Coefficients presented for 100 litre increases in 120-day milk yield.

### In-calf results

##### Table S11. Adjusted hazard ratios and 95% confidence intervals for calving in the first 42 days of the calving period (Holstein-Friesians); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **HR (95% CI)** |
| Daughter fertility EBV | 0.0529 (0.00494) | < 0.001 | 1.05 (1.04 - 1.06) |
| Milk yield at 120 days (L) | 0.0472 (0.0605) | 0.435 | 1.05 (0.931 - 1.18) |
| Protein percentage at 120 days (splines) |
| 1 | 2.75 (1.07) | < 0.01 | - |
| 2 | 4.68 (5.24) | 0.371 | - |
| 3 | 1.13 (3.56) | 0.75 | - |
| Age at calving (splines) |
| 1 | 0.245 (0.285) | 0.389 | - |
| 2 | -0.401 (0.219) | 0.067 | - |
| Days calved at MSD (splines) |
| 1 | 1.2 (0.0663) | < 0.001 | - |
| 2 | 3.34 (0.246) | < 0.001 | - |
| 3 | 1.37 (0.117) | < 0.001 | - |
| System |
| Split | ref |  | 1 |
| Seasonal | 0.239 (0.0457) | < 0.001 | 1.27 (1.16 - 1.39) |
| Temperature humidity index (splines) |
| 1 | -0.302 (0.0657) | < 0.001 | - |
| 2 | -0.678 (0.245) | < 0.01 | - |
| 3 | -1.23 (0.145) | < 0.001 | - |
| Milk yield at 120 days x protein percentage at 120 days (splines) |
| Milk x protein 1 | -0.0521 (0.027) | 0.0538 | - |
| Milk x protein 2 | -0.11 (0.143) | 0.441 | - |
| Milk x protein 3 | -0.065 (0.115) | 0.573 | - |
| Milk yield at 120 days x age at calving (splines) |
| Milk x age 1 | -0.0184 (0.00769) | < 0.05 | - |
| Milk x age 2 | -0.00438 (0.00553) | 0.429 | - |

a Regression coefficients and their standard errors from a mixed effects logistic regression model of explanatory variables for conception to the first insemination after calving.

b Coefficients presented for 100 litre increases in 120-day milk yield.

##### Table S12. Adjusted hazard ratios and 95% confidence intervals for calving in the first 42 days of the calving period (Jerseys); model outputs a

|  |  |  |  |
| --- | --- | --- | --- |
| **Explanatory variable** | **Coefficient (SE)** | **P value** | **HR (95% CI)** |
| Daughter fertility EBV | 0.0784 (0.0168) | < 0.001 | 1.08 (1.05 - 1.12) |
| Milk yield at 120 days (L) | 0.247 (0.0961) | < 0.05 | 1.28 (1.06 - 1.55) |
| Protein percentage at 120 days | 1.93 (0.719) | < 0.01 | 6.9 (1.69 - 28.3) |
| Age at calving (splines) |
| 1 | 0.0615 (0.166) | 0.71 | - |
| 2 | -0.536 (0.0843) | < 0.001 | - |
| Days calved at MSD (splines) |
| 1 | 3.31 (0.327) | < 0.001 | - |
| 2 | 1.1 (0.241) | < 0.001 | - |
| Temperature humidity index (splines) |
| 1 | 0.315 (0.297) | 0.289 | - |
| 2 | -1.54 (0.182) | < 0.001 | - |
| Milk x protein | -0.0724 (0.0272) | < 0.01 | 0.93 (0.882 - 0.981) |

a Regression coefficients and their standard errors from a mixed effects logistic regression model of explanatory variables for conception to the first insemination after calving.

b Coefficients presented for 100 litre increases in 120-day milk yield.