Youngstock survival single step

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Introduction

Test runs
uSS is single step setup with official genotypes (uSS =full, uSS_r =reduc)
tSS is single step setup but where genotypes are manipulated (tSS =full, tSS_r =reduc)
EBV is single step setup but without any genotypes, thus a traditional model (ebv =full, ebv_r =reduc)

The model, the parameters, the dataset and the pedigree are the same for all runs. The data cut for reduc is the same for all runs. Only AI bulls born in 2009 or later included, because earlier investigations have shown, that including genotypes from calves have the effect of that the trends were severe overestimated.

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RANDOM    RHY1
MODEL SCALE
BV1: HP1 = heterosis(bwxhf holxrdc) FHY1    - YS parity -  RHY1 G(nav_id) ! WEIGHT = wHP1
BV2: HP2 = heterosis(bwxhf holxrdc)    - FHY2 YS parity T2 RHY1 G(nav_id) ! WEIGHT = wHP2
BV3: BP1 = heterosis(bwxhf holxrdc) FHY1    - YS parity -  RHY1 G(nav_id) ! WEIGHT = wBP1
BV4: BP2 = heterosis(bwxhf holxrdc)    - FHY2 YS parity T2 RHY1 G(nav_id) ! WEIGHT = wBP2
BV5: combined YSSindex = HP1*3.582 + HP2*4.285 + BP1*1.781 + BP4*2.791;
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Manipulation of genotypes are done based on the analysis of the allele frequencies, thus for SNPs changing more than 30 percent point in allele frequence from 2009 birth year class to 2024 birth year class, we have decided to manipulate the genotype file where the SNP is fixed to 0. That means that all animals are having the same homozygote for these SNPs. For uSS and tSS only genotypes from bulls born after 2008 are included thus 5428 genotypes, (different from “normal” single step setup where we included all genotypes animals born after 2008). The reason is, that only calves, that have survived has been genotyped and earlier runs with all genotypes has shown severe overestimation of genetic trend, when all genotypes has been included.
The breeding values are postprocessed/standardized, where base animals have same mean and std as in the traditional official youngstock survival breeding values. Base animals are here defined as females and males having a record for HP1, HP2, BP1 or BP2. All base animals are born 9-11 years ago, and without genotype, and have a Nordic country code in id_nor, in total 1010474 base animals.
Below you find tables for genetic trend and correlations for

- Nordic AI bulls with minimum of 50 offspring.
- Nordic AI bulls born >=2019 without any offspring

Legarra Reverter was done as linear regression: full = reduc, for Nordic AI bulls with minimum of 50 offspring in full run, no offspring in reduced run, and where the sire of the bull has minimum 50 offspring in reduced run.

Standardisation

Mean and std for base animals table 1

trait	Variable	N	Mean	Std
1	ebv1	1010474	96.57	6.92
1	ebv_r1	1010474	96.57	6.92
1	uss1	1010474	96.57	6.92
1	uss_r1	1010474	96.57	6.92
1	tss1	1010474	96.57	6.92
1	tss_r1	1010474	96.57	6.92
2	ebv2	1010474	97.77	5.87
2	ebv_r2	1010474	97.77	5.87
2	uss2	1010474	97.77	5.87
2	uss_r2	1010474	97.77	5.87
2	tss2	1010474	97.77	5.87
2	tss_r2	1010474	97.77	5.87
3	ebv3	1010474	96.54	6.90
3	ebv_r3	1010474	96.54	6.90
3	uss3	1010474	96.54	6.90
3	uss_r3	1010474	96.54	6.90
3	tss3	1010474	96.54	6.90
3	tss_r3	1010474	96.54	6.90
4	ebv4	1010474	98.00	5.75
4	ebv_r4	1010474	98.00	5.75
4	uss4	1010474	98.00	5.75
4	uss_r4	1010474	98.00	5.75
4	tss4	1010474	98.00	5.75
4	tss_r4	1010474	98.00	5.75
5	ebv5	1010474	97.07	6.02
5	ebv_r5	1010474	97.07	6.02
5	uss5	1010474	97.07	6.02
5	uss_r5	1010474	97.07	6.02
5	tss5	1010474	97.07	6.02
5	tss_r5	1010474	97.07	6.02

BV1 is HP1 heifer early survival

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                                        Sires with minimum 50 offspring, 1 table    2
 Obs   BYR  _TYPE_  _FREQ_    ebv1  ebv_r1   uss1  uss_r1   tss1  tss_r1  sebv1  sebv_r1  suss1  suss_r1  stss1  stss_r1
   1  2009     1      223     97.3    97.4   97.0    97.3   97.1    97.3   10.4     10.3   10.3     10.2   10.2     10.1
   2  2010     1      193     95.0    95.2   94.9    95.2   94.9    95.2   11.1     11.1   11.4     11.4   11.2     11.2
   3  2011     1      154     97.1    97.5   96.9    97.3   96.8    97.3   11.4     11.2   11.1     11.0   11.0     10.8
   4  2012     1      171    100.1   100.4  100.2   100.3  100.1   100.3   11.1     11.1   11.6     11.5   11.4     11.3
   5  2013     1      151     98.9    98.6   99.7    99.0   99.5    99.0   10.9     10.6   11.2     11.0   11.1     10.9
   6  2014     1      114    101.8   101.0  102.4   101.3  102.2   101.1   12.5     12.2   12.6     12.3   12.5     12.2
   7  2015     1       83    100.1    99.2  100.6    99.2  100.4    99.0   10.5     10.0   10.6     10.0   10.5      9.9
   8  2016     1       66    103.5   101.5  104.0   102.6  103.8   102.3   10.1      7.6   10.2      8.4   10.1      8.2
   9  2017     1       66    100.2    98.8  100.9   100.1  100.7    99.8   10.1      7.9    9.6      8.0    9.5      7.9
  10  2018     1       78    102.8   100.8  104.4   102.9  104.1   102.5   10.6      6.5   10.2      7.8   10.1      7.6
  11  2019     1       56    106.6   100.3  108.2   103.2  107.8   102.8    9.6      4.8    9.5      5.3    9.3      5.2
  12  2020     1       58    106.6   102.1  107.7   104.0  107.4   103.6    9.8      4.7    9.5      7.2    9.4      7.0
  13  2021     1       40    106.6   101.7  108.1   104.1  107.8   103.7   10.3      3.5   10.7      6.0   10.7      5.8
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                                        Sires with minimum 50 offspring, 1 table    3
              Obs    _TYPE_    _NAME_        ebv1      ebv_r1        uss1      uss_r1        tss1      tss_r1
               1     MEAN                   99.69       98.83      100.06       99.33       99.95       99.21
               2     STD                    11.32       10.16       11.55       10.56       11.38       10.40
               3     N                    1454.00     1454.00     1454.00     1454.00     1454.00     1454.00
               4     CORR      ebv1          1.00        0.88        0.97        0.87        0.97        0.87
               5     CORR      ebv_r1        0.88        1.00        0.86        0.95        0.86        0.96
               6     CORR      uss1          0.97        0.86        1.00        0.90        1.00        0.90
               7     CORR      uss_r1        0.87        0.95        0.90        1.00        0.91        1.00
               8     CORR      tss1          0.97        0.86        1.00        0.91        1.00        0.90
               9     CORR      tss_r1        0.87        0.96        0.90        1.00        0.90        1.00
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                                         sires without any offspring, 1    table    4
 Obs   BYR  _TYPE_  _FREQ_    ebv1  ebv_r1   uss1  uss_r1   tss1  tss_r1  sebv1  sebv_r1  suss1  suss_r1  stss1  stss_r1
  1   2019     1        8    102.5   102.5  103.9   101.9  103.5   101.5   4.8      3.7      6.1      5.1     6.0      4.8
  2   2020     1        8    105.1    99.1  106.5   102.4  106.3   101.9   5.7      3.9      6.9      8.5     6.8      8.1
  4   2022     1       19    104.3   101.2  106.7   103.7  106.3   103.3   6.3      2.3      7.2      6.5     7.2      6.3
  5   2023     1       42    104.6    99.9  107.0   103.1  106.7   102.8   6.9      2.9      7.8      5.9     7.7      5.7
  6   2024     1       23    105.9   100.3  107.0   104.0  106.6   103.3   7.9      2.5      7.1      4.9     7.0      4.7
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                                         sires without any offspring, 1    table
              Obs    _TYPE_    _NAME_        ebv1      ebv_r1        uss1      uss_r1        tss1      tss_r1
               1     MEAN                 104.686     100.412     106.696     103.284     106.333     102.824
               2     STD                    6.709       3.016       7.235       5.999       7.192       5.732
               3     N                    102.000     102.000     102.000     102.000     102.000     102.000
               4     CORR      ebv1         1.000       0.147       0.729       0.020       0.741       0.025
               5     CORR      ebv_r1       0.147       1.000       0.160       0.468       0.151       0.469
               6     CORR      uss1         0.729       0.160       1.000       0.492       0.998       0.503
               7     CORR      uss_r1       0.020       0.468       0.492       1.000       0.479       0.996
               8     CORR      tss1         0.741       0.151       0.998       0.479       1.000       0.492
               9     CORR      tss_r1       0.025       0.469       0.503       0.996       0.492       1.000
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BV2 is HP2, heifer late survival

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                                          Sires with minimum 50 offspring, 2 table   6
Obs   BYR   _TYPE_   _FREQ_    ebv2   ebv_r2    uss2   uss_r2    tss2   tss_r2   sebv2   sebv_r2   suss2   suss_r2   stss2   stss_r2
  1  2009     1        223     98.6     98.7    98.4     98.6    98.5     98.7    10.1      10.2     9.7       9.8     9.6       9.7
  2  2010     1        193     96.8     97.0    96.6     96.9    96.7     96.9    11.4      11.4    11.3      11.2    11.1      11.1
  3  2011     1        154     97.9     98.1    97.8     98.0    97.9     98.0    11.8      11.9    11.3      11.4    11.2      11.3
  4  2012     1        171    101.6    102.1   101.5    101.9   101.5    101.9    10.5      10.4    10.3      10.2    10.2      10.1
  5  2013     1        151    101.2    101.5   101.5    101.9   101.5    101.8    11.8      11.6    11.6      11.4    11.5      11.2
  6  2014     1        114    101.5    101.0   101.5    101.1   101.4    100.9    11.6      11.9    11.4      11.7    11.3      11.7
  7  2015     1         83    102.2    103.1   102.6    103.7   102.5    103.4    10.2      10.3    10.0      10.1    10.0      10.1
  8  2016     1         66    106.3    104.8   107.1    107.0   106.8    106.6     8.8       6.9     8.7       7.5     8.7       7.4
  9  2017     1         66    101.4    101.3   102.7    104.2   102.6    103.8    11.5       8.3    11.5       9.3    11.4       9.2
 10  2018     1         78    105.2    103.6   106.4    106.9   106.1    106.4    12.9       7.3    12.1       7.1    12.0       7.1
 11  2019     1         56    108.7    102.9   110.0    106.7   109.8    106.2     9.7       5.8     8.9       7.2     8.9       7.2
 12  2020     1         58    107.0    104.3   109.2    108.2   109.0    107.9     8.5       4.2     8.2       6.9     8.2       6.7
 13  2021     1         40    107.2    103.2   109.5    107.9   109.2    107.4    10.5       4.5     9.6       5.8     9.6       5.7

                                          Sires with minimum 50 offspring, 2 table   7
              Obs    _TYPE_    _NAME_        ebv2      ebv_r2        uss2      uss_r2        tss2      tss_r2
               1      MEAN                 101.13      100.70      101.49      101.56      101.43      101.43
               2      STD                   11.40       10.38       11.29       10.68       11.19       10.52
               3      N                   1454.00     1454.00     1454.00     1454.00     1454.00     1454.00
               4      CORR     ebv2          1.00        0.85        0.98        0.86        0.98        0.86
               5      CORR     ebv_r2        0.85        1.00        0.84        0.95        0.84        0.96
               6      CORR     uss2          0.98        0.84        1.00        0.88        1.00        0.88
               7      CORR     uss_r2        0.86        0.95        0.88        1.00        0.88        1.00
               8      CORR     tss2          0.98        0.84        1.00        0.88        1.00        0.88
               9      CORR     tss_r2        0.86        0.96        0.88        1.00        0.88        1.00

                                           sires without any offspring, 2   table   8
Obs   BYR   _TYPE_   _FREQ_    ebv2   ebv_r2    uss2   uss_r2    tss2   tss_r2   sebv2   sebv_r2   suss2   suss_r2   stss2   stss_r2
 1   2019     1        8      102.9    107.4   104.8    107.9   104.8    107.8    9.9       2.3      8.5       5.1     8.5      5.1
 2   2020     1        8      108.3    101.8   109.8    105.0   109.3    104.4    1.8       5.3      5.1       7.8     4.8      7.4
 4   2022     1       19      104.2    102.5   106.5    106.1   106.3    105.7    8.4       3.4      9.5       8.7     9.4      8.6
 5   2023     1       42      104.0    102.3   107.5    107.5   107.3    106.9    6.8       3.4      6.8       5.8     6.6      5.7
 6   2024     1       23      104.7    101.9   107.7    107.3   107.5    106.6    7.7       2.4      6.8       4.9     6.7      4.9

                                           sires without any offspring, 2   table   9
              Obs    _TYPE_    _NAME_        ebv2      ebv_r2        uss2      uss_r2        tss2      tss_r2
               1      MEAN                104.353     102.578     107.186     106.941     106.971     106.382
               2      STD                   7.318       3.572       7.463       6.450       7.330       6.343
               3      N                   102.000     102.000     102.000     102.000     102.000     102.000
               4      CORR     ebv2         1.000       0.325       0.758       0.210       0.766       0.217
               5      CORR     ebv_r2       0.325       1.000       0.269       0.513       0.270       0.525
               6      CORR     uss2         0.758       0.269       1.000       0.616       0.997       0.616
               7      CORR     uss_r2       0.210       0.513       0.616       1.000       0.612       0.997
               8      CORR     tss2         0.766       0.270       0.997       0.612       1.000       0.615
               9      CORR     tss_r2       0.217       0.525       0.616       0.997       0.615       1.000
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BV3 is BP1, bull calves early survival

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                                          sires with minimum 50 offspring, 3 table  10
Obs   BYR  _TYPE_  _FREQ_   ebv3  ebv_r3   uss3  uss_r3   tss3  tss_r3  sebv3  sebv_r3  suss3  suss_r3  stss3  stss_r3
  1  2009     1      223    97.6    97.6   97.3    97.6   97.4    97.6   10.3     10.3    10.3     10.2    10.2     10.1
  2  2010     1      193    95.2    95.3   95.0    95.3   95.2    95.4   11.4     11.4    11.6     11.6    11.4     11.5
  3  2011     1      154    97.4    97.6   97.1    97.4   97.1    97.4   11.3     11.1    11.1     10.9    10.9     10.7
  4  2012     1      171   100.3   100.5  100.5   100.6  100.5   100.5   11.1     11.1    11.4     11.3    11.4     11.2
  5  2013     1      151    98.7    98.5   99.6    99.0   99.5    98.9   10.9     10.7    11.2     11.1    11.1     11.0
  6  2014     1      114   102.3   101.2  103.0   101.5  102.7   101.4   12.6     12.4    12.6     12.4    12.6     12.3
  7  2015     1       83   100.1    99.2  100.7    99.3  100.5    99.2   10.7     10.2    10.7     10.2    10.6     10.1
  8  2016     1       66   104.0   101.8  104.9   103.0  104.7   102.8   10.0      7.5    10.0      8.4    10.0      8.2
  9  2017     1       66   100.6    98.9  101.7   100.4  101.4   100.2   10.8      8.2    10.4      8.4    10.3      8.3
 10  2018     1       78   102.9   100.8  104.6   102.9  104.2   102.6   10.9      6.6    10.7      8.0    10.6      7.8
 11  2019     1       56   107.8   100.4  109.5   103.3  109.1   102.8    9.7      4.8     9.2      5.4     9.1      5.3
 12  2020     1       58   106.8   102.2  108.2   104.3  107.8   103.9    9.8      4.7     9.6      7.3     9.5      7.2
 13  2021     1       40   107.4   101.5  109.1   104.0  108.6   103.7   10.3      3.6    10.9      6.2    10.6      6.0

                                          Sires with minimum 50 offspring, 3 table  11
              Obs    _TYPE_    _NAME_       ebv3     ebv_r3       uss3     uss_r3       tss3     tss_r3
               1     MEAN                  99.95      98.94     100.42      99.51     100.31      99.40
               2     STD                   11.42      10.23      11.69      10.63      11.52      10.46
               3     N                   1454.00    1454.00    1454.00    1454.00    1454.00    1454.00
               4     CORR     ebv3          1.00       0.88       0.97       0.87       0.97       0.87
               5     CORR     ebv_r3        0.88       1.00       0.86       0.95       0.86       0.95
               6     CORR     uss3          0.97       0.86       1.00       0.90       1.00       0.90
               7     CORR     uss_r3        0.87       0.95       0.90       1.00       0.90       1.00
               8     CORR     tss3          0.97       0.86       1.00       0.90       1.00       0.90
               9     CORR     tss_r3        0.87       0.95       0.90       1.00       0.90       1.00

                                           sires without any offspring, 3   table  12
Obs   BYR  _TYPE_  _FREQ_   ebv3  ebv_r3   uss3  uss_r3   tss3  tss_r3  sebv3  sebv_r3  suss3  suss_r3  stss3  stss_r3
 1   2019     1        8    102.4   102.4  104.5   101.9  104.0   101.6   4.7      3.6     5.8      4.9     5.7      4.8
 2   2020     1        8    106.1    99.5  108.3   102.8  107.6   102.1   5.1      4.5     6.8      8.6     6.5      8.6
 4   2022     1       19    104.6   101.3  107.6   103.8  106.9   103.4   5.9      2.4     7.4      6.8     7.4      6.5
 5   2023     1       42    104.6   100.0  107.4   103.1  106.9   102.7   6.7      2.7     7.4      6.0     7.2      5.8
 6   2024     1       23    106.1   100.4  107.7   103.9  107.3   103.4   7.6      2.6     7.1      5.0     7.2      4.8

                                           sires without any offspring, 3   table  13
              Obs    _TYPE_    _NAME_       ebv3     ebv_r3       uss3     uss_r3       tss3     tss_r3
               1     MEAN                104.873    100.510    107.382    103.284    106.824    102.863
               2     STD                   6.453      3.017      7.056      6.073      6.989      5.877
               3     N                   102.000    102.000    102.000    102.000    102.000    102.000
               4     CORR     ebv3         1.000      0.171      0.716      0.040      0.727      0.038
               5     CORR     ebv_r3       0.171      1.000      0.168      0.469      0.158      0.486
               6     CORR     uss3         0.716      0.168      1.000      0.526      0.997      0.517
               7     CORR     uss_r3       0.040      0.469      0.526      1.000      0.509      0.996
               8     CORR     tss3         0.727      0.158      0.997      0.509      1.000      0.501
               9     CORR     tss_r3       0.038      0.486      0.517      0.996      0.501      1.000
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BV4 is BP2, bull calves early survival

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                                    sires with minimum 50 offspring, 4 table  14
  Obs   BYR  _TYPE_  _FREQ_   ebv4  ebv_r4   uss4  uss_r4   tss4  tss_r4  sebv4  sebv_r4  suss4  suss_r4  stss4  stss_r4
    1  2009     1      223    98.6    98.6   98.6    98.5   98.6    98.6    8.9      9.0    8.7      8.9    8.6      8.8
    2  2010     1      193    97.0    97.1   97.1    97.2   97.2    97.3   10.9     11.0   10.8     10.8   10.7     10.7
    3  2011     1      154    99.2    99.3   99.1    99.3   99.1    99.2   10.1     10.1    9.7      9.9    9.6      9.8
    4  2012     1      171   100.8   101.3  100.6   101.1  100.6   101.1   10.5     10.6   10.2     10.3   10.1     10.2
    5  2013     1      151   101.6   101.7  101.6   101.8  101.5   101.7   11.0     10.9   10.9     10.7   10.8     10.6
    6  2014     1      114   100.9   100.2  100.8   100.5  100.6   100.3   10.3     10.8   10.2     10.6   10.2     10.5
    7  2015     1       83   101.2   101.7  101.5   102.3  101.4   102.1    9.4      9.6    9.4      9.5    9.3      9.5
    8  2016     1       66   105.3   104.1  105.7   105.9  105.6   105.6    8.0      6.0    8.1      6.6    8.2      6.5
    9  2017     1       66    99.9   100.0  100.9   102.7  100.8   102.5   11.0      7.4   10.8      8.3   10.7      8.3
   10  2018     1       78   103.7   102.5  104.4   105.4  104.2   105.0   10.4      6.1    9.8      5.9    9.7      5.7
   11  2019     1       56   104.6   101.4  105.4   104.4  105.2   104.0    7.9      5.4    7.5      7.1    7.5      7.0
   12  2020     1       58   105.4   102.4  107.1   106.3  107.0   105.9    7.7      3.6    7.4      5.9    7.2      5.6
   13  2021     1       40   103.4   101.8  105.0   105.7  104.9   105.3    8.7      4.3    8.3      5.5    8.2      5.4
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```
                                    sires with minimum 50 offspring, 4 table  15
                 Obs    _TYPE_    _NAME_       ebv4      ebv_r4        uss4      uss_r4        tss4      tss_r4
                  1      MEAN                100.61      100.29      100.84      101.08      100.81      100.96
                  2      STD                  10.20        9.50       10.07        9.74        9.98        9.60
                  3      N                  1454.00     1454.00     1454.00     1454.00     1454.00     1454.00
                  4      CORR     ebv4         1.00        0.88        0.98        0.88        0.98        0.88
                  5      CORR     ebv_r4       0.88        1.00        0.86        0.95        0.86        0.96
                  6      CORR     uss4         0.98        0.86        1.00        0.90        1.00        0.90
                  7      CORR     uss_r4       0.88        0.95        0.90        1.00        0.90        1.00
                  8      CORR     tss4         0.98        0.86        1.00        0.90        1.00        0.90
                  9      CORR     tss_r4       0.88        0.96        0.90        1.00        0.90        1.00
```

```
                                     sires without any offspring, 4   table  16
  Obs   BYR  _TYPE_  _FREQ_   ebv4  ebv_r4   uss4  uss_r4   tss4  tss_r4  sebv4  sebv_r4  suss4  suss_r4  stss4  stss_r4
   1   2019     1       8    101.6   104.4  103.1   105.6  102.9   105.6   7.0      3.0      5.1      4.5     5.2      4.7
   2   2020     1       8    105.6   100.9  107.5   103.8  107.4   103.3   2.9      3.2      5.2      5.0     5.0      4.7
   4   2022     1      19    101.4   100.4  103.3   103.8  103.1   103.5   7.0      3.2      8.4      8.4     8.3      8.2
   5   2023     1      42    101.3   100.6  104.3   105.4  104.1   105.0   5.4      3.0      5.9      4.9     5.7      4.7
   6   2024     1      23    101.7   100.2  104.2   105.0  104.1   104.4   6.6      2.0      6.3      4.4     6.3      4.0
```

```
                                     sires without any offspring, 4   table  17
                 Obs    _TYPE_    _NAME_       ebv4      ebv_r4        uss4      uss_r4        tss4      tss_r4
                  1      MEAN               101.735     100.775     104.157     104.814     103.980     104.422
                  2      STD                  6.085       3.037       6.612       5.630       6.511       5.433
                  3      N                  102.000     102.000     102.000     102.000     102.000     102.000
                  4      CORR     ebv4        1.000       0.401       0.711       0.276       0.726       0.287
                  5      CORR     ebv_r4      0.401       1.000       0.278       0.495       0.279       0.511
                  6      CORR     uss4        0.711       0.278       1.000       0.697       0.996       0.692
                  7      CORR     uss_r4      0.276       0.495       0.697       1.000       0.686       0.996
                  8      CORR     tss4        0.726       0.279       0.996       0.686       1.000       0.684
                  9      CORR     tss_r4      0.287       0.511       0.692       0.996       0.684       1.000
```

BV5 is combined youngstock survival index

```
                                     sires with minimum 50 offspring, 5 table  18
 Obs   BYR  _TYPE_  _FREQ_   ebv5  ebv_r5   uss5  uss_r5   tss5  tss_r5  sebv5  sebv_r5  suss5  suss_r5  stss5  stss_r5
   1  2009     1      223    97.9    98.0   97.8    97.9   97.8    98.0   10.1     10.1    9.8      9.8    9.7      9.7
   2  2010     1      193    95.8    96.0   95.7    95.9   95.8    96.0   11.2     11.3   11.2     11.2   11.0     11.1
   3  2011     1      154    97.8    98.1   97.6    97.9   97.7    97.9   11.5     11.7   11.2     11.3   11.0     11.1
   4  2012     1      171   101.0   101.4  100.9   101.3  100.8   101.3   10.4     10.4   10.3     10.3   10.3     10.2
   5  2013     1      151   100.7   100.8  101.1   101.1  100.9   101.0   11.4     11.1   11.4     11.0   11.2     11.0
   6  2014     1      114   101.5   100.8  101.7   101.0  101.6   100.8   11.7     11.9   11.6     11.9   11.6     11.8
   7  2015     1       83   101.2   101.5  101.8   102.0  101.7   101.9   10.0     10.0    9.9      9.8    9.8      9.7
   8  2016     1       66   105.9   104.1  106.5   106.2  106.3   105.7    9.0      6.7    9.0      7.5    9.0      7.4
   9  2017     1       66   100.6   100.1  101.8   102.8  101.7   102.4   10.8      8.2   10.5      8.8   10.5      8.7
  10  2018     1       78   104.4   102.7  105.8   105.9  105.6   105.4   12.1      7.0   11.4      7.3   11.3      7.1
  11  2019     1       56   107.6   101.9  109.1   105.5  108.8   105.0    8.8      5.5    8.1      6.9    8.0      6.8
  12  2020     1       58   107.2   103.4  109.2   107.2  109.0   106.7    8.7      4.4    8.3      7.0    8.2      6.8
  13  2021     1       40   106.5   102.4  108.6   106.8  108.3   106.3   10.4      4.3   10.0      6.1   10.0      6.0
```

```
                         sires with minimum 50 offspring, 5 table  19
              Obs    _TYPE_    _NAME_        ebv5      ebv_r5        uss5      uss_r5        tss5      tss_r5
               1     MEAN                  100.57       99.96      100.94      100.81      100.87      100.66
               2     STD                    11.21       10.22       11.20       10.56       11.07       10.39
               3     N                    1454.00     1454.00     1454.00     1454.00     1454.00     1454.00
               4     CORR      ebv5          1.00        0.86        0.98        0.87        0.98        0.87
               5     CORR      ebv_r5        0.86        1.00        0.85        0.96        0.85        0.96
               6     CORR      uss5          0.98        0.85        1.00        0.90        1.00        0.90
               7     CORR      uss_r5        0.87        0.96        0.90        1.00        0.90        1.00
               8     CORR      tss5          0.98        0.85        1.00        0.90        1.00        0.90
               9     CORR      tss_r5        0.87        0.96        0.90        1.00        0.90        1.00
```

```
                                      sires without any offspring, 5   table  20
 Obs   BYR  _TYPE_  _FREQ_   ebv5  ebv_r5   uss5  uss_r5   tss5  tss_r5  sebv5  sebv_r5  suss5  suss_r5  stss5  stss_r5
  1   2019     1       8    102.6   105.8  104.5   106.1  104.5   105.8   7.1      2.0     5.8      4.3     5.8      4.0
  2   2020     1       8    107.4   100.9  109.4   104.3  109.0   103.6   2.4      4.7     5.8      7.4     5.6      7.3
  4   2022     1      19    103.7   101.5  106.3   105.3  105.9   104.8   7.3      3.2     9.0      8.8     8.7      8.5
  5   2023     1      42    103.6   101.1  107.2   106.1  106.8   105.8   6.7      3.3     6.7      5.8     6.6      5.5
  6   2024     1      23    104.5   101.0  107.3   106.4  106.9   105.6   8.0      2.5     7.0      4.7     6.9      4.6
```

```
                          sires without any offspring, 5   table  21
              Obs    _TYPE_    _NAME_        ebv5      ebv_r5        uss5      uss_r5        tss5      tss_r5
               1     MEAN                 103.980     101.471     106.912     105.804     106.588     105.314
               2     STD                    6.937       3.379       7.173       6.331       7.063       6.097
               3     N                    102.000     102.000     102.000     102.000     102.000     102.000
               4     CORR      ebv5         1.000       0.278       0.738       0.171       0.750       0.189
               5     CORR      ebv_r5       0.278       1.000       0.233       0.503       0.231       0.505
               6     CORR      uss5         0.738       0.233       1.000       0.606       0.997       0.617
               7     CORR      uss_r5       0.171       0.503       0.606       1.000       0.598       0.996
               8     CORR      tss5         0.750       0.231       0.997       0.598       1.000       0.611
               9     CORR      tss_r5       0.189       0.505       0.617       0.996       0.611       1.000
```

Legarra Reverter regression

```
HOL Legarra Reverter regression  table  22
Obs     t    name     no      b1      rsq
  1     1    ebv     159    0.72     0.28
  2     1    tss     159    0.77     0.39
  3     1    uss     159    0.76     0.38
  4     2    ebv     159    0.47     0.12
  5     2    tss     159    0.60     0.25
  6     2    uss     159    0.59     0.24
  7     3    ebv     155    0.74     0.30
  8     3    tss     155    0.78     0.40
  9     3    uss     155    0.76     0.39
 10     4    ebv     155    0.56     0.16
 11     4    tss     155    0.73     0.34
 12     4    uss     155    0.73     0.35
 13     5    ebv     162    0.54     0.16
 14     5    tss     162    0.65     0.29
 15     5    uss     162    0.65     0.29
```

Studies based on SNP solutions

SNP solutions were divided in groups according to the change in SNP frequencies from birth year 2009 to 2024. This was done both for the full and reduced run. Results are standardised, so SNPs the smallest change (change in SNP frequence less than 7 %) are 1, and other differences are put in relation to this group. In general, the mean value of the SNPs is bigger, when the difference in frequency is bigger. Differences in SD are not so big.

```
                            Mean solution full run depending of change in SNP fequence     09:14 Sunday, April 27, 202

 Obs    dif_r    _FREQ_     esnpbv1     esnpbv2     esnpbv3     esnpbv4    essnpbv1    essnpbv2    essnpbv3    essnpbv4

   1       0     26074        1.00        1.00        1.00        1.00        1.00        1.00        1.00        1.00
   2      10      7197       -6.06      -27.89       -8.45      -16.96        1.16        1.16        1.16        1.17
   3      15      4697        6.81       12.82       13.04       -1.24        1.18        1.17        1.18        1.18
   4      20      3100       12.96       19.84       19.24        3.76        1.18        1.20        1.18        1.21
   5      25      2023      -10.65       -4.51      -21.45       15.87        1.18        1.18        1.18        1.18
   6      30      1275      -29.44      -45.80      -45.71      -10.44        1.25        1.24        1.25        1.23
   7      35       709      -25.72        6.07      -34.51        7.81        1.14        1.13        1.14        1.15
   8      40       432      -54.09      -51.80      -91.70        7.24        1.18        1.11        1.17        1.12
   9      45       216       13.00      108.96       24.82       52.00        1.10        1.11        1.11        1.11
  10      50       139      -33.98     -108.86      -54.95      -26.98        1.29        1.16        1.28        1.15
  11      55        95       -3.01       91.29       -5.24       51.36        1.11        1.07        1.09        1.12
  12      60        83      -63.88       20.97      -97.96       41.17        1.24        1.21        1.26        1.17
  13      65        62       87.30      406.68      130.84      191.98        1.11        1.18        1.14        1.15
  14      70        48      -69.61     -178.94     -120.92      -76.17        0.87        1.02        0.83        1.15
  15      75        47       45.65        6.64       51.52       -7.51        0.98        0.95        1.02        0.89
  16      80        33       11.40      398.32       13.48      184.76        1.20        0.98        1.20        0.88
  17      85        40      -97.37     -383.31     -162.48     -140.79        0.74        0.78        0.76        0.71
  18      90        60      -53.86      113.00      -70.33       70.08        0.71        0.65        0.70        0.67
  19      95         5     -445.92    -1009.54     -649.01     -469.28        2.00        1.80        1.97        1.64
  20     100         7    -1896.77    -5468.85    -2911.76    -2364.11        1.85        1.77        1.81        1.78
```

Same is done for the reduced run. Differences in mean were not so big between the groups.

```
                         Mean solution reduced run depending of change in SNP frequence   09:14 Sunday, April 27,

 Obs    dif_r    _FREQ_    esnpbv1    esnpbv2    esnpbv3    esnpbv4    essnpbv1    essnpbv2    essnpbv3    essnpbv4

   1       0     26074       1.00       1.00       1.00       1.00       1.00        1.00        1.00        1.00
   2      10      7197      -2.91      -4.33      -3.36      -4.32       1.17        1.15        1.17        1.15
   3      15      4697       1.87       1.17       2.40      -0.37       1.19        1.16        1.19        1.17
   4      20      3100       3.57       0.86       3.76      -0.10       1.19        1.20        1.20        1.20
   5      25      2023      -7.19      -2.24      -9.30       2.72       1.20        1.21        1.20        1.21
   6      30      1275      -2.98       1.65      -2.27       3.65       1.22        1.22        1.22        1.21
   7      35       709      -1.84       4.25      -1.39       4.43       1.18        1.14        1.18        1.15
   8      40       432     -12.27      -0.57     -14.95       4.10       1.13        1.12        1.12        1.14
   9      45       216      -0.74       9.09       0.24      10.78       1.09        1.05        1.09        1.05
  10      50       139     -23.59     -39.11     -27.07     -32.33       1.24        1.17        1.24        1.14
  11      55        95     -10.24       5.77     -10.64      10.51       1.13        1.12        1.11        1.18
  12      60        83       4.92      29.28       6.42      31.04       1.21        1.23        1.21        1.19
  13      65        62      26.12      32.61      28.51      29.96       1.10        1.06        1.10        1.09
  14      70        48     -20.61     -18.82     -22.91     -19.70       0.66        0.84        0.63        1.00
  15      75        47       5.41      14.45       2.41      16.87       0.99        1.02        1.00        1.00
  16      80        33     -19.48      45.06     -22.01      45.47       1.04        1.02        1.05        0.95
  17      85        40     -54.61     -60.14     -66.85     -36.69       0.79        0.83        0.81        0.75
  18      90        60     -11.98      12.02     -10.21      13.93       0.68        0.71        0.67        0.75
  19      95         5      -4.88     -30.28       5.36     -57.03       0.53        0.61        0.50        0.74
  20     100         7    -498.50    -673.20    -556.33    -617.69       1.64        1.73        1.53        1.84
```

Next part is only calculated for trait bv1 (Heifer period one)

As both full and reduced run were executed, the correlation between the SNP estimated were calculated. There is a tendency to bigger correlations when difference in SNP frequency (dif_r) increase.

Dif_r	N	Corr_full_reduc
0	26074	0.81
10	7197	0.81
15	4697	0.81
20	3100	0.81
25	2023	0.81
30	1275	0.81
35	709	0.81
40	432	0.81
45	216	0.78
50	139	0.81
55	95	0.82
60	83	0.88
65	62	0.89
70	48	0.80
75	47	0.88
80	33	0.93
85	40	0.85
90	60	0.92
95	5	0.76
100	7	0.95

DGV
Base on the SNP solution DGVs were calculated for all four runs.
dgv_full_all: Full run and all SNPs used to calculate DGVs
dgv_full_del: Full run and only SNPs with dif_r less than 30 are used.
dgv_red_all: Reduced run and all SNPs used to calculate DGVs
dgv_red_del: Reduced run and only SNPs with dir_r less than 30 are used.

Raw means of bulls used for standardization clearly show that SD is bigger, when all SNPs are used.

DGV's are standardized, so VG bulls (status 1) born I 2010 have nearly same mean and SD. Genetic trends are biggest when all SNPs are used, and it is biggest in the full run.

```
                                      The SAS System                         15:09 Thu

                                  The MEANS Procedure

  Variable           N            Mean         Std Dev         Minimum         Maximum
  ------------------------------------------------------------------------------------
  dgv_full_all     193      -0.0086365       0.0448447      -0.1987984       0.0727971
  dgv_full_del     193     0.000919224       0.0409719      -0.1715642       0.0753948
  dgv_red_all      193       0.0012187       0.0449071      -0.1921987       0.0900564
  dgv_red_del      193       0.0061828       0.0411066      -0.1684924       0.0842230
  ------------------------------------------------------------------------------------
```

```
                                                        The SAS System                         15:09 Thursday, April 24, 202

                                     sdgv_       sdgv_      sdgv_      sdgv_      ssdgv_      ssdgv_      ssdgv_     ssdgv_
Obs    year    _TYPE_    _FREQ_    full_all    full_del    red_all    red_del    full_all    full_del    red_all    red_del
```

```
 1    2010     0       249     99.670     99.666    99.672    99.667     9.8052     9.8372    9.7904    9.8176
 2    2011     0       192    102.250    101.832   102.177   101.914     9.0986     9.0855    8.8191    8.7647
 3    2012     0       212    104.854    104.303   104.302   103.962     9.7257     9.8895    9.6055    9.7259
 4    2013     0       173    104.383    103.812   103.501   103.137     9.8427     9.8085    9.5859    9.5551
 5    2014     0       134    107.344    106.262   105.624   104.902    10.7505    10.6417   10.4409   10.4092
 6    2015     0       104    104.391    103.416   102.595   101.861     9.9670     9.8713    9.4060    9.2885
 7    2016     0        86    107.378    106.318   105.543   104.697     9.3092     9.3208    8.3117    8.2309
 8    2017     0        82    106.760    105.320   104.889   103.826     8.1384     8.1966    7.3389    7.4287
 9    2018     0       109    109.019    107.628   106.514   105.481     8.6564     8.8117    7.5200    7.5231
10    2019     0        84    110.695    109.066   107.021   105.762     8.2424     8.3228    5.7477    5.7333
11    2020     0        88    111.062    109.533   107.519   106.284     8.7828     8.8215    7.2462    7.3104
12    2021     0        61    112.200    110.616   108.339   107.082    10.3076    10.5089    6.8288    6.7851
13    2022     0        72    109.659    107.715   107.054   105.686     9.2668     9.4536    7.7999    7.8153
14    2023     0        51    111.499    109.849   107.657   106.438     8.1280     8.2352    6.6333    6.5622
15    2024     0        25    111.107    108.922   108.113   106.435     5.7743     5.9798    5.5195    5.5516
```

Legara Reverter tests were done both when all SNPs were used and when only SNPs with dir_r less than 30 were used. Results are similar. Correlation for bulls used in the test was 0.995.

Conclusion of the investigations of changes in SNP frequence on DGVs:

- Bigger SD
- Steeper genetic tend
- Little effect on Legara Reverter test
- High correlation of DGVs in the two runs

```
                             Analysis of Variance

                                    Sum of           Mean
Source                    DF       Squares         Square    F Value    Pr > F

Model                      1    6397.82188     6397.82188     168.64    <.0001
Error                    157    5956.12260       37.93709
Corrected Total          158         12354


             Root MSE              6.15931    R-Square     0.5179
             Dependent Mean      107.81126    Adj R-Sq     0.5148
             Coeff Var             5.71305


                             Parameter Estimates

                              Parameter       Standard
   Variable         DF         Estimate          Error    t Value    Pr > |t|

   Intercept         1         21.44740        6.66832       3.22      0.0016
   sdgv_red_all      1          0.81729        0.06294      12.99      <.0001
                                   The SAS System                          15:09 T

                             Analysis of Variance

                                    Sum of           Mean
Source                    DF       Squares         Square    F Value    Pr > F

Model                      1    6397.22001     6397.22001     165.24    <.0001
Error                    157    6078.27539       38.71513
Corrected Total          158         12475


             Root MSE              6.22215    R-Square     0.5128
             Dependent Mean      106.54123    Adj R-Sq     0.5097
             Coeff Var             5.84013


                             Parameter Estimates

                              Parameter       Standard
   Variable         DF         Estimate          Error    t Value    Pr > |t|

   Intercept         1         20.53312        6.70906       3.06      0.0026
   sdgv_red_del      1          0.82148        0.06391      12.85      <.0001
```