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Estimation of genetic trend for the backfat depth of pigs of Large White breed in two Ukrainian pedigree farm

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ABSTRACT

The BLUP method is presently the most widely accepted method for predicting the genetic merit of pigs. However Ukraine is still among the countries where this selection method is awaiting for introduction. Therefore, our aim was to demonstrate the effectiveness of BLUP and REML methods on two selected pedigree farm data near Poltava. Analyses were carried out altogether on 1153 records (167 sires, 549 dams). Backfat measurements were recorded by Piglog 105 instrument over the6/7 thoracic vertebra at the age of 6–7 months between 1997 and 2007. Due to the very small data size, the genetic parameters of the backfat depth were estimated for the Hungarian Large White dataset. Then with the help of these parameters, breeding values were estimated for the population of the present study using the PEST software applying single trait animal model. Least square means were highly stable for the examined period. Although the effect of year was significant (P<0.01) the differences between the various years proved to be different only between 1994 and 1998 and between 1994 and 1999. Moreover the difference between the largest and smallest least square mean was less than 1 mm. Although the differences in the BLUE estimates were exceeding that of the GLM procedure (Figure 1) still it can be stated that the effects of the year-birth is relatively small, especially during the last 5 years. When the mean breeding values were regressed on the successive years the estimated annual genetic trend was 0.002 mm but it was not significant (P=0.15). This result is unfavourable and suggests that the selection method used in the farms tested is inefficient in respect of backfat thickness.
(Keywords: pig, BLUP, backfat)

INTRODUCTION

The BLUP method (*Henderson,* 1975) is presently the most widely accepted method for predicting the genetic merit mainly due to its favourable mathematical properties (*Kennedy et al.,* 1988). The application of this procedure can be considered as a routine method and its firs use in pig breeding was documented 25 years ago (*Hudson and Kennedy,* 1985). Since the most of the European countries officially introduced the method and the selection is based on BLUP breeding values (of various traits). The results of the BLUP selection were demonstrated by several authors (*Kovac and Groeneveld,* 1990; *Chen et al.,* 2002, 2003; *Wolf et al.,* 2005; *Nagy et al.,* 2008). However there are still some countries which still not implement BLUP selection and use the conventional Hazel indices. The reasons may be various but among these the most important might be the uninterested breeders and/or lack of the necessary infrastructure (data collection systems etc). Ukraine is among the countries which still awaiting the official introduction of the BLUP procedure. Yet there is a clear intention towards that direction from the side of the Pig Breeding Institute, Poltava, Ukraine. The objective of the present study was to collect data from the nearby pig farms and analyze the collected data (for the first time) using BLUP and REML methods.

MATERIALS AND METHODS

The genetic analysis was carried out using the data of 1153 female Large White pigs collected by the Pig Breeding Institute, Poltava between 1993–2007. The animals were originating from two herds (91, 1062), from 167 sires and 549 dams. During the measurements the backfat depth values were recorded using Piglog 105 device over 6/7 thoracic vertebra at the age of 6–7 months. The animals were kept in small groups up to 25 pigs on an *ad libitum* feeding regime. The basic statistics of the backfat depth is given in *Table 1*. Due to the unbalanced data structure across the subsequent years the least square means were calculated for the successive years using PROC GLM (*SAS*, 2004) taking into account the effects of year and month of birth and herds of origin.

Table 1

Number of records, minimum, maximum values and standard deviation of the backfat depth (mm) measurements

Year	N	Minimum	Maximum	Std[1]
1993	92	21	30	1.11
1994	97	21	30	1.18
1995	51	26	30	1.11
1996	21	27	29	0.75
1997	48	27	30	0.89
1998	129	26	30	0.75
1999	85	27	33	1.11
2000	63	27	30	0.82
2001	126	27	30	0.59
2002	50	27	29	0.47
2003	93	27	29	0.42
2004	35	27	28	0.41
2005	171	27	29	0.46
2006	70	27	28	0.12
2007	22	28	28	0.00
1993-2007	1153	21	33	0.82

[1] Standard deviation

Due to the very small data size, the genetic parameters of the backfat depth was estimated for the Hungarian Large White dataset described by *Csató et al.* (2002) using VCE5 (*Kovac and Groeneveld,* 2003). Then with the help of these parameters, breeding values were estimated for the population of the present study using the PEST (*Groeneveld,* 1990) software applying single trait animal model:

$$y = Xb + Za + e \quad (1)$$

Where:
y= vector of observations,
b= vector of fixed effects,
a= vector of random animal effects, e vector of random residual effects,
X and Z are incidence matrices relating records to fixed and random animal effects, respectively. Expected values of a and e were E(a)=E(e)=0. The variance-covariance structure assumed to be $V(a)= \sigma^2_a$, $V(e)=I\ \sigma^2_e$, and cov(a,e)=cov(e,a)=0, where A is the numerator relationship matrix. Also $cov(y,a)=ZAI\sigma^2_a$.

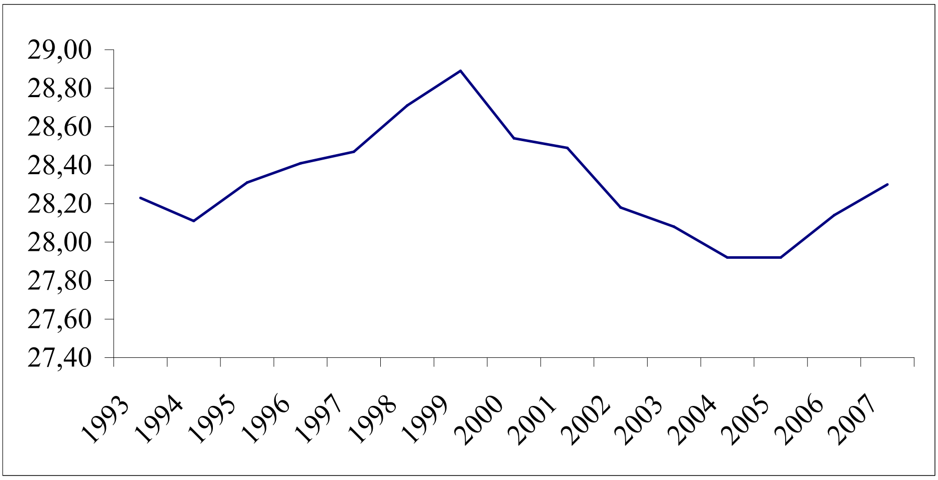
In the present study the year-month (of birth) and herd of origin were considered as fixed effects, while the additive genetic effects were treated as random effects.

RESULTS AND DISCUSSION

The results of the GLM procedure is depicted in *Figure 1*.

Figure 1

Least square means of the backfat measurements in the examined period



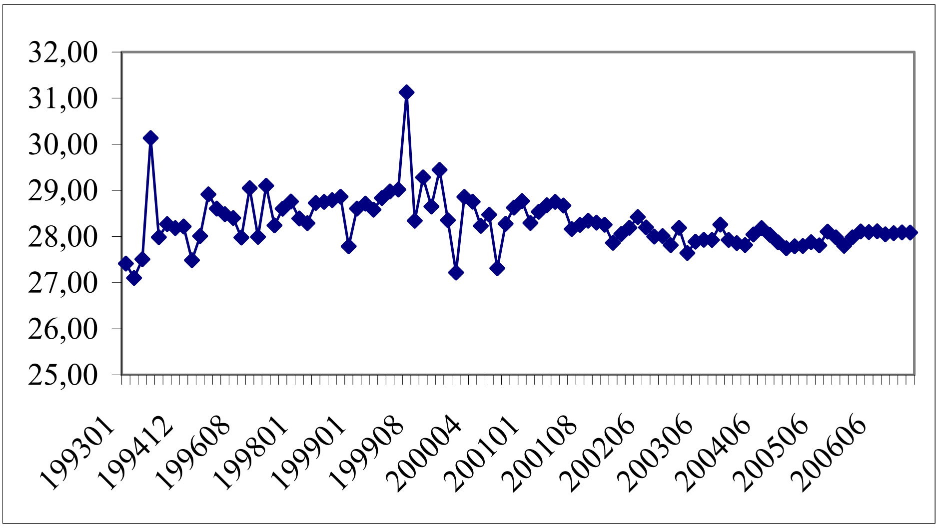
It can be seen that the least square means were highly stable for the examined period. Although the effect of year was significant (P<0.01) the differences between the various years proved to be different only between 1994 and 1998 and between 1994 and 1999. Moreover the difference between the largest and smallest least square mean was less than 1 mm. These values were similar to that of *Csató et al.* (2002) for backfat measurements recorded on the shoulder for Hungarian Large White (26.24 mm) and Hungarian Landrace (25.85 mm) pigs.

As reported by *Csató et al.* (2002) the heritability of the Hungarian Large White pigs was 0.35 for the backfat depth measured at the shoulder. Compared to the literature the value reported by *Csató et al.* (2002) was lower than that of *Clutter and Brascamp* (1998) reviewing 16 references. The average heritability for average backfat depth was 0.49 (the estimates ranged between 0.12–0.74) for these 16 studies which is moderately high. It has to be noted that in Hungary other authors also found low heritability estimates for average backfat depth (*Groeneveld et al.,* 1996; *Tran et al.,* 1993). The reason for this difference between the Hungarian and international estimates might be that as suggested by *Groeneveld et al.* (1996) there might be some problems recording this trait. It has to be kept in mind also that generally the field test traits are much less precise than that of the station test traits. This was demonstrated by *Sellier* (1998) who found that the heritability of backfat was 30% higher when it was estimated in the course of a station test rather than in a field test.

The BLUE results for the Ukrainian population showed that there was only a small difference between the two groups of origin (1.19 mm) thus it can be presumed that the environmental differences were small between the groups. The BLUEs of the year-month effects are shown in the *2 Figure*.

Figure 2

BLUE estimates of the backfat measurements in the examined period



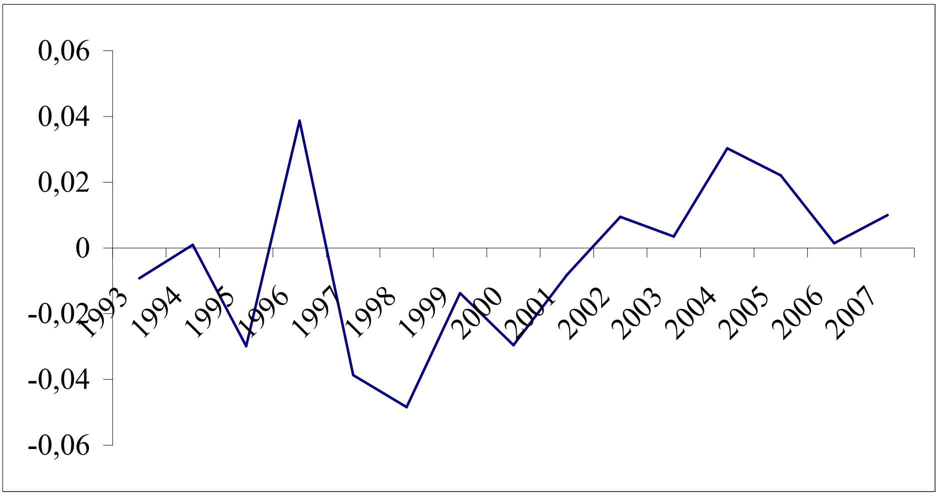
Although the differences in the BLUE estimates were exceeding that of the GLM procedure (*Figure 1*) still it can be stated that the effects of the year-birth is relatively small, especially during the last 5 years. The result suggests that probably no major changes in the technology were conducted at least during the last couple of years. The mean of the estimated breeding values (backfat depth) born in the same years are depicted in *Figure 3*.

When the mean breeding values were regressed on the successive years the estimated annual genetic trend was 0.002 mm but it was not significant (P=0.15). This result is unfavourable and suggests that the selection method presently used in the farms tested for selection is inefficient in respect of backfat thickness improvement. On the contrary *Hudson and Kennedy* (1985) found an annual genetic trend of -0.12 mm for Yorkshire and -0.18 mm for Landrace. *Groeneveld et al.* (1998) and *Wolf et al.* (1998)

found similar values justifying that body composition can efficiently be improved by BLUP selection for backfat depth.

Figure 3

Mean of the estimated breeding values (batckfat depth) born in the same years



CONCLUSIONS

The results of the present study justify that although the data was not yet quite adequate for genetic parameter estimation using the parameters of a large dataset the breeding values still could be estimated. As expected no genetic trend was found because the selection was not based on the BLUP procedure. Further effort should be made to correct data across the herds near the Pig Breeding Institute of Poltava to introduce the BLUP procedure at least locally. Application of the BLUP procedure will have a positive effect on the selected traits. As a consequence other pig herds will hopefully also join those pig herds that are already selecting the breeding animals on BLUP breeding values thus the selection response will accelerate in the future in Ukraine.

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REFERENCES

Chen, P., Baas, T.J., Mabry,. J.W., Dekkers J.C.M., Koehler, K.J. (2002). Genetic parameters and trends for lean growth rate and its components in U.S. Yorkshire, Duroc, Hampshire, and Landrace pigs. J. Anim. Sci., 80. 2062-2070.

Chen, P., Baas, T.J., Mabry, J.W., Koehler K.J., Dekkers J.C.M. (2003). Genetic parameters and trends for litter traits in U.S. Yorkshire, Duroc, Hampshire, and Landrace pigs. J. Anim. Sci., 81. 46-53.

Clutter, A.C., Brascamp, E.W. (1998). Performance traits. In: The genetics of the pig. (Ed.): Rothschild, M.F., Ruvinsky, A. CAB International, Wallingford, Oxon, U.K. 634.

Groeneveld, E. (1990). PEST Users' Manual. Institute of Animal Husbandry and Animal Behaviour Federal Research Centre, Neustadt, 1-80.

Groeneveld, E., Csató, L., Farkas, J., Radnóczi, L. (1996). Joint genetic evaluation of field and station test in the Hungarian Large White and Landrace populations. Arch. Tierz., 39. 513-531.

Henderson, C.R. (1975). Best linear unbiased estimation and prediction under selection model. Biometrics, 31. 423-447.

Hudson, G.F.S., Kennedy, B.W. (1985). Genetic Trend of Growth Rate and Backfat Thickness of Swine in Ontario. J. Anim Sci., 61. 92-97.

Kovac, M., Groeneveld, E. (2003). VCE-5 Users' Guide and and Reference Manual. Version 5.1. University of Ljubljana, Biotechnical Faculty, Department of Animal Science, Domzale, Slovenia; Institute of Animal Science, Federal Agricultural Research Centre, Mariensee, Neustadt, Germany, 1-68

Nagy, I., Csató, L., Farkas, J., Gyovai, P., Radnóczi, L., Komlósi, I. (2008). Genetic parameters of direct and ratio traits from field and station tests of pigs. Arch. Tierz., 51. 166-172.

Sas Institute inc. (2004). SAS/STAT® 9.1 User's Guide. Cary, NC, USA

Sellier, P. (1998). Genetics of Meat and Carcass traits. In: The genetics of the pig. (Ed.): Rothschild, M.F., Ruvinsky, A. CAB International, Wallingford, Oxon, U.K. 634.

Tran, A.T. (1992). Évszaki hatások a sertések üzemi sajátteljesítmény-vizsgálatában. Állattenyésztés és Takarmányozás. 41. 29-39.

Wolf, J., Wolfova, M Groeneveld, E., Jelinkova, V. (1998). Estimation of genetic and environmental trends for production traits in Czech Landrace and and Large White Pigs. Czech J. Anim. Sci., 43. 545-550.

Wolf, J., Zakova, E. Groeneveld, E. (2005). Genetic parameters for a joint genetic evaluation of production and reproduction traits in pigs. Czech J. Anim. Sci., 50. 3. 96-103.

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