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Analysis of fixed effects for the performance test traits of the Hungarian pigs

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ABSTRACT

Authors jointly analyzed station field and slaughterhouse datasets (collected and owned by the National Institute for Agricultural Quality Control between 2004.01.01 and 2009.04.30) of the Hungarian Large White, Hungarian Landrace pigs and their cross. Number of records were 5 396, 193 813) and 13 165 for station, field and slaughterhouse tests, respectively. Using multi-trait animal models the magnitude of the most important fixed effects (sex, genotype, herd, station, slaughterhouse and operator) were estimated for proportion of the valuable cuts (station test), days of test (station test), age at the end of the field test and lean meat percentage (field-slaughterhouse test), respectively. Most fixed effects were substantial except for genotype and sex which were negligible and small respectively.
(Kulcsszavak: fixed effects, BLUP, pig, performance tests)

INTRODUCTION

The primary objective of the performance tests to provide reliable data which can be evaluated in order to obtain correct ranking among breeding animals (breeding animal candidates). Although the performance tests are planned to exclude the various effects as much as possible the appearance of these effects is inevitable. The objective of the present analysis was therefore to evaluate the magnitude of the environmental and other effects for examined traits (proportion of the valuable cuts, days of test, age and lean meat percentage) of the Hungarian Large White, Hungarian Landrace pigs and their cross in the course of their station, field and slaughterhouse tests.

MATERIALS AND METHODS

The analysis was carried out using the joint dataset of the Hungarian Large White, Hungarian Landrace pigs and their cross in the course of their station (n=5 396), field (n=193 813) and slaughterhouse (13 165) tests conducted between 2004.01.01 and 2009.04.30.

Station test (progeny test)

For the purpose of the station test a castrate and a female from the same litter are sent to the station between the ages of 65–77 days (random selection is assured). Body weight (BW) of the animals at the age of 65 days should be at least 17 kg but not greater than 32 kg. After some preliminary adaptation period the test begins at the age of 80 days (body weight at this age is at least 23 kg) and ends with reaching the final weight of 105 kg.

Animals are fed *ad libitum* and penned individually. Days of test (DOT), proportion of valuable cuts (neck, shoulder, loin and ham) (VC%) were recorded. Moreover body weight is measured at the beginning and at the end of the test with an accuracy of 1 kg.

Field test (own performance test)
In the field test ultrasonic (SONOMARK 100) fat depth measurements were taken from boars and gilts between 80 and 110 kg between the 3rd and 4th lumbar vertebrae (8 cm laterally from the spinal cord), between the 3rd and 4th ribs (6cm laterally from the spinal cord) and the loin muscle area between the 3rd and 4th ribs (6 cm laterally from the spinal cord). Using these measurements lean meat percentage (LMP) can be calculated. Age (AGE) and body weight (with an accuracy of 1 kg) of the animals were recorded at the same time. Gilts are kept in groups up to 25 pigs while boars are raised in smaller groups up to 15 on an *ad libitum* feeding regime.

Slaughterhouse test (progeny test)
This performance test although was theoretically available for a long time became more frequent only during the last years due to the increasing costs of the station tests. In order to evaluate the sows and boars 2 and 50 progeny were sent to the abattoir, respectively. The hot carcass weight has to be in the range of 50–120 kg but in our trial the range was much smaller (cca 80–110 kg). The lean meat percentage (LMP) is estimated from the same composite traits described at the field test. During the analysis the lean mean percentage obtained from the field and from the slaughterhouse tests were treated as identical traits.

The evaluated traits were: age at the end of the test (station test, field-slaughterhouse test), proportion of the valuable cuts (station test), and lean meat percentage (field-slaughterhouse test). Descriptive statistics of the evaluated traits are presented in *Table 1*.

Table 1

Descriptive statistics of the examined traits

Trait	Minimum	Maximum	Mean	Std.
BW (kg) (Live weight at the end of the station test)	103	110	105.2	1.85
BW (kg) (Live weight at the end of the field test)	80	149	98.1	9.99
AGE (day) (Age at the end of the station test)	123	200	157.9	12.24
AGE (day) (Age at the end of the field test)	120	300	179.8	22.8
VC% (%) (Proportion of the valuable cuts (station test))	45,0	59,6	50.7	2.66
LMP (%) (lean meat percentage (field-slaughterhouse test)	50	65	57.7	1.87

The datasets were evaluated with VCE5 (*Kovac and Groeneveld,* 2003) and PEST (*Groeneveld,* 1990) softwares applying multi-trait animal model. The structure of the model (following *Farkas,* 2008 and *Nagy et al.,* 2008) is given in *Table 2.*

Table 2

Structure of the multi-trait animal model

Trait	Type	Level	DOT (days of test, station test)	VC% (proportion of the valuable cuts, station test)	AGE (age at the end of the field test)	LMP (lean meat percentage, field-slaughterhouse test)
BW (kg) (Live weight at the end of the station test)	C	1	x	-	-	-
Genotype (Hungarian Large White, Hungarian Landrace pigs and their cross)	F	3	x	x	x	x
Year-month (Year and month of the station test)	F	65	x	x	-	-
Sex (male, female, castrate)	F	3	x	x	x	x
Herd (Place of the field test)	F	79	x	x	x	x
Station (Place of the station test)	F	5	x	x	-	-
BW (kg) (Live weight at the end of the field test)	C	1	-	-	x	-
Year-month (year and month of the field test)	F	65	-	-	x	x
Operator (operator of the ultrasound device)	F	20	-	-	x	x
Abattoir	F	4	-	-	-	-/x
Litter (random litter effect)	R	83 305	x	x	x	x
Animal (additive genetic effect)	A	233 776	x	x	x	x

RESULTS AND DISCUSSION

Genetic parameter estimations were not the primarily objective of this study therefore the results are not provided. Magnitude of the sex effects are presented in *Figures 1–2.*

Male animals showed the most favourable performances for all traits. However the observed differences were relatively small. This result was in accordance with our previous study (*Nagy et al.*, 2001). The genotype effects were very close to zero therefore these effects were not depicted.

Figure 1

Magnitude of the sex effects for proportion of the valuable cuts (station test) and days of test (station test), respectively (males vs. females; castrated vs. females)

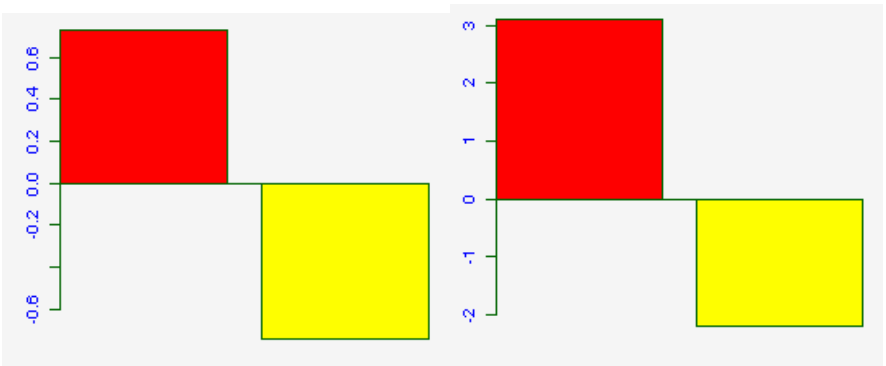
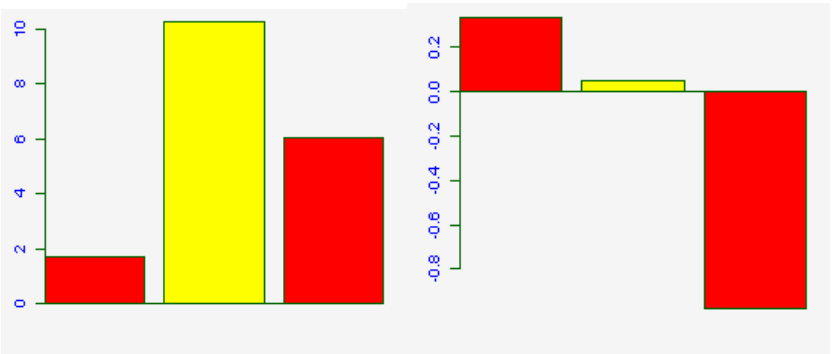


Figure 2

Magnitude of the sex effects for age at the end of the field test and lean meat percentage (field-slaughterhouse test), respectively (males vs. females vs. castrated)



The herd effects can be seen in *Figures 3–4*. Unlike the previous environmental factors the magnitudes of the herd effects were large for all traits but especially for the proportion of the valuable cuts and for age at the end of the field test. For these traits the magnitude of these effects reached the 25–40% of the phenotypic mean of the trait. This result also justified the relatively recently introduced BLUP procedure (*MGSZH*, 2009) and shows that with the conventional indices it could be impossible to evaluate the breeding candidate animals correctly but within herds.

Figure 3

Magnitude of the herd effects for proportion of the valuable cuts (station test) and days of test (station test), respectively

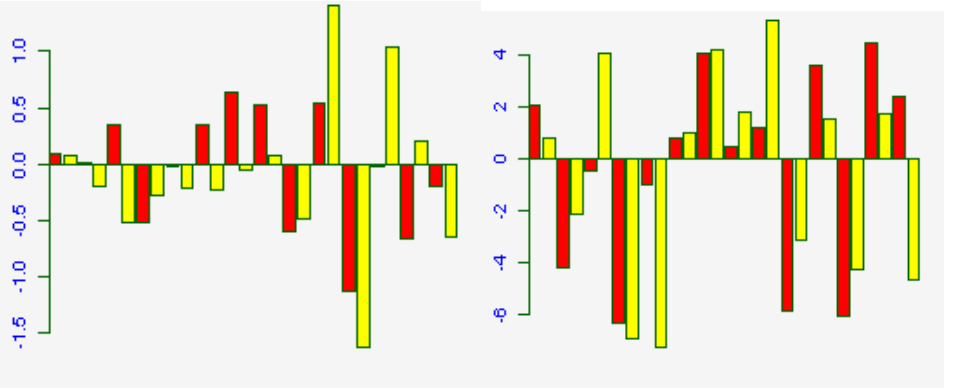
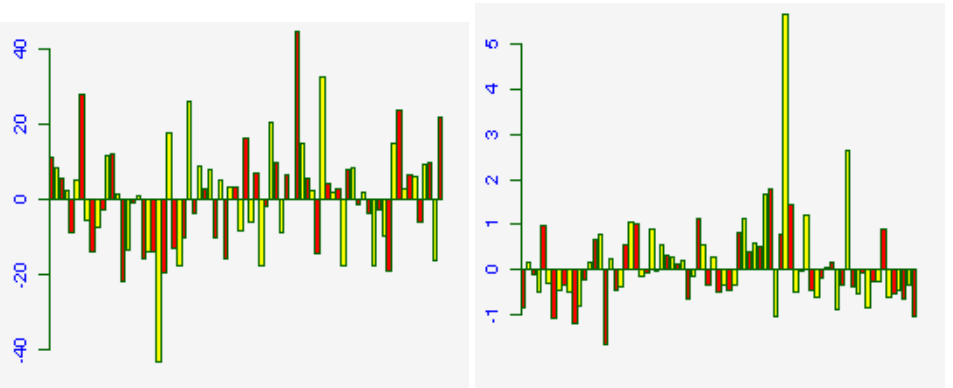


Figure 4

Magnitude of the herd effects for age at the end of the field test and lean meat percentage (field-slaughterhouse test), respectively



Station and slaughterhouse effects are shown in *Figures 5–6*. Due to the limited available space, the year-month effects are not depicted. For of the valuable cuts and days of test the magnitude of the year-month effects were cca the same as the station. For age and for lean meat percentage the observed year-month effects were relatively small and they were about the same in magnitude as the sex effects. Contrary to *Kovac and Groeneveld* (1990) in the present study no regular cyclic pattern was not apparent for the year-month effects. *Nagy et al.* (2001) reported that the highest lean meat percentage values were observed during autumn meanwhile summer was the most disadvantageous season of all. However *Nagy et al.* (2001) also noted that the differences were negligible (1.63%). *Tran et al.* (1992) reported similar results.

The station effects were slightly higher in magnitude to that of the herd effects. The differences between these two effects were however small. Generally the station test is

planned to exclude the station effect as much as possible using the same penning and feeding regime (*MGSZH*, 2009). From the results it can be seen that this effort is partly reworded in the relatively small effects for the proportion of valuable cuts. Very similar station effects were found for percentage of valuable cuts by *Pescovicova et al.* (1999) as in this study. Nevertheless, substantial differences could be observed for days on test. This latter result also justifies the official introduction of the BLUP system and shows that even the most reliable station test would lead conventional index scores not fully capable for correct ranking of the animals across stations.

Figure 5

Magnitude of the station effects for proportion of the valuable cuts (station test) and days of test (station test), respectively

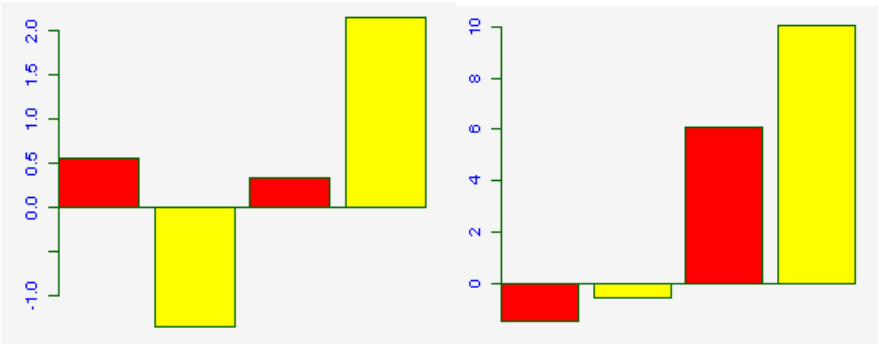
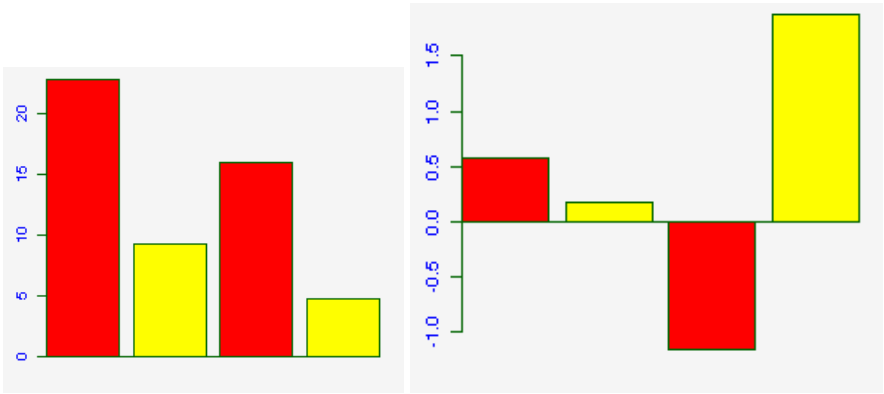


Figure 6

Magnitude of the slaughterhouse effects for age at the end of the field test and lean meat percentage (field-slaughterhouse test), respectively

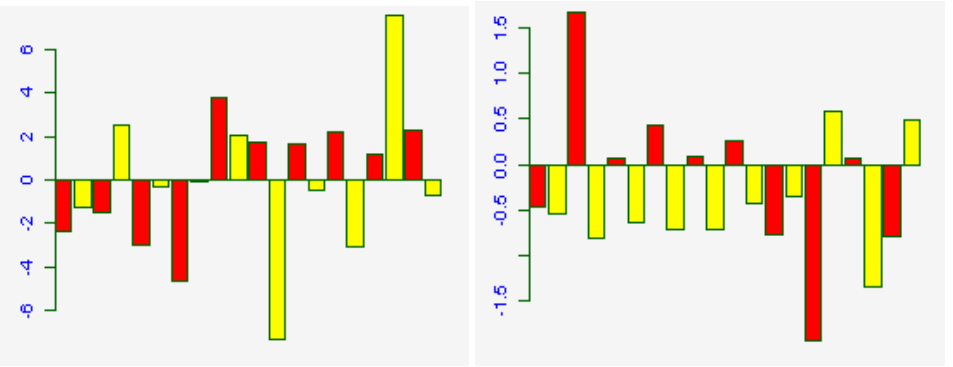


The slaughterhouse effects were similar in magnitude to that of the station tests. It has to be noted that although the ideal situation would be that the breeders could test their boars and sows at several abattoirs it is almost impossible due to market reasons. Non-partners

of certain can receive substantially lower price at another slaughterhouses thus evaluation of the slaughterhouses are probably suboptimal. The operator effects are provided in *Figure 7*.

Figure 7

Magnitude of the operator effects for age at the end of the field test and lean meat percentage (field-slaughterhouse test), respectively



Similarly to the abattoir effects the operators' evaluation would be optimal if several persons at the same time would evaluate the pigs within a herd and also if one operator would evaluate several herds. Unfortunately these criteria are not fully met. Nevertheless it is still very important to place the operators'code to the animal model because their personal care could probably be improved.

CONCLUSIONS

Based on the results it can be concluded that genotype and sex effects were negligible and small while all other effects were substantial for the evaluated traits. Thus the conventional indices could not rank breeding animals properly and the recent official introduction of the BLUP procedure can be justified.

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