

## EVALUATION OF AN INFLUENCE OF USED BOAR'S BREED AND INDIVIDUALITY ON BIRTH WEIGHT OF PIGLETS

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### Abstract

The aim of the study was to evaluate an influence of breed and individuality of used boar on birth weight of piglets. Piglets of dam breeds (Czech Large White x Czech Landrace) and sire breeds (Czech Large White – sire line, Duroc and hybrid Pietrain) were monitored in an experiment.

In all cases boars and gilts after sire breed boars they had higher birth weight than piglets after dam breed boars. Higher average birth weight of boars in comparison with gilts was determined in all studied breeds.

The highest average birth weight was determined in boars (1.90 kg) and gilts (1.67 kg) after hybrid boars of Pietrain breed, after that in offspring after boars of Duroc breed – boars 1.78 kg and gilts 1.57 kg. Offspring after boars of Czech Large White – sire line had the lowest average birth weight in sire breeds.

In dam breeds better results were reached by boars of Czech Landrace in average with average birth weight 1.44 kg in boars and 1.37 kg in gilts in comparison with offspring after boars of Czech Large White, where an average birth weight of boars 1.38 kg and gilts 1.31 kg was determined. Statistical conclusive difference on a level of importance ( $P \leq 0.001$ ) was found among birth weights of boars as well as gilts.

Higher average birth weights were found in piglets of sire breeds in comparison with dam breeds. The highest average birth weights were reached by piglets after hybridization of Duroc boars with Czech Large White – sire line sows (1.82 kg) and hybrid Pietrain (1.82 kg). The lowest average birth weight (1.24 kg) was reached by Czech Landrace piglets. Statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth weights of breeds Czech Landrace and hybrid Pietrain, Duroc, Czech Large White – sire line x Pietrain, Pietrain x Czech Large White – sire line.

**Key Words:** birth weight of piglets, boar, sow, reproduction

Quantity, birth weight and vitality of piglets in litter have an economical importance for breeder. Birth weight of piglet determines intensity of fattening. Basic precondition for production of high-quality meat it is balanced litter and piglets with average birth weight. Birth weight is important for survival of piglet from birth till weaning. Alonso –Spilsbury et al. (2007) mention in their study that low birth weight of piglets it is one of the causes of piglet's mortality from birth till weaning. They mention that the highest rate of mortality in pigs it is in interval from birth till weaning – from 10 to 20 % of live born piglets.

Weight under 1 kg is believed to be a critical. If the piglet with such a low weight will not die till weaning, low birth weight has an influence on the following development. Such a piglet reaches carcass weight later, fattening lasts longer and costs for stabling and feeding are higher. Piglet needs its limited reserves of energy after birth for thermoregulation and movement to find teat. Another energies and protective substances are gained from colostrum. Piglets with low birth weight quite often die because of starving – lack of energy does not allow intake of colostrum (Václavková, 2010). Piglets with weight less than 0.8 kg are considered as not

suitable for breeding. Magnabosco et al. (2015) confirmed in their study piglets with lower birth weight than 1.1 kg have higher mortality and because of lower colostrum intake they have lower growth ability in comparison with piglets with higher birth weight. An optimal birth weight of live born piglet should be between 1.3 – 1.6 kg. With growing number of piglets in litter their birth weight is decreasing which has influence on results of weaning and following part of their life till the end of fattening. Piglets from numerous litters show lower growth ability and lower carcass value. Roehe, R. (1999) et al. mention in their study with growing number of born piglets the birth weight is decreasing. But birth weight is not related only with the numerosness of the litter but with genotype too (Ritter et al., 1992, Leenhouwers et al., 1999), with order of litter and size of placenta (Biensen et al., 1999).

Birth weight of piglets is important for survival of piglets and postnatal growth. A lot of authors mention that only low percentage of piglets with low birth weight (less than 0.8 kg) will survive till weaning (Falkenberg et al., 1994, Quiniou et al., 2002). Piglets with low birth weight reach lower weaning weight they have lower growth ability and they use more food

from birth till slaughter (Gonyou et al., 1998, Wolter a Ellis, 2001). An influence of birth weight on their growth was studied by Beaulieu et al. (2010) and they found that piglets with lower birth weight are reaching lower live weight in weaning, 5 and 7 weeks after weaning and their fattening lasts longer. Václavková, Rozkot, Bělková (2014) studied an influence of birth weight of piglets on their growth and carcass traits. Authors divided piglets into 4 groups according to birth weight. Piglets with birth weight lower than 1000 g were in the first group, piglets with weight 1001 – 1200 g were in the second group, 1201 – 1500 g in the third and 1501 and more in the fourth group. In piglets with growing birth weight an average daily gain was growing in intervals – birth – weaning and weaning – slaughter. Because of high average daily gain pigs from the fourth group (birth weight 1501 and more g) reached slaughter weight for one month earlier than pigs from the second group (birth weight 1001 – 1200 g). High numerous litters cause low average birth weight and high mortality of piglets during breeding.

## Material and Methods

Genetic pig centrum where the experiment was running it is aimed on production of high quality genetic material of dam and sire pig breeds and boars for C position. Farm was built to suit all rules of European Union with respect to requirement of top-ranking gene pool maintaining. Process of breeding works in mode of national program of the Czech Republic under methodical guidance of Union of pig breeders of Bohemia and Moravia. All pedigree pigs are written in official pedigree book of Czech Republic. Farm cooperates with French national program of pig breeding. Breeding is involved into health program of Union of pig breeders so it is connected with strict biological protection – protection against entry of diseases to breeding. The main part of this it is entry to breeding through “hygienic loop”. Occurrence of serious productive diseases and health level is monitored and health condition of breeding is declared by relevant certificates.

Capacity of object it is 500 sows of dam and sire breeds. Capacity includes pregnant gilts. Productive potential is 12 000 piglets/year (30 kg). 3 500 gilts and 500 boars are produced after selection. BLUP animal model is used for selection. Dam breeds in a centrum are: Czech Large White (CLW) and Czech Landrace (CL). Sire breeds in a centrum are: Duroc (D), Czech Large White – sire line (CLW – sire line), hybrid Pietrain ( $\geq 75\%$  Pietrain) (H84). Planed number of bred sows it is 300 sows of CLW and 100 sows of CL. Plan in sire breeds it is 30 sows of D,

40 sows of CLW – sire line and 30 sows of H84. Wide breed base of pure breed animals enables to do strict selection and production of high quality gilts and boars. By hybridization of CLW and CL (both in dam and sire position) sows of F1 generation are produced. Breeding enables to produce pedigree boars for C position for production of carcass hybrids as CLW – sire line, CLW – sire line x D (line 34), CLW – sire line x PN (line 48), D x PN (line 38) and  $\geq 75\%$ PN (line H 84). Boars are used for natural breeding or for using in stations of insemination.

The main aim is production of breeding piglets. Not breeding piglets are relocated to fattening house in age of 3 months and weight of 30 kg. Piglets for breeding are at the same age and weight relocated to rearing house of pedigree material. Individual tests and measuring are done in rearing house of pedigree material. In animals intended for export ranks of screening for diseases and vaccinations necessary for transportation are done. Gilts and boars are suitable for sale and breeding in age of 6 months and weight of app. 100 kg.

An influence of breed and individuality of used boars on birth weight of piglets was evaluated in this experiment. Evaluation of reproductive traits in boars in pedigree breeding is done in boars of 5 breeds. Four of them are pure breed – Czech Large White, Czech Landrace, Duroc and Czech Large White – sire line and one hybrid breed Pietrain ( $\geq 75\%$ PN). Produced piglets are pure breed (in a frame of breed) or hybrids. In dam breeds they are hybrids (CLW x CL) and sire breeds CLW – sire line x D (line 34), CLW – sire line x PN (line 48), D x PN (line 38). In dam and sire breeds position of mother and father can be substituted in a frame of hybridization.

Studied piglets were born from October 2015 till February 2016. Birth weight was weighted in a range of 3 – 4 hours after farrowing. Hanging digital weighing machine with accuracy on 10 g was used for determination of birth weight of piglets.

Born piglets were divided into several groups according to used boar in a frame of dam (CLW and CL) and sire breeds (D, CLW – sire line, H 84). Birth weight of piglets was evaluated according to sex of piglet. Dam breed CLW and sire breed D were used to determine an influence of boar individuality on birth weight of piglets. Basic statistical characterizations were determined in studied file of birth weights of piglets: average, standard deviation, minimum, maximum of studied trait.

Data were evaluated by statistical program STATISTICA 10 and for test of differences among groups statistical method ANOVA, Tukey HSD test was used. Testing was done on a level of importance  $P \leq 0.05$ ,  $P \leq 0.01$  and  $P \leq 0.001$ .

## Results and Discussion

In Table 1 and Graph 1 there is an average weight of live born boars and gilts divided according to breeds of used boars for insemination. In Graph 1 there is evident difference in birth weights among sire and dam breeds of pigs in live born boars and gilts. In all cases boars and gilts after boars of sire breeds had higher birth weight than offspring after boars of dam breeds. In all studied breeds a higher average birth weight was determined in boars in comparison to gilts. Bocian et al. (2012) detected in their study higher birth weight in gilts (1.35 kg) in comparison to boars (1.25 kg). Detected difference in birth weight between sexes it was statistical conclusive ( $P \leq 0.05$ ).

The highest average birth weight was found in boars (1.90 kg) and gilts (1.67 kg) after hybrid boars of Pietrain breed (H 84), then in offspring after boars of Duroc breed (D) – boars reached birth weight 1.78 kg and gilts 1.57 kg. From sire breeds the lowest average birth weight was determined in offspring after boars of Czech Large White – sire line (CLW – sire line). In sire breed weight of born piglets can be influenced by breeding goal aimed on meat efficiency.

In dam breeds better results in average were reached after boars of Czech Landrace with average birth weight 1.44 kg in boars and 1.37 kg in gilts in comparison with offspring after Czech Large White with an average birth weight 1.38 kg in boars and 1.31 kg in gilts. According to Pražák (2007) sows of dam breeds should have numerous litters with an average weight of piglets in a range of 1.6 – 1.8 kg with good weight balance. High mortality is detected in piglets with low birth weight. Higher birth weight than 2.2 kg is not required too because of higher occurrence of dead born piglets.

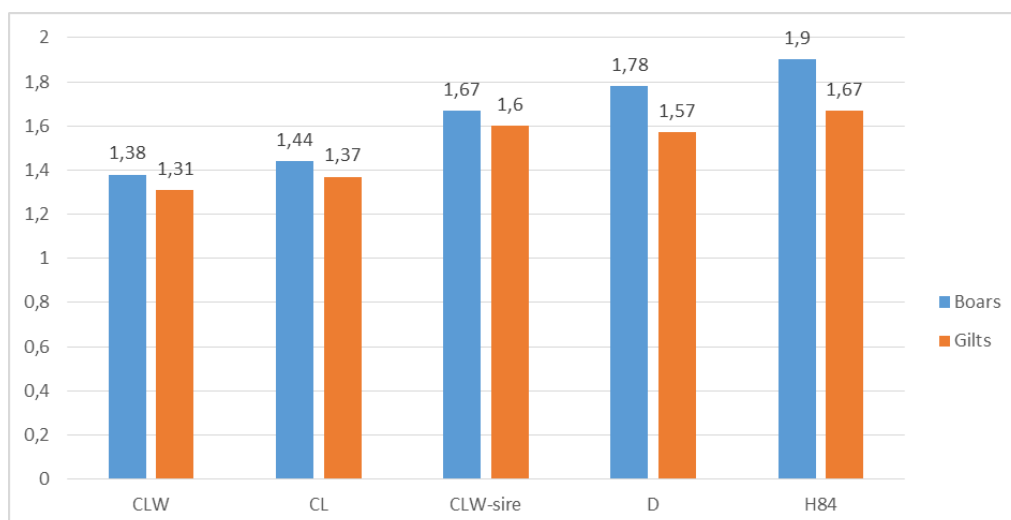
Statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth weights of boars and in gilts too as it is shown in Table 1. According to Magnabosco et al. (2015) because of higher number of piglets in a litter breeders prefer birth weight around 1 kg with a higher risk of mortality and lower growth ability. Gondret et al. (2006) compared growth in group of piglets with low birth weight (in average 1.05kg) and with high birth weight (in average 1.89kg). Piglets with low birth weight were older for 12 days in the end of fattening and percentage of lean meat was lower.

**Table 1. Average weight of live born piglets after boars of all studied breeds**

| State register of boar | Boars |                              | Gilts |                             |
|------------------------|-------|------------------------------|-------|-----------------------------|
|                        | n     | Average (kg)                 | n     | Average (kg)                |
| CLW                    | 199   | 1.38 <sup>a,b,c</sup> ± 0.28 | 166   | 1.31 <sup>d,e</sup> ± 0.26  |
| CL                     | 147   | 1.44 <sup>f,g,h</sup> ± 0.28 | 155   | 1.37 <sup>ch,i</sup> ± 0.30 |
| CLW – sire line        | 34    | 1.67 <sup>a,f</sup> ± 0.26   | 37    | 1.60 <sup>d,gh</sup> ± 0.29 |
| D                      | 83    | 1.78 <sup>b,g</sup> ± 0.29   | 70    | 1.57 ± 0.32                 |
| H 84                   | 21    | 1.90 <sup>c,h</sup> ± 0.20   | 22    | 1.67 <sup>e,i</sup> ± 0.32  |

a,b,c,d,e,f,g,h,gh,i  $P \leq 0.001$

**Graph 1. Average weight of live born piglets after boars of all studied breeds**



In Table 2 there is an average weight of live born piglets after boars of CLW. Mostly in all born piglets after boars of CLW breed (except one sample) boars had higher birth weight in comparison with gilts. The highest average birth weight (1.44 kg) in boars was determined in offspring after boar with state register FMB 46. The lowest birth weight in boars (1.18 kg) was determined in offspring after boar with state register DMD 22.

Values of an average birth weight in gilts are mostly the same in a range from 1.30 – 1.34 kg to gilts after boar with state register DMD 22 – gilts with the lowest determined birth weight 1.09 kg. The highest average birth weight in gilts (1.34 kg) was determined in gilts after boar with state register FMB 46. Determined

average values of birth weight of boars and gilts after boars of CLW breed are shown in Graph 2.

In Table 3 and Graph 3 there are shown average birth weights of boars and gilts after boars of Duroc breed.

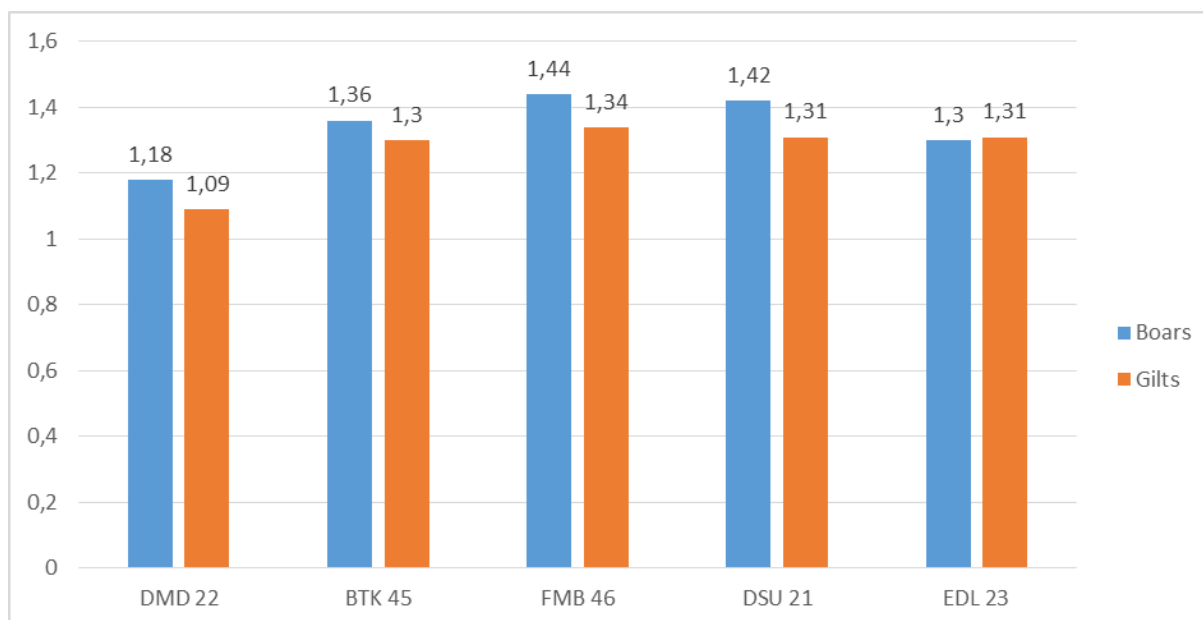
The highest average birth weight in boars (1.70 kg) was determined in offspring after boar with state register CBA 22. On the contrary the lowest average birth weight in boars (1.43 kg) was determined in offspring after boar AMG 45.

Identically as in boars the highest average birth weight in gilts (1.60 kg) was determined in offspring after boar CBA 22. The lowest average birth weight in gilts (1.50 kg) was determined in a group after boar EDG 21.

**Table 2. Average weight of live born piglets after boars of CLW breed**

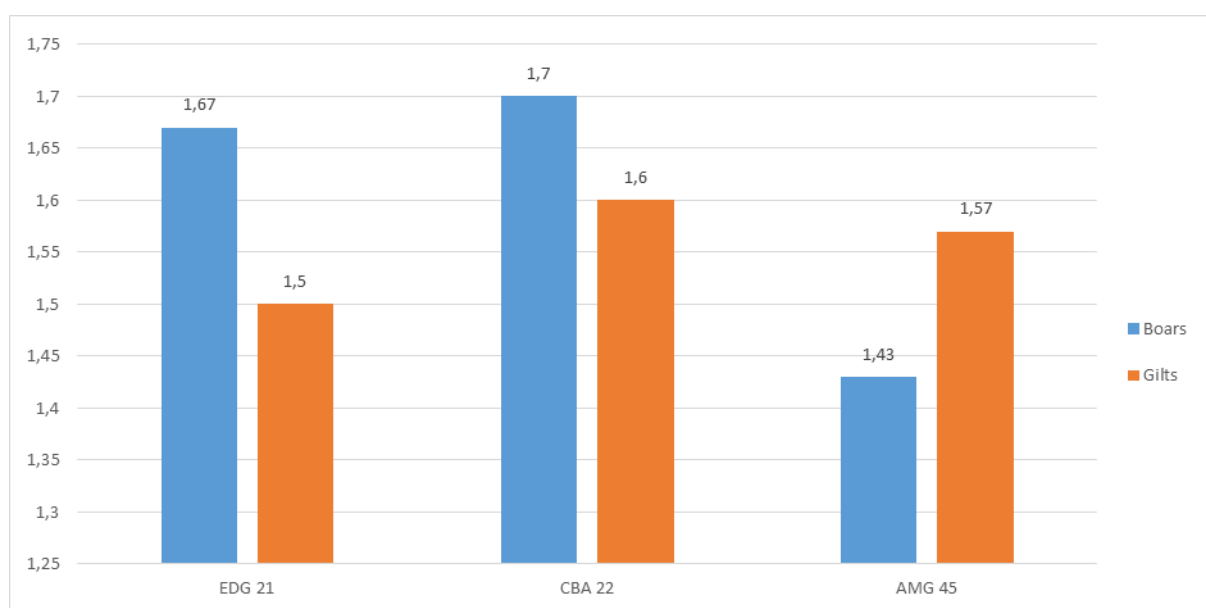
| State register of boar | Boars |              | Gilts |              |
|------------------------|-------|--------------|-------|--------------|
|                        | n     | Average (kg) | n     | Average (kg) |
| <b>DMD 22</b>          | 39    | 1.18 ± 0.26  | 26    | 1.09 ± 0.27  |
| <b>BTK 45</b>          | 75    | 1.36 ± 0.33  | 63    | 1.30 ± 0.39  |
| <b>FMB 46</b>          | 17    | 1.44 ± 0.40  | 7     | 1.34 ± 0.35  |
| <b>DSU 21</b>          | 22    | 1.42 ± 0.23  | 23    | 1.31 ± 0.29  |
| <b>EDL 23</b>          | 24    | 1.30 ± 0.17  | 25    | 1.31 ± 0.26  |

**Graph 2. Average weight of live born piglets after boars of CLW breed**



**Table 3. Average weight of live born piglets after boars of Duroc breed**

| State register of boar | Boars |              | Gilts |              |
|------------------------|-------|--------------|-------|--------------|
|                        | n     | Average (kg) | n     | Average (kg) |
| <b>EDG 21</b>          | 35    | 1.67 ± 0.38  | 26    | 1.50 ± 0.29  |
| <b>CBA 22</b>          | 31    | 1.70 ± 0.41  | 24    | 1.60 ± 0.21  |
| <b>AMG 45</b>          | 7     | 1.43 ± 0.18  | 8     | 1.57 ± 0.32  |

**Graph 3. Average weight of live born piglets after boars of Duroc breed**

In Table 4 and Graph 4 there are shown average birth weights of piglets according to studied breed.

Higher average birth weights were determined in piglets of sire breeds in comparison to dam breeds. The highest average birth weight was reached by piglets after hybridization of boars Duroc with sows of Czech Large White – sire line (1.82 kg) and hybrid Pietrain (1.82 kg) with a number of 17 weighted piglets in the first combination and 5 piglets in the second combination. The most numerous group of weighted piglets (321) was a group of CLW piglets with an average weight 1.29 kg. The lowest average birth weight (1.24 kg) was reached by group of Czech Landrace piglets with 176 of live born piglets. Average weights of individual breeds are shown in Graph 4. Statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth

weight of CL and H84, D, CLW - sire line x H84, H84 x CLW – sire line. Statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth weight of CL x CLW and CLW – sire line x H84. After that statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth weight of CLW and CLW – sire line x H84, D, D x H 84, H 84 x CLW – sire line. And the last statistical conclusive difference (on a level of importance ( $P \leq 0.001$ )) was found among birth weight of CLW – sire line x H 84 and D. The rest of statistical conclusive differences on levels of importance  $P \leq 0.05$  and  $P \leq 0.01$  are mentioned in Table 4. Klimiene (2004) investigated weight of piglets of purebreds Lithuanian White, Yorkshire, Landrace, Hampshire and Duroc. The biggest birth weights were in piglets of Duroc breed (1.48 kg).

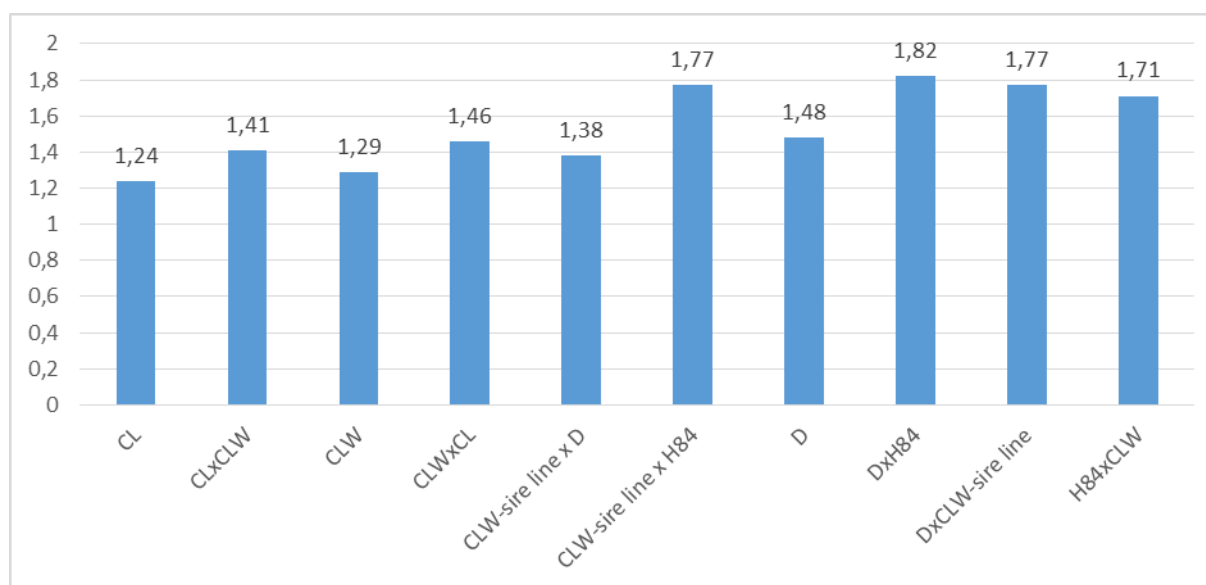
**Table 4. Statistical characteristics of average birth weight according to breed**

| Breed                 | n   | Average                            | S <sub>x</sub> | x <sub>max</sub> | x <sub>min</sub> |
|-----------------------|-----|------------------------------------|----------------|------------------|------------------|
| CL                    | 176 | 1.24 <sup>e,a,i,j,k,b,l,f,m,</sup> | 0.33           | 1.90             | 0.40             |
| CLxCLW                | 126 | 1.41 <sup>e,o,g,h</sup>            | 0.41           | 2.30             | 0.60             |
| CLW                   | 321 | 1.29 <sup>p,q,r,c,s,E</sup>        | 0.32           | 2.38             | 0.50             |
| CLWxCL                | 44  | 1.46 <sup>a,F,d</sup>              | 0.30           | 2.15             | 0.60             |
| CLW – sire line x D   | 18  | 1.38 <sup>G,H,</sup>               | 0.38           | 2.10             | 0.70             |
| CLW – sire line x H84 | 45  | 1.77 <sup>i,o,p,F,G,t</sup>        | 0.41           | 2.50             | 0.75             |
| D                     | 131 | 1.48 <sup>j,q,t,A,</sup>           | 0.33           | 2.35             | 0.80             |
| DxH84                 | 5   | 1.82 <sup>b,r</sup>                | 0.45           | 2.20             | 1.00             |
| Dx CLW – sire line    | 17  | 1.82 <sup>k,g,d,H,A,</sup>         | 0.46           | 2.60             | 1.15             |
| CLW – sire line       | 8   | 1.77 <sup>f,c</sup>                | 0.50           | 2.35             | 1.00             |
| H84x CLW – sire line  | 7   | 1.71 <sup>l,h,s</sup>              | 0.49           | 2.70             | 0.60             |
| H84                   | 36  | 1.75 <sup>m,E,</sup>               | 0.40           | 2.40             | 1.40             |

P≤0.05–a,A,b,c,d

P≤0.01–e,E,f,F,g,G,h,H

P≤0.001–i,j,k,l,m,n,o,p,q,r,s,t

**Graph 4. Statistical characteristics of average birth weight according to breed**

## Conclusion

From reached results it is possible to say that in all cases boars and gilts after boars of sire breeds reached higher average birth weight in comparison with offspring after boars of dam breeds. The highest average birth weight was found in boars (1.90 kg) and gilts (1.67 kg) after hybrid boars of Pietrain breed. The lowest average birth weight was found in offspring after Czech Large White boars – 1.38 kg in boars and 1.31 kg in gilts. In all studied breeds an average birth weight of boars was higher in comparison with gilts.

After evaluation of an influence of boar's individuality in a frame of individual breeds it is

possible to say that (with exception of few samples) birth weights in boars and gilts were similar without distinctive differences.

Higher average birth weights were determined in piglets of sire breeds in comparison with dam breeds. The highest average birth weights were reached by piglets after hybridization of boars Duroc with sows Czech Large White – sire line (1.82 kg) and hybrid Pietrain (1.82 kg).

The lowest average birth weight (1.24 kg) was reached by piglets of Czech Landrace.

In sire breed weight of born piglets can be influenced by breeding goal aimed on meat efficiency.

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