

## THE INFLUENCE OF THE SEASONALITY ON BOARS SPERM PRODUCTION - BREEDER OF DIFFERENT SPECIES

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### Abstract

The goal of the research was to give comparative evaluation of the sperm quality of boars from four breeds: Landrace, Yorkshire, Pietrain and Duroc in accordance with the seasons of the year. The research took place within State Enterprise on Raising and Pig Cross Breeding “Moldsiungibrid” in 2013. The results of the comparative evaluation demonstrated that based on ejaculate content, average per year, better results showed the Landrace and Yorkshire breed boars (255.61 and 276.11 ml); lower ejaculate content had Pietrain breed boars – 253.35 ml and Duroc – 214.27 ml. Semen obtained in one ejaculation from Yorkshire breed boar, has the capacity to bred 11 sows, with Landrace and Pietrain – 10 sows and with the Duroc breed boar semen – 8 sows (on dilution 1:4). It was found that, boars sperm production depends on the seasons of the year: the ejaculate content of Landrace breed boars was lower by 14.84 ml in autumn than in winter and summer; in the case of Pietrain breed boars, it varies from 240.65 ml in spring to 265.78 ml in autumn; in the case of Yorkshire breed boars - from 252.62 ml in spring to 303.87ml in summer and Duroc breed from 191.31 ml in winter till 230.13 ml in summer.

*Key words:* boar, sperm quality, breed, season

*List of abbreviations:* C.A.S.A - Computer Assisted Semen Analysis, ISAS PSUS - Porcine Semen Analysis Systems

### Introduction

Pig breeding is based on knowledge of the principles of growth, development and biological characteristics of this species. The conditions of rhythmic pork production can be achieved, providing uniform manifestations of sexual function in boars and sows throughout the year. In the conditions of industrial production, sexual function in pigs occurs irregularly throughout the year (Tarabrin, 2002, 2005, 2006; Kovalenko, 2000, 2001). During some seasons the reproductive function in pigs is suppressed, and the effectiveness of insemination is reduced (Hughes, 1998).

Of all environmental conditions, temperature has a special role (Corcuera et al., 2002), because it is one of the big-

gest differential factors between the seasons that induces changes in biological functions.

There are also interbreeding differences that influence the level of boar semen (Revenko, 1983). It is therefore advisable to examine the sperm quality of boars of different breeds in addition to the seasonality. It is important to clarify the relationship between the individual characteristics of the ejaculate (volume, concentration, mobility, the total number and the number of mobile spermatozoa in the ejaculate).

The aim of the present study was to demonstrate the influence of boar breed and season on semen parameters in industrial piggeries located in a temperate climate in the Republic of Moldova.

## Material and Methods

In order to assess the quality and to perform a comparative analysis of sperm of male pigs of Landrace, Yorkshire, Duroc and Pietrain breeds depending on the season of the year, a scientific experiment was conducted in 2013 at the State Enterprise for Pig Selection and Hybridization “Mold-suingibrid” in the district of Orhei, the Republic of Moldova. During the experimental period (one year), seasons were defined as follows: winter: January to March; spring: April to June; summer: July to September, and autumn: October to December.

The boars for the experiment were selected, and divided into three groups (3 heads each) according to their breed, age and body weight (using the method of pair-analog, Ovsyan-nikov, 1976).

Semen was collected from each of the boars two times per week. Sperm viability, the ejaculate volume and the sperm concentration were tested. The collection of the semen ejaculates was performed by manual method on an artificial vagina. The concentration of the obtained sperm was determined using computerized sperm analysis (C.A.S.A) and the program ISAS PSUS. The total quantity of sperm was determined multiplying the ejaculate volume to the sperm concentration. The filtered sperm-rich fraction was collected using the gloved-hand technique into a 250 ml insulated vacuum bottle.

The animals were kept in identical conditions; the individual pen area was 10 m<sup>2</sup>/boar, and the floor surface was made of concrete. The pigs were fed mixed fodders, balanced in accordance with the accepted feeding norms (Kalashnikov et al., 2003). The concentration of nutrients in the mixed fodder was as follows: the metabolic energy – 12.16 MJ, brut protein – 121.65 g, lysine 5.80 g, methionine + cystine – 4.57 g, calcium – 7.5 g, phosphorus – 5.8 g, and sodium 3.11 g per kg, depending on the boar’s age and breeding performance. The food intake was individualized for each boar and the access to water was ad libitum.

The obtained experimental data were processed using the biometric method and the Student criterion (t) (Plohinsky, 1978; Cucu et al., 2004).

## Results and Discussions

The study included a total of 555 ejaculates from 12 boars (Table 1).

The sperm analysis of the boars of different breeds showed that the average volume of the examined ejaculate was 249.14 ml. During the year, the total volume of ejaculate in the boars of Landrace breed ranged from 241.52 to 257.04 ml, and was a little lower in autumn compared to the winter and spring-summer periods (Table 2).

In the Yorkshire boars this index had the highest value in summer – 303.87ml, and in spring it was lower – 252.62 ml (Table 3). The largest average volume of semen was received from the Yorkshire boars (276.0 ± 12.35 ml, Table 6), and the smallest – from the boars of Duroc breed (214.27 ± 8.30 ml, Table 6).

A characteristic feature for the Duroc boars, among the studied genotypes, was that the volume of semen was small in winter, spring and autumn, amounting to 191.31 ml in winter, while in summer its volume amounted 38.82 ml higher. The volume of ejaculate of the Pietrain boars in winter and autumn were higher and almost the same (265.46 and 265.78 ml, respectively) with a downward trend in spring and summer (and 240.65 ml and 241.55 ml) (Tables 2, 3, 4, 5).

The content of sperm in the ejaculate volume on average during the study period was highest in the boars of Landrace breed (207,25 mlrd). The smallest number of spermatozoa was obtained from the boars of Duroc and Pietrain breed (134.59 and 164.61 mlrd respectively).

When comparing the data, it was observed that the content of spermatozoa in the ejaculate volume of all boars of Duroc and Pietrain breed was higher in summer.

The evaluation of one of the main indicators of semen, namely, sperm concentration, suggests that it is greatly influenced by both the breed of a boar and the season of the year. In terms of concentration, the semen of boars of Landrace and Pietrain breed was stable during the whole year, which indicates the possibility of obtaining the same amount of semen doses regardless of the season (Table 6).

When compared by seasons, it was observed that sperm counts in a dose was the best in autumn for all the breeds of hogs except the Yorkshire boars, whose total numbers of spermato-

**Table 1**  
**Structure of the data set per breeds**

Variable	Breeds				All breeds
	Landrace	Yorkshire	Duroc	Pietrain	
Number of ejaculates	87	77	62	94	320
Average number of ejaculates per boar	29	25.67	20.67	31.33	26.37

zoa per dose dose was higher in summer (5000.91mlrd).The boars of Landrace breed showed the best indices with a total number of sperm per dose of 5144.21 mlrd.

Smital et al. (2004) and Smital (2009) found that the number of usable doses per collection or the number of functional spermatozoa exhibited clear seasonality, with the highest val-

ues from autumn to winter and the lowest values from spring to summer, which is in good agreement with our findings.

The average progressive motility of spermatozoa was 84.14% (Table 7, Figure 1-4) with the best motility characteristic (85.14%) and a better suitability (82.52%) in the Landrace boars.

**Table 2**  
**Characteristics of sperm production of the boars of Landrace breed, ( $\bar{X} \pm S\bar{x}$ )**

Season /Indicators	Winter	Spring	Summer	Autumn
Number of ejaculates	20	34	16	17
Volume of ejaculate, ml	256.36±27.66	257.04±16.3	256.35±20.11	241.52±19.99
Numbers of spermatozoa per ejaculate, mlrd	202.27±36.53	208.2±36.07	214.33±64.48	204.18±44.28
Numbers of spermatozoa per per dose, mlrd	4855.13±67.33	5196.73±367.59	5004.54±176.06	5520.45±497.53
Sperm concentration, million/mL	775.64±64.72	807.96±129.01	827.26±242.25	826.61±125.88

**Table 3**  
**Characteristics of sperm production of the boars of Yorkshire breed, ( $\bar{X} \pm S\bar{x}$ )**

Season /Indicators	Winter	Spring	Summer	Autumn
Number of ejaculates	24	21	12	20
Volume of ejaculate, ml	289.76±23.46	252.62±32.85	303.87±31.63	258.17±20.78
Numbers of spermatozoa per ejaculate, mlrd	207.5±18.54	149.13±27.23	183.71±21.06	185.02±8.01
Numbers of spermatozoa per per dose, mlrd	4860.83±69.94	4738.17±68.89	5000.91±99.25	4660.95±112.53
Sperm concentration, million/mL	715.26±16.56 ***	582.53±30.36	603.89±16.9	721.17±27.98

\*P < 0.05, \*\*P < 0.01, and \*\*\*P < 0.001.

**Table 4**  
**Characteristics of sperm production of the boars of Duroc breed, ( $\bar{X} \pm S\bar{x}$ )**

Season /Indicators	Winter	Spring	Summer	Autumn
Number of ejaculates	21	18	8	15
Volume of ejaculate, ml	191.31±9.82	214.44±28.01	230.13±13.7	221.20±18.3
Numbers of spermatozoa per ejaculate, mlrd	116.89±9.87	122±35.16	139.19±25.82	160.07±19.09
Numbers of spermatozoa per per dose, mlrd	4687.4±38.83	4196.05±455.64	5033.23±459.59	5081.56±447.51
Sperm concentration, million/mL	610.04±34.37	551.05±90.58	596.17±73.73	726.42±78.8

**Table 5**  
**Characteristics of sperm production of the boars of Pietrain breed, ( $\bar{X} \pm S\bar{x}$ )**

Season /Indicators	Winter	Spring	Summer	Autumn
Number of ejaculates	23	37	12	22
Volume of ejaculate, ml	265.46±34.14	240.65±31.84	241.55±17.64	265.78±9.09
Numbers of spermatozoa per ejaculate, mlrd	168.55±14.46	149.80±15.79	154.42±5.55	185.66±16.07
Numbers of spermatozoa per per dose, mlrd	4990.66±99.5	4898.1±97.75	4827.31±100.91	4714.17±72.77
Sperm concentration, million/mL	641.9±32.16	629.02±44.9	642.72±23.86	698.39±53.17

Similar results were obtained by Hurum and Gorokhov (1988) who found that the boars of Landrace breed had the best sperm production, and the boars of Duroc breed had the worst sperm production.

**Table 6**  
General characteristics of the sperm production of the boars of all breeds during 2013, ( $\bar{X} \pm S\bar{x}$ )

Indices	Breed			
	Landrace	Yorkshire	Duroc	Pietrain
Number of ejaculates	87	77	62	94
Volume of ejaculate, ml	255.61±3.76	276.11±12.35	214.27±8.30	253.35±7.08
Numbers of spermatozoa per ejaculate, mlrd	207.25±2.66	181.34±12.04	134.59±9.73	164.61±8.07
Numbers of spermatozoa per per dose, mlrd.	5144.21±143.58	4815.22±74.33	4749.56±204.32	4857.7±58.22
Sperm concentration, million/mL	809.37±12.10	655.71±36.37	620.92±37.35	653.10±15.14
Normal, M/ml	600.60±22.43	524.86±29.79	472.56±15.03	504.00±13.76
Motility, %	82.21±1.34	85.20±1.12	82.96±1.53	84.48±0.86
Number of functional spermatozoa, %	76.61±1.88	83.33±1.22	81.18±1.53	82.58±0.95

**Table 7**  
Effect of boars within the breed and the seasons of the year on semen trait, ( $X \pm Sx$ )

	Winter	Spring	Summer	Autumn
	Normal, M/ml	<i>Landrace</i>		
584.05±67.52		664.78±97.32	593.09±179.86	560.76±109.45
<i>Yorkshire</i>				
604.83**±31.9		533.51±20.07	469.25±15.36	491.86±15.37
<i>Duroc</i>				
	469.1±31.41	437.68±61.93	472.4±62.76	511.08±54.74
	<i>Pietrain</i>			
	518.34±34.34	530.61±24.27	499.61±14.24	467.39±29.33

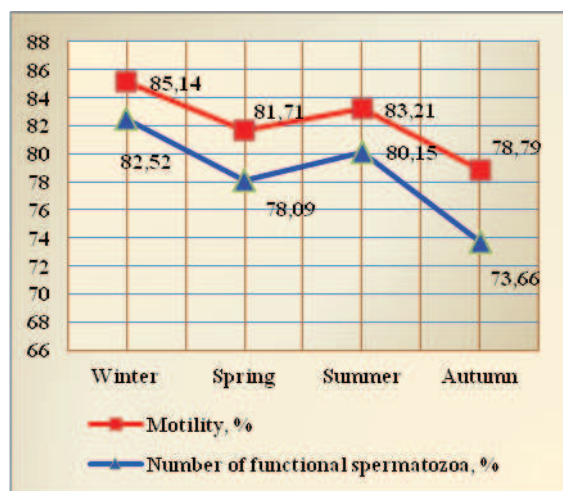


Fig. 1. Effect of Landrace boars within the seasons of the year on semen trait

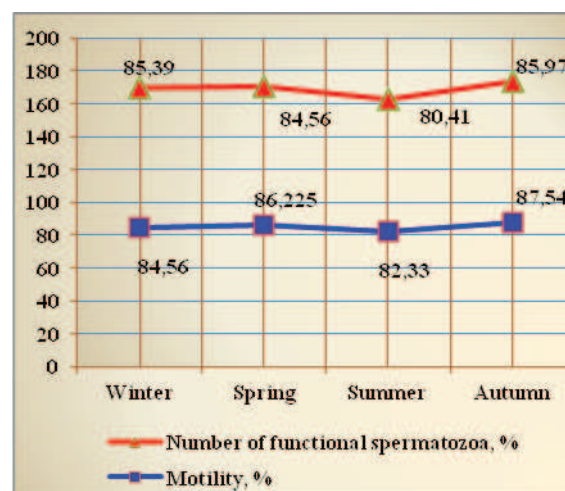


Fig. 2. Effect of Yorkshire boars within the seasons of the year on semen trait

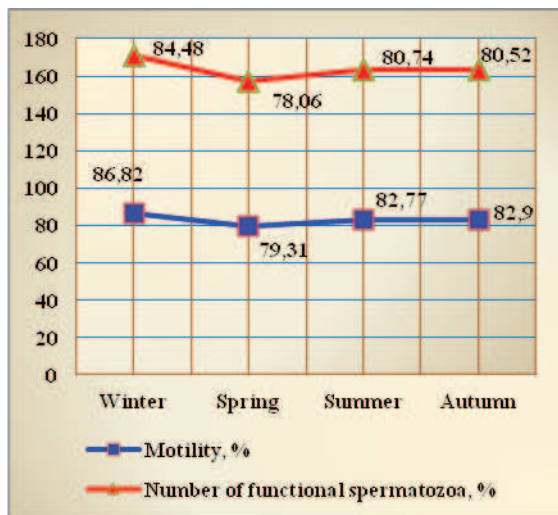


Fig. 3. Effect of Duroc boars within the seasons of the year on semen trait

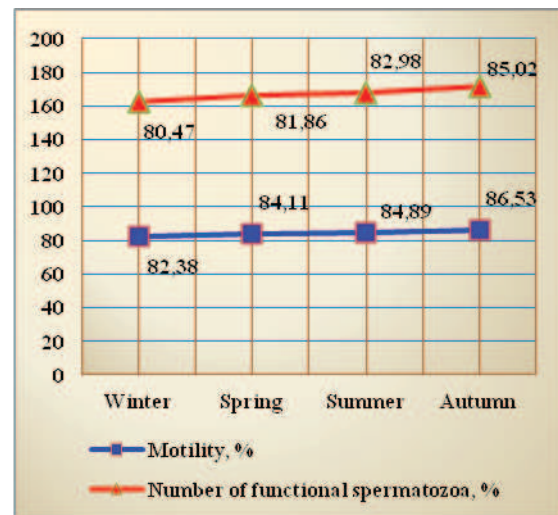


Fig. 4. Effect of Pietrain boars within the seasons of the year on semen trait

## Conclusions

Breed differences existed in testes size, sperm per ejaculate, ejaculate volume, concentration and motility of sperm. Similarities among breeds concerning sperm motility indicate that some reproductive characteristics in boars have been conserved throughout thousands of years of selection. The volume of ejaculate, sperm concentration and motility in the boars also depend on the seasons of the year: in spring and summer its volume is significantly higher, and the sperm concentration is significantly lower than in autumn and winter.

In autumn the ejaculate content of Landrace breed boars was lower by 14.84 ml than in winter and summer; in the case of the Pietrain breed boars it varied from 240.65 ml in spring to 265.78 ml in autumn; in the case of the Yorkshire breed boars it ranged from 252.62 ml in spring to 303.87 ml in summer, and the Duroc breed showed in index of 191.31 ml in winter and 230.13 ml in summer.

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