INVESTIGATIONS ON SPERM PRODUCTION IN PIC BOARS

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ABSTRACT *- The biological material was represented by PIC boars for whom the main indices of spermiogram were estimated. The mean ejaculated volume was by 327.0 ± 14.4 ml lower in boars from SL 1075 (304.3 ± 7.3 ml) and insignificantly higher in boars from SL 408 (349.8 ± 7.2 ml). The volume was much influenced by age of boars and season. The mean concentration of sperm in spermatozoon was of 343.9 ± 9.1 x 10^6 spermatozoids/ml with significant differences between these two synthetic lines: 386.6 ± 12.1 x 10^6 spermatozoids/ml in SL 1075 and 301.2 ± 9.8 x 10^6 spermatozoids/ml in SL 408. The mean concentration was higher between 2 and 3 years and in autumn. The mean number of dose/ejaculate was of 20.8, differences being found according to SL of boars (19.7 in SL 408 and 22.0 in SL 1075), age of boars (15.2 at the age of one year, 21.7 at the age of two years, 24.8 at the age of three years and 22 at the age of 3.5 years) and according to the season when sample was taken over: 22.9 in spring, 17.9 in summer, 22.3 in autumn and 20.3 in winter.*

Key words: boars, indices of spermogram, influence factors, artificial insemination

Rezumat – Cercetări privind producţia spermatică la vierii PIC. *Materialul biologic a fost reprezentat de vieri PIC, pentru care s-au apreciat principalii indici de spermogramă. Volumul mediu al ejaculatului a fost de 327.0 ± 14.4 ml, mai mic la vierii din LS 1075 (304.3 ± 7.3 ml) şi nesemnificativ mai mare la vierii aparţinând LS 408 (349.8 ± 7.2 ml). (349.8 ± 7.2 ml). Volumul a fost condiţionat semnificativ de vârsta vierilor, sezon şi individualitate. Concentraţia medie a spermei în spermatozoizi a fost de 343.9 ± 9.1 x 10^6 10^6 spermatozoizi/ml cu diferenţe semnificative între cele două linii sintetice: 386.6 ± 12.1 x 10^6 spermatozoizi/ml la LS 1075 şi 301.2 ± 9.8 x 10^6 spermatozoizi/ml la LS 408, crescînd progresiv până la vârsta cuprinsă între 2 şi 3 ani şi în sezonul de toamnă. Numărul mediu de doze/ejaculat a fost de 20.8, diferenţiat în funcţie de linia sintetică*

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a vierilor (19.7 la LS 408 şi 22.0 la LS 1075) şi de vârsta vierilor (15.2 la vârsta de 1 an, 21.7 la 2 ani, 24.8 la 3 ani şi 22 la 3.5 ani).

Cuvinte cheie: vieri, indici de spermogramă, factori de influență, însămânțare artificială

INTRODUCTION

Making boar spermogram is an essential condition for a good reproduction activity. The value of sperm indices is in continuous dynamics. It is related to some environment and heredity factors, such as breed, age, synthetic line, etc. Our study had the aim to monitor the sperm production in PIC hybrid boars, bred under intensive system. The value of sperm indices is found in continuous dynamics in connection with some factors of external environment (feeding, microclimate, frequency of samplings, breeding systems, etc.) and some hereditary factors, such as breed, age, synthetic line, etc. By optimizing feeding, microclimate from shelter, sampling regime according to specific spermatogenetic potential, an efficient management is ensured. Our study had as aim to monitor the sperm production in PIC hybrid boars, bred under intensive system.

MATERIALS AND METHODS

Three PIC boars from SL 1075, used for obtaining young sows Camborough and five PIC boars from SL 408, used for obtaining the hybrid for fattening, represented the biological material. Investigations have been conducted since the age of 8 months and until the age of 44 months.

Boars were bred in individual boxes with an area of 6 m^{2}. The rhythm of using in reproduction was sperm sampling followed by 4 days of repose.

The sperm sampling was done manually. The main analysed sperm indices were the volume of ejaculate, sperm concentration in spermatozoids, mobility and number of doses/ ejaculate, long viability and disappearance of spermatozoids.

The volume of ejaculate was assessed directly in the collector glass. The concentration was determined by the help of the Spermacue photo-densimeter and, periodically, by the help of the haemocitometer. The mobility was determined by optic microscope with phase contrast, representing the rate of proper movement spermatozoids. The long viability index was calculated as the product of the sum of mobility means between two successive determinations and the interval between examinations. The disappearance index or energetic potential is the product of the sum of mobility values and the sum of minutes until mobility disappeared. The last two indicators have been assessed after the dilution of seminal material with Merk III diluter, at a ratio ensuring a concentration of 4 billion mobile spermatozoids /dose.

RESULTS AND DISCUSSION

The average ejaculate volume (from the age of 8 to 44 months) was of 304.3 ml in boars from SL 1075 and insignificantly higher in boars from SL 408 (349.8 ml), values found at the upper limit of the ones quoted by the specialty literature for most of swine breeds (Bogdan et al., 1999; Dinu, 1978)[1]. In both synthetic lines, we have noticed an ascending curve from the beginning of management until the age of 3 years, proving that the functioning of annex glands reached their peak at that period. Even after the age of 36 months the volume of ejaculate was maintained at a proper level, although a significant decrease (by 38.7 ml) was registered in the boars from SL 1075 (*Table 1*).

Table 1

Volume of ejaculate in boars according to age (ml)

Statistical parameters	Age (months)				Mean	Line
	8-12	13-24	25-36	37-44		
$\overline{X}$	259.3	314.8	341.0	302.3	304.3	1075
± $S_{\overline{X}}$	8.8	7.5	10.7	6.8		
V%	28.9	21.7	26.2	22.6		
$\overline{X}$	229.0	369.6	391.6	409.2	349.8	408
± $S_{\overline{X}}$	6.0	8.2	7.7	14.1		
V%	20.7	23.2	21.9	26.8		

The level of the ejaculate volume registered a significant individual influence in boars from both synthetic lines.

Table 2

Season dynamics of the ejaculate volume (ml)

Statistical parameters	Season				Mean	Line
	Spring	Summer	Autumn	Winter		
$\overline{X}$	348.4	264.2	304.2	300.1	304.3	1075
± $S_{\overline{X}}$	6.3	7.2	6.5	8.3		
V%	22.8	25.8	21.3	21.2		
$\overline{X}$	357.2	333.4	361.9	346.8	349.8	408
± $S_{\overline{X}}$	9.2	9.1	8.2	12.0		
V%	27.1	26.6	30.7	33.0		

[1] **TĂPĂLOAGĂ Dana, 2004 –** *Computer-based micromorphometry study on spermatozoids in boars.* Ph D Thesis, University of Agricultural Sciences and Veterinary Medicine of Bucharest

The season analysis of sperm quantity has shown significantly lower values in summer (264.2 ml in SL 1075 and 333.4 ml in SL 408), compared to the other periods of the year, when the level of this indicator varied insignificantly (*Table 2*).

The mean concentration of sperm in spermatozoids was of $327.0x10^6$ spermatozoids/ml, insignificantly differentiated according to the synthetic line (386.6 in SL 1075 and 301.2 in SL 408 – expressed in million spermatozoids/ml). For this indicator, too, the values were found above the most frequent ones from the specialty literature ($150 – 250x10^6$ spermatozoids/ml) (Bogdan et al., 1999; Dinu, 1978)[2] [3].

As concerns the evolution of concentration in connection with the age of boars, close levels were found during the estimate, more reduced values at the beginning of the reproduction activity and higher ones at the age of 3 years (*Table 3*). The registered values proved that since the age of 1 year, spermatogenesis was found at optimum intensity, functioning of seminipherous epithelium being maintained after the age of 3 years, too.

Table 3

Sperm concentration in spermatozoids (millions of spermatozoids/ml)

Statistical parameters	Age (months)				Mean	Line
	8-12	13-24	25-36	37-44		
$\overline{X}$	370.3	387.2	421.5	367.4	386.6	1075
$\pm S_{\overline{X}}$	12.1	8.6	9.2	16.3		
V%	22.3	22.3	21.9	24.7		
$\overline{X}$	288.9	298.5	315.2	302.2	301.2	408
$\pm S_{\overline{X}}$	14.1	7.9	8.4	12.4		
V%	25.1	23.8	24.0	25.8		

Values comparable to the ones we found have been recently used in boars from Duroc, Pietrain (Kunc, 2002) and PIC breeds[4], these breeds contributing to the creation of synthetic lines 1075 and 408.

The action of high temperatures in summer on spermatogenesis was followed by the significant diminution in gametes/ml, the values of concentration being lower with 52 million spermatozoids/ml, compared to the maximum level reached in autumn (*Table 4*). Taking into account these variations, the estimate of

[2] **Feredean T., 1972** – *Contribution on the study of factors influencing swine fertility under artificial insemination.* Ph.D. Thesis, Agronomical Institute of Bucharest

[3] **Tănase D., 1981** – *Investigation on the influence of stressing factors from swine units on sows fertility.* Ph.D. Thesis, Agronomical Institute of Iaşi.

[4] **Nacu Gh., 2005** – *Investigations on some opportunities for improving the reproduction function in swine.* Ph.D. Thesis, University of Agricultural Sciences and Veterinary Medicine, Iaşi

each ejaculate was required, for avoiding the production of doses with lower spermatozoid concentration, which could annihilate the fecundity of sows.

Table 4

Season dynamics of sperm concentration in spermatozoids

Statistical parameters	Season				Mean	Line
	Spring	Summer	Autumn	Winter		
$\overline{X}$	389.4	364.5	416.7	375.7	386.6	1075
$\pm S_{\overline{X}}$	11.0	11.7	11.4	10.7		
V%	19.1	25.3	21.2	23.0		
$\overline{X}$	305.1	285.8	312.0	301.8	301.2	408
$\pm S_{\overline{X}}$	10.0	9.5	11.1	9.9		
V%	26.8	26.1	23.4	25.7		

Mobility of spermatozoids was between 75.6% and 80.2%, without significant differences related to genetic line, age of boars or season of sampling.

Mean number of doses /ejaculate was of 22 in boars from SL 1075 and 19.7 from SL 408.

Peaks of the values for this indicator were registered at the age of 2-3 years, when boars from SL 1075 gave, on the average, 26.5 doses and boars from SL 408, 23.1 doses (*Table 5*). The great volume and concentration of the ejaculate resulted in getting a great number of doses/ejaculate with a concentration/ dose of 4 billions of mobile spermatozoids.

Table 5

Number of doses/ejaculate according to the age of boars

Characteristics		Age (months)				Mean
		8-12	13-24	25-36	37-44	
No. doses/ejaculate	SL 408	12.4	20.7	23.1	23.2	19.7
	SL 1075	18.0	22.8	26.5	20.8	22.0

Table 6

Season dynamics of dose number/ejaculate

Characteristics		Season				Mean
		Spring	Summer	Autumn	Winter	
No. doses/ejaculate	SL 408	20.4	17.8	21.1	19.6	19.7
	SL 1075	25.4	18.0	23.6	21.1	22.0

The mean number of doses has evolved according to volume and concentration of the ejaculate, being more reduced in summer and higher in spring (*Table 6*).

Values comparable to the ones we found have been recently used in boars from Duroc, Pietrain (Kunc, 2002) and PIC breeds[4], these breeds contributing to the creation of synthetic lines 1075 and 408.

The quality of the seminal material was assessed according to some indicators less used in seminology laboratories, such as long viability and spermatozoid death indices.

The mean index of spermatozoid survival at the refrigeration temperature, also called the long viability index, was of 23.67, almost identical for the samples from boars belonging to analysed lines: 23.70 in boars from SL 408 and 23.65 in boars from SL 1075.

The season analysis of this indicator did not point out a constant evolution. In boars from SL 408, more reduced values were found in spring (23.65) compared to summer (23.75), while in boars from SL 1075, the case was reverse: 24.00 in spring and 23.3 in summer (*Table 7*).

The mean index of spermatozoid death was of 212.8 according to the source of seminal material: 195.0 in SL 408 and 230.7 in SL 1075. Although the difference between absolute values was clear, the analysis of variance did not point out significant differences. This made us consider that the resistance of spermatozoids was not influenced by boars' synthetic line. For this indicator, too, the evolution was not constant, the conclusion being that the biological value of spermatozoids expressed by means of long viability and death indices was close, indifferently of the period of ejaculate sampling (*Table 7*).

Table 7

Values of long living and death indices in boars

Month	Synthetic line	Index	
		Long viability	Death
APRIL	408	23.65	202,5
	1075	24.00	234,2
Mean in April		23.82	218.3
JULY	408	23.75	188,0
	1075	23.30	227,5
Mean in July		23.52	207.7
Mean SL 408		23.70	195.0
Mean SL 1075		23.65	230.7
MEAN		23.67	212.8

CONCLUSIONS

The sperm yield of PIC boars belonging to synthetic lines 1075 and 408 allows the breeding of a small stock, with the opportunity of using the most valuable boars.

The sperm volume and the spermatozoid concentration are superior to those of the most frequent data from specialty literature, quoted for breeds and hybrids bred in Romania. On the average, 20.8 doses/ejaculate are obtained.

Internal environment factors, such as synthetic line, age and individuality influence greatly spermatozoid volume and concentration, and less spermatozoid mobility, death and long viability spermatozoid indices.

The values of studied spermgram indices were more reduced in summer, the registered results being in concordance with the specialty references, according to which high temperatures influenced negatively spermatogenesis.

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