Influence of Terminal Boar Genetic Type on Conception Rate

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Abstract
The existence of variability between boar genetic types on sows fecundity (measured by the percentage of fertile insemination or percentage of return after insemination) was observed in some studies but is insufficiently experienced and explained. The aim of this paper is to underline the existence of influence of terminal boar genetic type on sows conception rate. In this way, were studied three lines of boars, which were mated with females of the same genetic type, as a scheme that prevents, if possible, the maternal influence. Research has revealed the existence of differences between genetic types of boars, but they are not statistically significant. Therefore, these observed differences can be attributed to other factors, particularly technological nature, which does not affect equality of opportunity for installation of pregnancy.

Keywords: boar genetic type, conception rate

1. Introduction

The existence of variability between boar genetic types related with sows fecundity (measured by the percentage of fertile mat or percentage of return after insemination) was observed, but insufficiently experienced and explained.
The relationship between boar genetic type and fertility of sows partner could be underlined from the to identify ways in which male influences the pregnancy installation status. These could be:
-the viability of embryos genetically transmitted by father;
-the male influence on embryo death rate
-the low male fertility as a consequence of chromosome abnormality existence;
-quantity and quality of semen;
-the development and functioning genitalia
Regarding the first point, Beris and Stoicia (1984) cites work by Dufour and Fahmy (1975) that led to the conclusion that the viability of a Yorkshire father sent his embryos is higher than that transmitted by a Landrace male.
On the following two aspects, Pery and Rowlands, 1962 [1], say that if fertilization is maded, approximately 100% of eggs would be fertilized. So, male can affect the embryonic mortality.
Where death occurs before implantation, this would partly explain the link between fertility and prolificacy, because to continue the state of pregnancy is required a minimum of four embryos implanted [1]. In addition, some chromosomal abnormalities are the cause of reduced fertility of boars [2].

2. Materials and methods

In order to achieve objectives, the biological material used in this experiment comes from SC Crinsuin SA and is represented by three genetic types of boars (PIC 408 PIC 410 and PIC 337), that have been paired with a number of sows under a working protocol that will be described below. Performances were analyzed over five calving, sample was drawn so that individuals

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having performance from every calving, because it wanted a balanced experimental design.

The research took place between 2008 – 2011, working methodology focusing on conception rate evaluation of the three genetic types of boars, by pairing them with hybrid sows (Large white x Landrace, produce in farm), maintained under the same environmental conditions, in the same conditions of feeding and at the same age (to exclude, if possible maternal influence). The results in terms of fertility were studied in comparison between the three genetic types of boars.

The experimental consisted of five stages, each dedicated to the study conception rate in terms of boars mating with different genetic types.

Thus, nulliparous gilts were divided into three groups, one group for each genetic type boars and artificially inseminated with semen. To ensure repeatability of results, the second calving remained the same pattern of mating. From the third calving until the fifth, the same groups of sows were artificially inseminated with semen from the same genetic types of boars, using a scheme that prevents maternal influence (on the principle of rotation). Sows farrowing within the same group are considered experimental and numbered as such.

To study variation in fertility, which has a binomial distribution, Fisher test was used to compare binomial proportions, known as the „exact probability test”. For this, we consider two independent sets of tests, denoted A and B. In this case „test” is represented by artificial insemination. Denote by a_1 the number of successes in the set A (size n_1) and by a_2 the number of successes in the set B (size n_2). We test the null hypothesis H_0 that the probability of success is the same for each lot ($\theta_1 = \theta_2 = \theta$). This probability of success, that we propose the same, it is estimated by the ratio between the total number of successes and the total number of tests: $\theta = (a_1 + a_2) / (n_1 + n_2)$.

Exact probability test statistics are denoted by P and are determined by the relationship:

$$P = \frac{C_{n_1}^{a_1} \cdot C_{n_2}^{a_2} \cdot \theta^{a_1+a_2} \cdot (1-\theta)^{(n_1+n_2)-(a_1+a_2)}}{C_{n_1+n_2}^{a_1+a_2} \cdot \theta^{a_1+a_2} \cdot (1-\theta)^{(n_1+n_2)-(a_1+a_2)}}$$

$$P = \frac{C_{n_1}^{a_1} \cdot C_{n_2}^{a_2}}{C_{n_1+n_2}^{a_1+a_2}}$$

$$P = \frac{n_1! \cdot n_2! \cdot (a_1+a_2)! \cdot (n_1+n_2-a_1-a_2)!}{a_1! \cdot (n_1-a_1)! \cdot a_2! \cdot (n_2-a_2)! \cdot (n_1+n_2)!}$$

For any value of P less than 0.05, the null hypothesis is rejected, accepting that the chances of successful to the two sets are not equal.

3. Results and discussion

In group 1, the females artificially inseminated with semen from PIC 408 boars, pregnancy was installed at 82.86% of the animals, while the sows inseminated with semen from PIC 410 and PIC 337 boars was recorded in average conception rate of 93.94% and 84% respectively.

The data analysis presented underline differences between conception rates of the three groups of sows belonging to group 1, the highest value of this parameter recorded in the case of females inseminated with semen from boars PIC 410 (93.94%) .

To ensure repeatability of results, the breeding scheme was maintained at calving II, meaning that groups of sows mated with the same genetic types of boars. They got the same values of conception rate, interesting being to maintain the same number of unsuccessful installation of pregnancy.

The sows belonging to group 3, pregnancy was installed as follows: the proportion of 85.71% of sows artificially inseminated with semen from PIC 408 boars, at a rate of 93.10% of sows artificially inseminated with sperm from boars PIC 410 and the rate of 91.67% in females inseminated with PIC 337.

As in the first two groups, the highest rate of conception seems to have sows inseminated with semen from PIC 410 boars.

The sows belonging to group 4, the situation conception rate on the three groups was: 88.46% of sows artificially inseminated with semen from PIC 408 boars remained pregnant; conception rate 93.55% for sows inseminated with PIC 410 boars; 91.43% of this parameter value recorded in females inseminated with boar PIC 337. From data analysis presented we can observe that there were differences in conception rates among the three groups of females, the highest value of this parameter recorded for all sows inseminated with PIC 410 boars.

The sows belonging to group 5 of the breeding scheme, again can be found a superior value for conception rate of sows artificially inseminated with semen from boars PIC 410 (95.35%), while in groups 1 and 3, pregnancy was installed at 77.27% of females inseminated with PIC 408 boars and 85.71% of those inseminated with PIC 337 boars.

Analyzing the results presented, it appears that if all five groups, the highest conception rate was obtained when using semen from PIC 410 boars. Thus, the results appear, at first side, to advocate for the use of PIC 410 boar on terminal position in obtaining commercial hybrid, its superiority can be attributed to a possible heterosis effect for characters related to the fecundant ability of semen. Results may be questionable, however, and such inferences can not be issued without a precise mathematical analysis, able to highlight the differences with high statistical certainty.

There were tested the observed differences between conception rates of sow groups. The results are presented in Table 1-5.

Analyzing the results presented in Table 1 – 5, whereas the value of P is greater than 0.05, the null hypothesis is accepted that meens the chances of success for the two sets are equal. In other words, the above are reduced to saying that the conception rate of sows in groups examined did not differ significantly, with one exception, namely that the experimental group 5, between sows inseminated with PIC 408 and those inseminated with semen from boars PIC 410 (situation due, most likely error of the sample).

The results obtained in this study are similar to those provided by various authors, showing that either can not question the existence of differences in the conception rate among different types of boars [3,4], or it is found, but can not be explained, and studies are not relevant [5]. These authors, however, emit the hypothesis that there would be some differences in semen quality, some anatomical features of the genital organs (testis and epididymis) and the reproductive behavior between hybrids boars and pure breeds.

However, there is some conceptual differences between the rates of sows artificially inseminated with semen from boars of different genetic types, even if they were not statistically significant. These observed differences can be attributed to several factors, particularly technological nature (excluding the sample errors).

Among these factors are mentioned: incorrect detection of females in heat, making mistakes in artificial insemination, capacity issues fecundant semen (errors in the processing of semen, improper storage at temperature and light, there is a high percentage of sperm caking causes in most cases by incorrect feed recipes made with high percentage of protein), etc.

Table 1. Comparison of conception rates using exact probability test of sow groups in experimental lot 1

Specification	Number of succese	Number of failures	Number of attempts	P
408	a_1=29	n_1-a_1=6	n_1=35	0.12^{NS}
410	a_2=31	n_2-a_2=2	n_2=33	
Total	a_1+a_2=60	(n_1+n_2)-(a_1+a_2)=8	n_1+n_2=68	
408	a_1=29	n_1-a_1=6	n_1=35	0.27^{NS}
337	a_2=21	n_2-a_2=4	n_2=25	
Total	a_1+a_2=50	(n_1+n_2)-(a_1+a_2)=10	n_1+n_2=60	
410	a_1=31	n_1-a_1=2	n_1=33	0.17^{NS}
337	a_2=21	n_2-a_2=4	n_2=25	
Total	a_1+a_2=52	(n_1+n_2)-(a_1+a_2)=6	n_1+n_2=58	

Table 2. Comparison of conception rates using exact probability test of sow groups in experimental lot 2

Specification	Number of succese	Number of failures	Number of attempts	P
408	a_1=29	n_1-a_1=6	n_1=35	0.12^{NS}
410	a_2=31	n_2-a_2=2	n_2=33	
Total	a_1+a_2=60	(n_1+n_2)-(a_1+a_2)=8	n_1+n_2=68	
408	a_1=29	n_1-a_1=6	n_1=35	0.27^{NS}
337	a_2=21	n_2-a_2=4	n_2=25	
Total	a_1+a_2=50	(n_1+n_2)-(a_1+a_2)=10	n_1+n_2=60	
410	a_1=31	n_1-a_1=2	n_1=33	0.17^{NS}
337	a_2=21	n_2-a_2=4	n_2=25	
Total	a_1+a_2=52	(n_1+n_2)-(a_1+a_2)=6	n_1+n_2=58	

Table 3. Comparison of conception rates using exact probability test of sow groups in experimental lot 3

Specification	Number of succese	Number of failures	Number of attempts	P
408	a_1=24	n_1-a_1=4	n_1=28	$0,23^{NS}$
410	a_2=27	n_2-a_2=2	n_2=29	
Total	a_1+a_2=51	(n_1+n_2)-(a_1+a_2)=6	n_1+n_2=57	
408	a_1=24	n_1-a_1=4	n_1=28	$0,24^{NS}$
337	a_2=33	n_2-a_2=3	n_2=36	
Total	a_1+a_2=57	(n_1+n_2)-(a_1+a_2)=7	n_1+n_2=64	
410	a_1=27	n_1-a_1=2	n_1=29	$0,35^{NS}$
337	a_2=33	n_2-a_2=3	n_2=36	
Total	a_1+a_2=60	(n_1+n_2)-(a_1+a_2)=5	n_1+n_2=65	

Table 4. Comparison of conception rates using exact probability test of sow groups in experimental lot 4

Specification	Number of succese	Number of failures	Number of attempts	P
408	a_1=23	n_1-a_1=3	n_1=26	0.29^{NS}
410	a_2=29	n_2-a_2=2	n_2=31	
Total	a_1+a_2=52	(n_1+n_2)-(a_1+a_2)=5	n_1+n_2=57	
408	a_1=23	n_1-a_1=3	n_1=26	0.31^{NS}
337	a_2=32	n_2-a_2=3	n_2=35	
Total	a_1+a_2=55	(n_1+n_2)-(a_1+a_2)=6	n_1+n_2=61	
410	a_1=29	n_1-a_1=2	n_1=31	0.34^{NS}
337	a_2=32	n_2-a_2=3	n_2=35	
Total	a_1+a_2=61	(n_1+n_2)-(a_1+a_2)=5	n_1+n_2=66	

Table 5. Comparison of conception rates using exact probability test of sow groups in experimental lot 5

Specification	Number of succese	Number of failures	Number of attempts	P
408	a_1=17	n_1-a_1=5	n_1=22	0.03^{**}
410	a_2=41	n_2-a_2=2	n_2=43	
Total	a_1+a_2=58	(n_1+n_2)-(a_1+a_2)=7	n_1+n_2=65	
408	a_1=17	n_1-a_1=5	n_1=22	0.22^{NS}
337	a_2=24	n_2-a_2=4	n_2=28	
Total	a_1+a_2=41	(n_1+n_2)-(a_1+a_2)=9	n_1+n_2=50	
410	a_1=41	n_1-a_1=2	n_1=43	0.13^{NS}
337	a_2=24	n_2-a_2=4	n_2=28	
Total	a_1+a_2=65	(n_1+n_2)-(a_1+a_2)=6	n_1+n_2=71	

4. Conclusions

In this study, there can be no question of the existence of differences between the conception rates in sows, caused by boars genetic types.

References

1. Beris, L., Stoicia, M., Genetica si ameliorarea suinelor, ed. Ceres, Bucuresti, 1984, pp. 23-122
2. Paraipan, V., Infertilitatea la suine, Ed. Ceres, Bucuresti, 1977, pp. 12-48
3. Einarsson, S., Fertility and serving ability of Swedish Landrace and Swedish Yorkshire boars, Nord Vet. Med., 1968, 20, 616
4. Wilson, E. R., et al, Reproductive and testicular characteristics of purebred and crossbred boars, Journal of Anim. Sci., 1977, 44, 939
5. Koh, T. J., Fertility of Liquid Boar Semen as Influenced by Breed and Season, J. Anim. Sci., 1976, 42, 138-144