

THE EFFECT OF MYCOTOXIN ADSORBENTS ON SOME SELECTED PARAMETERS OF BOAR SEMEN

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ABSTRACT

The studies were carried out at the State Enterprise for Pig Selection and Hybridization "Moldsuinhybrid" (Republic of Moldova), from 18.03.2014 till 06.08.2014, using boars of Landrace, Yorkshire, Duroc and Pietrain breeds in order to understand the impact of the enterosorbent "Primix-Alfasorb" on breeding boars' semen production. During the first period of the experiment the adsorbent was not added to the boars' diet; during the second period of the experiment (60 days) the basic compound feed (BF) was supplemented with the preparation "Primix-Alfasorb" at the level of 300 g/t; during the final (third) period (40 days) the animals were again fed to basic feed. It was observed that, when the breeding boars were fed on compound feed supplemented with the additive «Primix-Alfasorb» at the level of 300g/t, the ejaculate volume increased, namely: during the second period of the experiment – in the boars of Landrace breed ($p < 0.05$), and during the third period – in the boars of Pietrain breed ($p < 0.1$). The total number of spermatozoa in the ejaculate was 139,54 milliard in Duroc boars, and up to 201,39 milliard in the boars of Pietrain breed. During the third period of the experiment, this index was high in the boars of all the breeds. As to the concentration of the spermatozoa, it was higher in Yorkshire boars by 13.52, 14.14 and 0.58%.

Keywords: *breeding boar, sperm production, sperm dose, sow, adsorbent.*

INTRODUCTION

The intensification of pig production requires extensive implementation of artificial insemination of animals as a highly effective method of reproduction and genetic progress. A significant number of boars do not manifest their potential due to the specificity of the industrial technology – lack of walks, solar insolation, shortage of fresh air and unbalanced feed diets on a number of components (Pohodnya *et al.*, 2004; Pohodnya, 2005; Pohodnya and Moroz, 2007; Narijny, 2003; Narijny *et al.*, 2006).

A promising way to increase the boars' reproductive functions under the conditions of industrial technology is the utilization of a number of environmentally friendly

biologically active preparations, which do not negatively affect the animals. The antifungal effect is one of the diverse effects of these preparations. Of all the possible contaminants of the feed for pigs, mycotoxins pose the highest risk. The contamination of agricultural produce with fungi toxins is observed in all agricultural regions of the world, and it is almost impossible to avoid. The average concentration of harmful fungi increased from 33 parts per billion in 2013 to 64 parts per billion in 2014; i.e. their concentration has almost doubled (<http://www.agritimes.ru/news/15554/mirovye-korma-zagryazneny-mikotoksinami>, 2015).

The contamination of raw materials with fungi and their metabolic products is a serious problem of livestock farms, which causes considerable economic damage (Kotik, 1999). Mycotoxins affect the feed quality, health and productivity of animals. Many mycotoxins which have mutagenic and carcinogenic properties pass into animal products (Akhmetov *et al.*, 2000; Tremasov, 2001; Hamidullin *et al.*, 2004). In this connection, special measures should be used to save raw materials from mold, first of all, to introduce in feed diets special feed additives – adsorbents – which can adsorb mycotoxins, control the growth of mold in feed and prevent the occurrence of mycotoxicosis in animals (<http://mitgroup.by/index.pl?act>, 2016).

Recent experimental studies have proved that the reproductive potential of livestock can be increased by using adsorbents of mycotoxins. It has been found that different adsorbents have different effects on mycotoxins (Brylin, 2008).

Multi-effect preparations that have passed special multi-stage processing neutralize mycotoxins, endogenous and exogenous toxic substances of different nature without binding vitamins and elements essential for animals' life. These chelators have an expressed bacteriostatic effect against opportunistic pathogenic microorganisms, and do not adversely affect the composition of the intestinal commensal flora, due to the imperfection of the crystal lattice of sorbents (<http://globusp.com/rentabelnoe-zhivotnovodstvo.html>, 2016). One of these adsorbents is the preparation «Primix-Alfasorb» produced by the LTD "Ariadne" (Ukraine).

MATERIALS AND METHODS

The studies on the effectiveness of the impact of the enterosorbent "Primix-Alfasorb" on the semen production of breeding boars were carried out at the State Enterprise for Pig Selection and Hybridization "Moldsungibrid", using boars of Landrace, Yorkshire, Duroc and Pietrain breeds (Ovsyannikov, 1976), from 18.03.2014 till 06.08.2014.

The boars were kept for a year in the same conditions, making them to walk permanently. During the first period of the experiment the adsorbent was not added to the boars' diet; during the second period of the experiment (60 days) the basic compound feed (BF) was supplemented with the preparation "Primix-Alfasorb" at the level of 300 g/t; during the final (third) period (40 days) the animals were again fed to basic feed (Table 1).

Table 1. Scheme of the experiment

The breed of the boars	no	Periods		
		Preliminary (without the preparation) 18.03 – 27.04.14	Control (with the use of the preparation) 28.04 – 27.06.14	Final (without the preparation) 28.06 – 06.08.14
		40 days	60 days	40 days
Landrace	3	BF	BF + 300 g/t «Primix-Alfasorb»	BF
Yorkshire	3			
Duroc	3			
Pietrain	3			

* "Primix-Alfasorb" is a mycotoxin adsorbent for animals. It consists of extruded bran, lignin, cellulose, hemicelluloses and pectin – not less than 700 mg. The additive has been developed by the LTD "Ariadne" (Odessa, Ukraine).

The male pigs' semen was collected in disposable sperm devices by manual method, using an artificial vagina of a stuffed animal on the walk ground twice a week (Kononov, 2002; Eskin *et al.*, 2007). When assessing the quality of boars' sperm using the program Porcine Semen Analysis Systems – ISAS PSUS, the following indices were taken into account: the volume of ejaculate (ml), its concentration (million/ml), its mobility (%) and the total number of spermatozoa in the ejaculate (million). Two hundred and twenty-nine ejaculates of twelve boars (3 heads in each group) were examined.

The obtained data was processed using the methods of variation statistics (Cucu, *et al.*, 2004; Plohinsky, 1969).

RESULTS AND DISCUSSION

It is well known that boars' metabolism occurs quite intensively. This is due to the fact that, when properly fed, a boar secretes a large enough volume of semen per one mating, and in order to form this quantity, as well as to regain the energy spent during the process of mating or semen collection, a lot of energy and nutrients are necessary.

During the experiment, the need of boars in energy and nutrients was determined in relation to their age, body weight, individual features and the intensity of their use (Kalashnikov A. *et al.*, 2003). The compound feed was supplemented with traditional feeding ingredients (in %): corn grain – 18.0, wheat – 20.0, barley – 27.8, peas – 16.8, wheat bran – 11.0, fish meal – 5.0, premix – 0.1, salt – 0.4 and chalk – 0.9. The diets were balanced using the Hybrimin program (Table 2).

Table 2. Nutritional value of the compound feed for breeding boars

Nutrients	in 1 kg
Energetic feed units	1.14
Exchange energy, MJ	12.2
Crude protein, g	144.89
Crude fiber, g	5.72
Lysine, g	7.76
Methionin + cystine, g	5.07
Calcium, g	8.07
Phosphorus, g	6.51

The studies have found that the boars of Pietrain and Landrace breeds have had the greatest volume of ejaculate, on average over the period of experience, namely 267.80 ml and 252.50 ml. The ejaculate volume of the Duroc boars was significantly lower (by 37.8 – 41.2 ml or by 27.97 – 52.72 ml) than of the boars in other experimental groups, due to their breed characteristics. The quantity of the obtained ejaculates from these boars were lower compared with other breeds, namely by 1.41 – 1.87 doses. Significant differences in the ejaculate volume were observed during the experimental periods: during the second period – in the Landrace boars ($p < 0.5$; $p < 0.05$), and during the third period – in the Pietrain boars ($p < 0.1$).

Table 3. Number of examined ejaculates of breeding boars of different breeds when fed to the preparation "Primix-Alfasorb», pieces

n = 3	Breeds of breeding boars			
	Yorkshire	Landrace	Duroc	Pietrain
I period	15	11	12	14
II period	30	28	25	15
III period	22	20	19	18

The sperm concentration in the animals of Yorkshire and Pietrain breeds was higher than in the boars of other breeds. The highest concentration was observed in the Yorkshire boars (755,54 million/ml), which was by 13.52, 14.14 and 0.58% higher than the value of the similar index in the boars of Landrace, Duroc and Pietrain breeds, respectively (Table 5).

ble 4. Total amount of the ejaculate of breeding boars of different breeds when fed to the preparation "Primix-Alfasorb" ($\bar{X} \pm S\bar{X}$), ml

n = 3	Breeds of breeding boars			
	Yorkshire	Landrace	Duroc	Pietrain
I period	243,533±14,298	240,24±15,550	225,33±19,648	259,28±7,926
II period	251,640±18,920	220,487±14,120*; (**)	201,13±23,392	238,92±24,050
III period	236,050±14,916	296,778±19,400	218,79±19,44	305,19±19,283*

Note: * $p < 0.1$; ** $p < 0.05$ – by the I period; (**) $p < 0.05$ – by the final period

 ble 5. The indicators of sperm production of the breeding boars, when the preparation "Primix-Alfasorb" was used, ($\bar{X} \pm S\bar{X}$)

n = 3	Breeds of breeding boars			
	Yorkshire	Landrace	Duroc	Pietrain
Number of sperm doses, doses (1:4)				
I period	12,117±0,715	12,012±0,777	11,27±0,982	12,96±0,396
II period	12,582±0,946	11,024±0,706(**)	10,06±1,170	11,95±1,203*;(*)
III period	11,803±0,746	14,839±0,970*	10,94±0,972	15,28±0,964
The total number of spermatozoa in the ejaculate, billion				
I period	186,578±14,879	165,933±26,145	138,4±14,886	183,58±12,42
II period	182,778±12,944	148,773±8,469(*)	133,22±17,38	182,2±19,167
III period	183,546±21,403	175,507±6,660	147,01±13,11	238,39±31,838
Concentration, million/ml				
I period	765,299±30,106	682,964±61,705	614,44±35,412	706,53±26,29
II period	728,740±37,25	681,210±60,818	659,82±10,942	774,21±104,62
III period	772,576±39,754	595,966±40,172	671,88±4,015	772,71±58,073

Note: * $p < 0.1$; ** $p < 0.05$ – by the I period; (**) $p < 0.05$ – by the final period

The highest number of normal spermatozoa, during the control, the first and the final periods, was observed in the group of the Yorkshire boars (705,51, 691,02, and 739,56 million/ml, respectively). The same tendency was observed in relation to the spermatozoa's motility, which, during the whole experiment, was generally higher in Yorkshire boars in comparison with the animals of Landrace, Duroc and Pietrain breeds. It should be noted that, during the final period, the sperm motility in the boars of this breed was the highest (678,13 million/ml), i.e. by 25.68, 12.06 and 1.92%, respectively, higher in comparison with the indices of the boars of other breeds (Table 6).

Spermatozoa's suitability was among the indices studied in the experiment. During the control period the lowest suitability of spermatozoa in the sperm was observed in Duroc boars (554,11 million/ml). The semen of Yorkshire boars was stable, which indicates the possibility of obtaining the same amount of semen doses.

The main index of the quality of breeding boars' sperm is its fertilizing ability. This ability was the highest in the boars of Landrace breed (77.53%). The animals of Pietrain and Duroc breeds surpassed the boars of Yorkshire breeds in this index by 10.2 % and 8.88 %, respectively (Table 6).

Table 6. The indicators of sperm production of breeding boars, when fed with the preparation "Primix-Alfasorb", ($\bar{X} \pm S\bar{X}$)

Indices	Breeds of breeding boars			
	Yorkshire	Landrace	Duroc	Pietrain
	The first period			
Normal, million/ml	705,51±28,945	600,51±16,901	556,73±39,712	650,37±30,027
Motile, million/ml	643,13±34,194	595,11±62,857	546,02±29,717	600,52±8,598
Motile and normal, million/ml	597,16±31,175	522,77±22,734	494,69±33,579	552,59±9,414
Good, million/ml	625,6±38,340	582,93±62,285	536,59±26,491	569,55±24,322
	The second period			
Normal, million/ml	691,02±28,551	634,71±71,768	603,91±32,886	685,21±69,159
Motile, million/ml	629,96±30,370	573,2±45,370	565,01±23,086	635,56±70,782
Motile and normal, million/ml	598,20±23,522	533,92±55,132	531,13±28,982	563,50±42,633
Good, million/ml	615,58±28,255	556,12±39,884	554,11±23,150	599,64±46,421
	The third period			
Normal, million/ml	739,56±39,515	577,50±34,616	639,75±13,028	736,05±57,533
Motile, million/ml	678,13±29,415	503,99±31,432	596,35±9,805	665,10±46,330
Motile and normal, million/ml	649,24±29,104	488,49±26,510	568,21±19,028	633,82±46,159
Good, million/ml	654,49±24,377	489,73±30,268	582,37±12,841	637,98±40,358

It is known that the quantity and quality of offspring, their economic-useful signs depend on the reproductive ability of breeding boars. During the experiment, the number of piglets per sow varied, on average, depending on breed, from 10,17 to 10,94 head, with no significant differences. It has been found that the addition of

the adsorbent to the compound feed for boars does not affect the insemination and the farrowing of sows.

CONCLUSION

- A promising way to increase the reproductive functions of boars in the conditions of industrial technology is the use of some adsorbents which have mycotoxins decontaminating properties.
- When boars are fed with feed supplemented with 300 g/t of the preparation “Primix-Alfasorb”, the quantitative and qualitative indicators of sperm increase, and the effectiveness of artificial insemination improves.
- The utilization of the preparation “Primix-Alfasorb” in the compound feed for breeding boars increases the ejaculate volume of the boars of Landrace breed ($p < 0.5$; $p < 0.05$) during the second period of the experiment, and that of the Pietrain boars ($p < 0.1$) during the third period. The total number of spermatozoa in the ejaculate varies depending on breeds – 139,54 milliard in Duroc boars, and up to 201,39 milliard in the boars of Pietrain breed; this index increases in boars of all breeds during the third period of the experiment. As to the concentration of spermatozoa, it was higher in Yorkshire boars in comparison with other breeds by 13.52, 14.14 and 0.58%.

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