Age of first insemination of gilts and their productivity

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Abstract. The influence of the age of the first insemination of pigs on their subsequent productivity was evaluated. In the period from 2017 to 2020, 167 pigs were inseminated in the company Plemzavod-Yubileyny in the Tyumen region, which were divided into groups. Productivity indicators were analyzed based on the number of piglets born. In 2017, 12.5 piglets were obtained in group III, where the age of the first insemination was 241-253 days, and 12.7 piglets were obtained in group VI (281-311 days). In 2018, 101 sows were farrowed out of 164 heads (groups I, II, III), 1123 piglets were received from them, 1037 live ones were received. The largest number of piglets born was observed in group IV-12.4 units. In 2019, the largest number of piglets born was observed in group III-11.4 units. In 2020, out of 181 farrowings, 135 units were received, of which 1,528 piglets, of which 1,507.5 live.

1 Introduction

In providing the population of Russia with meat products, a significant role is assigned to pig breeding as the most intensive and efficient branch of animal husbandry, due to the extremely valuable biological characteristics of these animals: fertility, early maturity, omnivorousness, a wide range of use of slaughter products and their long-term storage.

In recent years, the use of sows has increased significantly. For a year, they began to receive 2.4 farrowings from a sow, 20-25 piglets per uterus. However, modern genetics and innovative technologies for keeping and raising animals make it possible to obtain up to 27-28 piglets. Denmark already receives 30 piglets from one sow per year. Effective technologies of pork in-line production in large industrial complexes have been developed [2].

In this regard, the age of introduction of replacement young stock into industrial use is of great importance. Too early use of them leads to weak offspring, reduced fertility, and later – to an increase in the cost of producing piglets. The late introduction of young gilts leads to an increase in the unproductive period of sow use. It should be noted that sows play a leading role in reproduction. The level of productivity, prospects and profitability of pig breeding depend on their age and their health [1].

Considering these circumstances and their importance in breeding work with mother breeds as the main means of production, we were faced with the task of identifying the

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most important factors influencing the productive use of sows on the basis of available information. In this regard, the aim of the research was to study the effect of the age of the first insemination of gilts on their subsequent productivity. The following tasks were set: to group the gilts according to the age of the first insemination; determine the relationship between age and subsequent productivity; to identify the optimal age of the first insemination.

Solving the issues of assessing the reproductive value of sows are important in understanding the reproductive potential of pig herds, especially breeds such as the Large White, Landrace, which are considered classic mothers [3].

2 Material and research methods

Much attention of breeders and geneticists of the world is directed to the creation of mother lines of pigs with high fertility, large piglet weight at birth, strong constitution and good health and longevity (duration of use). These indicators make it possible to stabilize technological processes on the farm by reducing the cost of introducing replacement young stock, recalculating feed, and improving the quality of offspring carcasses. Sows play a leading role in reproduction. The level of productivity, the prospects for the development of pig breeding and the profitability of running the industry depend on the state of their health.

The world experience of the pig breeding industry indicates that it is difficult to combine reproductive, meat and fattening qualities in one breed due to the low efficiency of simultaneous selection for many characteristics.

The terms of the productive use of sows depend on how proliferation, milk production and the safety of the litter will change with age. You should not change the sow every 2-3 years if all her indicators remain at a high level. According to the data of domestic and foreign scientists, the productivity of queens increases every year, and then begins to gradually decrease. On average, the duration of the use of the uterus is 5-7 years or 7-8 farrows. Sows show their best qualities in 2-5 farrowings.

The search for reserves for increasing the duration of the use of sows and obtaining the maximum number of piglets has become an urgent direction of research [2].

The research was carried out using the database of Plemzavod-Yubileiny, Tyumen region. Gilts of large white breed were studied. The following indicators were taken into account: the age of the first insemination, the number of gilts with abortion in different periods, the number of born and live piglets [3].

To identify the relationship between age and productivity, a grouping of gilts was carried out [4].

3 Results and discussion

The pigs were divided into groups according to the age of the first insemination. The results are shown in Table 1.

Table 1. Grouping of gilts according to the age of the first insemination.

Group	Age of first insemination. days	Number of pigs. units	Average live weight. kg	Termination of pregnancy. days			Sprouted. units	Piglets received	
				0-32	33-114	retired. units		Total. units	Alive. units
2017									
I	217-228	27	147	7	2	1	17	190	179
II	229-240	46	153	8	4	4	30	306	278
III	241-253	36	157	6	7	4	19	238	222
IV	254-267	20	166	2	3	2	13	151	138
V	268-280	8	170	1	1	1	5	50	47
VI	281-311	9	195	1	—	—	8	102	100
2018									
I	212-229	60	141	1 2	3	3	42	469	445
II	230-241	54	149	9	2	3	39	417	377
III	242-253	32	160	6	3	3	20	237	215
IV	257-268	14	166	2	2	2	8	99	95
V	270-277	4	180	—	—	—	4	41	40
2019									
I	209-229	84	138	4	5	4	66	735	672
II	230-241	54	146	3	2	2	47	516	487
III	242-254	19	158	—	2	2	13	148	130
IV	255-265	7	161	—	—	—	7	61	59
V	268-304	3	177	—	—	—	3	29	29
2020									
I	211-229	82	143	4	6	6	64	710	704
II	230-241	75	153	5	5	5	60	672	660
III	242-254	14	159	4	2	1	7	96	94
IV	256-268	7	169	2	1	1	3	38	37.5
V	271-288	3	190	1	1	—	1	12	12

Note: the data was processed in the spreadsheet editor M. Excel package "Data Analysis", confidence level $P \leq 0,95$.

Analysis of the results of insemination of large white pigs for 4 years (2017-2020) showed that the age began to decrease with each subsequent year. So in 2017, the fluctuations in the age of the first insemination were min – 217 days, max – 311 days, the interval within the group was 11 days. The largest number of 102 gilts, out of 146 units were inseminated in the period from 229 days to 267 days. From 102 gilts (II, III, IV groups) 62 units farrowed, 695 piglets were obtained from them, live – 638 units [9].

It should be noted that the pigs of the I group, inseminated at the age of 217-228 days, had a high rate of born piglets of 11.2 per farrowing. While the pigs of group II – 10.2, group III – 12.5, group IV – 10.6, group V – 10.0, group VI – 12.7. The largest number of piglets born was observed in group III – 12.5 units, where the age of the first insemination was 241-253 days and in group VI – 12.7, where the age of the first insemination was 281-311 days.

In 2018, the age of the first insemination was min – 212 days, max – 277 days, the interval within the group was 17 days. The largest number of 164 gilts, out of 164 units were inseminated in the period from 212 days to 277 days. Of the 164 gilts (groups I, II, III), 101 units were farrowed, 1123 piglets were obtained from them, live – 1037 units. In terms of one farrowing, it was obtained in group I – 11.2, in group II – 10.7, in group III – 11.8, in group IV – 12.4, in group V – 10.2. The largest number of piglets born was observed in group IV (12.4 units), where the age of the first insemination was 257-268 days.

In 2019, the variability in the age of the first insemination was min – 209 days, max – 304 days, the interval within the group was 11 days. The largest number of 157 gilts, out of 167 units were inseminated in the period from 209 days to 304 days. Of 157 gilts (groups I, II, III), 126 units were farrowed, 1399 pigs were obtained from them, live – 1289 units. In terms of one farrowing, it was obtained in group I – 11.1, in group II – 10.9, in group III – 11.4, in group IV – 8.7, in group V – 9.6. The largest number of piglets born was observed in group III, 11.4 units, where the age of the first insemination was 242-253 days.

In 2020, the age of the first insemination ranged from min – 211 days to max – 288 days, the interval within the group was 18 days. The largest number of 171 gilts, out of 181 units were inseminated in the period from 211 days to 288 days. Of 171 pigs (groups I, II, III), 131 units were farrowed, 1478 piglets were obtained from them, of which 1458 were live. In terms of one farrowing, it was obtained in group I – 11.1, in group II – 11.2, in group III – 13.7, in group IV – 12.7, in group V – 12.0. The largest number of piglets born was observed in group III, 13.7 units, where the age of the first insemination was 242-254 days (8-8.4 months).

An analysis of the insemination of gilts and its effectiveness in the period from 2017 to 2020 was carried out. (fig. 1).

Fig. 1. Dynamics of the results of insemination of pigs.

There was a positive trend in the percentage of gilts farrowing in 2019-2020, compared to 2017-2018. In 2020, there is a decrease by 8% in violations in the first half of pregnancy (0 to 32 days), by 4% in the second half of pregnancy (33-114 days), leading to abortion compared to 2017. It should be noted that the number of sows with terminated pregnancies in the studied years was uneven, which may be explained by the influence of various environmental, technological and other factors [5,6].

The study of the percentage of inseminations of gilts and the results of surveys, depending on the age of the first insemination, is shown in the graphs (Fig. 2).

Fig. 2. Efficiency of insemination of pigs depending on the age of the first insemination.

During the period of 2017, 18.5% of pigs were inseminated in group I, of which 11.6% farrowed, 18.3% of piglets were born, of which 17.3% are alive; in group II, 31.5 were inseminated, 20.5% of them farrowed, 29.5% of piglets were born, of which 26.8% were alive; in group III, 24.7% of gilts were inseminated, 13.0% of them farrowed, 23% of piglets were born, of which 21.4% were alive; in group IV, 13.7% were inseminated, of which 8.9% farrowed, 14.6% of piglets were born, of which 13.3% were alive. The composition of groups V and VI is small, which affected the percentage of inseminated and farrowed 5-6%, born and live piglets 4.8-4.5 and 9.8-9.6%, respectively.

In the period of 2018, in group I, 36.6% of gilts were inseminated, of which 25.6% farrowed, 37.1% of piglets were born, of which 35.2% are alive; in group II 32.9 were inseminated, 23.8% of them farrowed, 33.0% of piglets were born, of which 29.8% were alive; in group III, 19.5% of gilts were inseminated, 12.2% of them farrowed, 18.8% of piglets were born, 17.0% of them were live; in group IV, 8.5 were inseminated, of which 4.9% farrowed, 7.8% of piglets were born, of which 7.5% were alive, in group V there were 4 gilts at the age of 270-277 days, which amounted to 2.4% all of them farrowed and 3.2% live piglets were obtained.

In the period of 2019, 50.3% of gilts were inseminated in group I, of which 39.5% farrowed, 49.4% of piglets were born, of which 45.1% are alive; in group II 32.3 were inseminated, 28.1% of them farrowed, 34.7% of piglets were born, of which 32.7% were

alive; in group III, 11.4% of pigs were inseminated, of which 7.8% farrowed, 9.9% of piglets were born, of which 8.7% were live; in group IV, 4.2 were inseminated, all farrowed, piglets were born 4.1%, of which 4.0% were alive, in group V there were 3 gilts aged 268-304 days, which amounted to 1.8%, all of them farrowed and received 1.9% of live piglets [10,11].

In the period of 2020, 45.3% of pigs were inseminated in group I, 35.4% of them farrowed, 46.5% of piglets were born, of which 46.1% were alive; in group II, 41.4 were inseminated, 33.1% of them farrowed, 44.0% of piglets were born, of which 43.2% were alive; in group III, 7.7% of pigs were inseminated, 3.9% of them farrowed, 6.3% of piglets were born, of which 6.2% were live; in group IV 3.9% were inseminated, 1.7% farrowed, 2.5% piglets were born, in group V there were 3 gilts aged 271-288 days, which amounted to 1.7% of them farrowed 0.6%, received 0 , 8% live pigs.

Graphical analysis showed that the first insemination of gilts is observed at a younger age of 7-9.6 months. (211-288 days) in 2020 compared to 7.3-10.4 months. (217-311 days) in 2017. The largest number of gilts, 86.7%, were inseminated at the age of 7 to 8 months, of which 68.5% farrowed, 90.5% of piglets were born, including 89.3% live. This is due to the introduction into the herd of gilts of specialized mother breeds with high vigor of growth and development, capable of showing high productivity [7,8].

4 Output

There was a positive trend in the percentage of gilts farrowing in 2020 compared to 2017. In 2020, there is a decrease by 8% in violations in the first half of pregnancy (0 to 32 days), by 4% in the second half of pregnancy (33-114 days), leading to abortion compared to 2017. The number of sows with terminated pregnancies in the studied years was uneven, which may be explained not by the ages of the first insemination, but by the influence of various environmental, technological and other factors [12].

A decrease in the age of the first insemination of gilts was noted, so in 2020 gilts were inseminated at a younger age of 7-9.6 months. (211-288 days) versus 7.3-10.4 months. (217-311 days) pigs in 2017. Analysis of the age of first insemination and the number of piglets obtained showed that the largest number of gilts, 86.7%, were inseminated at the age of 7 to 8 months, of which 68.5% farrowed, 90.5% of piglets were born, including 89.3% alive. This is due to the introduction into the herd of gilts of specialized mother breeds with high vigor of growth and development, capable of showing high productivity.

The minimum age for the first insemination of Large White gilts was 209 days in 2019, that is, 6.9 months. the average live weight is 138 kg, from them 11.1 piglets were received per one farrowing. It should also be noted that gilts bred at the age of 217-228 days had a high birth rate of 11.2 piglets per farrowing in 2017. High rates of received piglets 13.7 per one farrowing were noted in gilts bred at 242-254 days, that is, 8-8.4 months. According to the research results, the most optimal age of the first insemination can be considered 7-8 months [13, 14, 15].

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