ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Productive Quality of Ranty Boar Depending by The Breed and Genotype.

Vladimir Anikeevich Pogodaev[1]*, Valentin Sergeevich Skripkin[2], Igor Gennadievich Rachkov[1], Svetlana Ivanovna Novopashina[1], Mikhail Yuryevich Sannikov[1], and Vitaliy Fedorovich Filenko[2].

[1]North-Caucasian Federal Scientific Agrarian Center, Zootekhnicheskiy lane 15, Stavropol 355017, Russia.
[2]Stavropol State Agrarian University, Technological Management Department, Zootekhnicheskiy lane 12, Stavropol 355017, Russia.

ABSTRACT

The relevance of the study is due to an objective prognosis of productivity based on the true genetic potential of animals when breeding pigs for improving productive qualities. Gender of the ryanodine receptor (RYR-1); estrogen receptor gene (ESR); meat production gene (H-FABP). The leading method to investigate this problem is to protect the pedigree value of animals based on DNA markers, which makes it possible to obtain information about the genotype of the animal and its productive qualities. The article presents data confirming the expediency of genetic diagnosis of the reproducing part of the herd, both boars and sows, which allow objectively to identify the alleles preferred for breeding. Selection of such animals as parental pairs will significantly increase the productivity of pigs.In addition to gene diagnostics, it is advisable to include quantitative and qualitative indices of sperm production in the reproductive process, based on the real age of the animals and breed, rather than being guided by exterior and weight indices. The genotypes BB (ESR gene), HHdd (H-FABR gene) and NN (RYR-1 gene) are preferred from the viewpoint of selection. Genotypes AB, HhDd and Nn above these genes are intermediate for selection, and genotypes AA, hhDD and nn are undesirable or unacceptable for further breeding. The materials of the article are of practical value for scientists, breeders and specialists in pig farms, as traditional methods of breeding to a large extent, supplemented by genetic markers, allow more efficient assessment, selection and selection of individuals with the desired genotypes.
Keywords: pigs, productivity, DNA diagnostics, genotype, genetic markers.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

In recent years, significant changes have taken place in the world selection of technologies for assessing the breeding value of farm animals. First of all, these technologies are associated with genomic scanning of economically valuable signs of productivity.

In 1984, Carey Myullis first proposed a method for amplifying DNA fragments, which was later called polymerize chain reaction (PCR).

In 1998, Hailie and Visheer proposed the term "genomic selection" [1], and in 2001, Movissen and co-authors [2] developed a fundamentally new methodology for assessing the pedigree value of animals based on DNA markers.

It is known that most of the economically valuable breeding features have a polygenic character, i.e. is controlled by a variety of genes. At the same time, there are genes, or rather the alleles of these genes, whose contribution to the manifestation of one or another sign of productivity, regardless of the effect of environmental factors, has a clearly pronounced effect.

Such genes are called the main genes of quantitative traits (Quantitative Trait Loci, QTL). Identification of differences between animals on allelic variants in DNA loci makes it possible to select animals directly from genotypes, i. E. on genetic markers. This approach is called marker selection or MAS-selection (Marker Assisted Selection, MAS) [3, 4].

Fundamental knowledge in the field of molecular genetics allowed, by 2010, to decipher the genomes of the main species of farm animals - cattle, pigs, sheep and carry out genotyping of animals by thousands of DNA markers. The most convenient for use in practical selection is SNP (Single Nucleotide Polymorphism), the so-called snip or single nucleotide polymorphism, i.e. a difference in the DNA sequence of one nucleotide in size (A, T, C or G), which may be the reason for changing the amino acid sequence in the protein. This, in turn, changes the manifestation of the sign of productivity in one direction or another.

For more rapid information about the animal genotype, Illumina and Affymetrix have developed DNA chips that allow the animal to genotype more than 50,000 SNP markers [5].

The most common and recognized in SNP-markers is the best linear unbiased forecast or BLUP - best linear unbiased prediction and Animal model, whose share determines the breeding value (TBV) [6]. Thus, the genomic score (Total Genomic Breeding Value, TGBV) of an animal consists of summing the indicators of the overall index of breeding value, taking into account the significance factors of each SNP marker.

Genotyping of animals made it possible to establish inheritance in the genes of certain valuable alleles almost immediately after birth, eliminating phenotypic evaluation during productive use. Thus, the pedigree value of the animal can be predicted at the earliest age, which increases the efficiency of selection selection by an order of magnitude [7,8,9].

Today, significant funds are allocated for the implementation of genomic studies of different types of farm animals that are conducted in more than two dozen countries. At the same time, the budget of these studies is hundreds of millions of dollars [4]. In order to be able to compare the genotypes of more animals and to determine the existence of links between known point mutations (SNPs) and pedigree value indicators, many foreign molecular genetic laboratories combine efforts, creating a single database [10].

Thus, DNA diagnostics is an actual direction of fundamental and applied biotechnology, which makes it possible to translate the selection of pigs to a qualitatively new level and to obtain an objective prognosis of productivity based on the true genetic potential of animals.

The purpose of our work was to study the productivity of boars - producers, depending on the breed and the genetic profile of DNA markers: the ryanodine receptor gene (RYR-1); estrogen receptor gene (ESR); meat production gene (H-FABP).

ISSN: 0975-8585

MATERIALS AND METHODS

The work was carried out by the employees of VNIIOK, a branch of the North Caucasian FNAC Federal State Educational Establishment, based on the SVK of Krasnogvardeysky District, ZAO Kroshov State Farm of the Trunovsky District, and the Stroipelsky Territory of the Novoaleksandrovsky District of the Stavropol Territory in 2017.

In the SVK of the Krasnogvardeysky District, 13 boar producers with a blood content of 50% duroc x 50% pietrene were examined, 12 hogs-producers of the early maturing breed (SM-1) and in the SKhPK "Russia" in the ZAO "Sovkhoz named after Kirov" of the Trunovsky district Novoaleksandrovsky district 31 boar producer of a large white breed.

An analysis of the genetic profile was carried out on boars produced by the following DNA markers: the ryanodine receptor gene (RYR-1); estrogen receptor gene (ESR); meat production gene (H-FABP).

DNA extraction from blood samples was carried out using a set of DIAtomTM DNA Prep 100 reagents. The polymorphism of the genes of stress sensitivity (RYR-1), fecundity (ESR) and meat (H-FABP) was studied by polymerase chain reaction (PCR) according to the techniques using primers matched so that the DNA fragment between them includes recognition sites specific for allelic variants of the genes. Amplification was carried out using sets of reagents for PCR amplification of DNA - Genepak PCR Core. The amplified products were digested with appropriate endonucleases and electrophoresed in a 2.0% agarose gel, followed by identification in ultraviolet light on a transilluminator and using the Gen Imager program.

The index of assessment of fattening and meat qualities of pigs was calculated by the formula:

$$O100 = 1.3\ (200- Ha) + 0.1\ (Xb-650) + 67\ (4.1-Xc) + 2\ (Xg-93) + 4\ (33-Xd) + 15\ (Xe\ -10.2);$$

where: Ha - the age of reaching 100 kg of live weight; Xb - the average daily gain; Xc - feed costs;Xg - length of the carcass; Xd is the thickness of the fat; Xe - the mass of the posterior third of the carcass.

RESULTSANDDISCUSSION

As a result of the genotyping of boars produced with blood (50% durok x 50% pietren), SVK of the Krasnogvardeisky District, Stavropol Territory, found that all animals were stress-resistant (gene RYR-1), and for the meat gene (H-FABP) in boars, four genotypes were identified - HHDd, HhDd, HHDD and HhDD.

The results of control fattening of gilt pigs in the genotype of boar genes for the RYR-1 and H-FABP genes are presented in Table 1.

Studies have established that animals with the genotype HHDd (group I) outperform the analogues of groups II, III and IV by an average daily increase of 8-49 g, and, consequently, the age of reaching a live weight of 100 kg for 2-6 days.

Substantially less deposition of subcutaneous fat was found in group I goblins, in which the genotype Dd of the H-FABP gene was in a heterozygous form. Thus, in young pigs of group I the thickness of the fat was less than in II, III and IV by 4.0-8.0% ($P > 0.95$). Positive influence of the dominant (desirable) form of the genotype HH (group I) on the weight of the ham and the area of the "muscular eye" was noted. They were higher than in groups II and IV on average by 3.0-6.1%, respectively.

The index of meat and fattening qualities of pigs, which includes 6 basic indicators of animal productivity, clearly demonstrates the superiority of group I gilts (HHDd) over peers of other variants of polymorphism. Differences ranged from 12 to 42 points.

Investigations into the effect of the genotypes of the RYR-1 and H-FABP genes on the productivity of the gilt pigs obtained from the boars-producers of various early-ripened meat breed genotypes (SM-1) in ZAO "Sovkhoz named after Kirov" of the Trunovsky District, Stavropol Territory (control fattening method) variants with the genotype NN HhDd exceed in age the achievements of live weight of 100 kg of analogues of group II

for 2 days. The average daily growth in young group I was higher by 8 g (Table 2).

A significant difference was found between the subcutaneous fat deposits in the group I goblins, in which the genotypes of the H-FABP gene were in a recessive form. Thus, the I group of pigs was superior to the analogues of Group II in the thickness of bacon by 4.2%. The positive effect of the H-FABP and RYR-1 genes with the desired genotypes of HhDd and NN on the weight of the ham and the area of the "muscle eye" was noted.

An objective assessment of fattening and meat qualities based on the sum of 6 main indicators expressed in the index clearly demonstrates the superiority of the animals of group I over peers of another variant of polymorphism, the difference was 32 points. To assess the productivity of pigs of a large white breed of the Grigoropolis type in the SKPK "Rossiya" Novoaleksandrovsky district of the Stavropol Territory The control fattening of the gilt pigs obtained from boars of different genotypes of the H-FABP gene was carried out (Table 3)

Studies have established that animals with the HHDd genotype (group I) outperform the analogues of groups II, III and IV by an average daily gain of 11-30 g and age of reaching a live weight of 100 kg for 1-3 days.

Substantially less deposition of subcutaneous fat was found in group I goblins, in which the genotype Dd of the H-FABP gene was in a heterozygous form. Thus, in young pigs of group I the thickness of the fat was less than in II, III and IV by 4.5-9.0% (P> 0.95). Positive influence of the dominant (desirable) form of the genotype HH (group I) on the weight of the ham and the area of the "muscular eye" was noted. They were higher than in II-IV groups on average by 2.9 - 4.2%, respectively.

The index of meat and fattening qualities (O100) of pigs, which includes 6 basic indicators of the productivity of animals, clearly demonstrates the superiority of the group I piglets (HHDd) over peers of other variants of polymorphism. Differences ranged from 14 to 32 points. However, it should be noted that in the general mass of animals this genotype is present in 21.0% of individuals, and in the majority of pigs the difference in productive qualities is practically leveled within the error.

Thus, when conducting the selection process in the breeder of the Russian Agricultural Production Association "Russia", as well as when purchasing boar producers for reproductive farms, preference should be given to animals carrying the HHdd and HHDd genotypes of the H-FABP gene.

Among a number of factors for the intensification of pig production, a special place belongs to purposeful cultivation and a comprehensive evaluation of the productive qualities, which results in the selection of the best boars-producers as the main individuals in the reproduction of pigs.

Puberty in boars is a slow process, as a result of which sperm formation and sexual desire are manifested simultaneously, starting at the age of 4 months.

Previous studies have shown that boar growth ends by the end of the first year of life, so an increase in the total number of semen and sperm production is accompanied not only by the development of puberty, but also by weight gain. The size of the testes is positively correlated with the total sperm volume and increases in proportion to the total body size. Sperm was successfully obtained from boars of 5 months of age, but both in volume and in content of immature and inferior spermatozoa, this sperm is much worse than sperm from mature boars. In addition, the authors do not exclude the influence of genetic differences on the development of puberty in boars of different breeds.

The genotyping of boar-producers with blood (50% durok X 50% pietren) in SVK of Krasnogvardeisky region according to the reproduction gene (ESR) showed that animals are divided into two genotypes - heterozygous AB and homozygous (desired) genotype BB.The results of the evaluation of boar sperm production showed a slight superiority of the boars of the BB genotype of the ESR gene in terms of ejaculate volume and sperm concentration. However, the number of rectilinearly mobile spermatozoa in boars of the homozygous genotype (BB) of the estrogen receptor was 44.7 billion for ejaculate, which is 6.2% more than for the heterozygous genotype (AB).

ISSN: 0975-8585

Table 1: Resultsofevaluationoffatteningandmeatqualitiesofyoungpigsobtainedfromboars-producersofdifferentgenotypesin SVK Ltd. InKrasnogvardeysky District, StavropolTerritory

№	Groups	Indicator							
		age of weight gain 100 kg, days	Daily weight gain (from 30 to 100 kg), g	feed costs for 1 kg weight gain, feed. units	length of carcass, cm	thick ness of bacon, mm	Weight of ham, kg	area of the «muscularеye», cm^2	O 100, score
1	RYR-1 NN H-FABP HHDd	174±2,8	827±1,8	3,28±0,5	98±0,5	23±0,1*	10,9±0,1	36±0,7	167
2	RYR-1 NN H-FABP HhDd	175±2,5	819±2,1	3,3±0,3	97±0,4	24±0,2*	10,7±0,1	35±0,5	155
3	RYR-1 NN H-FABP HHDD	178±2,7	789±3,1	3,34±0,2	96±0,5	25±0,1	10,4±0,4	35±0,4	134
4	RYR-1 NN H-FABP HhDD	180±2,8	778±3,3	3,40±0,4	95±1,2	25±0,2	10,4±0,2	33±0,7	125

*P>0,95

Table 2: Results of assessment fattening and meat qualities of young pigs obtained from boars-producers of different genotypes of early maturing meat in ZAO "Sovkhoz named after Kirov" of Trunovsky district

№	Groups	Indicator							
		age of weight gain 100 kg, days	Daily weight gain (from 30 to 100 kg), g	feed costs for 1 kg weight gain, feed. units	length of carcass, cm	thickness of bacon, mm	Weight of ham, kg	area of the «muscularеye», cm^2	O 100, score
1	RYR-1 NN H-FABP HhDd	177±2,9	792±3,9	3,17±0,7	96±0,5	23±0,2	10,9±0,5	35±0,9	163
2	RYR-1 NN H-FABP HhDD	179±4,2*	784±4,7**	3,49±0,6**	96±1,0	24±0,6***	10,7±0,4	33±0,6*	131

*P>0,95

ISSN: 0975-8585

Table 3: Results of the assessment of fattening and meat qualities of young pigs obtained from boars-producers of different genotypes of KB rocket in the «Russia» joint-stock company «Novoaleksandrovsky district»

№	Groups	Indicator							
		age of weight gain 100 kg, days	Daily weight gain (from 30 to 100 kg), g	feed costs for 1 kg weight gain, feed. units	length of carcass, cm	thickness of bacon, mm	Weight ofham, kg	area of the «musculareye», cm^2	O 100, score
1	RYR-1 NN H-FABP HHDd	172±2,0	850±1,5	3,2±0,1	99±0,3	22±0,1	10,8±0,2	37±0,5	182
2	RYR-1 NN H-FABP Hhdd	173±2,1	839±2,0	3,24±0,2	98±0,2	23±0,2*	10,6±0,1	36±0,2	168
3	RYR-1 NN H-FABP HhDd	174±2,8	825±1,8	3,21±0,2	98±0,3	23±0,2*	10,6±0,1	36±0,3	167
4	RYR-1 NN H-FABP HhDD	175±2,5	820±3,5	3,30±0,1	97±0,1	24±0,1*	10,4±0,2	35±0,2	150

*P>0,95

In boars of different genotypes, differences were established for such indicators as the fertilization of sows (by 6.9%), the production of live piglets (0.5 piglets), preservation (2.2%) in favor of animals with a homozygous BB genotype.

At the same time, the bulk (90%) of boars produced by OOO SVK are carriers of the heterozygous AV genotype.

According to the results of genotyping of boars-producers of the CM-1 breed in CJSC "Sovkhoz named after Kirov" of the Trunovsky district, it was found that in the reproductive part of the herd the desired genotype of the ESR gene of the ESR gene is present in 25.0% of animals, and 75% of boars are carriers of the genotype AB. At the same time, a high content of allele B (0.625) is noted in the genotypes of the ESR gene in this breed. Thus, the probability of inheritance of the genotype BB (desirable for reproduction) is high in offspring from these boar-producers.

In addition, the effect of different allelic state of the estrogen receptor gene on the reproductive qualities of the SM-1 boars.

Genotyped boars have differences in such indicators as the fertilization of sows (by 7.1%), the production of live piglets (0.4 pigs), and preservation (2.9%) in favor of animals with a homozygous BB genotype.

Genotyping of boars - producers of large white breed in the "Russia" CSPC "Novoaleksandrovsky region for the reproduction gene (ESR) showed that animals are divided into two genotypes - heterozygous AB and homozygous (desired) genotype BB. Undesired homozygous genotype AA is not detected. In addition, all animals by gene (RYR-1) are stress-resistant.

The carried out genotyping of boar-producers allowed to establish the advantage of the homozygous genotype (BB) by fertilization by 6.8% and the safety of piglets at 30 days of age by 3.0%. This regularity can be traced in all farms, regardless of the method of insemination (covering) of animals and the breed composition of boars.

On the basis of the obtained data, it can be stated that the gene pool of father's genotypes in the region created is quite competitive for the implementation of more promising and large-scale projects of breeding specialized types of pigs with the involvement of a small contingent of imported intensive meat breeds.

CONCLUSIONS

On the basis of the obtained data, it can be stated that the gene pool of father's genotypes in the region created is quite competitive for the implementation of more promising and large-scale projects of breeding specialized types of pigs with the involvement of a small contingent of imported intensive meat breeds.

The obtained data confirm the expediency of genetic diagnosis of the reproducing part of the herd both boars and sows, which will allow objectively to identify the alleles preferred for breeding. Selection of such animals as parental pairs will significantly increase the productivity of animals in the region.

However, in addition to gene diagnosis, it is desirable to include the boar producers in the reproductive process to take into account the quantitative and qualitative indicators of sperm production, based on the real age of the animals and breeds, rather than being guided by exterior and weight indices.

Based on the results of earlier observations and subsequent studies on the evaluation of utility indicators of productivity in the context of allelic systems, it should be clarified that the genotypes BB (ESR gene), HHdd (H-FABR gene) and NN (RYR- 1). Genotypes AB, HhDd and Nn above these genes are intermediate for selection, and genotypes AA, hhDD and nn are undesirable or unacceptable for further selection.

Traditional breeding methods, to a large extent, supplemented by genetic markers, allow evaluation, selection and selection of individuals with desirable genotypes to be much more effective.

REFERENCES

[1] Haley C.S., Visscher P.M. Strategies to utilize marker – quantitative trait loci associations. J. Dairy Sci. 1998, 81(2), pp. 85-97.

[2] Meuwissen T.H.E. Genomic selection: The future of animal breeding. Norwegian University of Life Sciences, Box 5003, 1432 As Norway. 2007,pp. 88-91.

[3] Zinoviev N., Gladyr E., Kunaeva E. Methods of marker-dependent breeding. Livestock breeding in Russia. 2006, 3,pp. 29-31.

[4] Kuznetsov V.M. Associations of blood groups with quantitative traits. Mas and genomic selection. 2010. [Electronic resource] URL: http: www. vm-Kuznetsov.ru> files/etude/13_blood_gs.pdf.

[5] Smaragdov M.G. Total genomic selection with the help of SNP as a possible accelerator of traditional selection. Genetics. 2009. 45(6). pp. 725-728.

[6] VanRaden P.M. Sullivan P.G. International genomic evaluation methods for dairy cattle. Genet. Selec. Evol. 2010,42,pp. 7.

[7] Goddard M.E. Hayes B.J. Genomic selection. Journal of Animal Breeding and Genetics. 2007, 124. pp. 323-330.

[8] Pogodaev V.A. Marynich S.V., Frolko E.G., Mishvelov, and Glushko A.Y. Meat Productivity Pigs with Different Parts of Blood from Breeds CM–1 and landrace. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016, 7(4), pp. 1345-1348.

[9] VanRaden P.M. Genomic imputation and evaluation using high density Holstein genotypes. J. Dairy Sci. 2013. 96. pp. 668-678.

[10] PogodaevV.A, Komlatsky V. I., Komlatsky G. V., Arylov Y. N., M. A. Nesterenko Productive and interior features of piglets when using biogenic stimulators SITR and ST. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2017, 8(6),pp. 632-637.