TECHNICAL UNIVERSITY OF MOLDOVA

As a manuscript

C.Z.U.: 638.162.3:546.3.

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THE EFECT OF USING HYBRID BOARS FOR GENETIC AND PRODUCTIVE POTENTIAL IMPROVEMENT OF SWINE

421.03 – THE TECHNOLOGY OF ANIMAL BREEDING AND OBTAINING ANIMAL PRODUCTS

Abstract of Phd Thesis in agricultural sciences

CHIŞINĂU, 2025

The thesis was elaborated within the Animal Resources and Food Safety Department of the Technical University of Moldova

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The thesis defence will take place at 02.07.2025, hour 14.00 during the meeting of Doctoral Commission with Technical University of Moldova, mun. Chișinău, MD-2049, Mircești 58 str, meeting room 304.

Doctoral thesis and summary can be consulted at the Technical University of Moldova library and on the web page of ANACEC (www.anacec.md) but also on web page TUM (http://repository.utm.md).

Opinions on the doctoral thesis can be sent to the email address of the secretary of Public Commission (tatianadabija30@gmail.com).

The summary can be sent to „....." ..... 2025.

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CONTENT

CONCEPTUAL MARKINGS OF THE RESEARCH

Theme actuality. The growth of pigs is determined by the population's preference for pork consumption, which in the Republic of Moldova accounts for more than 52% of total meat production. This is why, within the structure of the types of meat consumed, pork occupies a leading position that will continue for a long time to come. Farms [20, 13] swine breeding and fattening units can be competitive by practicing the intensive system, based on the use of modern and efficient selection and hybridization technologies for feeding and exploitation. The use of these technologies must ensure the continuous carcass increase and meat quality by permanently reducing feed consumption per kilogram of gain and labor force. Performance and competitiveness for the production process can be achieved by using the most productive breeds, lines and types of pigs well acclimatized and selected in local conditions in hybridization systems. In order to obtain efficient productions from a quantitative and qualitative point of view, more tasks are needed towards the effective exploitation of the heterosis phenomenon by creating synthetic lines, selected for certain characteristics and productivity directions [7, 9, 10].

Description of the situation in the research field and identification of research problems. The populations formed and improved under the conditions of our country, as well as the import genotypes, require their rational use in the system of raising swine. Unlike other species of domestic animals in pigs, the fat is distributed in the layer, in many countries bacon is used efficiently and willingly in food products, being prepared according to certain recipes, which are traditional among different nations. The productive potential increase for swine of is base strictly on determined tasks regarding the creation of the selection material for obtaining competitive hybrids, thus forming premises for the efficiency of pork production. This requires the establishment and development of breeding units, where work would be carried out to create specialized lines and types of pigs, used to produce commercial hybrids. [4, 11, 12]. Reducing the period of genetic material attainment towards the process of fattening and production of competitive meat presents a problem, which can be solved by introducing into the hybridization systems different genetic types of hybrid boars, having a biracial, triracial or multiracial structure. Therefore [5] the final product accumulates the performance qualities of the pig breeds, a situation that accelerates the process of forming the productive potential of the pigs.

Purpose of the work: scientific argumentation of the effect of the use of hybrid pigs in the hybridization process and reduction of the training period and identification of genetic types with capacities to produce quality meat in accordance with consumer requirements.

Research objectives

1. Prolificacy evaluation and lactation capacity of sows depending on the genetic type of the parental pig forms.

2. Comparative assessment of piglet birth weight and body mass of young swine depending on parental swine breeds.

3. Studying the growth rate and fattening capacity of hybrid youth.

4. Carcass quality evaluation, morphological structure and meat quality assessment in hybrid young animals.

Research hypothesis - evaluation and argumentation of types of production for swine competitive biological material based on the use of hybrid pigs in hybridization schemes.

Synthesis of research methodology and justification of research methods

The research methodology was developed based on the scientific concepts of swine farming scientists [4, 17]. Through their use, reproductive capacity, growth and development of young swine, hematological and biochemical indices, carcass quality, meat and muscle and adipose tissue formation were evaluated by using hybrid boars in the hybridization process.

THESIS CONTENT

The **Introduction** argues the topic actuality, the situation in the field and the premises for the development and efficiency of pork production based on the implementation of scientific research results, the purpose and objectives of the research, the research hypothesis, the synthesis of the methodology and the justification of selected research methods, as well as the summary of thesis sections.

1. PRODUCTIVITY IMPROVING FEATURES IN SWINE

The first chapter shows the results of scientific research presented by authors from the Republic of Moldova and other countries regarding the role of hybridization in increasing meat quantity and quality by capitalizing on the heterosis phenomenon. We also show the effect of using multiple hybrid production variants which is argued based on the assessment of the ability to combine breeds and specialized lines of pigs.

2. MATERIAL, METHODS AND RESEARCH CONDITIONS

The research was conducted within the State Agrarian University of Moldova and the Department of Animal Resources and Food Safety, of the Technical University of Moldova, and the experiments were carried out in the production unit for raising and fattening swine SC "Agroseminvest" SRL in Burlăceni village, Cahul district. To achieve the purpose of the work and obtain the genetic material, Landrace x Great White sows, Pietrain, Duroc, and Duroc x

Pietrain hybrid boars (AXIOM Company), as well as triracial hybrid boars obtained by using Great White x Landrace sows and Pietrain boars (Hypor Company, Romanian branch), there were imported from France and used in the experimentation process.

The study was conducted in 5 experimental batches of hybrids, in the formation of which the maternal form in all batches was the Landrace x Large White product, and the paternal form was purebred Pietrain and Duroc boars; Duroc x Pietrain hybrid boars; (Large White x Landrace) x Pietrain; (Large White x Landrace x Pietrain) x Pietrain. Each variant consisted of 6 Landrace x Great White gilts and 30 hybrid, tri-racial and tetra-racial young. In the process of forming the experimental groups, the analogous principle was applied, where the origin, body mass and age of the sows were taken into account.

The reproductive capacity of 6 sows was studied on a batch of 30 heads, and the evaluation indices were: prolificacy determined by counting the live piglets born, the mass of a piglet at birth, the lactation capacity assessed by weighing the batch of piglets at the age of 21 days. In order to assess the growth rate and meat production, 150 young pig heads were selected, analogously according to origin, age and body weight. The animals were weighed at the end of each month to determine the average daily gain and the age at which they reached 110 kg. During the growth and development period, blood samples were collected from 3 samples from each experimental batch at the age of 90 days, for general blood analysis, hematological and biochemical parameters and protein fraction content. The analyzes were performed in the "Vulcănești Health Center". The specific consumption was calculated based on the records of the feed administered, compared to the monthly gain.

The control slaughter was carried out at a body weight of 110-120 kg, a total of 15 heads of 3 from each batch were slaughtered. The carcass evaluation was carried out while hot, through gravimetric and dimensional measurements, according to the following indices: carcass mass - by weighing on an electronic scale; large carcass length - from the first cervical vertebra to the pubic bone; small length from the pubic bone to the first thoracic vertebra; slaughter yield - was calculated by relating the carcass mass to the live weight. The thickness of the layer of fat at the withers, loins, saddles and rump was measured with a tape measure. For the study development of ham, the weight was determined, with an electronic scale, the length with a ribbon from the pubic bone perimeter to the hock. The development of the internal organs was assessed by weighing each organ separately. To evaluate the quality of the meat, muscle tissue samples were collected from the long dorsal muscle, in the amount of 250g/sample, where the amount of: water, protein, fat and collagen was found. The analyzes were carried out at the "Cagle lab's"

device, manufactured in Germany, IȘPBZMV. The samples were first minced in a meat grinder with a sieve section diameter of 4 and 1 mm.

The amino acid analyzer T 339 M was used to determine the content of amino acids". The analysis was carried out in the laboratory of the Institute of Physiology and Sanocratology of the Academy of Sciences of Moldova. The assessment of the percentage of muscle tissue in the carcass was carried out by the two point method (Zwei punkte - ZP), approved in the EU. Two linear measurements are made on the carcass, such as the thickness of the bacon above the Gluteus medius muscle including the skin thickness (S1) and the thickness of the meat in a straight line between the medullary canal of the spine and the anterior tip of the Gluteus medius muscle (S2) and entering the results obtained into the calculation formula: Y= 51.1639 - 0.6145 x S1 + 0.1910 x S2.Pentru determinarea capacității de reținere a apei (CRA) s-a folosit metoda Grau-Hamm iar pentru aprecierea capacitatății de pierdere la fierbere (CPF) s-a utilizat metoda Lohse-Schroder.

Determination of meat quality was carried out using 3 meat samples collected from each experimental lot. Organoleptic indicators: color, odor, taste. Technological indicators: pH and water retention capacity. Meat pH was determined in laboratory conditions using a pH meter. Color was assessed subjectively using the Canadian 5-note standard. The organoleptic examination of fresh meat was evaluated by taste and smell.

The data obtained was processed biometrically by the method of statistical variations using the Microsoft Office Excel program and the Student Standard, Плохинский Н [17].

3. INCREASING THE PRODUCTIVE POTENTIAL OF SWINE

3.1. Reproductive capacities of swine. Multiple research conducted until present testify the fact that the substantial increase [6, 11] in pig productivity is largely attributable to the heterosis effect achieved by combining specialized lines and breeds in the hybridization process. This resulted, to growth energy, viability and prolificacy of animals in the hybridization process are significantly increased [16]. The evaluation of the reproductive qualities of sows demonstrates that the crossbreeding and hybridization of pigs, implemented in production units, have substantially contributed to achieving better results in increasing pig productivity. Table 3.1 reflects the reproductive capacities of swine achieved by using different genetic types.

Table 3.1

Reproductive capacities of swine, $\overline{X} \pm S\overline{x}$, n=6

Batch	Genetic type	Prolificacy, cap.	Piglet weight at birth, kg	
			Vieruși	Scrofițe
I (control)	L x MA x P	11,50 ±0,76***	1,41 ± 0,02*	1,48 ± 0,03**
II	L x MA x (MA x L x P)	12,83 ± 0,79	1,54 ± 0,02	1,60 ± 0,02
III	(L xMA) x (MA x L x P) x P	13,33 ±0,84***	1,51 ± 0,10	1,43 ± 0,10
IV	L x MA x D	11,66 ± 1,45	1,69 ± 0,03*	1,69 ± 0,03**
V	L x MA x (D x P)	13,00 ± 1,06	1,56 ± 0,03	1,51 ± 0,02

Sows prolificacy is influenced by the genetic type of the breeds used to produce hybrids. In group III where prolific breeds participated to the crossbreeding, an average of 13.33 piglets were obtained per farrowing, and a smaller number of piglets in group I, the difference being equal to 1.83 piglets (B>0.95). In batches II, IV and V, the prolificacy of sows is quite high, which proves that the combinations of breeds studied have a superior productive value and can be used to produce hybrids for fattening and marketing. The theoretical argument is that in the hybridization process, prolificacy increases, due to the fact that, the heterosis effect is greater for traits with reduced heritability. This is why the production of hybrids is profitable and allows for a reduction in the number of sows needed to reproduce piglets. But this means that financial expenses related to the reproduction process are decreasing, and economic indicators are tending to increase. Growth divergence between piglets and sows during is prezent in figure 3.1.

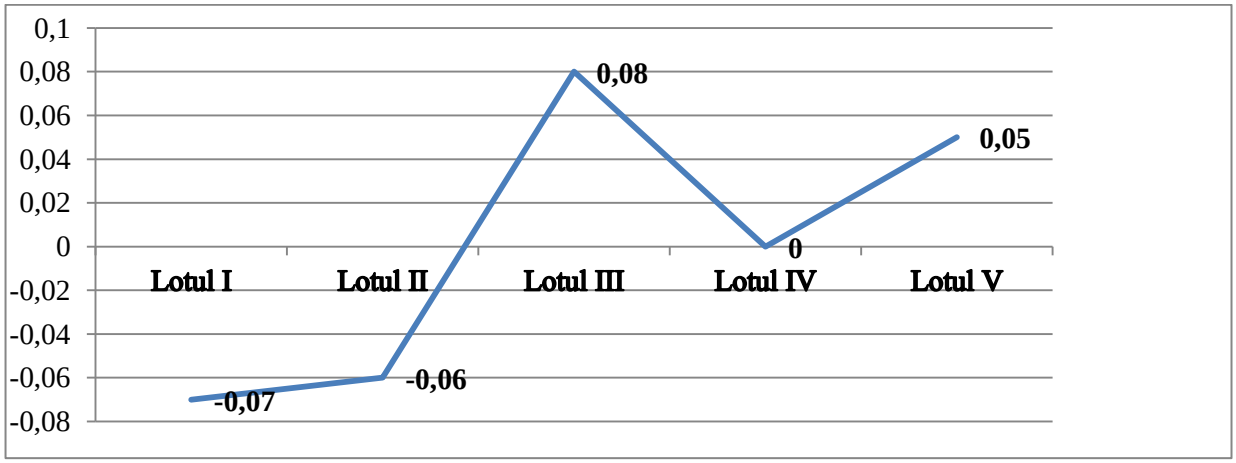

Figure 3.1 **Growth divergence between piglets and sows during the embryonic period, kg**

Regarding the weight of a piglet at birth, better results were achieved in batches IV and V, where their weight was 1.56-1.69 kg. Significant differences were recorded between groups

IV and I of 0.28 kg for piglets and 0.21 kg for sows. Therefore, the influence of the genetic type (Duroc breed) on the formation of body mass during the embryonic period and later in the postembryonic period is obvious. During the growing period, it is important to monitor the mass values of piglet batch from birth until the age of 21 days. The viability of the piglets is taken into account and thus the aim is to keep alive as many animals as possible during this difficult period of growth and product development. [15] A lot will also depend on the milk production of the sows, i.e. their lactating ability and the maternal qualities of the sows. If these indicators are within the limits of ensuring the viability and intensive growth of piglets, in the result we will obtain animals, which will ensure the efficiency of the reproduction and production activity in the hybridization process. The experimental results achieved using purebred and hybrid boars are presented in table 3.2.

Table 3.2

Piglet weight lot at birth and at the age of 21 days depending on the genotype of the animals, $\overline{X} \pm S\overline{x}$, n=5

Batch	Genetic type	Piglet weight at birth, kg	Piglet weight at 21 days, kg
I (control)	L x MA x P	18,17 ± 0,22*	66,25 ± 1,85**
II	L x MA x (MA x L x P)	21,25 ± 0,38*	77,32 ± 2,38
III	(L xMA) x (MA x L x P) x P	19,61 ± 1,02	82,55 ± 3,25**
IV	L x MA x D	20,66 ± 0,80	67,88 ± 5,32
V	L x MA x (D x P)	19,80 ± 0,42	72,47 ± 4,02

The weight of the batch of piglets at birth varies depending on the genotype of the animals and better results were obtained in batch II, where the average weight of the piglets was 21.25 kg. Significant differences were obtained between groups II and III, II and V, respectively equal to 1.64 kg (B>0.95) and 1.45 kg (B>0.95). The weight of the piglet group at the age of 21 days was higher in group III, and the difference compared to group I was significantly equal to 16.3 kg (B>0.999). In groups II, IV and V a tendency of prevalence of the body mass of the piglets compared to group I of animals is observed.

3.2. Piglet growth and fattening capacity

Intensive [3, 17, 8] breeding of young swine allows for faster recovery of expenses incurred for breeding purposes and the profit made can be used to re-technologize farms by implementing new modern equipment as needed. This can be ensured by using hybrid animals that achieve high growth rates, especially in the 2-4 month age period, when the largest amount

of muscle tissue is formed [9]. The results of determining the average hybrids daily gain are presented in table 3.3.

Table 3.3

Average daily growth during growth periods, g, $\overline{X} \pm S\overline{x}$, n=30

Batch	Genetic types	Age , days		
		30-60	60-90	60-180
I (control)	L x MA x P	289 ± 10,65	441 ± 8,71	724 ± 9,10
II	L x MA x (MA x L x P)	347 ± 14,75	376 ± 15,6**	690 ± 7,53***
III	(L x MA) x (MA x L x P) x P	318 ± 10,25	427 ± 13,43	669 ± 10,12
IV	L x MA x D	392 ± 12,29*	439 ± 12,06	799 ± 16,88***
V	L x MA x (D x P)	331 ± 13,52	458 ± 11,79**	752 ± 10,94

The average daily hybrid youth gain varies depending on the genotype of the swine and the period of growth. However, the hybrids in group IV achieved a higher average daily gain in the time interval 30-60 days equal to a difference compared to group I of 103 g (B> 0.999), and in the period 60-180 days the difference was 109 g (B> 0.999). The hybrids from batch V showed a higher growth rate in the period of 60-90 days, and the difference in the average daily gain was equal to 82 g (B> 0.99). It is worth mentioning that young swine from experimental group I also achieved gains of more than 700 g in the reference period of 60-180 days.

The experimental results reveal that as the animals age, the specific consumption increases, but there are also differences between the hybrid batches. The lowest consumption was attested in the young pigs from the experimental batch II, where during the growth period from 151-180 days it constituted 2.79 kg. In all age periods, a more intense increase in specific consumption was manifested in the pig youth of the experimental group IV, where the paternal form was the Duroc breed, which is characterized by higher accumulations of fat in the carcass, compared to the Pietrain breed, which produces meat with lower taste qualities. This happens due to the lower amount of fat contained in muscle tissue. At the same time, a thinner layer of bacon is formed in the casings, requested by the producer and consumer. Since more energy is consumed during the formation of adipose tissue, feed consumption increases accordingly, reaching 3.1 kg per growth unit in the last development period in group IV. In piglet batch I, II, III, V, the specific consumption varies from 2.79-2.92 kg. This indicator has a decisive influence on the cost of production, because feed occupies over 70 percent in the cost price structure. This is why, it is more efficient to promote genetic types of pigs that consume less feed when forming meat production. We must also take into account the quality of carcasses and meat requested by the consumer, specified by tenderness, juiciness and taste, properties largely dependent on the

content of fat in the meat. Although, the optimal choice of the hybridization option is influenced by the market requirements, where the price of carcasses, meat and even bacon is formed. In the case when bacon is sold at a good price, the insignificant increase in specific consumption cannot affect the cost price of production achieved by fattening young. For the production process, it is always taken into account that the increase in the amount of fat accumulated in the carcass contributes to the increase of feed consumption per kg of gain. In this case, the genetic potential of the hybrid used in the production process is largely relied on, which can ensure the consumer's requirements in quality and the producer's in the efficiency of meat production. When delivering meat, market requirements are important, and this requires the producer to use hybrid variants for fattening, which form the required amount of meat, the carcasses having the bacon layer corresponding to the consumer's requirements.

3.3. Swine evaluation of haematological and biochemical indexes

One of the most common types of research [14] concerning animal's health is the blood test. Of all the components that make up it, hemoglobin performs the most important function, and its value is an indicator of the well-being of the animals or the presence of pathology in the body [19].

Red blood cells play a key role in the saturation of organs and tissues with oxygen, as well as in the acid-base balance of the blood.

Table 3.4

Hematological index evaluation in the blood tissue, g / l, $\overline{X} \pm S\overline{x}$, n=3

Batch	Hematological indicators		
	hemoglobin	erythrocytes , 10^{12}	leukocyte, 10^{9}
I (control)	127,00 ± 0,57*	7,43 ± 0,10	25,43 ± 2,35
II	124,67 ± 1,85	7,22 ± 0,15	30,60 ± 1,46**
III	124,00 ± 0,57	7,61 ± 0,01**	25,03 ± 0,29**
IV	125,00 ± 0,57	7,10 ± 0,14**	28,46 ± 1,99
V	123,33 ± 0,33*	7,59 ± 0,03	26,50 ± 5,06

According to data presented in table 3.4 there is a non-significant increase in hemoglobin content in group I compared to animals in group V with a moderate significance of the difference, which was 4 g / l ($B \geq 0.95$). As a result, in batches where Pietrain and Duroc meat breeds were used in different combinations, the hemoglobin content was higher. Red blood cells play a key role in maintaining homeostasis and providing the body with oxygen. In addition, they are involved in various reactions such as regulation of acid-base balance, transport of amino acids and fats, absorption of toxins, etc. The best results in terms of erythrocyte content were

obtained in groups III and V, respectively 7.61 x 10 ² and 7.59 x 10 ². and a significant difference was established between groups III and IV (B ≥ 0.99), while in the second group the erythrocyte content was 0.39 lower than in group III (7.22 x 10^{12}). Erythrocytes were obtained in groups III and V, respectively 7.61 x 10 ² g / l and 7.59 x 10 ² g / l and a significant difference was established between groups III and IV (B ≥ 0.99), while in the second group the erythrocyte content was 0.39 lower than in group III (7.22 x 10^{12} g / l). The number of leukocytes varied from 23.3 x 10^9g / l in group III to 30.6 x 10^9g / l in the second group with a difference of 5.57 x 10 (B ≥ 0.99). Proteins ensure the evolution of metabolic processes to the extent that they are an indispensable material for the formation of new cells, the regeneration of cellular structures, the creation of immunity, the synthesis of enzymes, hormones and the transport of various substances (table 3.5).

Table 3.5

Biochemical evaluation of blood test according to swine genotype, $\overline{X} \pm S\overline{x}$, n=3

Batch	Biochemical index			
	ALT u/l	AST u/l	Proteine total/g/l	albumin, g/l
I (control)	99,80 ± 6,33*	88,53 ± 0,96	89,33 ± 0,31*	35,83 ± 0,14
II	91,56 ± 5,42	92,40 ± 3,28*	89,16 ± 0,63	36,70 ± 0,32*
III	90,06 ± 2,02	86,33 ± 0,14*	87,86 ± 0,78	36,50 ± 0,20
IV	91,66 ± 0,29	89,63 ± 0,26	71,33 ± 0,46*	35,70 ± 2,34
V	84,13 ± 0,29*	88,30 ± 1,38	79,76 ± 0,72	30,53 ± 0,26*

A biochemical blood test (table 3.5) allows us to state that there was a higher blood protein content in groups I-II of hybrids, which exceeded 89 g / l. This phenomenon is apparently associated with a more intensive protein synthesis in animals from these experimental groups. Also, significant differences were established between the young swine of the IV and I batches in terms of protein content (B ≥ 0.999). Plasma proteins are composed of albumins and globulins. The albumin fraction is involved in maintaining the balance between the protein of blood plasma and the protein of various tissues, and globulins play a plastic role in the body. During the experiment, the albumin content in blood plasma was studied, since albumin is involved in the transport of free fatty acids, bilirubin, hormones and drugs. A low albumin content means the presence of various infections in the body and hemorrhage. Sometimes albumin is studied to justify the nutritional state of the body. According to results obtained in the experiment, the albumin content in the blood of experimental young swine varied within the

limits of 30.53 g / l. in batch V and 36.5 g / l. in group II, which means that the growth and development of the hybrids proceeded normally.

The blood (table 3.6) glucose level in young hybrid animals in different combinations varied from 5.68 mmol/l (group I) to 6.19 (group II), and the calcium level from 2.55 mmol/l (group III) to 2.81 mmol/l (group II) with a moderate tendency to increase in batch II.

Table 3.6

Blood glucose and calcium content, mmol / l, $\overline{X} \pm S\overline{x}$, n=3

Batch	Glucose	Calcium
I (control)	5,68 ± 0,41	2,64 ± 0,14
II	6,19 ± 0,60*	2,81 ± 0,09*
III	5,70 ± 0,85*	2,55 ± 0,13*
IV	6,09 ± 0,70	2,60 ± 0,22
V	5,93 ± 0,26	2,79 ± 0,19

Consequently, no significant differences were established between the experimental groups of animals. These results indicate that the pig's body maintains a constant level of glucose and calcium in the blood and body tissues, and vital functions continue normally.

4. THE INFLUENCE OF THE GENETIC TYPE OF BOARS ON THE QUALITY OF CARCASSES AND MEAT IN SWINE

4.1. The effect of using different types of boars for carcass improvement

Through the efficient breeding of pig hybrids, important productions of meat and fat of good quality [2] can be obtained with low feed consumption. Due to this fact, the expenses for the purpose of their growth are recovered more quickly, and the profit enters the production circuit in a shorter time. To achieve these goals, it is necessary to implement modern technologies for intensive breeding of young swine, which will contribute to reducing the fattening period and the amount of combined feed consumed to obtain weight gain, with a structure satisfying the consumer's requirements. The degree of influence of the boar genotype on the carcass weight and slaughter yield of young pigs is presented in table 4.1.

Table 4.1

The influence of boar genetic type on carcass weight and slaughter yield, $\overline{X} \pm S\overline{x}$, n=3

Batch	Genetic type	Weight alive, kg	Carcass weight, kg	Slaughter yield, %
I (control)	L x MA x P	112,66 ± 1,45*	83,76 ± 1,17	74,3
II	L x MA x (MA x L x P)	114,33 ± 2,40*	80,30 ± 0,62*	70,2
III	(L x MA) x (MA x L x P) x P	114,00 ± 2,08	82,70 ± 1,78	72,5
IV	L x MA x D	113,67 ± 2,02	81,20 ± 2,41	71,4
V	L x MA x (D x P)	114,00 ± 1,15	83,67 ± 0,97*	73,3

The results presented show that the hybrids from batches I and V were characterized by the highest yield at slaughter, constituting 73.3% -74.3%. The differences between these batches and batches II, III and IV vary from 2-4%. Thus, the experimental variants V and I can have a significant influence on the quantity and quality of meat production in the fattening process of swine formed by using purebred boars and hybrids of French origin.

4.1.1. Carcass length, bacon thickness and ham development

To appreciate meat production in hybrid youth, it is important to know the value of the characters, which correlate positively with the proportion of meat in the carcass. This allows us to accelerate the process of assessing the quality of carcasses, establishing the morphological structure and the effects of hybrid production. This can happen [14] when the basis is genotypic combinations, which ensure significant accumulations of muscle mass and the formation of quality meat (table 4.2).

Table 4.2

The degree of influence of the boar genotype on the carcass length and ham development in swine, $\overline{X} \pm S\overline{x}$, n=3

Batch	Carcass length, cm		Ham developemnt		
	Big	Small	Weight, kg	Length, cm	Perimeter, cm
I (control)	101,37 ± 0,37*	96,10 ± 0,55	10,07 ± 0,07	43,00 ± 0,12	93,23 ± 0,45
II	114,33 ± 0,33*	96,00 ± 0,57*	11,33 ± 0,03*	57,67 ± 0,33*	92,00 ± 1,15
III	112,67 ± 0,33	97,33 ± 0,33*	9,27 ± 0,09*	43,27 ± 0,23	92,20 ± 0,47
IV	110,00 ± 1,55	95,67 ± 0,88	9,93 ± 0,18	41,00 ± 2,51*	85,00± 4,04*
V	104,00 ± 0,58	96,67 ± 0,88	9,63 ± 0,09	44,33 ± 0,33	93,67 ± 0,67*

There are differences between batches of hybrids, regarding the length of the carcasses and the development of the hams formed during the growth and development periods of the pig youth. In the experimental batches, the young pigs produced carcasses where the large length varied between 104 and 114.3 cm, the differences compared to the control batch were 2.63-12.96 cm, and the highest degree of authenticity (B≥ 0.999) was reported between experimental batches II and I, which demonstrates that good results can also be obtained when using boars resulting from combinations between three breeds, thus accelerating the hybridization process by shortening the period of production of hybrids. In facilities with modern technologies, where pork is produced by intensive methods, this technological element is of particular importance, because it reduces the expenses related to the reproduction of young pigs destined for fattening.

Table 4.3

Thickness fat layer formation in young swine depending on the genetic type of the boars, mm, $\overline{X} \pm S\overline{x}$, n=3

Carcass region	Batch				
	I (control)	II	III	IV	V
Whithers	27,6 ± 0,15	37,3 ± 0,39*	30,0 ± 0,11	31,3 ± 0,68	23,3 ± 0,18*
Spine	20,6 ± 0,07	30,3 ± 0,03*	22,0 ± 0,11	21,0 ± 0,20	20,0 ± 0,06
Low spine	27,3 ± 0,12	32,3 ± 0,14*	26,3 ± 0,08	19,3 ± 0,067*	21,7 ± 0,12
Croup	10,7 ± 0,07*	19,0 ± 0,30	10,7 ± 0,06*	15,0 ± 0,25	14,0 ± 0,32

The table data reveal that there are differences between the experimental lots regarding the thickness of the bacon layer and its uniformity on the upper line of the carcasses. Under intensive exploitation conditions, the superiority of the hybrids was demonstrated regarding the reduction of fat accumulations in the layer and the extension of the period of intensive growth of

muscle tissue. In table 4.3, results are presented that certify the ability to form the thickness of the bacon layer depending on the region of the carcasses in different variants of the hybrids.

4.1.2. Muscle tissue formation under the influence of tgenetic type of boars

Depending on the body weight at slaughter or carried out various research aimed at identifying the peculiarities of the formation of carcass quality in different genotypes. Investigations carried out also included the estimation of the percentage of muscle tissue, using a precise method, which is practiced in small slaughterhouses in the European Union, called the two-point method (Zwei Punct, ZP) (table 4.4).

Table 4.4

Evaluation of muscle tissue in swine hybrid carcasses, $\overline{X} \pm S\overline{x}$, n=3

Batch	Thickness of the bacon layer above the muscle Gluteus medius (with skin), mm (S1)	Thickness of the meat between the medullary canal and the anterior tip of the muscle Gluteus medius (S2), mm	Estimated muscle tissue percentage-method ZP, %
I (control)	11,7 ± 0,58	85 ± 1,41	59,21
II	14,3 ± 0,37	71 ± 1,41	55,94
III	15,7 ± 0,60	86 ± 1,22	57,94
IV	13,3 ± 0,74	77 ± 0,71	58,93
V	13,3 ± 0,60	77 ± 1,41	57,70

The percentage of muscle tissue in the carcasses of the young pigs in the experimental groups varies according to the genotype, formed by combining different specialized breeds of pigs. The ZP method allowed the estimation of the lean meat content in the carcasses, without performing dissection, a method practiced in the past with much effort. A higher percentage of muscle tissue was detected in hybrids from groups I, and IV, which constituted 58, 93% and 59.21%, being higher by 3.27% compared to experimental group II of pig youth. The pig hybrids resulting from the combination of the maternal form Landrace x Great White and purebred and multiracial boars produced carcasses with a high content of muscle tissue (lean meat). According to the EU classification grid, the carcasses from all experimental groups were classified in group E with 57-59 %, except for the hybrids from experimental group II.

The percentage of lean meat was directly influenced by the amount of muscle mass formed in the carcass, a fact that depends on the genotype of the young pig, and the results obtained from the investigations are also confirmed in the works of other authors, where it is mentioned that a higher percentage of muscle tissue was achieved by combining the maternal breeds with purebred calves Pietrain, Duroc, but also by using hybrid boars [18].

Meat quality is influenced by both hereditary traits and environmental factors and, consequently, pork quality management is a complex and difficult process. In the food production system, meat and meat products occupy a special place in providing the population with proteins, fats and some extractive substances from them, which are irreplaceable in a complete and rational human diet. An important role in determining the nutritional value of pork is the appearance, color, smell, active acidity (pH), water holding capacity, taste, tenderness, juiciness, losses during cooking, etc. The complex of such indicators excites or, on the contrary, suppresses the secretory motility of the human digestive organs and becomes of particular importance when the issue of organic animal products arises.

4.2. Improving meat quality through the use of hybrid boars

Pork meat [1] is the most commonly consumed meat worldwide. Producers, in order to obtain higher profits, have innovated the practices and technologies of raising and processing meat. As a result, the need to implement new procedures and rigid control to obtain high-quality raw material (pork) has increased. Organoleptic characteristics are used as the first indicators for the freshness of meat, but due to transformations depending on temperature, humidity and the activity of microorganisms, which occur after slaughter, the quality of meat can be diminished, which is taken into account in the storage and processing process.

Table 4.5

Chemical composition and nutritional qualities of meat,%

Batch	Water	Fat	Protein	Collagen
I (control)	79,41 ± 0,06	0,87 ± 0,05	20,06 ± 0,05	1,54 ± 0,03
II	79,66 ± 0,43*	1,26 ± 0,58	20,19 ± 0,16*	1,58 ± 0,08
III	78,78 ± 0,84*	0,98 ± 0,32	19,98 ± 0,10*	0,10 ± 0,14
IV	79,55 ± 0,20	1,11 ± 0,28	20,16 ± 0,13	1,49 ± 0,09
V	78,97 ± 0,20	0,50 ± 0,13	20,02 ± 0,07	1,63 ± 0,18

Therefore, it is necessary to identify healthy sources of protein for human consumption, which can be found in lean meat, formed by pig hybrids resulting from the combination of different genetic types. In the experiments carried out and the results presented in table 4.5, it is revealed that the protein content is characteristic of quality pork and varies between 19.98 and 20.16%, but the differences identified between the hybrid variants are insignificant. The meat of the hybrids is characterized by a moderate fat content, located in the limits of 0.50-1.26%, indices that confirm the good quality of the meat. But in the end, the differences between the

genotypes regarding the main nutritional elements are not significant. The chemical composition of the meat changes with age, but also depends on the genotype of the animals. The meat from the Landrace and Duroc breeds is of good quality, but the Landrace breed produces meat whose chemical composition is more optimal and thus the nutritional qualities are higher. It is for these reasons that the breed was used to produce performance hybrids. The water content in the meat of this breed is lower compared to the Great White breed and is not influenced by the weight at slaughter. The percentage of fat in the long dorsal muscle is much lower than in the average meat sample and varies from 1.5 to 4-6% in different breeds and hybrids.

Table 4.6

Evaluation of essential amino acid content in the longus dorsalis muscle of hybrids, g/kg

	Batches				
Amino acids	**I (control)**	**II**	**III**	**IV**	**V**
Threonine	7,0741762	7,1518516	7,1365515	7,9707623	7,532978
Valine	6,8238017	5,5692855	5,6929167	6,4628603	4,867595
Methionine	3,3534578	4,3250475	2,96053	0,7169983	3,053175
Isoleucine	13,6659905	10,346632	10,488001	14,390244	11,80824
Leucine	21,1971448	16,149706	19,562816	22,743106	18,31421
Phenylalanine	7,5205407	8,3274882	6,7931053	7,1436037	7,645093
Lysine	6,7231746	6,5900092	6,0683672	6,209883	5,66644
Histidine	30,8222496	22,388741	20,566606	28,929458	29,52008
Arginine	7,4103313	8,5617567	5,2990653	5,3897654	8,192519
Σ Amino acids	104,5908672	89,410518	84,567958	99,956682	96,60033

In total, 9 essential amino acids (table 4.6), were studied, and the total amount of amino acids in the experimental batches varied from 84.567958 to 104.5908672 g/kg. Pork meat is a superior source of protein, due to the fact that it contains the 9 essential amino acids necessary to restore and maintain body tissues. The nutritional value of meat is influenced by the quality of proteins, mineral salts and vitamins, limited fat content. It is for these reasons that pork can become a component part of the human diet. In smaller quantities, the amino acid methionine was identified, which ranged in the experimental groups from 0.7169983 to 4.3250475 g/kg. In the largest quantities, histidine was contained, constituting 20.566606 to 30.8222496 g/kg, in all experimental groups.A particular importance was the determination of the level of lysine and phenylalanine, because these two essential amino acids have the role of tissue development, as well as the synthesis of vitally important substances, such as: antibodies, hormones and enzymes.

In groups II and V, a higher content of arginine was found 8.5617567 and 8.192519, which demonstrates that in these experimental groups the young pigs showed a more intensive growth of adipose tissue stored in the layer. The content of non-essential amino acids is presented in table 4.7.

Table 4.7

Evaluation of non-essential amino acid content in the longus dorsalis muscle, g/kg

Amino acids	Batches				
	I (control)	**II**	**III**	**IV**	**V**
Serine	6,87906487	6,8620309	7,1737766	8,0043891	7,649911
Proline	3,39655556	3,9755264	4,5954382	5,3629349	3,934415
Alanină	8,14098276	12,085074	8,7872421	10,049575	9,28998
Tyrosine	6,07818578	6,467344	5,7124893	5,8898312	6,200249
Σ amino acids	24,49478897	29,389975	26,268946	29,30673	27,07456

Per total, 4 non-essential amino acids were studied, the total amount of which ranged from 24.49478897 to 29.389975 g/kg. Alanine was present in the highest amounts and ranged from 8.14098276 to 12.085074 g/kg.

4.2.1. Influence of genotype for the technological qualities of meat

Meat quality represents the degree of consumer satisfaction when purchasing, preparing and consuming meat. A large number of indicators are used to estimate the quality of meat, when it is raw or consumed in various forms, cooked or industrially processed in the preparation of sausages, hams and other foods. For consumers, it is important that the meat has superior organoleptic qualities, i.e. it should be rosy in color, tender, juicy and full of flavor. At the same time, the meat should have a low-fat content, reduced cooking losses, and superior hygienic and nutritional qualities. The processor advocates for meat with appropriate technological qualities, which means a normal pH, water retention capacity according to the norms in force, good preservation capacity, etc. To determine the degree of compliance with these requirements, quality indices classified into four groups are used: organoleptic, hygienic, nutritional and technological. Technological indices represent the meat's ability to transform into quality products.

The results of the evaluation of the technological qualities of meat are presented in table 4.8 where the water retention capacity, hydration capacity, boiling loss capacity and acidity (pH) of the meat are evaluated, the latter having important effects in the meat processing process in this case for the preparation of different types of cooked hams. A strong correlation is mentioned

between the technological yield of meat and the water retention capacity (r=0.6-0.7) of fresh meat. The quality of meat is also influenced by acidity, because it conditions the technological yield of multiple products as well as the quality of finished meat preparations, thus high pH is not beneficial for preserving raw meat or for transforming them into dried products, because it favors the difficult absorption of salt in meat and as a result microorganisms develop intensively. For cooked products, a pH higher than 6.3 is acceptable, allowing the stopping of microbial proliferation by boiling. The meat color is also influenced by the pH level, which, being low, determines a lighter shade of the meat, and the percentage of loss during boiling increases.

Table 4.8

Assessment of technological qualities of meat, %

Batch	Water retention capacity, %	The ability to hydrate meat, %	Boiling loss capacity, %	Meat pH (24 ore)
I (control)	58,42	45,97	42,90	6,20
II	52,99	45,71	43,46	6,27
III	52,51	41,58	43,35	5,93
IV	50,92	46,14	42,99	5,77
V	43,26	38,42	43,41	6,00

The water retention capacity is one of the main qualities of meat, being a breed characteristic, but also depending on environmental factors. In the products obtained through various hybridization variants, different values of water retention capacity were identified. The meat of the hybrids in batch I had a higher water retention capacity, which was 58.42%, and in batch V the value of this index was 43.26%, the differences being equal to 15-16%. The results of the research demonstrate that in principle the acidity has normal values and is placed in the range from 5.77 to 6.27, so quality products can be prepared from this meat in a dry state or subjected to boiling.

Economic efficiency of research results

The main objective of the pig breeder is to obtain animals characterized by quality carcasses, with abundant amounts of lean meat, with superior nutritional and technological capabilities. Low production costs and food safety guarantees will stimulate consumers to use this product through diversification. Due to the very good precocity of the species, the recovery of expenses is faster, and the profit made can be reinvested in a shorter time. Therefore, there is a

need to implement advanced methods of pig breeding, based on the use of hybridization systems by exploiting the heterosis phenomenon. It is important to reduce the period of establishment of parental forms using for this purpose hybrid boars obtained by combining two, three or more specialized lines or breeds of pigs. In this way, conditions are created for the production of meat with a special purpose: fresh consumption, processing for the preparation of quality sausages, bacon and other products at the request of the consumer.

The effect of parental combinations depends on the genetic distance, or the degree of divergence between breeds. When the productive qualities of breeds are very variable, we can expect a greater reproductive effect, and the carcass performance of hybrids represents the average of the parental breeds.

The economic efficiency of the research results obtained by using hybrid boars was calculated based on the average mass of a hybrid at the age of 180 days, the amount of feed consumed by young pigs during the lactation, growth and fattening periods, the average price of achieving a kg of live weight, the cost of a kg of combined feed, other expenses: water, electricity, fuel, veterinary expenses, tax services.

The use of hybrid boars in hybridization schemes led to the production of young pigs whose productivity was quite varied, influenced by the growth rate and specific consumption of the genetic types that participated in the formation of the biological material. The hybrid young pigs from batch IV achieved a body mass of 116.98 kg in 180 days due to a greater increase in the growth and fattening period. As a result of saving feed, a profit of 415.2 lei was obtained compared to the young pigs from batch I, where the Pietrain breed was used as the paternal form in the production of hybrids, for which a slower growth rate is characteristic. Between batches II and V, these differences amounted to 181 and 159.9 lei.

The economic effect from the production of triracial hybrid youth (Landrace x Large White x Duroc) amounted to 954.9 lei/head and the tetraracial hybrid youth (Landrace x Large White x Duroc x Pietrain) determined an economic effect of 534.36 lei/head.

Fattening of young pigs based on the use of hybrid boars contributes to increasing the growth rate, efficient utilization of feed and obtaining quality carcasses and meat. Therefore, increasing the benefit from the production activity is ensured by raising as many hybrid piglets as possible obtained from as few sows as possible, using various effective schemes based on the exploitation of the heterosis phenomenon. Depending on the final product planned to be produced, which means carcasses with developed muscles, with little or a lot of bacon, meat with superior taste and nutritional qualities, breed combinations are formed, which contribute to achieving these goals.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

1. The use of hybrid boars in hybridization systems has contributed to shortening the production period of hybrids, increasing the reproductive capacity, growth rate at fattening, improving carcass and meat quality. Thus, to achieve the desired results, genetically distant parental combinations are formed, thus ensuring a superior productive potential of hybrids formed under the influence of the combinative capacity of specialized breeds and genetic types of boars.

2. The reproductive effect of the pigs was manifested by achieving a higher productivity of sows in group III, and its value on average was 13.33 piglets, prevailing over the number of products from group I with 1.83 piglets (B> 0.95). This confirms the possibility of using the hybridization system (batch III) to multiply the number of hybrids intended for fattening. The value of the weight of the piglet batch at birth was more representative in lot II of piglets, constituting 21.25 kg, and the difference between lots I and II was 3.08 kg (B> 0.999). During the growth period up to 21 days, better results were obtained in lot III, and the difference compared to lot I was 16.3 kg (B> 0.999). In batches II, IV and V there is a tendency for the piglet mass to prevail compared to lot I of young swine.

3. The growth capacity of the hybrids varies depending on the genotype of the animals and thus, at the age of 21 days, better results were obtained in the III group of piglets. In the following growth periods, superior results were obtained in groups IV and V, where the hybrids were obtained by using Duroc breed boars and the Pietrain x Duroc genetic type. The difference in average daily gain during the period 30 - 60 days was 103 g (B> 999), and during the period 60 - 180 days – 109g compared to the hybrids in group I. The piglets in batch V showed a higher growth rate during the growth period 60-90 days, and the difference was equal to 82 g (B> 0.99).

4. Experimentation with different hybrid variants contributed to the finding that the quality of the carcasses depends on the length, which varies between 104 and 114.3 cm, uniformity characterized by a thinner layer of bacon in the spinal region obtained in batches V and IV of hybrids, where the thickness of the bacon did not exceed 20-21 mm. The percentage of muscle tissue varies depending on the genetic type of the boars. According to the EU classification grid, the carcasses of hybrids from batches I, III, IV and V were classified in group E with 57-59%.

5. In the batches where Pietrain and Duroc meat breeds were used to produce hybrids in various combinations, the hemoglobin and erythrocyte content was higher. The higher blood protein content in some variants of hybrid animals is explained by more intensive protein

synthesis. The development of internal organs was dependent on the genetic type of the animals, formed under the influence of the ability to combine specialized breeds and characterized by good functioning, being beneficial to the intensive growth of muscle tissue.

6. The protein content in the meat of young pigs obtained by using hybrid pigs varies between 19.98 and 20.6%, results that confirm the good quality of the meat. In the long dorsal muscle, different values of water retention capacity were identified, and the quality of the meat was under the influence of acidity. Thus, in experimental tri- and multiracial hybrids, the values of this indicator were 5.77-6.27, being within the limits necessary for the preparation of quality products.

Recommendations:

1. Increasing the reproductive and productive capacities of swine can be effectively achieved through the use of hybrid boars in hybridization systems, thus contributing to the acceleration of the process of obtaining hybrids with qualities of forming carcasses and branded meat

2. The multiplication of the number of piglets obtained from the base sows is achieved through the hybridization system (L x MA) x (MA x L x P) x P, based on the use of hybrid boars that ensure obtaining 13.33 piglets and thus the herd of sows necessary for the reproduction of the hybrids and ensuring the production of the planned amount of meat, is reduced.

3. For carcasses production with a thin layer of bacon (15 - 18 mm) and globular hams, it is recommended to use the Pietrain breed or the hybrid swine. The formation of meat with superior taste and nutritional qualities is achieved by using hybrid boars Pietrain x Duroc or Great White x Landrace x Pietrain in hybridization systems, while ensuring the diversity of meat and bacon products.

Bibliography

1. CERNEV, I., ROTARU, I. Influența tipurilor genetice ale suinelor asupra formării calității carcaselor, capacităților nutriționale și tehnologice ale cărnii. In: Revista de Ştiinţă, Inovare, Cultură şi Artă „Akademos", 2024, nr. 4(75), pp. 97-109. ISSN 1857-0461.

2. CERNEV, I. Influența genotipului vierilor asupra dezvoltării organelor interne și formării producției de carne la hibrizii de suine. In: Inovații în zootehnie și siguranța produselor animaliere – realizări și perspective: dedicata celei de-a 65-a aniversări de la fondarea Institutului științifico-Practic de Biotehnologii în Zootehnie și Medicină Veterinară, 30 septembrie - 1 octombrie 2021, Maximovca. Maximovca: "Print-Caro" SRL, 2021, pp. 36-40. ISBN 978-9975-56-911-8.

3. CERNEV, I. Utilizarea vierilor hibrizi în sporirea producţiei la suine, Universitatea Agrară de Stat din Moldova. Tezele celei de-a 75-a conferinţă ştiinţifică a studenţilor, masteranzilor şi doctoranzilor, Nr. 2(60) / 2022 / ISSN 2537-6373 / ISSNe 2537-6381., p. 128.

4. ROTARU, I., CERNEV, I., DONICĂ, I., SECRIERU S. Recomandări privind utilizarea vierilor hibrizi şi procedeelor tehnologice de înfiinţare a fermelor în suinicultură:.,Universitatea Agrară de Stat din Moldova, Institutul Ştiinţifico-Practic de Biotehnologii în Zootehnie şi Medicină Veterinară, Chişinău, 2022 / ISBN 978-9975-164-54-2., p.54.

5. ROTARU, I., CERNEV, I. Efectul utilizării vierilor hibrizi în sporirea capacităţii de creştere şi dezvoltare a tineretului suin. Universitatea Agrară de Stat din Moldova, Ştiinţa Agricolă, Nr. 2 / 2019 / ISSN 1857-0003 / ISSNe 2587-3202. pp. 129-134.

6. ROTARU, I., CERNEV, I. The influence of the boars genoype on the carcasses and meat quality in swine hibrids, University of Agricultural Sciences and Veterinary Medicine Iasi, Scientific Papers-Animal Science Series: Lucrări Ştiinţifice - Seria Zootehnie, vol. 75, 2020, p.154-158.

7. ROTARU, I., CAISÎN, L., CIBOTARU, E., SECRIERU, S. Suinicultură: Tehnologii avansate de creștere și exploatare a tipurilor genetice de porcine, Tratat/ Coordonator și redactor științific; Ilie Rotaru, Chișinău, Print- Caro, 2023 ISBN 978-9975-165-67-9, 532p.

8. ROTARU, I. The swine productive capacity depending on used breeds for the hybrid production. In: Scientific Papers Series D. Animal Science, 17-18 septembrie 2015, București. București, România: CERES Publishing House, 2015, Volume LVIII, pp. 324-329. ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750.

9. ДАНИЛОВА, Т. Влияние межпородного скрещивания на откормочные и мясные качества молодняка свиней. В: Научный фактор в стратегии инновационного развития свиноводства: сб. материалов XXII Международной науч.-практической конф. 9-11 сент. 2015. Гродно, 2015, с. 47-51. ISBN 978-985-537-071-1.

10. ЕРЕМИЯ, Н., КИЛИМАР, С., РОТАРУ, И. et.al. Технологии в животноводстве. Chisinau. Print Caro, 2014, ISBN 978 9975-56-100-8, 484 с.

11. ЗАБОЛОТНАЯ, А. Эффективность скрещивания гибридных свиноматок F 1 с хряками пород дюрок, терминальный и пьетрен. В: Свиноводство. 2015, № 7, с. 15-16. ISSN 0039- 713X.

12. ЗАБОЛОТНАЯ, А., СБРОДОВ, С., ЧЕРКАСОВ, С. Откормочные и мясные качеств товарных гибридов свиней. В: Свиноводство. 2012, № 4, с. 19-21. ISSN 0039-713X.

13. ИВАНОВА, И. Воспроизводительные качества хряков современных генетических линий. В: Научное обеспечение инновационного агропромышленного комплекса регионов РФ: Международная науч.-практическая конф., 06 февр. 2018, Лесниково, 2018, с. 763-767. ISBN 978-5-91596-119-6.

14. КОЛДАЕВА, Е., ШАРНИН, В., МИХАЙЛОВ, Н. Комбинационная способность - основа гибридизации свиней. В: Свиноводство. 2013, № 1, с. 14-16. ISSN 0039-713X.

15. ЛАЗАРЕВИЧ, А., ЕФИМОВА, Л., ИВАНОВА, О. Анализ эффективности скрещивания гибридных свиноматок с чистопородными и терминальными хряками. В: В мире научных открытий. 2016, № 12(84), с. 108-123. ISSN 2072-0831.

16. ПЕРМЯКОВ, А., КОЗЬМИНА, Н. и др. Новое селекционное достижение в отечественном свиноводстве. В: Свиноводство. 2019, № 8, р. 4-5. ISSN 0039-713X.

17. ПЛОХИНСКИЙ, Н. Руководство по биометрии для зоотехников, М. Колос, 1969, 256 р.

18. ПОГОДАЕВ, В., ПАРКОВ, И. Влияние породы и генотипа на продуктивные качества хряков-производителей. В: Аграрный научный журнал. 2018, № 3, р. 27-33. ISSN 2313-8432.

19. ЧЕРНЕВ, И. Влияние генотипа хряков на гематологические и биохимические показатели крови у гибридных свиней, Розведення і генетика тварин, Институт разведения и генетики животных имени М.В. Зубця НААН, Міжвідомчий тематичний науковий збірник № 61, Киевская обл.,Украина, 2021, ISSN 2312-0223, р. 186.

20. ШЕЙКО, И., ФЕДОРЕНКОВА, Л., ХРАМЧЕНКО, Л. Влияние гибридных хряков на продуктивность молодняка. В: Зоотехния. 2005, № 3, р. 25-27. ISSN 0235-2478.

LIST OF SCIENTIFIC WORKS PUBLISHED ON THE THESIS TOPIC

- **Monographs, books**

1. ROTARU, I., **CERNEV, I.,** DONICĂ, I., SECRIERU, S. Recomandări privind utilizarea vierilor hibrizi şi procedeelor tehnologice de înfiinţare a fermelor în suinicultură: Universitatea Agrară de Stat din Moldova, Institutul Ştiinţifico-Practic de Biotehnologii în Zootehnie şi Medicină Veterinară, recomandări, Chişinău, 2022, 54 p, ISBN 978-9975-164-54-2.

2. DONICĂ, I., DANILOV, A., MAŞNER, O., ROTARU, I., **CERNEV, I.** Instrucțiune de bonitare a porcinelor, Institutul Ştiinţifico-Practic de Biotehnologii în Zootehnie şi Medicină Veterinară, Universitatea Tehnică a Moldovei, Maximovca: „Print Caro", 2024, p. 64, ISBN 978-9975-180-23-8.

- **Articles in scientific collections (Category B).**

In journals from the National Register of specialized journals, indicating the category

3. ROTARU, I., **CERNEV, I.** The effect of using hybrid boars in increasing the growth and development capacity of young swine. Agricultural Science Magazine. No. 2/ 2019. Chișinău, p.129-134, ISSN 1857-0003 / ISSNe 2587-3202.

DOI: 10.5281/zenodo.3625590.

https://ibn.idsi.md/sites/default/files/imag_file/129-134_6.pdf

4. **CERNEV, I,** ROTARU, I. The influence of swine genetic types on the formation of carcass quality, nutritional and technological capabilities of meat. In: Magazine of Science, Innovation, Culture and Art ''Akademos", 2024, nr. 4(75), pp. 89-96. ISSN 1857-0461.

5. **CERNEV, I,** ROTARU, I. The productive capacities of hybrids formed by using different genetic types of swine. Agricultural Science Magazine. Nr.2 2024. Chișinău, p. 91-98, ISSN 1857-0003 E-ISSN 2587-3202

- **Articles in international collections**

6**. ЧЕРНЕВ, И.** Влияние генотипа хряков на гематологические и биохимические показатели крови у гибридных свиней. Розведення і генетика тварин. Институт разведения и генетики животных имени М.В. Зубця НААН. Міжвідомчий тематичний науковий збірник № 61, Киевская обл.,Украина. 2021, p. 186-191. УДК: 636.4:575.22:612.015.

7. ROTARU, I., **CERNEV, I**. The influence of the boars genoype on the carcasses and meat quality in swine hibrids. Scientific Papers-Animal Science Series: Lucrări Ştiinţifice - Seria Zootehnie, Iași, Romania. vol. 75, 2021, p.154-158. ISSN 2067-2330, ISSN-L 1454-7368.

In International Scientific Conference Proceedings (Republic of Moldova)

8. ROTARU, I., **CERNEV I**. The effect of using hybrid boars for increasing the reproductive potential of swine. Animal Husbandry and Agricultural Biotechnologies materials of the International Scientific Symposium "85 years of the Faculty of Agronomy - achievements and perspectives"", dedicated to the 85th anniversary of the founding of the State Agrarian University of Moldova, Nr. 3 / 2020. P.89-93 / ISSN 1857-0070.

https://ibn.idsi.md/sites/default/files/imag_file/89-93_16.pdf

9. **CERNEV, I.** The influence of boar genotype on the development of internal organs and the formation of meat production in pig hybrids. In: Innovations in animal husbandry and the safety of animal products – achievements and perspectives dedicated to the 65 th anniversary of the founding of the Scientific-Practical Institute of Biotechnologies in Animal Husbandry and Veterinary Medicine. Print Caro. Maximovca, 2021. p.36-40. ISBN 978-9975-56-911-8.

10. ROTARU, ILIE., SECRIERU, SERGIU., **CERNEV, IVAN**. Trends and perspectives in the production of meat with superior organoleptic, nutritional and technological qualities. In: Innovations in animal husbandry and safety of animal products – achievements and perspectives dedicated to the 65th anniversary of the founding of the Scientific-Practical Institute of Biotechnologies in Animal Husbandry and Veterinary Medicine. Print Caro. Maximovca, 2021. p.221-225. 978-9975-56-911-8.

Theses in scientific collections

11**. CERNEV, I.** The use of hybrid boars in increasing pig production, State Agrarian University of Moldova. Theses of the 75th scientific conference of students, master's and doctoral students, Nr. 2(60) Chișinău, 2022. p.28. ISSN 2537-6373 / ISSNe 2537-6381.

ADNOTARE

CERNEV Ivan, «Efectul utilizării vierilor hibrizi în ameliorarea potențialului genetic și productiv al suinelor». Teză de doctor în științe agricole, Chișinău, 2025

Structura tezei: introducere, patru capitole, concluzii generale și recomandări, bibliografie din 189 de titluri, 7 anexe, 101 pagini de text de bază, 23 figuri, 30 tabele.

Rezulatele obținute sunt publicate în 11 lucrări științifice.

Cuvinte cheie: rasă, heterozis, hibrizi, carcasă, tip genetic, carne, calitate, vieri, spor în greutate, consum specific.

Scopul lucrării: argumentarea științifică a efectului utilizării vierilor hibrizi în procesul de hibridare și reducere a perioadei de formare și identificare a tipurilor genetice cu capacităţi de producere a cărnii de calitate în concordanţă cu cerinţele consumatorului.

Obictivele cercetării: evaluarea prolificităţii şi capacităţii de alăptare a scroafelor în dependenţă de tipul genetic al vierilor utilizați la producerea hibrizilor de suine; aprecierea comparativă a greutății purceilor la naștere și masei corporale a tineretului suin în funcţie de formele parentale de suine; analiza vitezei de creştere şi capacităţii de îngrăşare a hibrizilor în procesul de creștere și dezvoltare; evaluarea calităţii carcaselor şi aprecierea producţiei de carne la suine obținute prin utilizarea vierilor hibrizi.

Noutatea şi originalitatea ştiinţifică a lucrării se justifică prin argumentarea științifică a noilor sisteme de hibridare elaborate în baza utilizării vierilor hibrizi și determinarea efectului reducerii perioadei de obținere a hibrizilor cu capacități de sporire a cantității și ameliorare a calității cărnii, asigurînd posibilitatea de a selecta varianta eficientă de producere în concordanţă cu cerinţele pieții.

Rezultatele obținute contribuie la soluționarea unei probleme științifice importante care constă în accelerarea, sporirea și ameliorarea producerii cărnii cu calități nutriționale organoleptice și tehnologice superioare prin utilizarea în sistemele de hibridare a vierilor hibrizi și posibilitatea de a selecta varianta eficientă de producere a materialului biologic performant.

Semnificația teoretică: investigațiile efectuate și rezultatele obținute au suplinit cunoștințele privind necesitatea de reducere a perioadei de obținere a hibrizilor comerciali trirasiali și multirasiali în baza utilizării diferitor tipuri de vieri hibrizi, contribuind astfel la ameliorarea calităților reproductive, stimularea creșterii, rezistenței și productivității suinelor.

Valoarea aplicativă a tezei: rezultă din elaborarea sistemelor de hibridare prin folosirea diferitor tipuri genetice de vieri, selectarea și recomandarea celor mai valoroase combinări pentru obținerea carcaselor și cărnii de calitate în diferite condiții pedoclimaterice și economice.

Implementarea rezultatelor științifice: a fost realizată la întreprinderea pentru creșterea și îngrășarea porcinelor SC «Agroseminvest» SRL, cu o capacitate de producere a 30 mii hibrizi comerciali pe an și în procesul didactic la Universitatea Tehnică a Moldovei.

ANNOTATION

CERNEV Ivan," The efficiency of using of hybrid boars in improving the genetic and productive potential of pigs". Dissertation for the degree of Doctor in Agricultural Sciences, Chisinau, 2025.

Structure of the thesis: Introduction, 4 chapters, general conclusions and recommendations, bibliography of 189 titles, 7 appendixes, 101 pages of the main text, 23 graphs, 30 tables. The results obtained have been published in 11 scientific articles.

Key words: Breed, heterotic vigor (heterosis), hybrids, carcase, genotype, meat, quality, boars, amount of growth, feed consumption.

The purpose of the work: consists in the scientific argumentation of the effect of the use of hybrid pigs in the hybridization process and reduction of the formation process and identify of genetic types with the capacity to produce quality meat in accordance with the consumer's requirements.

The main objectives: Assessment of fertility and lactation ability of sows depending on the genetic type of boar used in the production of hybrid young pigs. A comparative assessment of the birth weight of piglets and the body weight of young piglets according to the parental forms of pigs. The study of the growth rate and fattening capacity of hybrids in the process of growth and development. Assessment of the quality of carcasses and assessment of the meat productivity of pigs obtained by using of hybrid of young pigs.

The novelty and scientific originality of the work: it is justified by the scientific argumentation of the new hybridization systems developed based on the use of boar hybrids and the determination of the effect of reducing the period of obtaining hybrids with the capacity to increase the quantity and improve the quality of the meat, ensuring the possibility of selecting the efficient production option in accordance with the requirements the markets.

The obtained results: Contribute to solving an important scientific task, which is to accelerate, increase and improve the production of meat with improved organoleptic, technological and nutritional qualities through the use of hybrid pigs in hybridization systems and the possibility of selecting an effective option for the production of biological material in accordance with market requirements.

Theoretical meaning: The conducted research and the obtained results supplemented the knowledge about the need to reduce the time required to obtain commercial triracial and multiracial hybrids based on the use of different types of hybrid boars, thereby contributing to the improvement of reproductive qualities and growth stimulation, sustainability and productivity of pigs.

The applied value of the work: It is conditioned by the development of hybridization systems using various boar genotypes, through the selection and recommendation of the most valuable combinations for obtaining carcasses and high-quality meat in various pedoclimatic and economic conditions.

Implementation of scientific results: It was conducted at the pig breeding and fattening enterprise SC "Agroseminvest" SRL, with a production capacity of 30 thousand commercial hybrids per year and in the educational process at the Technical University of Moldova.

АННОТАЦИЯ

ЧЕРНЕВ Иван, «Эффективность использования гибридных хряков в улучшении генетического и продуктивного потенциала свиней». Диссертация на степень доктора сельскохозяйственных наук, Кишинев, 2025.

Структура диссертации: введение, четыре главы, общие выводы и рекомендации, библиография из 189 источников, 7 приложений, 101 страниц основного текста, 23 графиков, 30 таблиц. Полученные результаты опубликованы в 11 научных статьях.

Ключевые слова: порода, гетерозис, гибриды, туша, генотип, мясо, качество, хряки, прирост, расход кормов.

Цель работы: Целью исследований было научное обосиоваиие эффективности использования гибридных хряков для ускорения процесса формирования и выявления геиотипов способных производить туши и мясо высокого качества в соответствии с требованиями потребителя.

Задачи исследования: оценка плодовитости и молочности свиноматок свиноматок в зависимости от генетического типа хряков, используемых при производстве гибридного молодняка свиней, сравнительная оценка массы поросят при рождении и массы тела молодняка поросят по родительским формам свиней, определение скорости роста и откормочной способности гибридов в процессе роста и развития, оценка качества туш и оценка мясной продуктивности свиней, полученных при использовании гибридного молодняка свиней.

Новизна и научная оригинальность работы заключается в научном обосновании новых вариантов гибридизации, основанных на использовании гибридных хряков и определении эффекта сокращения сроков получения гибридов, способствующие формированию и увеличению количества и улучшения качества свинины и возможность отобрать эффективный вариант в соответствии с требованиями рынка.

Полученные результаты способствуют решению важной научной задачи, заключающейся в ускорении, увеличении и совершенствовании производства мяса с улучшенными органолептическими, технологическими и пищевыми качествами за счет использования в системах гибридизации гибридных свиней и возможности подбора эффективного варианта производства биологического материала в соответствии с требованиями рынка.

Теоретическое значение: проведенные исследования и полученные результаты дополнили знания о необходимости сокращения сроков получения коммерческих трехпородных и многопородных гибридов на основе использования разных типов гибридных хряков, способствуя тем самым улучшению воспроизводительных качеств, стимуляции роста, устойчивости и продуктивности свиней.

Прикладное значение диссертации: она обусловлена разработкой систем гибридизации с использованием различных генотипов хряков, подбором и рекомендацией наиболее ценных комбинаций для получения туш и качественного мяса в различных педоклиматических и экономических условиях.

Внедрение научных результатов проведено на свиноводческом предприятии по откорму свиней SC «Agroseminvest» SRL, Кагульского района, мощностью производства 30 тысяч товарных гибридов в год и в учебном процессе Технического Университета Молдовы.

CERNEV IVAN

EFECTUL UTILIZĂRII VIERILOR HIBRIZI ÎN AMELIORAREA POTENŢIALULUI GENETIC ȘI PRODUCTIV AL SUINELOR

421.03 – TEHNOLOGIA CREȘTERII ANIMALELOR ŞI OBȚINERII PRODUSELOR ANIMALIERE

Rezumatul tezei de doctor în științe agricole

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CHIŞINĂU, 2025