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OPERATIONAL VALUE AND PRODUCTIVITY OF LARGE WHITE BREED SOWS OF THE FRENCH SELECTION BY THE “AXIOM” COMPANY

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The study presents the results of research on the lifespan, breeding longevity, and reproductive performance of Large White sows of French selection with varying operational value, as well as the calculation of the economic efficiency of their use. The research was conducted at the pedigree breeding farm for Large White pigs of LLC “Agroprime Holding” in the Odesa region and in the Animal Husbandry Laboratory of the State Institution “Institute of Grain Crops” of the National Academy of Agrarian Sciences of Ukraine. The study presents the results of research on the lifespan, breeding longevity, and reproductive performance of Large White sows of French selection by the “AXIOM” company with varying operational value, as well as the calculation of the economic efficiency of their use. The research was conducted at the pedigree breeding farm for Large White pigs of LLC “Agroprime Holding” in the Odesa region and in the Animal Husbandry Laboratory of the State Institution “Institute of Grain Crops” of the National Academy of Agrarian Sciences of Ukraine. It was established that the lifespan of Large White sows of French selection by the “AXIOM” company is 34.1 months, while their breeding longevity is 26.3 months. In terms of prolificacy and litter weight at weaning at 60 days of age, they exceed the minimum requirements for the elite class by an average of 18.46%. Considering intrabreed differentiation by the “operational value of the sow” index (Kh1), a significant difference was found between sows of groups I and III in lifespan (10.2 months), breeding longevity (10.6 months), number of farrowings obtained (2.1), number of live piglets obtained during the breeding period (40.9 head), prolificacy (2.8 head), number of piglets at weaning at 28 days of age (1.9 head), litter weight at weaning at 28 days of age (10.1 kg), and litter weight at weaning at 60 days of age (29.3 kg). The piglet survival rate to weaning at 28 days of age among sows of groups I, II, and III ranged from 89.8% to 95.4%. The proportion of significant pairwise correlation coefficients between the Kh1 index, long-term adaptation traits, and reproductive performance of sows was 100%. The highest additional product gain was obtained from sows of group I, amounting to +5.77%, with a value of +367.23 UAH per head per farrowing. The selection criterion for the leading group of sows by the “operational value of the sow” index (Kh1) is its value in the range of 84.41–105.88 points.

Keywords: sow, genotype, lifespan, duration of breeding use, reproductive qualities, operational value.



ЕКСПЛУАТАЦІЙНА ЦІННІСТЬ ТА ПРОДУКТИВНІСТЬ СВИНОМАТОК ВЕЛИКОЇ БІЛОЇ ПОРОДИ ФРАНЦУЗЬКОЇ СЕЛЕКЦІЇ КОМПАНІЇ «АХІОМ»

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У роботі наведено результати досліджень тривалості життя, тривалості племінного використання та відтворювальних якостей свиноматок великої білої породи французької селекції компанії «АХІОМ» різної експлуатаційної цінності та розраховано економічної ефективності їх використання. Дослідження проведено в умовах племінного заводу з розведення свиней великої білої породи ТОВ «Агропрайм Холдинг» Одеської області та лабораторії тваринництва Державної установи Інституту зернових культур НААН. Установлено, що тривалість життя свиноматок великої білої породи французької селекції компанії «АХІОМ» становить 34,1 міс, тривалість племінного використання – 26,3 міс, а за багатоплідністю і масою гнізда на час відлучення у віці 60 діб переважають мінімальні вимоги класу еліта в середньому на 18,46 %. З урахуванням внутріпородної диференціації за індексом «експлуатаційна цінність свиноматки» (Kh_1) достовірну різницю встановлено між свиноматками I і III піддослідних груп за тривалістю життя (10,2 міс), тривалістю племінного використання (10,6 міс), кількістю одержаних опоросів становить (2,1), кількістю живих порослят, одержаних за період племінного використання (40,9 гол), багатоплідністю (2,8 гол), кількістю порослят на час відлучення у віці 28 діб (1,9 гол), масою гнізда на час відлучення у віці 28 діб (10,1 кг), масою гнізда на час відлучення у віці 60 діб (29,3 кг). Показник збереженості порослят до відлучення у віці 28 діб свиноматок I, II і III піддослідних груп коливається у межах від 89,8 до 95,4 %. Кількість достовірних коефіцієнтів парної кореляції між індексом Kh_1 , ознаками довготривалої адаптації та відтворювальних якостей свиноматок становить 100 %. Максимальну прибавку додаткової продукції одержано від свиноматок I піддослідної групи. Вона становить +5,77 %, а її вартість дорівнює +367,23 грн. / гол / опорос. Критерієм відбору свиноматок провідної групи тварин за індексом «експлуатаційна цінність свиноматки» (Kh_1) є його значення на рівні 84,41-105,88 бала.

Ключові слова: свиноматка, генотип, тривалість життя, тривалість племінного використання, відтворювальні якості, експлуатаційна цінність.

Introduction. The realization of the genetic potential of animals of foreign selection—particularly regarding the reproductive qualities of sows and boars, as well as the fattening and meat qualities of their offspring—is possible under conditions of compliance with optimal, scientifically substantiated feeding and housing standards. These paratypic factors help to reduce the impact of stressors and, accordingly, increase lifespan, breeding longevity, and productive traits (Hetia A.A., 2009; Dudka O.I., 2009; Shulha Yu.I. et al., 2011; Kyslynska A.I., 2012, 2013; Cheng J. et al., 2018; Pelykh N.L., Plokhova A.V., 2019; Vashchenko P.A., 2019; Yen N. et al., 2019; Dudka O.I., 2020; Pasiuta A.H. et al., 2020; Kremez M.I. et al., 2022; Berezovskyi M.D., Vashchenko P.A., 2022).



Thus, the research results of R.L. Susol indicate that Pietrain sows of French selection by the “ADN” company, based on the results of their first farrowing, are characterized by high reproductive performance (Susol R.L., 2010). The average age at puberty in Pietrain replacement gilts is 173.54 ± 11.17 days, the estrus cycle length is 21.08 ± 3.44 days, the age at first successful insemination is 244.45 ± 9.76 days, and the age at first farrowing is 361.95 ± 7.39 days. The author states that the above indicators demonstrate the good adaptive capacity of Pietrain pigs to the climatic conditions of southern Ukraine and to the technological conditions of the farm.

Voloshchuk V. and Vasylyv A. note that, according to the breeding value index and adaptation index, Large White sows outperform Landrace, Duroc, Hampshire, and Pietrain sows by +10.7%, +22.7%, +28.6%, and +31.6%, and by +20.1%, +35.7%, +41.2%, and +47.6%, respectively (Voloshchuk V., Vasylyv A., 2014). An assessment of the operational value of sows showed that Large White and Landrace sows are the most suitable for intensive use under industrial complex conditions. In terms of the number of viable piglets per inseminated sow, animals of these breeds fall into the “high operational value” category. For this indicator, the difference between Landrace and Large White sows, and Duroc, Hampshire, and Pietrain breeds is 0.1, 6.2, 5.3, and 5.3 points, respectively.

Thus, the chosen research direction is relevant and has practical significance for the further development of the pig breeding industry.

The aim of the study was to investigate the lifespan, breeding longevity, and reproductive performance of Large White sows of French selection by the “AXIOM” company, as well as their operational value and the economic efficiency of their use under the conditions of the pedigree breeding farm for Large White pigs of LLC “Agroprime Holding” in the Odesa region.

Materials and methods. The research was conducted under the conditions of the pedigree breeding farm for Large White pigs of LLC “Agroprime Holding” in the Odesa region and the Animal Husbandry Laboratory of the State Institution “Institute of Grain Crops” of the NAAS of Ukraine (2023–2025). The work was carried out in accordance with the research program of the National Academy of Agrarian Sciences of Ukraine No. 31 “*Genetic improvement of farm animals, their reproduction, and biodiversity conservation*” (Genetics, conservation, and reproduction of bioresources in animal husbandry).

The evaluation of Large White sows of French selection (company “AXIOM”) was performed taking into account the following quantitative traits: lifespan (months), breeding longevity (months), total number of farrowings obtained, total number of live piglets obtained (head), prolificacy (head), number of piglets at weaning at 28 days of age (head), litter weight at weaning at 28 days of age (kg), litter weight at weaning at 60 days of age (kg), and piglet survival rate to weaning at 28 days of age (%). Litter weight at weaning at 60 days of age was determined according to Appendix 10 to paragraph 4.4.7 of the *Instruction on Pig Appraisal (Instruction on Pig Appraisal; Instruction on Breeding Record Keeping in Pig Production, 2003)* in the modification by V.I. Khalak (Khalak, 2009) (Table 1).



Table 1.

Correction coefficients for adjusting litter weight at weaning at 60 days of age

Age at weaning, days	Coefficient	Age at weaning, days	Coefficient
21	3,000	41	1,708
22	2,976	42	1,656
23	2,952	43	1,604
24	2,928	44	1,552
25	2,904	45	1,500
26	2,880	46	1,460
27	2,804	47	1,420
28	2,728	48	1,380
29	2,652	49	1,340
30	2,500	50	1,300
31	2,428	51	1,275
32	2,356	52	1,250
33	2,284	53	1,225
34	2,212	54	1,200
35	2,140	55	1,150
36	2,064	56	1,120
37	1,988	57	1,090
38	1,912	58	1,060
39	1,836	59	1,030
40	1,760	60	1,000

The selection index of sow reproductive traits (SISRT) (1) and the operational value index of the sow (2, 3) were calculated using the following mathematical models:

$$SISRT = (6,0 \times X_1) + \left[9,34 \times \left(\frac{X_2}{X_3} \right) \right] \quad (1)$$

where: SISRT – selection index of sow reproductive traits, points; X_1 – prolificacy, head; X_2 – litter weight at weaning, kg; X_3 – age at weaning, days (Akimov O.V. et al., 2023);

$$Kh_1 = \left[\frac{(W \times P) + F}{G + F} \right] + N \quad (2)$$

$$\text{where: } F=S+K \quad (3)$$

where: Kh_1 – “operational value of the sow” index, points; W – breeding longevity (from the beginning of the first pregnancy to the last weaning of piglets), months; G – lifespan of the sow (from birth to the last weaning of piglets), months; P – number of farrowings; S – service period (from the date of weaning to the date of insemination), days; K – period from the date of insemination to the confirmation of pregnancy by ultrasound diagnosis (USD), days; N – total number of live piglets obtained, head (Khalak V.I., 2025).

The feeding and housing conditions for the sows of the experimental groups were identical and complied with zootechnical standards. The economic efficiency of the research results was calculated using the following data: purchase price per unit of



production according to current prices in Ukraine; average animal productivity; average increase in primary production (%), expressed as a percentage per head when applying a new or improved breeding achievement compared to the productivity of animals under baseline use (Ladyka V.I. et al., 2023).

Biometric processing of the obtained data was carried out according to generally accepted methods (Kovalenko V.P. et al., 2010; Petrovska I.R. et al., 2022). The strength of the correlations between traits was determined according to Chaddock's scale (Sydorova A.V. et al., 2003) (Table 2).

Table 2.

Chaddock's scale for grading the strength of the correlation between quantitative traits

Correlation coefficient value	Strength of correlation
0,1-0,3	Weak
0,3-0,5	Moderate
0,5-0,7	Noticeable
0,7-0,9	High
0,9-0,99	Very high

Research results. Analysis of primary zootechnical records and the results of our study indicate that the lifespan of Large White sows of French selection (n=40) is 34.1 ± 0.85 months (Cv = 15.79%), breeding longevity – 26.3 ± 0.98 months (Cv = 23.84%), total number of farrowings – 5.5 ± 0.16 (Cv = 19.00%), total number of live piglets obtained – 69.3 ± 2.76 (Cv = 25.23%), prolificacy – 12.6 ± 0.26 head (Cv = 13.41%), number of piglets at weaning at 28 days of age – 11.6 ± 0.15 head (Cv = 8.58%), litter weight at weaning at 28 days of age – 89.8 ± 1.49 kg (Cv = 10.55%), litter weight at weaning at 60 days of age – 237.6 ± 3.88 kg (Cv = 10.35%), and piglet survival rate to weaning at 28 days of age – $92.1 \pm 0.45\%$. The selection index of sow reproductive traits (SISRT) is 103.38 ± 2.036 points (Cv = 12.46%).

The results of the study on lifespan, breeding longevity, and reproductive performance of sows with different differentiation levels according to the Kh_1 index are presented in Table 3. It was found that sows of group I ($Kh_1 = 84.41-105.88$ points) outperformed sows of groups II ($Kh_1 = 66.12-82.69$ points) and III ($Kh_1 = 40.30-58.89$ points) in lifespan by 5.0 (td = 3.49; $P < 0.01$) and 10.2 months (td = 8.36; $P < 0.01$), and in breeding longevity by 3.6 (td = 2.15; $P < 0.05$) and 10.6 months (td = 4.90; $P < 0.01$), respectively.

The difference between the animals of the specified groups in terms of the number of farrowings obtained was 0.8 (td = 3.33; $P < 0.01$) and 2.1 (td = 8.07; $P < 0.001$); in the number of live piglets obtained during the breeding period – 17.6 (td = 6.76; $P < 0.001$) and 40.9 head (td = 16.61; $P < 0.001$); in prolificacy – 1.2 (td = 2.55; $P < 0.05$) and 2.8 head (td = 4.67; $P < 0.001$); in the number of piglets at weaning at 28 days of age – 0.8 (td = 2.35; $P < 0.05$) and 1.9 head (td = 5.13; $P < 0.001$); in litter weight at weaning at 28 days of age – 5.3 kg (td = 1.76; $P > 0.05$) and 10.1 kg (td = 2.70; $P < 0.05$); in litter weight at weaning at 60 days of age – 13.5 kg (td = 1.58; $P > 0.05$) and 29.3 kg (td = 3.09; $P < 0.01$); and in the selection index of sow reproductive traits (SISRT) – 8.52 points (td = 2.30; $P < 0.05$) and 19.09 points (td = 4.07; $P < 0.001$). The highest piglet survival rate to weaning at 28 days of age ($95.4 \pm 0.86\%$) was recorded in sows of group III.

The coefficient of variation (Cv, %) for lifespan, breeding longevity, and absolute reproductive performance indicators of sows in the experimental groups ranged from 6.52% (number of piglets at weaning at 28 days of age in sows of group II) to 27.82% (breeding longevity in sows of group III).



Table 3.

Lifespan, breeding longevity, and reproductive performance of sows with different differentiation levels according to the Kh₁ index

Indicators, units of measurement	Biometric indicators	Kh ₁ index, points		
		84,41-105,88	66,12-82,69	40,30-58,89
		Groups		
		I	II	III
		operational value		
		high	medium	low
n	11	15	14	
Lifespan, months	$X \pm S_x$	39,5±0,881	34,5±1,13	29,3±0,85
	$\sigma \pm S_\sigma$	2,93±0,624	4,40±0,804	3,20±0,604
	$C_v \pm S_{C_v}, \%$	7,41±1,579	12,75±2,330	10,92±2,064
Duration of breeding use, months	$X \pm S_x$	31,3±1,52	27,7±0,71	20,7±1,54
	$\sigma \pm S_\sigma$	5,05±1,076	2,75±0,502	5,76±1,088
	$C_v \pm S_{C_v}, \%$	16,13±3,439	9,92±1,813	27,82±5,258
Total farrowings obtained during breeding period	$X \pm S_x$	6,6±0,20	5,8±0,14	4,5±0,17
	$\sigma \pm S_\sigma$	0,67±0,142	0,56±0,102	0,65±0,122
	$C_v \pm S_{C_v}, \%$	10,15±2,164	9,65±1,764	14,44±2,729
Total live piglets obtained, head	$X \pm S_x$	90,2±2,17	72,6±1,45	49,3±1,48
	$\sigma \pm S_\sigma$	7,19±1,533	5,62±1,027	5,54±1,047
	$C_v \pm S_{C_v}, \%$	7,97±1,699	7,74±1,414	11,23±2,122
“Operational value of the sow” index (Kh ₁), points	$X \pm S_x$	92,59±2,217	74,98±1,482	51,12±1,48
	$\sigma \pm S_\sigma$	7,35±1,567	5,74±1,049	5,56±1,051
	$C_v \pm S_{C_v}, \%$	7,93±1,690	7,65±1,398	10,87±2,054
Prolificacy, head.	$X \pm S_x$	13,7±0,41	12,5±0,25	10,9±0,46
	$\sigma \pm S_\sigma$	1,36±0,289	1,00±0,182	1,72±0,325
	$C_v \pm S_{C_v}, \%$	9,92±2,115	8,00±1,462	15,77±2,981
± to elite class	z_{01}	+2,7	+1,5	-0,1
	%	+19,70	+12,0	-0,90
Number of piglets at weaning at 28 days of age, head	$X \pm S_x$	12,3±0,29	11,5±0,19	10,4±0,23
	$\sigma \pm S_\sigma$	0,97±0,206	0,75±0,137	0,87±0,164
	$C_v \pm S_{C_v}, \%$	7,88±1,680	6,52±1,191	8,36±1,580
Litter weight at weaning at 28 days of age, kg	$X \pm S_x$	95,3±2,36	90,0±1,86	85,2±2,90
	$\sigma \pm S_\sigma$	7,84±1,671	7,20±1,316	10,85±2,051
	$C_v \pm S_{C_v}, \%$	8,22±1,752	8,00±1,462	12,73±2,406
Litter weight at weaning at 60 days of age, kg	$X \pm S_x$	252,9±6,87	239,4±5,01	223,6±6,52
	$\sigma \pm S_\sigma$	22,80±4,861	19,41±3,548	24,40±4,612
	$C_v \pm S_{C_v}, \%$	8,97±1,912	8,10±1,480	10,91±2,062
± to elite class	κ_2	+72,9	+59,4	+43,6
	%	+28,82	+24,81	+19,49
Piglet survival rate to weaning, %	$X \pm S_x$	89,8±0,67	92,0±0,51	95,4±0,86
SISRT, points	$X \pm S_x$	113,22±3,097	104,7±2,030	94,13±3,52
	$\sigma \pm S_\sigma$	10,27±2,189	7,86±1,436	13,17±2,489
	$C_v \pm S_{C_v}, \%$	9,07±1,933	7,50±1,371	13,99±2,644



The calculations of pairwise correlation coefficients between lifespan, breeding longevity, reproductive performance indicators of sows, and the Kh_1 index indicate considerable variability of this biometric parameter (-0.547 ± 0.1109 to $+0.999 \pm 0.0003$) (Table 4).

Table 4.

Pairwise correlation coefficients between lifespan, breeding longevity, reproductive performance indicators of sows, and the Kh_1 index

Trait		Biometric indicators		Strength of correlation
<i>x</i>	<i>y</i>	<i>r</i> ± <i>Sr</i>	<i>tr</i>	
Kh ₁ , бала	1	+0,777±0,0627***	12,39	High
	2	+0,721±0,0760***	9,49	High
	3	+0,863±0,0404***	21,37	High
	4	+0,999±0,0003***	3158,42	Very high
	5	+0,644±0,0926***	6,95	Moderate
	6	+0,977±0,0072***	135,79	Very high
	7	+0,451±0,1260**	3,58	Moderate
	8	+0,527±0,1143***	4,61	Moderate
	9	-0,547±0,1109***	4,93	Moderate

Note: 1 – lifespan, months; 2 – breeding longevity, months; 3 – total number of farrowings obtained; 4 – total number of live piglets obtained, head; 5 – prolificacy, head; 6 – number of piglets at weaning at 28 days of age, head; 7 – litter weight at weaning at 28 days of age, kg; 8 – litter weight at weaning at 60 days of age, kg; 9 – piglet survival rate to weaning at 28 days of age, %; ** – $P < 0.01$; *** – $P < 0.001$

Significant correlation relationships were established between the following pairs of traits: $Kh_1 \times$ lifespan ($r = +0.777$, $tr = 12.39$); $Kh_1 \times$ breeding longevity ($r = +0.721$, $tr = 9.49$); $Kh_1 \times$ total farrowings obtained ($r = +0.863$, $tr = 21.37$); $Kh_1 \times$ total live piglets obtained ($r = +0.999$, $tr = 3158.42$); $Kh_1 \times$ prolificacy ($r = +0.644$, $tr = 6.95$); $Kh_1 \times$ number of piglets at weaning at 28 days of age ($r = +0.977$, $tr = 135.79$); $Kh_1 \times$ litter weight at weaning at 28 days of age ($r = +0.451$, $tr = 3.58$); $Kh_1 \times$ litter weight at weaning at 60 days of age ($r = +0.527$, $tr = 4.61$); $Kh_1 \times$ piglet survival rate to weaning at 28 days of age ($r = -0.547$, $tr = 4.93$).

Calculations of the coefficients of linear regression ($R_{x/y}$, $R_{y/x}$) between the Kh_1 index, lifespan, breeding longevity, prolificacy, and litter weight at weaning at 28 days of age in Large White sows of French selection ranged from 0.040 (breeding longevity \times Kh_1 index) to 6.763 (Kh_1 index \times prolificacy) (Table 5).

Table 5.

Linear regression coefficient between the Kh_1 index, lifespan, breeding longevity, prolificacy, and litter weight at weaning at 28 days of age in Large White sows of French selection, n = 40

Trait		Biometric indicators	
<i>x</i>	<i>y</i>	$R_{x/y}$	$R_{y/x}$
Lifespan, months	<i>Kh₁ index, points</i>	0,235	2,563
Breeding longevity, months		0,040	2,044
Prolificacy, head		0,061	6,763
Litter weight at weaning at 28 days of age, kg		0,240	0,845



The calculation of the economic efficiency of the research results shows that the highest additional product gain was obtained from sows of group I ($Kh_1 = 84.41-105.88$ points) (Table 6).

Table 6.

Economic efficiency of the research results

Group	Kh_1 index	n	Litter weight at weaning at 28 days of age, kg	\pm to the average population value, %	Value of additional production, UAH / head / farrowing
III	40,30-58,89	14	85,2 \pm 2,90	-5,12	-325,86
II	66,12-82,69	15	90,0 \pm 1,86	+0,22	+14,00
I	84,41-105,88	11	95,3 \pm 2,36	+5,77	+367,23

Note: The selling price of young pigs at the time of the experimental part of the study was 94.50 UAH per 1 kg of live weight.

The increase amounts to +5.77%, with a value of +367.23 UAH per head per farrowing.

Discussion. The results of our research indicate the effectiveness of using a new method for evaluating the operational value of sows, which takes into account breeding longevity and lifespan, service period length, the period from insemination to confirmation of pregnancy by ultrasound (USD), as well as the total number of farrowings and live piglets obtained during the breeding period. The distribution of animals according to the operational value index of the sow (Kh_1) shows that animals of group I, with an index ranging from 84.41 to 105.88 points, are characterized by higher indicators of long-term adaptation and productivity and belong to the “high operational value” category.

The high significance of the pairwise correlation coefficients between the Kh_1 index and most productivity indicators ($r = 0.451-0.999$, $P < 0.001$) indicates its informativeness and the appropriateness of its use in breeding work. The positive and strong correlations of Kh_1 with lifespan, breeding longevity, prolificacy, and litter weight at weaning at 28 days confirm the complex nature of this index as an integrated measure of productive longevity and reproductive potential of sows. At the same time, the identified negative correlation of Kh_1 with piglet survival to 28 days of age ($r = -0.547$) may be explained by management factors or physiological limitations of highly productive animals.

The linear regression coefficients (0.040–6.763) demonstrate varying degrees of influence of individual traits on the Kh_1 index, providing a basis for targeted improvement of key reproductive traits through selection.

The economic analysis confirmed the practical significance of using the Kh_1 index for animal selection: the highest additional product gain (+5.77%, or +367.23 UAH/head/farrowing) was obtained from sows of group I, which have the highest index values. This indicates a direct relationship between the comprehensive assessment of operational value and production profitability.

The effectiveness of evaluating sows by the “operational value” trait for animals with different operational value levels is also confirmed by the results of the experiment by Dudka O.I. (Dudka O.I., 2009, 2020). The author established that, with increasing age and number of farrowings, the adaptation ability index of sows decreases. It was found that the lifespan and breeding longevity of Ukrainian Steppe White sows range from 18.9 to 128.0 and from 5.9 to 116.2 months, respectively; for Ukrainian Steppe Spotted sows,



these indicators are 20.1–99.8 and 5.8–85.8 months, respectively. Over the breeding period, sows of these breeds produced 6.95 and 6.65 farrowings and a total of 74.3 and 64.6 live piglets, respectively. The quantitative difference in operational value indicators, calculated per sow for all viable piglets, between breeding lines of Ukrainian Steppe White sows was 9.3–4.9 head (28.7–15.7%), while in Ukrainian Steppe Spotted sows it was 13.0–6.3 head (36.8–17.8%). According to the operational value scale, sows of these lines meet the requirements of the medium level (21–39 head).

The obtained results regarding the lifespan (34.1 months) and breeding longevity (26.3 months) of Large White sows of French selection by the “AXIOM” company are consistent with the data of Dudka (2009, 2020), who noted that in Ukrainian Steppe White sows, these indicators may vary from 18.9 to 128.0 months and from 5.9 to 116.2 months, respectively, depending on housing conditions, feeding, and individual adaptive capacity. However, the average values recorded in our study are more stable and have a lower coefficient of variation, which may indicate a high level of herd uniformity.

In terms of prolificacy (12.6 head), our results exceed the figures reported by Pelykh and Plokhova (2019) for sows of various genotypes (10.8–11.4 head), as well as the data of Kyslynska (2013) for Large White sows of Hungarian selection (11.2 head), indicating breeding progress in enhancing reproductive capacity.

The litter weight at weaning at 60 days of age (237.6 kg) in our study significantly exceeds the results obtained by Kremez et al. (2022) for sows of different selection levels (210–225 kg), which may be attributed both to the genetic characteristics of the line and to optimized feeding under the farm’s conditions.

The identified strong correlations between the Kh_1 index and the number of live piglets obtained during the productive period ($r = 0.999$) are consistent with the findings of Voloshchuk and Vasylyv (2014), who reported a high level of association between comprehensive evaluation indexes and key reproductive traits. At the same time, the negative correlation of Kh_1 with piglet survival ($r = -0.547$) partially coincides with the data of Dudka (2020), who noted that highly productive sows sometimes exhibit a higher loss of offspring due to physiological and technological factors.

These findings confirm the effectiveness of selecting highly productive sows by the “operational value” trait using both traditional and innovative evaluation methods.

Thus, the research results demonstrate the effectiveness of introducing the operational value index (Kh_1) into the sow evaluation system as a tool for simultaneously improving productivity, longevity, and the economic efficiency of the pig breeding industry.

Conclusions

1. It was established that the lifespan of Large White sows of French selection by the “AXIOM” company is 34.1 ± 0.85 months, and their breeding longevity is 26.3 ± 0.98 months. In terms of prolificacy and litter weight at weaning at 60 days of age, they exceed the minimum requirements for the elite class by 12.69% and 24.24%, respectively..

2. Taking into account intrabreed differentiation according to the “operational value of the sow” index (Kh_1), a significant difference was found between sows of groups I and III in lifespan (10.2 months; $td = 8.36$), breeding longevity (10.6 months; $td = 4.90$), number of farrowings obtained (2.1; $td = 8.07$), total number of live piglets obtained during the breeding period (40.9 head; $td = 16.61$), prolificacy (2.8 head; $td = 4.67$), number of piglets at weaning at 28 days of age (1.9 head; $td = 5.13$), litter weight at weaning at 28 days of age (10.1 kg; $td = 2.70$), and litter weight at weaning at 60 days of age (29.3 kg; $td = 3.09$). The highest piglet survival rate to weaning at 28 days of age ($95.4 \pm 0.86\%$) was recorded in sows of group III.

3. The number of significant pairwise correlation coefficients between the Kh_1



index and the absolute reproductive performance indicators of sows was 100%. The linear regression coefficient ($R_{x/\gamma}$, $R_{\gamma/x}$) between the Kh_1 index, lifespan, breeding longevity, prolificacy, and litter weight at weaning at 28 days of age in Large White sows of French selection ranged from 0.040 to 6.763.

4. The highest additional product gain was obtained from sows of group I, amounting to +5.77%, with a value of +367.23 UAH per head per farrowing. The selection criterion for the leading group of sows according to the “operational value of the sow” index (Kh_1) is a value in the range of 84.41–105.88 points.

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