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Reproductive Qualities of Romanov Sheep with Regard to the Paratypic Factors

V. I. Hodov, D. Abylkasymov, N. P. Sudarev, O. V. Abrampalskaya, P. I. Migulev

Abstract: ***The article discusses the results of own studies of the authors, the literature data, and the best practices of Romanov sheep breeding. The research was performed at the two Romanov sheep pedigree breeding units in the Tver region, LLC Rassvet and LLC PF Pokrov. This breed has several advantages, such as the possibility of insemination in any season, early maturing, multiparity, the quality of sheepskin, and the taste of the lamb meat. The authors studied the productivity and the reproductive ability of ewes depending on the season, the age of insemination, the live weight, the birth type of the lamb crop. More lambs are obtained in the lambings during the autumn and winter from the ewes after three and more lambings. The survival rate is higher in the winter and summer lambings. The optimal time of insemination is 12 – 13 months. At these farms, three lambings were obtained in two years.***

Keywords: ***the age at first insemination, birth type, ewes, lamb crop survival rate, lambs' weaning, lambing, live weight, polyestricity, reproductive ability, Romanov sheep.***

I. INTRODUCTION

The interest in lamb meat is constantly growing, therefore, scientists and sheep farmers are paying attention to improving the meat productivity of Russian sheep breeds. Meat productivity in sheep breeding may be increased using both breeding and technology methods [1] - [5]. Making sheep breeding in the Russian Federation competitive and profitable requires increasing lamb production at least twice from the 12 kg of live weight per sheep a year [6], [7].

One of particularly valuable coarse wool sheep breeds in Russia is the Romanov breed created at peasant farms in the Ivanovo, Tver and Yaroslavl provinces in the second half of the eighteenth century as a result of long purposeful breeding of northern short-tailed sheep. The demand for the Romanov sheep in Russia and abroad is increasing, rather than decreasing. Romanov sheep are a valuable gene pool of the sheep with worldwide importance [8]. Currently, the Romanov sheep breed is one of the most promising ones; it is bred not only in Russia but also in most countries of Western Europe, as well as in the USA, Canada, Mongolia, and several other countries [8], [9]. This breed is characterized by the world's best sheepskins, unsurpassed natural multiparity, and polyestricity, i.e., by the ability to reproduce throughout the year. This allows sustainable production of young lamb meat, more frequent use of lambings, rational use of the premises during the off-season, and natural and cultivated pastures in the summer.

However, in the practice of breeding Romanov sheep, the technology is used, in which mating occurs in the spring and lambing — in the autumn. The main disadvantage of this technology is the fact that after autumn lambing, lambs' keeping till almost eight months of age in buildings is more expensive.

The research was aimed at comparative studying the effect of paratypic genetic factors and crossbreeding on the off-season liveability of young animals, the productivity, and the reproductive ability of Romanov sheep, and on the efficiency of breeding them in the Tver region.

Therefore, one of the tasks of the work was studying the productivity and the reproductive ability of Romanov ewes, depending on several paratypic factors: the season, the age at first insemination, the live weight, the type of lamb crop birth.

II. METHODS

A. General Description

Materials for the research were the data of primary zootechnical and pedigree accounting, the database of the "SELEX – SHEEP" application, the data in the zootechnical records of the farm (Form No. 6) and the values in the documents of pedigree and production accounting in sheep breeding, as well as the results of own analytical research.

B. Algorithm

The research was performed at the two Romanov sheep pedigree breeding units in the Tver region, LLC Rassvet and LLC PF Pokrov. The paper also studied the state of the Romanov breed in Russia, Central Russia, and the Tver region by the materials of the yearly periodical about sheep and goat breeding in the Russian Federation (the All-Russian Research Institute of Pedigree Work (VNIIplem), 1995 – 2018).

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* Correspondence Author
V.I. Hodov*, Federal State Budgetary Educational Institution of Higher Education "Tver State Agricultural Academy", Tver, Russia. E-mail: vi-khodov@mail.ru.
D. Abylkasymov, Federal State Budgetary Educational Institution of Higher Education "Tver State Agricultural Academy", Tver, Russia.
N.P. Sudarev, Federal State Budgetary Educational Institution of Higher Education "Tver State Agricultural Academy", Tver, Russia.
O.V. Abrampalskaya, Federal State Budgetary Educational Institution of Higher Education "Tver State Agricultural Academy", Tver, Russia.
P.I. Migulev, Federal State Budgetary Educational Institution of Higher Education "Tver State Agricultural Academy", Tver, Russia.

For the comparative analysis and estimation of the herds, all possible economically useful and breeding symptoms of Romanov sheep were taken into account. The factors that influence the productivity and the reproductive ability of animals have been studied by making gradation by the studied characteristics.

The research methodology was based on the scientific and methodological developments by domestic and foreign scientists in the fields of breeding, population genetics and animal farming. For the analysis of the zootechnical parameters, the relationship between the symptoms and the productivity and herd reproduction indicators, the authors used the methods of variation statistics intended for planning and processing the results of population-genetic experiments and observations. The materials of the research were biometrically processed, and the data obtained during the analysis of biological regularities were compared with the use of electronic computer systems.

III. RESULTS

Polyestricity has important economic importance since ewes can lamb twice a year. Sheep feature early maturity, but theaves should be used for reproduction after 10 – 11 months of age. The period of pregnancy is 140 – 153 days. In one lambing, ewes usually bring 2 – 3 lambs [10].

Fertility is a genetically conditioned trait. This is evidenced by the high variability of multiparity in sheep of various breeds, which is at the same time subject to significant changes under the influence of paratypic factors [11].

Depending on the season, changes in the results of lambing were observed in the Romanov sheep (Table I)

The yield of lambs per one ewe in the autumn was 2.59 at LLC Rassvet, and 2.69 at LLC PF Pokrov, and in the winter — 2.58 and 2.66, respectively. In the spring and summer, these figures were lower: 2.40 and 2.49 in the summer, and 2.43 and 2.30 in the spring.

This leads to the conclusion that the highest number of lambs in the lambings of Romanov ewes occurs in the autumn and winter.

Table – I: Results of Romanov ewes' lambings with regard to the season of calving (2013 – 2016)

Season	LLC Rassvet			LLC PF Pokrov		
	The number of ewes	Obtained lambs, animals		The number of ewes	Obtained lambs, animals	
		total	per one ewe		total	per one ewe
Winter	272	729	2.58	208	553	2.66
Spring	132	304	2.30	144	350	2.43
Summer	84	202	2.40	68	169	2.49
Autumn	220	569	2.59	188	506	2.69
Total	708	1,804	2.51	608	1,578	2.60

Young animals' survival rate is one of the important efficiency indicators in the industry. In this regard, the authors studied the lambs' survival rate, depending on the lambing season (Table II).

Table – II: Lambs' survival rate in different lambing seasons (2013 – 2016)

Season	LLC Rassvet			LLC PF Pokrov		
	Obtained lambs, animals	Preservation rate after weaning		Obtained lambs, animals	Preservation rate after weaning	
		animals	%		animals	%
Winter	729	663	90.9	553	514	92.9
Spring	304	264	86.8	350	294	84.0
Summer	202	188	93.0	169	154	91.1
Autumn	569	472	82.9	506	430	85.0
Total	1,804	1,587	88.0	1,578	1,392	88.2

The highest lamb survival rate after weaning was also observed in the winter and summer lambings of ewes — 90.9 % and 93.0 %, respectively, in the herd of LLV Rassvet, while in the herd of LLC PF Pokrov, these figures were 92.9 % and 91.1 %.

The preservation rates after the spring and autumn lambings were much worse, and at LLC Rassvet reached 86.8 % and 84 %, while at LLC PF Pokrov, they reached 82.9 % and 85.0 %, respectively. Based on the foregoing, it may be concluded that the winter and the summer are more favorable seasons for lambing since the highest crop per one ewe is observed in these seasons, along with the best survival rate after weaning.

Table – III: Multiparity of Romanov ewes depending on the age

Lambing age	LLC Rassvet			LLC PF Pokrov		
	The number of ewes	Obtained lambs, animals		The number of ewes	Obtained lambs, animals	
		total	per one ewe		total	per one ewe
I	89	206	2.31	118	278	2.36
II	194	475	2.45	202	521	2.58
III	175	464	2.65	139	364	2.62
IV	144	368	2.69	91	244	2.68
V and more	96	253	2.64	55	148	2.69
Average	698	1,786	2.56	605	1,555	2.57

Analysis of the ewes' multiparity (Table III) depending on the lambing age showed an increase in the number of lambs obtained from one ewe from the first to the 4th – 5th lambing. The effect of the age at the first fruitful insemination on the ewes' multiparity (autumn and winter lambing) showed that the optimal time of sheep insemination in the conditions of these farms was 12 – 13 months (Table IV).

Table – IV: The effect of the age at the first fruitful insemination on ewes' multiparity (autumn and winter lambing)

Indicators	LLC Rassvet			LLC PF Pokrov		
	Age, months			Age, months		
	less than 12	12.1 — 13.0	13.1 and more	less than 12	12.1 — 13.0	13.1 and more
Average age, months	11.3	12.5	13.3	10.8	12.6	13.4
Lambed ewes, animals	78	101	65	57	121	104

Obtained lambs, animals	178	243	158	132	294	246
from one ewe, animals	2.28	2.41	2.43	2.32	2.43	2.36

Insemination of ewe lambs at this age ensures the highest lamb crop — 2.41 animals at LLC Rassvet and 2.43 animals at LLC PF Pokrov. The ewe lambs are allowed to mate when their live weight reaches 30 kg.

Adult sheep with the live weight of more than 50 kg are more fertile (Table V).

Table – V: Multiparity of Romanov ewes with various body weights (except for first lambings, the autumn and winter lambings)

Indicators	LLC Rassvet			LLC PF Pokrov		
	Live weight, kg			Live weight, kg		
	less than 50	50 and more	average	less than 50	50 and more	average
Average live weight of ewes, kg.	47.8	53.4	51.1	48.5	55.7	52.7
Lambed ewes, animals	112	163	275	98	139	237
Obtained lambs, animals	286	434	720	251	373	624
Multiparity, %	255	266	262	256	268	264
Per one ewe	2.55	2.66	2.62	2.56	2.68	2.64

The main trait in breeding Romanov sheep is ewes' multiparity. However, the live weight of the lambs at birth and their survival rate directly depend on the type of lamb crop birth, i.e., on the number of lambs in the litter. As shown by the results of analyzing (Table VI) lambing of the ewes at the second lambing and older, most ewes (75.2 %) gave birth to three (43.5 %) and two (31.7 %) lambs, and a considerable number of sheep gave birth to four lambs (22.3 %).

Table – VI: Live weight and lambs survival rate, depending on the birth type (without first lambings, LLC Rassvet)

Birth type	Number of lambings	% of total calving	Average live weight of one animal at birth, kg	The survival rate after weaning, %
Y-1	12	2.5	2.86 ± 0.12	100
Y-2	150	31.7	2.64 ± 0.17	95.6
Y-3	267	56.5	2.38 ± 0.10	79.5
Y-4	44	9.3	1.83 ± 0.16	81.3
Average (total)	(473)	(100)	2.46 ± 0.14	83.8

With the number of lambs in the litter increasing, their average live weight at birth decreases, and the number of stillborn fetuses grows steadily. Thus, the average live weight of a lamb at singleton birth (Y-1) was 2.86 kg, and at birth (Y-4) — 1.83 kg, respectively; the number of stillborn lambs was 2.0 % at twins lambing (Y-2) and 9.0 % when quadruplet lambing (Y-4), respectively. Ewes' multiparity not only results in an increased number of stillborn lambs in the litter but also reduces the survival rate of the lambs after weaning.

Similar results were obtained in the herd at another breeding unit, LLC PF Pokrov (Table VII).

Table – VII: Live weight and lambs survival rate, depending on the birth type (without first lambings, LLC PF Pokrov)

Birth type	Number of lambings	% of total calving	Average live weight of one animal at birth, kg	The survival rate after weaning, %
Y-1	6	1.75	2.91 ± 0.10	83.3
Y-2	108	31.5	2.80 ± 0.13	92.5
Y-3	178	51.9	2.41 ± 0.17	85.8
Y-4	51	14.9	2.03 ± 0.12	81.4
Average (total)	(343)	(100)	2.50 ± 0.15	87.2

The authors analyzed the reproductive ability of Romanov ewes from the comparative perspective of the two breeding farms (Table VIII). The age of the first fruitful ewes' insemination and lambing was almost the same, 11.4, 11.8 and 16.3, 16.7 months, respectively. The efficiency of ewes' insemination after lambing was different. Good results of insemination were observed in the herd of lambs after the first lambing at LLC Rassvet — 91.8 %, vs. that at LLC PF Pokrov — 87.5 %.

Table – VIII: Romanov ewes' reproductive ability indicators

Indicators	Farm	
	LLC Rassvet	LLC PF Pokrov
The number of lambs after the first lambing	85	112
The age at first insemination, months	11.4 ± 0.41	11.8 ± 0.61
The age at lambing, months	16.3 ± 0.36	16.7 ± 0.38
Inseminated after lambing within (animals/%):		
3 months	58 / 68.2	71 / 63.4
6 months	75 / 88.2	92 / 82.1
9 months	78 / 91.8	98 / 87.5
Culling (animals/%)	7 / 8.2	14 / 12.5

The duration of the service period (the period between lambing and insemination) and fruitful insemination of ewes depends on many paratypic factors. The time of lambs' weaning from mothers plays a special role. The authors studied the Romanov ewes' reproductive ability indices at various times of lambs' weaning (Table IX).

Table – IX: Romanov ewes' reproductive ability at various times of lambs' weaning

Indicators	Group				
	I	II	III	IV	V
Times of lambs' weaning	25 – 30	60 – 70	90 – 100	110 – 120	Without weaning
The number of ewes	55	67	105	123	48
The period between lambings, days	257 ± 11.2	285 ± 16.4	298 ± 17.1	304 ± 14.6	303 ± 9.8
Service period, days	110 ± 8.8	137 ± 6.4	151 ± 10.3	157 ± 13.2	155 ± 11.6

Multiparity	2.45	2.53	2.56	2.50	2.42
Coefficient of reproductive qualities	1.42	1.28	1.22	1.20	1.20

In the breeding work with Romanov sheep, one should consider the breeding and genetic breeding parameters. The main indicators of trait variability are the standard deviation (σ) and the coefficient of variation (Cv).

Studying the diversity of the economically useful traits of the sheep herd showed that the coefficient of variation in many characteristics was low and amounted up to 10 %, except for the period between lambings (PBL) and service period (SP), where these values were relatively high and amounted to 23.6 and 24.2 %, respectively (Table X). These indicators are to be used for screening the ewes, or the above-mentioned intervals should be regulated using various technology methods, for example, early lambs' weaning from ewes. The variability coefficients in terms of the live weight of theaves at the age of 12 months, the age of the first insemination, and multiparity are quite low, indicating high uniformity of the herd in terms of these traits.

Table – X: Variability of the economically valuable traits of Romanov sheep

Trait	X ± m	lim	σ	Cv, %
Live weight of the lambs at birth, kg (n=677)	2.28 ± 0.008	1.6 – 2.9	0.22	9.6
The live weight of theaves at the age of 12 months, kg (n=483)	37.6 ± 0.13	32.3 – 42.9	2.9	7.8
The age at first insemination, months (n=483)	11.6 ± 0.04	10.2 – 13.0	0.88	7.6
Multiparity, animals (n=1316)	2.56 ± 0.04	1.0 – 5.0	0.14	5.3
The live weight of ewes, animals (n=1255)	51.2 ± 0.16	44 – 58	5.84	11.4
The period between lambings, days (n= 845)	302.4 ± 2.46	277 – 328	71.4	23.6
Service period, days (n= 845)	155.4 ± 1.30	98 – 185	37.6	24.2

For the full understanding whether the studied factors have effect at all on the basic breeding traits, in this case, on multiparity, survival rate and the live weight of young animals at the moment of weaning, and for determining the effect of the studied factor on the variability of the trait, one-way ANOVA analysis was made.

Table – XI: Shares of the effect of individual factors on the breeding traits of Romanov sheep (η_x^2, %)

Factor	Multiparity	Survival rate	Live weight of young animals
Season (of lambing)	8.7	23.8	11.6
Lamb crop birth type	-	33.5	38.1
Lambing ewes' age	27.2	13.4	7.3
Times of lambs' weaning	6.3	18.8	21.4
Gender	-	2.8	26.2
Stud rams (fathers)	16.6	12.5	9.3

As shown in Table XI, the shares of the effects on some main breeding traits of the sheep were different. Ewes' multiparity is mainly influenced by the age of the ewes — 27.2 %, and stud rams – fathers — 16.6 %. The effect of the season was insignificant — 8.7 %, as well as the time of weaning the lambs from the ewes — 6.3%. The young animals' preservation rate before weaning was most significantly influenced by the type of lamb crop birth — 33.5 %, the season of lambing — 23.8 %, and the time of lambs' weaning — 18.8 %. The share of influence of the gender factor on the lambs' preservation rate was minimal — 2.8 %. The productive trait of the lambs' live weight at the moment of weaning was significantly influenced by the type of lamb crop birth — 38.1 %, the gender — 26.2 %, and the time of lambs' weaning — 21.4 %. The live weight of lambs was insignificantly influenced by such factors as stud rams — fathers and the age of lambing ewes, the share of which amounted to 9.3 %and 7.3 %, respectively.

In general, it may be stated that good breeding traits in the sheep depend significantly on the studied factors. They have different efficiency, and the share of influence of some of them is quite high. Therefore, the potential of the animals may be significantly improved by taking into account the shares of these factors on the productive trait during sheep screening

IV. THE ECONOMIC EFFICIENCY OF THE STUDY

To assess the economic efficiency of growing young Romanov sheep with consideration of their preservation rate and live weight, a comparative analysis of the indicators that depended on the time of birth was made (Table XII).

Table – XII: Economic efficiency of growing lambs born in various seasons (per one animal)

Indicators	Lambing season			
	Winter	Spring	Summe r	Autumn
Lambs born	1,282	654	371	1,075
Survival rate at the age of 10 months, %	78.8	73.4	82.8	77.5
nimals	1,010	480	307	833
Live weight at the age of 11 – 12 months, kg	42.6	39.3	38.7	43.5
Cost of growing one animal, for 12 months, rubles	4,874	5,508	5,220	4,644
The average sale price of 1 kg of the live weight, rubles	320	320	320	320
Revenue from one animal sold, rubles	13,632	12,576	12,384	13,920
Profit per one animal, rubles	8,758	7,068	7,164	9,276
Profit per 100 animals considering the survival rate, thousand rubles	690.1	518.8	593.2	718.9

The costs of growing one animal over the 12 months after lambing fluctuated considerably. It mainly depended on the cost of the changing diets of the young animals in various age periods and the keeping conditions in various seasons.

While the profit per one young animal depended on the live weight and the cost of growing, the profit per 100 animals considering the lamb crop survival rate mainly depended on the season of lamb birth.

V. CONCLUSION

Winter and summer are the most favorable seasons for lambing since in these seasons, the highest crop per one ewe is observed, along with the best survival rate after weaning.
The highest lamb yields per single ewe at both breeding farms were observed in the ewes with three and more lambings. Therefore, the lamb yield increases considerably with the age of the ewes. The optimal time for inseminating sheep in the conditions of these breeding farms is 12.1 – 13 months. The earlier the lambs are weaned from the ewes, the better the ewes' reproductive ability is, since the duration of the service period and the PBL reduces; therefore, one can expect high reproductive ability. The best variant for using more frequent lambing at these farms was the variant with three lambings in two years.

REFERENCES

1. Kh. A. Amerkhanov, M. V. Egorov, and E. L. Revyakin, *Aktualynye aspekty vedeniya ovtsevodstva i kozovodstva v sovremennyh usloviyah [Relevant aspects of sheep and goats breeding in the modern conditions]*. Moscow: FSBSI Rosinformagrotekh, 2012.
2. N. P. Sudarev, A. S. Abramyan, and D. Abylkasymov, *Romanovskaya poroda ovets (Osnovy razvedeniya v tsentralynoj Rossii) [The Romanov sheep breed (The basics of breeding in Central Russia)]*, 2nd ed., rev. and amend. Scientific and practical recommendations. Tver: The Tver State Agricultural Academy, 2017.
3. E. A. Babich, N. A. Kikebayev, V. A. Raketsty and A. A. Baisakalov. (2019, June). Dependence of Growth and Development of Rearing Stock in Northern Kazakhstan on the Origin of Servicing Bulls. *Agri Bio. Research Publishers*. Vol. 24(1). Available: http://agribiop.com/dependence-of-growth-and-development-of-rearing-stock-in-northern-kazakhstan-on-the-origin-of-servicing-bulls/
4. S. Kaldybayev, K. Kubenkulov, I. Alimaev and K. Erzhanova. (2019, June). The Modern State of Degraded Pastures in the Submontane Semi-desert and Desert Zones of Kazakhstan. *Agri Bio. Research Publishers*. Vol. 24(1). Available: http://agribiop.com/the-modern-state-of-degraded-pastures-in-the-submontane-semi-desert-and-desert-zones-of-kazakhstan/
5. I. Ju. Dominitsty, G. P. Demkin, V. V. Salautin and N. A. Pudovkin. (2019, June). Morphometric Characteristics of Pathological Processes in the Lungs, Liver and Kidneys in Calves with Catarrhal Bronchopneumonia. *Agri Bio. Research Publishers*. Vol. 24(1). Available: http://agribiop.com/morphometric-characteristics-of-pathological-processes-in-the-lungs-liver-and-kidneys-in-calves-with-catarrhal-bronchopneumonia/
6. N. I. Kravchenko, "Zanimatysya ovtsevodstvom vygodno. Osnova rentabelynosti – mnogoplodie ovtsematok i intensivnoe vyraschivanie yagnyat" [Sheep breeding is profitable. The bases of profitability are ewes' multiparity and intensive lamb growing], *Animal Breeding in Russia*, vol. 6, 2014, pp. 7–9.
7. A. I. Erokhin, S. A. Erokhin, and E. A. Karasev, *Intensifikatsiya vosproizvodstva ovets [Intensification of sheep reproduction]*. Moscow: Infra-M, 2012.
8. D. D. Arsenyev, and V. Y. Lobkov, "Problemy i perspektivy razvitiya romanovskogo ovtsevodstva" [Problems and perspectives of Romanov sheep breeding development], *Bulletin of the Agrarian and Industrial Complex of the Upper Volga region*, vol. 3(23), 2013, pp. 27–31.
9. N. A. Fedorov, A. I. Erokhin, and L. S. Novikov, *Romanovskoe ovtsevodstvo [Romanov sheep breeding]*. Moscow: Agropromizdat, 1987.
10. A. I. Erokhin, E. A. Karasev, and S. A. Erokhin, *Romanovskaya poroda ovets: Sostoyanie, sovershenstvovanie, ispolyzovanie genofonda [The Romanov sheep breed: State, improvement and the use of the gene pool]*. Moscow: FSSI Rosinformagrotekh, 2005.
11. B. Xiao-Dan, C. Ming-Xing, J. Hai-Guo, F. Li, and Y. Su-Cheng, "Estrogen receptor as a candidate gene for prolificacy of Small Tail Han sheep", *Acta Genetica Sinica*, vol. 32, 2005, pp. 1060–1065.