Productivity assessment of sheep from the Karnobat Fine Fleece Breed by genealogical lines

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Abstract

Subject of the study were 341 sheep from the Karnobat Fine Fleece breed, ownership of the Institute of Agriculture – Karnobat. The productivity of animals born between 2013 and 2017 was analyzed. The genealogical structure of the flock included 3 breeding lines – 777, 2081 and 1825. The main selection traits that were studies were: live weight at weaning, at 1.5 years and 2.5 years, wool yield and staple length at 1.5, 2.5 and 3.5 years, clean wool yield and clean fibre at 1.5 and 2.5 years. This information was collected from the Pedigree book of the farm. The data were obtained through standard methods and instructions provided in the Instruction for control of productive traits (2011), issued by the Association for Breeding Fine Fleece Sheep in Bulgaria. The following measurements were made: 951 measurements of live weight, 870 measurements of wool yield and staple length and 579 samples were analyzed for clean wool yield and clean fibre. The data were processed according to the variation statistics methods and adjusted for the influence of the year. The study on the Karnobat Fine Fleece breed reported a positive lineage effect for the 1825 line for live weight at 1.5 and 2.5 years – 54,100 kg and 59,230 kg and for staple length at all ages – 13.62, 11.52 and 11.40 cm. Animals from the 2081 line exhibited higher results for the wool yield trait – 7.950 kg and 7.280 kg, clean wool yield trait – 65.81% and 66.50% and clean fibre trait – 5.230 kg and 4.840 kg at 1.5 and 2.5 years. Minimal linear differentiation on the basis of live weight and wool productivity traits in sheep of the Karnobat Fine Fleece breed was found. Narrowed genetic diversity does not allow successful selection and genetic progress on the studied traits in the population.

Key words: Karnobat fine fleece breed, genealogical lines, live weight, wool yield, clean wool yield, clean fibre

Оценка на продукстивността на овце от Карнобатската тънкорунна порода по генеалогични линии

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Резюме

Обект на проучването са 341 овце от Карнобатската тънкорунна порода, собственост на ИЗ – Карнобат. Изследвана е продуктивността на животните, родени в периода 2013–2017 година. Генеалогичната структура на стадото включва 3 развъдни линии – 777, 2081 и 1825. Проучени са основните селекционни признаци: живо тегло при отбиване, на 1,5 и 2,5 години, вълнодобив и дължина на щапела на 1,5, 2,5 и 3,5 години, рандеман на вълната и чисто влакно на 1,5 и 2,5 годишна възраст. Информацията е получена от Родословната книга на фермата. Данните са получени по стандартните методи и указания предвидени в Инструкцията за контрол на продуктивните признаци (2011) от Асоциацията за развъждане на тъкорунните овце в България. Направени са 951 измервания на живо тегло, 870 на вълнодобив и дължина на щапела и 579 проби са изследвани за рандеман и чисто влакно. Данните са обработени по методите на вариационната статистика и коригирани за влияние на годината. Проучването на Карнобатската тънкорунна порода овце отчита положителен ефект на линейната принадлежност при линия 1825 за живо тегло на 1,5 и 2,5 години – 54,100 kg и 59,230 kg и за дължина на вълната на всички възрасти – 13,62, 11,52 и 11,40 cm. Животните от линия 2081 показват по-високи резултати за признаците вълнодобив – 7,950 kg и 7,280 kg , рандеман – 65,81% и 66,50% и чисто влакно – 5,230 kg и 4,840 kg на 1,5 и 2,5 години. Установена е незначителна линейна диференциация по признака живо тегло и признаците на вълнодайната продуктивност при овце от Карнобатската тънкорунна порода. Стесненото генетично разнообразие не предполага успешна селекция и генетичен прогрес по изследваните признаци в популацията.

Ключови думи: Карнобатска тънкорунна порода, генеалогични линии, живо тегло, вълнодобив, рандеман, чисто влакно

Introduction

The reduction of the number of sheep in our country over the last three decades has mostly affected Fine Fleece sheep breeding. Purebred linear breeding is the main method for selection when preserving endangered breeds. The Karnobat Fine Fleece breed is highly endangered and the only herd of this breed is raised at the Institute of Agriculture in Karnobat. At this critical volume, it is necessary to look for options to preserve and reduce the level of homozygosity in the population. Studies of the main productive traits in genealogical lines in Fine Fleece sheep breeds in Bulgaria have been made by Boykovski et al. (2009, 2012, 2015; 2018); Dimitrov (2006); Panayotov et al. (2000); Slavova (2000); Slavova et al. (2012, 2016); Slavov (2007); Staykova, Stancheva (2010); Stancheva et al. (2015); Tsonev (2014). The phenotypic and genotypic parameters of the Karnobat Fine Fleece sheep breed were studied by Antonova (1973); Balevska et al. (1979); Dimitrov (1987); Iliev et al. (1999, 2001, 2010, 2017, 2019); Lazarov (1981); Mihailova et al. (1979). The analyzes of the productivity in the nucleus flocks of the breeds contribute to the formation of a new breeding strategy in the Fine Fleece sheep breeding, as well as to the economic survival of the flocks. Our authors recommend the incorporation of the three breeds in the Bulgarian Fine Fleece breed, with preserved, differentiated interbreed types. This raises the need for current research and motivates our development.

The purpose of this study is to assess the productivity of sheep from the Karnobat Fine Fleece breed by genealogical lines.

Material and methods

Subject of the study were 341 sheep from the Karnobat Fine Fleece breed, ownership of the Institute of Agriculture – Karnobat. The productiv-

ity of animals born between 2013 and 2017 was analyzed. The genealogical structure of the flock included 3 breeding lines – 777, 2081 and 1825. Animals of line 777 – 134 had the largest relative share (39.3%) of the entire herd. The ancestor of the line is a purebred breeder of the Australian Merino breed, imported from Australia. The institute used seed material from it, obtained in Regional Directorate for Selection and Reproduction in Animal Husbandry – Targovishte. Line 2081 has 118 animals (35.8%) and originates from a ram with 50% Australian blood from the Veselinovo village, Yambol region. The third line is 1825 with 85 sheep (24.9%) of the herd. This line originated from a breeder ram of the Northeast Bulgarian fine Fleece breed, purchased from Devnya, Varna region. Selection traits that were included in the study were: live weight at weaning, at 1.5 and 2.5 years, wool yield and staple length at 1.5, 2.5 and 3.5 years, wool yield and clean fiber at 1.5 and 2.5 years. The information was obtained from the Pedigree book of the farm. The data were obtained according to the standard methods and guidelines provided in the Instruction for control of productive traits (2011) by the Association for Breeding of Fine Fleece Sheep in Bulgaria. 951 measurements of live weight, 870 measurements of wool yield and staple length were made and 579 samples were tested for yield and clean fiber. Live weight was measured to the nearest 0.5 kg, taking into account the exact age in days at weaning, for comparability of data. The amount of wool obtained was determined individually and measured to the nearest 0.1 kg. To determine the wool yield and to calculate the clean fiber, samples of 50 g of wool were taken. The receipt of the materials and the research was carried out according to the methodology applied in the laboratory of wool science in the town of Shumen. The data were processed according to the methods of variation statistics and were adjusted for the influence of the year.

Results and discussion

Data on live weight, wool yield and staple length traits based on lines and the effect of lineage are given in Table 1. Lambs with the highest live weight at weaning were those from line 777 (24.770 kg). At 1.5 and 2.5 years of age, sheep from line 1825 were statistically superior to other lines (54.100 kg and 59.230 kg) ($P < 0.001$). The animals of line 2081 ($P < 0.01$) had lower live weight at all studied ages. The average weight of the studied ages in our study has lower values than the results of Dimitrov (1987) and Iliev (2001, 2010) for the same levels. Slavov (2007) also reported higher live weights at weaning, at 1.5 and 2.5 years in the Dobrudzha-type sheep of the North East Bulgarian Fine Fleece breed. Slavova (2019) gave data with higher average weight at weaning, which in the following ages was lower in the Thracian Fine Fleece breed. Tsonev (2014) published similar values for the trait in the nucleolus herds of the Fine Fleece population. Stancheva et al. (2015) found that the average values of live weight in Fine Fleece sheep from the flocks of the Agricultural Academy ranged from 46.800 to 53.400 kg in sheep in 18 months and from 55.800 to 65.100 kg in ewes. Boykovski et al. (2018) reported a higher live weight at weaning of the Shumen type of North East Bulgarian Fine Fleece breed. Our results indicate that the differences in the live weight trait, based on lineage, were minimal. The phenotypic variation was significantly higher at weaning (from C = 12.31% to C = 12.73%) which can be explained by the effect of the mother on the growth abilities. Selection intensity also had an effect and during the following ages it decreased.

Offspring of line 2081 gave larger amounts of unwashed wool up to 2.5 years of age (7.950 kg and 7.280 kg) ($P < 0.001$, $P < 0.05$) (Table 1). The animals from line 1825 performed lower than their peers on the first shearing, after which they gave average results on the second and significantly higher wool yield at 3.5 years (6.930 kg) ($P < 0.001$). Sheep from the 777 line had significantly lower amounts of unwashed wool at 2.5 and 3.5 years ($P < 0.001$, $P < 0.01$). The variation coefficient values for wool production were relatively low and indicated that the differences between the lines were insignificant and the results were multidirectional. Slavov (2007) reported analogous to our results for the North

Таблица 1. Живо тегло, вълнодобив и дължина на щапела по линии
Table 1. Live weight, wool yield and staple lenght in line

Линии / Line	Признаци – възраст Traits – age											
	n	x ± S_x	C	ефект на линията / effect at line	n	x ± S_x	C	ефект на линията / effect at line	n	x ± S_x	C	ефект на линията / effect at line
1. Живо тегло, кg 1. Live weight, кg		при отбиване / at weaning				на 1.5 години / at 1.5 years				на 2.5 години / at 2.5 years		
777	134	24.77 ± 0.26	12.31	0.35	127	53.40 ± 0.23	4.78	-0.09	114	58.67 ± 0.25	4.52	-0.08
2081	122	23.94** ± 0.28	12.73	-0.48	117	53.16 ± 0.24	4.80	-0.33	103	58.07** ± 0.26	4.57	-0.52
1825	85	24.55 ± 0.33	12.42	0.13	81	54.10*** ± 0.28	4.72	0.61	68	59.23*** ± 0.32	4.48	0.64
Общо средно / Average	341	24.42 ± 0.17	12.48		325	53.49 ± 0.14	4.77		285	58.59 ± 0.16	4.53	
LSD				0.39				0.34				0.39
2. Вълнодобив, кg 2. Wool yield, кg		на 1.5 години / at 1.5 years				на 2.5 години / at 2.5 years				на 3.5 години / at 3.5 years		
777	127	7.83 ± 0.07	9.81	0.07	115	7.03** ± 0.07	10.26	-0.13	103	6.39*** ± 0.06	10.27	-0.25
2081	118	7.95*** ± 0.07	9.66	0.19	104	7.28* ± 0.07	9.90	0.12	91	6.73 ± 0.07	9.75	0.09
1825	83	7.39*** ± 0.08	10.39	-0.37	70	7.18 ± 0.09	10.04	0.02	59	6.93*** ± 0.09	9.47	0.29
Общо средно / Average	328	7.76 ± 0.04	9.90		289	7.16 ± 0.04	10.07		253	6.64 ± 0.04	9.88	
LSD				0.10				0.11				0.11
3.Дължина на щапела, cm 3. Staple length, cm		на 1.5 години / at 1.5 years				на 2.5 години / at 2.5 years				на 3.5 години / at 3.5 years		
777	127	13.07 ± 0.19	16.21	-0.25	115	11.11 ± 0.16	15.92	-0.14	103	10.92 ± 0.15	13.62	-0.21
2081	119	13.37 ± 0.19	15.85	0.05	104	11.22 ± 0.17	15.77	-0.03	91	11.19 ± 0.16	13.29	0.06
1825	83	13.62* ± 0.23	15.56	0.30	69	11.52* ± 0.21	15.36	0.27	59	11.40* ± 0.19	13.04	0.27
Общо средно / Average	329	13.32 ± 0.12	15.91		288	11.25 ± 0.10	15.72		253	11.13 ± 0.09	13.36	
LSD				0.28				0.26				0.26

** – $P < 0.05$; ** – $P < 0.01$; *** – $P < 0.001$*

East Bulgarian Fine Fleece breed, and Slavova (2019) indicated lower values for wool yield in the Thracian Fine Fleece breed of the same ages, respectively by 4%, 16% and 8%. Tsonev (2014) found an average wool yield from 7.740 kg to 8.440 kg in Fine Fleece sheep in 18 months.

The data analysis on staple length (Table 1) indicates that it is in accordance with the requirements of the breed. The staple length of sheep in 18 months from line 1825 was significantly longer (13.62 cm) ($P < 0.05$), and line 777 had the shortest. At 2.5 and 3.5 years this tendency continued. The trait was characterized by the highest values in sheep from line 1825 of all studied ages (13.62, 11.52 and 11.40 cm) ($P < 0.05$). The animals from line 2081 give data for levels around the mean with various insignificant deviations, without statistical certainty. The values of the coefficients of variation for average wool length were low to medium and showed insignificant variation between the different lines of the studied ages. Sheep from the Trakia Fine Fleece breed have a longer staple length at 18 months – 14.567 cm, but with age the data ranged from 9.08 to 9.40, which was lower compared to our results (Slavova, 2019). Slavov (2007) also reported lower results on this basis for the North East Bulgarian Fine Fleece breed. Stancheva et al. (2015) indicated an average staple length in sheep in 18 months and ewes, from 10.06 cm to 14.40 cm and from 9.10 cm to 10.68 cm, respectively, of Fine Fleece flocks raised in the institutes of the Agricultural Academy.

The comparison between the three lines in our study showed that line 1825 had a positive deviation from the average for the studied sample of the live weight and staple length traits at all studied levels. The sheep from line 2081 were characterized by higher values of wool yield at the studied ages, which was probably due to the better density of wool. Line 777 presented the highest growth rate in lambs up until weaning, without statistical significance, and for the other indicators indicated medium to low levels of the studied selection traits. Iliev (2010) found a significant superiority of the offspring of line 777 in live weight, staple length and yield of the wool. According to the same author, line 1825 was presented with a positive deviation from the average for the amount of wool and the obtained pure fiber.

Таблица 2. Рандеман на вълната и чисто влакно по линии
Table 2. Clean wool yield and clean fibre in line

Линии / Line	Признаци – възраст / Traits – age							
	n	$x \pm S_x$	C	ефект на линията / effect at line	n	$x \pm S_x$	C	ефект на линията / effect at line
1. Рандеман на вълната, % / 1. Clean wool yield, %	на 1.5 години / at 1.5 years				на 2.5 години / at 2.5 years			
777	118	$63.25^{***} \pm 0.61$	10.45	-1.43	113	64.28 ± 0.68	11.28	-1.00
2081	109	$65.81^{**} \pm 0.63$	10.05	1.13	100	$66.50^{*} \pm 0.73$	10.91	1.22
1825	75	65.28 ± 0.76	10.13	0.60	64	65.14 ± 0.91	11.13	-0.14
Общо средно / Average	302	64.68 ± 0.38	10.22		277	65.28 ± 0.44	11.11	
LSD				0.89				1.11
2. Чисто влакно, kg / 2. Clean fibre, kg	на 1.5 години / at 1.5 years				на 2.5 години / at 2.5 years			
777	118	4.950 ± 0.07	15.39	-0.07	113	$4.520^{**} \pm 0.07$	16.26	-0.15
2081	109	$5.230^{***} \pm 0.07$	14.57	0.21	100	$4.840^{***} \pm 0.07$	15.19	0.17
1825	75	$4.830^{***} \pm 0.09$	15.78	-0.19	64	4.680 ± 0.09	15.71	0.01
Общо средно / Average	302	5.020 ± 0.04	15.18		277	4.670 ± 0.04	15.74	
LSD				0.10				0.11

* – $P < 0.05$; ** – $P < 0.01$; *** – $P < 0.001$

The obtained data for wool yield and clean fiber traits along the lines and the effect of the line are reflected in Table 2. The analysis of wool yield indicated high results in sheep in 18 months and in ewes at the age of 2.5 years, which exceed the requirements for the breed. The sheep from line 2081, which originates from the Australian Merino breed, performed better in the two studied ages (65.81% and 66.50%) ($P < 0.01$, $P < 0.05$). The animals from line 777 have lower results on this basis, and those from 1825 gave small and varied fluctuations around the average without statistical significance. The variation between the individual lines was minimal. The same trend was maintained in the analysis of the results for the obtained clean fiber (Table 2). Line 2081 dominated its peers, with an average of 5.230 kg and 4.840 kg of clean fiber at 1.5 and 2.5 years, respectively ($P < 0.001$). The animals from line 777 ($P < 0.01$) had lower results, and those from 1825 were presented with multidirectional and close to the average deviations for the group of studied animals. The variation coefficients values ranged from 14.57% to 16.26% and showed minimal differences between lines without significance. The Karnobat Fine Fleece sheep breed in our study was characterized by a higher yield and amount of clean fiber, compared to the results of Slavov (2007) for the Northeastern Bulgarian Fine Fleece breed, Staykova et al. (2010) for the Askanian, Iliev (2010) for the same breed and Tsonev (2014) for the three Bulgarian Fine Fleece breeds. The average levels of these selection traits exceeded those stated in the report of the Association for breeding Fine Fleece sheep in Bulgaria for 2019, summarized for the entire Fine Fleece population in our country. The established minimal significant and insignificant linear differentiation in the studied herd showed that it will be hardly possible to conduct successful selection on these productive traits.

Conclusions

The study of the Karnobat Fine Fleece sheep breed reported a positive effect of the lineage in line 1825 for live weight at 1.5 and 2.5 years – 54.100 kg and 59.230 kg and for wool length at all ages – 13.62, 11.52 and 11.40 cm.

The animals from line 2081 showed higher results for the wool yield trait – 7.950 kg and 7.280 kg, clean wool yield – 65.81% and 66.50% and clean fiber – 5.230 kg and 4.840 kg at 1.5 and 2.5 years.

Minimal linear differentiations were found on the basis of live weight and the wool productivity traits in sheep of the Karnobat Fine Fleece breed. Narrowed genetic diversity does not imply successful selection and genetic progress on the studied traits in the population.

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