

Zootechnical and Economic Characteristics of Sheep Genetic Resources in Plovdiv Area Lowlands

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Abstract

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The study took place within 2002 - 2004 in 17 towns and villages of Plovdiv area lowlands. Zootechnical and economic characteristics of three sheep genetic resources was made, namely, the Synthetic dairy sheep population, White Maritza Sheep and Patch faced Maritza sheep, bred on the plains of Plovdiv area. Primary information was collected from 29 private sheep farms by questionnaires and 2 to 6 visits to each farm, annually. It is characteristic of the area that Synthetic sheep population is grown on farms with an average of 283 ewes while White and Patch faced Maritza sheep are grown in small flocks on small-scale farms with an average of 31 and 32 ewes, respectively. It was found that milk yield per ewe of the Synthetic dairy population was 115.50 l that was insignificantly higher than Patch faced Maritza sheep - 112.76 l and White Maritza sheep - 101.60 l. Milk yield of studied sheep genetic resources was good, though not high. The number of lambs sold per ewe of the Synthetic dairy population was 0.92 and Patch faced and White Maritza sheep values for this index were 0.79 and 0.80, respectively. There was no difference between the average weight of Patch faced and White Maritza lambs sold, on the one hand and Synthetic dairy, on the other - 18.78 kg, 19.67 kg and 18.08 kg. The same was true about prolificacy coefficient - 1.34, 1.34 and 1.29, no significant differences between them. In each specific production system, the provision of alfalfa hay per ewe was 185.13 kg for Patch faced Maritza sheep, 174.57 kg for White Maritza sheep and 154.76 kg for the Synthetic population. Feed costs in Patch faced and White Maritza sheep flocks was higher, i.e. 173.03 kg and 180.74 kg and in the Synthetic dairy population - 152.25 kg. The percentage of revenue from milk in Patch faced Maritza sheep was 46.50%, White Maritza sheep - 43.86% and Synthetic population flocks - 48.64%. Lamb sales was the second major revenue source with insignificant breed dependent variation, i.e. 32.43% in Patch faced Maritza sheep flocks, 37.73% on White Maritza farms and 37.90% on Synthetic population farms. The gross income per one Patch faced Maritza sheep was BGN 73.86, White Maritza - BGN 65.55 and Synthetic population - BGN 69.90.

Key words: zootechnical and economic characteristics, sheep breeds

Introduction

The identification of breeding objectives is the corner-stone of a breeding program. Very often they are either identified intuitively or copied from other breeds or species of farm animals without an accurate analysis of the consequences on production systems profitability or social and economic effect incurred (Gabina et al., 1999).

In 1998, the FAO working group on sheep and goat genetic resources developed a working program aiming at revising and defining the objectives for genetic improvement of sheep and goat breeds in different Mediterranean and non-Mediterranean countries as well as making an analysis of different production systems. Following this program, a number of authors conducted studies and came up with characteristics of sheep and goat production systems in terms of technical and economic efficiency as well as genetic resources involved (Natale et al., 1999; Gabina et al., 1999; Kukovics et al., 1999 and Nabradi et al., 1999).

Specialized literature on sheep and goat breeding in Bulgaria is dominated by studies of productive performance of different sheep breeds as well as phenotypic and genotypic characteristics of different populations, etc. Scientific investigations related to the analysis of purely economic or social aspects of sheep and goat production in different regions are scarce (Ivanov, 1990; Stoykova, 2004; Momchilov, 2005; Dinev and Todorov, 2006).

The objective of the present study is to make a zootechnical and economic characteristics of three sheep genetic resources, bred on the lowlands of Plovdiv, with operating breeding organizations and approved breeding programs - the Syn-

thetic dairy sheep population, White Maritza and Patch faced Maritza sheep, each grown in specific production systems.

Material and Methods

The study took place in the period 2002 - 2004 in 17 towns and villages of Plovdiv area lowlands (Saedinie, Radinovo, Tzarimir, Rogosh, Belozem, Dalbok Izvor, Patriarch Evtimovo, Zlatitrap, Konush, Assenovgrad, Parvomai, Brestnik and Boyantzi, etc.). The study covered 29 sheep farms. Primary information was collected by questionnaires based on 2 to 6 visits to each farm during the respective year. To achieve the target of the study, 25 zootechnical and 21 economic indexes were calculated, grouped in subgroups characterizing the different aspects of sheep production, namely: flock structure indexes, productive and reproductive indexes, basic feed costs and percentage of feed produced on the farm. Some zootechnical and economic indexes were calculated per ewe, the term referring to the number of lambed sheep and yearlings. The quantity of basic feed per ewe (hay, straw and concentrate feed) also encompassed feed expenses for other categories such as lambs prior to weaning, yearlings and ram sires. The gross margin in this study was calculated as the difference between revenues from sales of sheep products and variable operating expenses for sheep growing.

Data were processed by the statistical package Statistica Stat Soft 6.1., used for the purpose of descriptive statistics for estimating the average tendency of the subject indexes for the studied genetic resources. Dispersion analysis was made (single- and double-factor) (ANOVA) for identifying the statistical significance of

differences in average values of the subject indexes and the effect of the factors of genetic resource (breed) and production year. Multiple comparisons were made between the average values of those zootechnical and economic indexes that demonstrated a statistically significant effect of the used genetic resource.

Results and Discussion

Preliminary analyses showed that the production year in the thus formed sample had no statistically significant effect on zootechnical and production characteristics of sheep genetic resources studied, dates on the effect of production year being ignored for that matter and only the breed effect presented in Tables 1 and 3. Analysis of dates from Tables 1 and 2 showed that farms with all three genetic resources were significantly different in terms of some basic structural indexes, such as number of all sheep categories, ewes and lambed yearlings. The fact is, sheep of Synthetic dairy population were grown on farms with comparatively large number of ewes - 283, while White and Patch faced Maritza sheep were preferred on small farms with an average of 31-32 ewes. The percentage of lambed yearlings was higher in White and Patch faced Maritza flocks - 63.17% and 53.42%, respectively, compared to Synthetic dairy sheep - 37.96% (Table 2). The differences in this index were statistically proven. Grown in small flocks, well fed and taken care of, female White and Patch faced Maritza lambs developed very well and achieved reproductive maturity at 8-10 months of age when over 50% of them were fertilized. This enabled their earlier fertilization and inclusion in a productive cycle as early as 13-15 months old. This

is a breeding practice used by almost all sheep breeders in the area but, obviously, to a larger extent in White and Patch faced Maritza sheep flocks.

There was no significant difference in flock structure of all three genetic resources, meaning that within-flock breeding practices used in White and Patch faced Maritza sheep and Synthetic dairy sheep population were very similar.

Data obtained on productive performance of the three genetic resources in breed-specific production systems turned out extremely interesting. Milk yield per ewe of the Synthetic dairy population was 115.50 l and insignificantly higher compared to milk yield of Patch faced Maritza sheep - 112.76 l. However, the difference with White Maritza milk yield was more substantial - 101.60 l. Regardless of the significant and insignificant differences in milk yield of major sheep breeding genetic resources of Plovdiv area, their milk productivity could be defined as not very high but still good. The milk yield of Plovdiv area sheep as established by this study was higher than Black-head Pleven sheep - 66.57 l in a similar study of Stoykova (2004). We have to emphasize that milk yield in this study was estimated as total milked and marketed quantity in a flock plus milk for household consumption, divided on the number of ewes. Milk yield estimated this way was not comparable to milk production control and was even underestimated, because, for one reason or another, not only ewes that were milked but also those that weren't, were counted. This same number of ewes encompassed also lambed yearlings with a much shorter lactation period (60-90 days) due to late lambing. Another extremely important parameter from zootechnical and economic point of view was the number of lambs

Table 1
Results of the single-factor dispersion analysis for identification of the effect of genetic resources on the zootechnical indices of sheep flocks from Plovdiv plains

Indices	MS effect	df effect	MS Error	df error	F	P
Flock structural indices						
Sheep of all categories, number	1264810	2	71750.8	77	17.62	***
Average number of ewes per flock	588444.1	2	31242.1	77	18.83	***
Lactating sheep, %	0.71	2	93.17	77	0	n.s.
Female yearlings, %	23.12	2	46.46	77	0.49	n.s.
Lambled yearlings, %	4438.19	2	540.32	77	8.21	***
Male yearlings, %	23.15	2	2.84	77	8.13	***
Rams, %	23.07	2	1.18	77	19.54	***
Breeding lambs, %	17.37	2	30.87	77	0.56	n.s.
Production indices						
Milk yield per ewe per lactation period, l	1450.71	2	281.01	77	5.16	**
Lambs sold per ewe	0.15	2	0.01	77	9.97	***
Weight per lamb sold, kg	18.12	2	6.43	77	2.81	n.s.
Wool yield per ewe, kg	0.74	2	0.3	77	2.43	n.s.
Reproductive indices						
Prolificacy	0.02	2	0.02	77	0.99	n.s.
Abortions, %	14.46	2	6.07	77	2.38	n.s.
Sterility, %	33.48	2	2.41	77	13.88	***
Basic feed consumption per ewe						
Alfalfa hay, kg	6604.88	2	683.51	77	9.66	***
Straw, kg	391.67	2	178.28	77	2.19	n.s.
Concentrate feed, kg	6504.94	2	709.74	77	9.16	***
Relative share of feed produced on the farm						
Alfalfa hay, %	6029.76	2	2115	77	2.85	n.s.
Straw, %	2701.39	2	2161.9	77	1.24	n.s.
Concentrate feed, %	17859.81	2	961.91	77	18.56	***
Compound feed, %	417	2	126.93	77	3.28	*
Lactation period, days	2459.2	2	811.83	77	3.02	n.s.
Confinement period, days	872.61	2	519.8	77	1.67	n.s.
Pasture period, days	872.62	2	519.8	77	1.67	n.s.

P<0.05 - *, P<0.01 - **, P<0.001 - ***

Table 2
Descriptive characteristics of zootechnical indices of sheep flocks of White Maritza, Patch faced Maritza and Synthetic dairy population genetic resources

Indices	Patch faced Maritza n = 20		White Maritza n = 24		Synthetic population n = 36	
	\bar{x}	S \bar{x}	\bar{x}	S \bar{x}	\bar{x}	S \bar{x}
Flock structural indices						
Sheep of all categories, number	48.9	2.58	46.42	5.16	415.16 ^{cc}	66.09
Average number of ewes per flock	32.4	1.59	31.42	4,30	283.75 ^{cc}	43.74
Lactating sheep, %	74.15	2.01	73.9	2.22	74.19	1.52
Female yearlings, %	17.81	1.97	17.41	1.33	16.09	0.95
Lambled yearlings, %	63.17 ^c	5.43	53.42 ^b	5.2	37.96 ^{cb}	3.51
Male yearlings, %	2.85 ^b	0.41	3.22 ^c	0.47	1.55 ^{bc}	0.16
Rams, %	2.56 ^{bb}	0.23	3.62 ^c	0.29	1.83 ^c	0.14
Breeding lambs, %	21.26	1.26	20.34	1.07	19.63	0.95
Production indices						
Milk yield per ewe per lactation period, l	112.76 ^a	3.46	101.6 ^{ab}	4.39	115.50 ^b	2.27
Lambs sold per ewe	0.79	0.03	0.8	0.03	0.92 ^{cc}	0.017
Weight per lamb sold, kg	18.78	0.6	19.67	0.702	18.08	0.26
Wool yield per ewe, kg	2.55	0.15	2.19	0.09	2.29	0.09
Reproductive indices						
Prolificacy	1.34	0.04	1.34	0.03	1.29	0.02
Abortions, %	3.31	0.6	3.32	0.72	2.1	0.19
Sterility, %	3.64 ^{cc}	0.43	1.28	0.38	1.78	0.17
Basic feed consumption per ewe						
Alfalfa hay, kg	185.13 ^c	7.29	174.57	5.23 ^b	154.76 ^{cb}	3.7
Straw, kg	94	2.99	102 ^a	2.68	96 ^a	2.24
Concentrate feed, kg	173.03 ^b	5.57	180.74 ^c	5.58	152.25 ^{bc}	4.51
Relative share of feed produced on the farm						
Alfalfa hay, %	49.29	10.99	46.89 ^a	10.03	23.58 ^a	6.97
Straw, %	40	11.23	37.5	10.09	22.22	7.02
Concentrate feed, %	70.93	7.44	68.12	6.93	26.97 ^{cc}	4.58
Compound feed, %	2.97	2.16	3.28	2.05	9.62 ^{aa}	2.12
Lactation period, days	186.60 ^a	6	182.33	8.15	168.83 ^a	3.09
Confinement period, days	145	5.81	155.75	5.42	145.91	2.95
Pasture period, days	220	5.81	209	5.42	219	2.95

Key symbols : Symbols for the statistical significance of differences between average values of group couples at the respective levels of significance: a (P < 0.05), b (P < 0.01), c (P < 0.001), cc (P < 0.001 – for the average within the group compared to each

Table 3
Results of the single-factor dispersion analysis for identification of the effect of genetic resource on the economical indices of Patch faced and White Maritza and Synthetic dairy population sheep flocks

Indices	MS effect	Df effect	MS error	Df error	F	P
Revenues from						
Milk	164.9	2	45.42	77	3.63	*
Lambs	218.91	2	32.79	77	6.67	**
Sheep	41.04	2	11.9	77	3.44	*
Yearlings	4.25	2	3.65	77	1.16	n.s.
Wool	0.49	2	0.17	77	2.78	n.s.
Hides	3.85	2	0.7	77	5.48	**
Manure	110.05	2	57.32	77	1.91	n.s.
Subsidies	0.41	2	0.22	77	1.84	n.s.
Revenues per ewe	2134.65	2	434.94	77	4.9	**
Expenses for						
Feed, purchased	1884.34	2	347	77	5.43	*
Feed, produced on the farm	7523.53	2	308.07	77	24.42	***
Cleaning of manure	12.39	2	1.21	77	10.18	***
Selection services	4.07	2	1.47	77	2.76	n.s.
Insurance	121.3	2	30.81	77	3.94	*
Shearing	17.17	2	0.78	77	21.76	***
Other expenses	21.26	2	2.65	77	8.01	***
Expenses per ewe	823.34	2	238.23	77	3.45	*
Lambs for household consumption	532.92	2	11.93	77	44.69	***
Milk for household consumption	252.37	2	8.32	77	30.34	***
Gross margin per ewe	380.11	2	119.81	77	3.173	*
Gross margin per farm	3.51	2	1.91	77	18.38	***

P<0.05 - *, P<0.01 - **, P<0.001 - ***

sold per ewe. This index was 0.92 for Synthetic dairy sheep and 0.79 and 0.80 for Patch faced and White Maritza sheep,

respectively. This index greatly depended on sheep prolificacy and flock replacement. The average body weight of lambs

Table 4
Loss and profit structure in Patch faced Maritza, White Maritza and Synthetic dairy population sheep flocks

Indices	Patch faced Maritza n = 20		White Maritza n = 24		Synthetic population n = 36	
	\bar{x}	S \bar{x}	\bar{x}	S \bar{x}	\bar{x}	S \bar{x}
Revenues from						
Milk, %	46.51	1.62	43.86 ^b	1.42	48.64 ^b	1.04
Lambs, %	32.43 ^{bb}	1.28	37.73	1.25	37.9	0.91
Sheep, %	5.8	0.47	5.83	1.04	3.78 ^{aa}	0.43
Yearlings, %	2.9	0.49	2.83	0.48	2.21	0.22
Wool, %	1.71	0.1	1.73	0.08	1.5	0.07
Revenues_hides, %	0.99 ^b	0.28	0.79 ^a	0.16	0.28 ^{ab}	0.09
Revenues_manure, %	0.06	0.01	0	0	0.23	0.11
Subsidies, %	9.58	1.87	7.231	2.039	5.462	0.79
Revenue per ewe, BGN	169.69	6.25	151.84 ^{bb}	3.94	166.29	2.83
Expenses for						
Feed, purchased, %	26.63 ^b	4.03	28.53 ^a	4.52	41.39 ^{ab}	2.71
Feed, produced on the farm, %	37.65	3.31	42.62	4.87	13.04 ^{cc}	2.26
Cleaning of manure, %	2.35 ^c	0.21	2.84 ^b	0.294	1.56 ^{bc}	0.15
Selection services, %	1.01 ^a	0.22	1.17	0.22	1.73 ^a	0.24
Insurance, %	8.16 ^{ba}	1.88	3.66 ^b	1.08	4.65 ^a	0.54
Shearing, %	0.86 ^a	0.25	0.18 ^a	0.11	1.71 ^{cc}	0.16
Other expenses, %	2.63 ^{cc}	0.58	0.82	0.33	1.06	0.11
Expenses per ewe, BGN	95.8	4.74	86.3 ^{aa}	2.57	96.4	2.21
Lambs for consumption, %	10.7	0.87	10.8	0.96	3.4 ^{cc}	0.31
Milk for consumption, %	6.37	0.89	6.8	0.73	1.57 ^{cc}	0.18
Gross margin per ewe, BGN	73.86 ^a	3.13	65.55 ^a	2.16	69.9	1.51
Gross margin per sheep farm, BGN	2558	132	2215	286	21206 ^{cc}	3411

Key symbols: Differences between the average levels at the respective significance rate:
a - P<0.05, b - P<0.01, c - P<0.001; n – number of observation within the class flock-year;

sold from Patch faced and White Maritza sheep farms was quite similar to Synthetic dairy - 18.78 kg, 19.67 kg and 18.08 kg. Obviously, this index experienced the effect of the great demand of light-weight lambs with body weight up to 25 kg on the Bulgarian market and the tradition of sheep milking after lamb weaning. Gabina et al. (1999) have reported that on sheep farms with Latxa dairy breed, lambs are slaughtered for meat at body weight of about 11 kg. Natale et al. have reported that lambs of Sarda breed are slaughtered at the age of about 1 month and body weight of about 10 kg. The established marketable body weight of lambs of sheep breeds, grown on the Plovdiv plains, was higher than that of marketed lambs of other sheep breeds in the Mediterranean countries.

Wool yield of Patch faced Maritza sheep in this study, i.e. 2.55 kg, corresponded to the results obtained by Dimov (1998) for the same breed - 2.80 kg. Wool yield of White Maritza sheep - 2.19 kg, was lower than reported by Dimov et al. (1999) for the same breed. Wool yield of Synthetic dairy sheep population in Plovdiv area for the period of this study (2002 - 2004) was 2.29 kg or about 1.3 kg lower than wool yield of sheep of the same population for an earlier period of its development - 3.62 kg (Dimov, 1995). Regardless of the differences in wool yield of all three genetic resources grown in Plovdiv area, whether big or small, either between them or compared to earlier studies, this parameter comprised a small part of the gross margin from Patch faced Maritza sheep - 1.71%, White Maritza - 1.73% and 1.50% for Synthetic dairy population (Table 4).

Prolificacy coefficient of the three genetic resources was about 1.3 without significant differences between them or compared to results on prolificacy for other

breeds such as Sarda (1.21), Latxa (1.28) and rasa Aragoneza (1.31) as well as other breeds of the Mediterranean basin with production systems that had been the subject of similar studies (Natale et al., 1999, Gabina et al., 1999, Olivian and Pardos, 1999, etc.).

Abortion is detrimental to production (lambs and milk), hence, revenue. As shown in Table 1, abortion percentage was very low without significant differences between the three genetic resources - 3.31%, 3.32% and 2.1% for Patch faced Maritza, White Maritza and Synthetic dairy sheep population, respectively.

Sterility in the flocks, involved in this study, was within the lower range and inevitable minimum values for sheep production. In spite of the fact that sterility in Patch faced Maritza flocks was significantly higher (3.64%) compared to White Maritza (1.28%) and Synthetic dairy population (1.78%), no explicit conclusions should be made because 3.64% sterility in a flock of 32 ewes would mean 1 barren and this is the inevitable minimum. Sterility is a phenomenon characteristic of any sheep flock regardless of the breed - aboriginal, introduced or newly created. No doubt, highest sterility percentages in a flock are undesirable, since this is directly related to reduction of revenue from a flock.

Concentrate feed and alfalfa hay expenses per ewe are an extremely important index as it reflects directly on the gross margin from the flock. On the other hand, it is a criterion for nutrition level and feed supplies, available to the flock. We have to emphasize that alfalfa hay and concentrate feed expenses per ewe in this study included the feed supplied to other categories, involved in flock reproduction, hence, the higher values compared to the calcu-

lation of feed expenses for ewes alone. However, since all sheep categories were present in the flocks of genetic resources in this study, the concentrate feed and alfalfa hay expenses calculated as mentioned above were an important parameter that might be indicative of nutrition levels and feed supplies.

Data on Table 2 show the higher nutrition levels in Patch faced and White Maritza flocks where the alfalfa hay consumption per ewe was 185.13 kg and 174.57 kg, respectively. Alfalfa hay consumption per ewe of the Synthetic dairy population was lower - 154.76 kg, compared to Maritza sheep flocks, but it should by no means be assumed as low level nutrition or insufficient hay supplies. The quantity of alfalfa hay fed to Maritza sheep flocks should rather be treated as an indicator of very good alfalfa hay supplies.

Similar to alfalfa hay costs, concentrate feed expenses were higher in Patch faced and White Maritza sheep flocks as well, i.e. 173.03 kg and 180.74 kg, respectively. In sheep of the Synthetic dairy population concentrate feed consumption was 152.25 - an indicator of comparatively high nutrition level as well, having in mind that Gabina et al. (1999) reported an average concentrate feed consumption per ewe of 113.72 kg in Latxa. In Sarda - a comparatively good milker - concentrate feed expenses per lactating ewe were 148.71 kg and the average annual concentrate feed costs per ewe were 97 kg, the latter being the adequate index to compare to our results on concentrate feed expenses in Maritza and Synthetic dairy sheep of Plovdiv area. Nutrition level of both Maritza and Synthetic dairy sheep proved comparatively high.

All sheep breeders of Plovdiv plains used straw as a basic feed and its annual

consumption in Maritza and Synthetic dairy sheep was almost equal and varied within 94 to 102 kg per ewe for all three genetic resources. We should bear in mind that this quantity also included the straw used as a bedding for all sheep categories on the farms.

About half of alfalfa hay consumption in Patch faced and White Maritza sheep flocks was produced on the farm, while the percentage of own production in Synthetic dairy sheep population was quite lower - 23.58%. This tendency was even stronger in concentrate feed, the percentage of farm produced hay fed to Patch faced and White Maritza sheep being 70.93% and 68.12%, respectively and for the Synthetic dairy sheep - 26.97%. This was partially due to the specificity of land owned by farmers. The more sheep on the farm, the more feedstuffs needed, hence, more land for their production that none of the sheep farmers in the study owned.

Generally, the use of compound feed in the flocks of the studied genetic resources in Plovdiv area was low. The percentage of compound feed in the total concentrate feed consumption in Synthetic dairy population flocks was 9.62% and in Patch faced and White Maritza sheep - 2.97 to 3.28%, respectively.

Lactation period in Patch faced and White Maritza sheep flocks was 182.33 ± 8.15 and 186.60 ± 6.00 days and shorter in Synthetic dairy sheep - 168.83 ± 3.09 days. Regardless of the small significant difference in lactation period in favor of Patch faced and White Maritza sheep vs. Synthetic population, lactation period duration in the flocks of all three genetic resources had been characteristic for this area of the country for quite a while. There were no significant differences between

the three genetic resources in terms of confinement (145 to 155 days) and pasture period (209 to 220 days), the values being characteristic of sheep flocks in Plovdiv area.

The profit and loss structure in sheep flocks gave a realistic idea of the production purpose of the respective breed. As shown in Table 4, there were no big differences between revenue structure in Patch faced and White Maritza sheep flocks, on the one hand and Synthetic dairy, on the other. It was found that the most significant revenue in sheep breeding came from milk sales. As a matter of fact, milk and lamb sales accounted for 80% of revenue in the studied flocks. The percentage of revenue from milk sales in Patch faced Maritza sheep flocks was 46.0%, in White Maritza - 43.86% and in Synthetic dairy - 48.64%. The Synthetic dairy sheep population was developed as a result of breeding schemes aiming at the creation of specialized dairy sheep breeding in Bulgaria and, according to the criteria for specialization in a certain type of production, the revenues from milk sales in the flocks should have been above 70% as in Sarda breed - 71.26% (Natale et al., 1999), Latxa - 74.4% (Gabina et al., 1999) and Chios - 69.6% (Ligda et al., 1999). Obviously, given the present condition of the Synthetic Bulgarian dairy population in one of the most favorable areas for sheep breeding, the production specialization has not been achieved and milk production level equals that of local Patch faced and White Maritza breeds. Lamb sales are the second important source of revenue in the flocks of the three genetic resources in Plovdiv area, the variation between breeds being within narrow limits from 32.43% in Patch faced Maritza sheep flocks to 37.90% in Synthetic dairy.

The third ranking revenue comes from subsidies, granted by State Fund Agriculture for the preservation of gene pools and elite specimens of valuable sheep breeds. The percentage of revenues from subsidies in Patch faced Maritza sheep flocks was 9.58%, White Maritza - 7.23% and Synthetic dairy - 5.46%.

The fourth important revenue source for the flocks were the sales of culled sheep with a variation of 3.78% to 5.80%.

The revenue from sales of yearlings, wool, hides and manure were insignificant to sheep breeders and regardless of their importance should be treated with reference to waste utilization in sheep production (yearling sales excluded).

Ultimately, the gross margin per 1 Patch faced Maritza sheep was 169.69 BGN, White Maritza - 151.84 BGN and Synthetic dairy - 166.29 BGN (Table 4).

Even though sheep breed had a proven effect on this index at significance rate of $P < 0.01$, there was no proven difference in revenue per one Patch faced Maritza vs. one Synthetic dairy ewe. The only statistically significant BGN 15.00 to BGN 18.00 lower revenues were those from growing White Maritza sheep vs. Patch faced Maritza and Synthetic dairy but those differences were not extremely important for the reason that the percentage of lambs and milk for home consumption was triple vs. Synthetic population. Even though the method of calculating revenue per ewe in our study was different from that of Stoykova (2004) for Black-head Plevan sheep, the revenues per ewe of all three genetic resources in Plovdiv area were higher than those reported by Stoykova (2004) - BGN 121.62 and similar to the results of Ivanov (1990).

The most important expense in sheep growing in Plovdiv area were feed costs

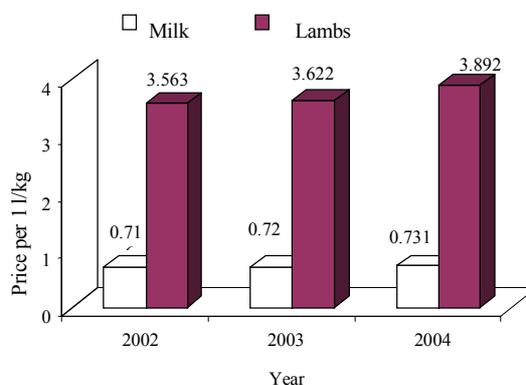


Fig. 1. Prices of raw sheep milk and body weight of lambs in sheep production systems in Plovdiv area for the period 2002 – 2004

(both purchased and produced on the farm). Total feed costs (both purchased and produced on the farm) in Patch faced Maritza flocks amounted to 64.28%, White Maritza - 71.15% and Synthetic dairy - 54.43%. The percentage of feed produced on the farm on White and Patch faced Maritza flocks was bigger than in Synthetic dairy. This was partially due to the small size of the flocks of local Maritza sheep and the specificity of farm land title in Bulgaria, where small owners prevail and Plovdiv is not an exception.

The structure of expenses in the flocks (Table 4) showed that the costs of medication, electricity, water, manure cleaning, breeding services, insurance and shearing, etc., were insignificant - less than 10%. It is difficult to find or even look for any breed-dependent tendency for expenses that are characteristic for all sheep breeding farms.

In White Maritza flocks, the expenses per ewe amounted to BGN 86.30 and were lower compared to expenses per ewe in Patch faced Maritza and Synthetic dairy flocks, where the values of this index were

BGN 95.80 and 96.40, respectively (Table 4).

The comparatively similar nutrition and growing practices of local Maritza breeds and the Synthetic dairy reflected in approximately the same expenses per ewe.

Gross margin is the most precise criterion of cost efficiency of sheep breeding. Ultimately, this is the money the owner and his family live on. The sample of sheep farmers is quite diverse with different family situations, therefore, the methods for calculation of net income, profit and economic efficiency used by Ivanov (1990), Stoykova (2004) and Momchilov (2005) are not applicable.

In this study, the gross margin per Patch faced Maritza ewe was BGN 73.86, BGN 65.55 per White Maritza ewe and 69.90 per ewe of the Synthetic dairy population. Compared to Sarda in Italy - gross margin of EUR 54.99 as per Natale et al. (1999) and the gross margin per Latxa ewe in Spain (EUR 57.60) as per Gabina et al. (1999), the gross margin of sheep genetic resources in Plovdiv area was lower by about 38% at an approximate exchange

rate of BGN:EUR 2:1.

The index of gross margin per sheep farm depends totally on number of ewes as the basic production category in sheep flocks and that is why its value is highest on the Synthetic population farms - BGN 21,206.00 - where the average number of ewes per farm was 283. The gross margin on Patch faced and White Maritza sheep farms was BGN 2,558.00 and BGN 2,215.00, respectively, with an average number of ewes per flock 31 - 32.

Besides number of ewes, the gross margin of sheep farms depends on the sales prices of major products, i.e. milk and lambs. Fig. 1 presents the sale prices on sheep farms studied.

Sales prices were comparatively stable throughout the period of study (2002 - 2004) with a slight tendency upwards. Sheep milk in Plovdiv area was sold at BGN 0.72 to 0.73 for 1 l raw sheep milk for the studied period. The price of 1 kg live weight of lambs showed a permanent tendency upwards with about 9.29%, the sales price varying within BGN 3.56 to BGN 3.89 per 1 kg of live weight in 2004.

Conclusions

The following conclusions can be made as a result of the present study:

- Synthetic dairy sheep are grown on farms with comparatively larger number of ewes - 283, unlike White and Patch faced Maritza sheep that are the choice of small-scale farmers with an average number of 31 - 32 ewes per flock.

- Flock structure of all three genetic resources does not differ significantly, meaning that within-flock breeding practices used for White and Patch faced Maritza sheep, on the one hand, and Syn-

thetic dairy, on the other, are quite similar.

- Ewes of the Synthetic dairy population had the highest milk yield per lactation period - 115.50 l, though insignificantly higher compared to Patch faced Maritza sheep - 112.76 l. The difference with White Maritza milk yield was more significant - 101.60 l. The results on milk yield characterize the studied sheep genetic resources of Plovdiv area as good, though not high, milkers.

- The number of lambs sold per ewe of the Synthetic dairy population was 0.92 and the values of this index for Patch faced and White Maritza sheep were 0.79 and 0.80, respectively. There was no difference in the average live weight of lambs sold from Patch faced and White Maritza farms and Synthetic dairy population - 18.78 kg, 19.67 kg and 18.08 kg.

- Prolificacy coefficients of the three genetic resources was 1.29 to 1.34 without significant differences between them. Wool yield of Patch faced Maritza sheep was 2.55 kg, White Maritza - 2.19 and Synthetic population - 2.29 kg.

- Local Patch faced and White Maritza sheep were comparatively well provided with alfalfa hay. In each breed-specific management system there were 185.13 kg per ewe of the Patch faced and 174.57 kg of the White Maritza sheep. Alfalfa hay consumption per ewe of the Synthetic population was lower - 154.76 kg. Concentrate feed consumption was higher in Patch faced and White Maritza flocks - 173.03 kg and 180.74 kg, respectively, and for Synthetic dairy population - 152.25 kg.

- The total revenues per ewe for all three genetic resources was as follows: BGN 169.69 for Patch faced Maritza sheep, BGN 151.84 for White Maritza and BGN 166.29 per ewe of the Synthetic dairy population.

- The relative share of revenues from milk of Patch faced Maritza sheep was 46.50%, White Maritza - 43.86% and Synthetic dairy - 48.64%. Lamb sales were the second major source of revenue, the breed-dependent variation being within comparatively narrow limits: 32.43% in Patch faced Maritza flocks, 37.73% in White Maritza and 37.90% on Synthetic dairy farms.

- The gross margin per Patch faced Maritza ewe was BGN 73.86, White Maritza - BGN 65.55 and Synthetic dairy - BGN 69.90. The index of gross margin per sheep farm is totally dependent on number of ewes (the basic production category in a flock), therefore, its value was the highest on Synthetic dairy farms - BGN 21 206.00, where the average number of ewes per farm was 283. The gross margin for Patch faced and White Maritza farms was BGN 2 558.00 and BGN 2 215.00 with an average number of ewes 31 - 32.

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