

EVALUATION OF THE PRODUCTIVITY OF WHITE AND COLOURED IMPROVED GOATS IN THE KUJAWY-POMERANIA PROVINCE IN COMPARISON WITH THE DOMESTIC POPULATION

Magdalena Mistrzak, Henryka Bernacka

University of Technology and Life Science in Bydgoszcz, Poland

Abstract. The aim of the study was the analysis of the condition of goat breeding and husbandry in the Kujawy-Pomerania Province and in country. The results concerning milk and reproduction performance of goats from this region can be used for working out a regional breeding programme. The following was taken into account in this study: the number of White and Coloured Improved goats covered by the performance recording, number of goats entered in the flock-books, milk performance results for the Kujawy-Pomerania Province as well as for Poland for the years 1996–2009, using the information published by the Central Animal Breeding Station and the documentation of the Regional Association of Sheep and Goats Breeders in Bydgoszcz. The number of flocks of White Improved goats covered by the performance recording in our country decreased from 170 in 1996 to 0 in 2009. A similar downward tendency was observed for the number of goats under milk recording. In the Kujawy-Pomerania Province, the number of goats under milk recording increased from 45 in 1996 to 289 in 2007, and fell to zero from 2008. Analysing the population of Coloured Improved goats, it turned out that, on average, in the whole country, the number of flocks of this breed increased from 17 in 1997 to 23 in 2004, and then decreased to 1 flock in 2009. Similarly, the number of goats under milk recording increased from 175 in 1997 to 917 in 2004 and then fell to 22 in 2009. In the analysed period, the extension of lactations, increased yields of milk, fat and protein and similar contents of these components in milk were found in White and Coloured Improved goats.

Keywords: goats, milk performance, population

INTRODUCTION

Goat breeding in Poland, despite its minor role in the animal production, finds a circle of supporters, not only among breeders, but also among people of other professions. The main arguments for the breeding and husbandry of goats are: their multipurpose character, good feed conversion, possibility of keeping in a small livestock and feed area, high

Corresponding author – Adres do korespondencji: dr hab. inż. Henryka Bernacka, Department of Small Ruminant Biology, University of Technology and Life Science, Mazowiecka 28, 85-084 Bydgoszcz, Poland, e-mail: Henryka.Bernacka@utp.edu.pl

adaptability, resistance to diseases, ease of milking as well as high nutritive and dietary value of milk [Ryniewicz and Krzyżewski 1997, Szymanowska and Lipecka 2000, Kondyli et al. 2007, Park et al. 2007, Strzałkowska et al. 2009, Strzelec and Niżnikowski 2009]. The main reason for hindering the development of goat breeding is a lack of breeding programme as well as too high dispersion and small size of goat flocks in our country [Bagnicka 1998, Bagnicka and Łukaszewicz 2000]. Some scientific centres have undertaken the research on the condition of goat breeding, analysing their production value in the selected regions of Poland [Bernacka et al. 1996, Mroczkowski et al. 1997, Bernacka 2002, Szymanowska and Lipecka 2000].

The aim of the present work was the evaluation of the milk performance of the population of White and Coloured Improved goats in Poland and the Kujawy-Pomerania Province in the years 1996–2009.

MATERIAL AND METHODS

When analysing the results concerning the condition of goat breeding and evaluation of goats productivity in the Kujawy-Pomerania Province as well as in Poland in the years 1996–2009, the information published by the Central Animal Breeding Station and the documentation of the Regional Association of Sheep and Goats Breeders in Bydgoszcz were used. In the Kujawy-Pomerania Province, the study involved 4 flocks of Coloured Improved goats until 2007 and 2 such flocks in 2008. There were 4 flocks of White Improved goats in 1996. One flock remained between 2002 and 2005 and 2 flocks remained between 2006 and 2007 (Table 1). The study involved a total of 21,945 White Improved goats and 8,000 Coloured Improved goats in Poland as well as 1642 and 1686 goats of respective breeds in the Kujawy-Pomerania Province. The following was taken into account in this study: the number of goats covered by performance recording, number of goats and bucks entered in the flock-books and milk performance results. Milk recording in the examined flocks was performed according to the A₄ method used by the National Centre for Animal Breeding.

To determine the developmental lines of the examined traits in the period under discussion, the trends method was applied. In order to calculate the trends, the first-order linear function was used according to the following formula [Zajac 1988]:

$$y_t = a_t + b,$$

where: a_t – the slope (regression slope) expressing the annual rate of an increase in the given trait, t – time expressed in consecutive numbers of years, b – level of a trait in a period.

The accuracy of the trend lines was evaluated based on the determination coefficients (R^2):

$$R^2 = \frac{\sum_{t=1}^n \left(y_t - \hat{y}_t \right)^2}{n}$$

where: y_t – actual value of a variable y in moment t ,
 $y^{\wedge}t$ – theoretical value of the dependent variable (based on the model),
 y – arithmetic means of the empirical values of the dependent variable.

Table 1. White (pb) and Coloured (pa) Improved goats covered by performance recording in country and the Kujawy-Pomerania Province in the years 1996–2009

Tabela 1. Kozy rasy białej (pb) i barwnej (pa) uszlachetnionej objęte oceną użytkowości w kraju i na terenie woj. kujawsko-pomorskiego w latach 1996–2009

Years Lata	Country / region Kraj / region	Evaluated goat flocks, heads Stada kóz pod oceną, osob.		Goats covered by performance recording, heads Kozy objęte oceną użytkowości, osob.		Goats entered in flock-books, % Kozy wpisane do ksiąg zarodowych, %		Bucks entered in flock-books, heads Kozły wpisane do ksiąg zarodowych, osob.	
		pb	pa	pb	pa	pb	pa	pb	pa
1996	Poland Polska	1704	18	3355	186	46.1	25.8	194	14
	region	4	–	45	–	–	–	3	–
1997	Poland Polska	144	17	2541	175	62.3	54.3	149	12
	region	3	1	26	17	–	–	3	1
1998	Poland Polska	63	21	1707	351	72.9	63.2	121	15
	region	1	3	60	59	71.8	22.0	3	3
1999	Poland Polska	63	21	1707	442	73.9	69.5	85	24
	region	1	3	60	66	60.0	19.7	3	4
2000	Poland Polska	57	23	2132	684	73.9	54.9	67	22
	region	3	3	98	93	70.4	39.8	4	5
2001	Poland Polska	60	24	2404	1060	67.9	48.6	63	26
	region	4	4	163	155	50.9	49.0	6	6
2002	Poland Polska	521	24	2362	910	72.7	59.8	55	20
	region	1	4	119	165	84.0	69.7	2	5
2003	Poland Polska	36	24	1638	861	82.4	60.3	42	14
	region	1	4	150	188	90.3	89.0	2	6
2004	Poland Polska	32	24	1668	917	70.6	69.6	32	21
	region	1	3	171	208	91.8	88.6	2	7
2005	Poland Polska	31	25	1712	882	61.7	73.4	40	31
	region	1	4	219	230	62.1	82.2	2	5
2006	Poland Polska	30	25	1772	936	73.6	95.2	52	32
	region	2	4	242	186	97.9	73.4	10	8

cont. Table 1 – cd. tab. 1

2007	Poland	13	15	568	440	75.9	61.4	12	13
	Polska								
	region	2	4	289	221	76.8	96.4	2	4
2008	Poland	0	5	60	134	81.7	87.3	6	4
	Polska								
	region	4	2	–	98	–	94.9	–	2
2009	Poland	2	1	37	22	67.6	86.4	2	2
	Polska								
	region	–	–	–	–	–	–	–	–

RESULTS

In Poland, two breeds of goats predominate: White and Coloured Improved. As it appears from the data presented in Table 1, the number of flocks of White Improved goats covered by performance recording in our country decreased from 170 in 1996 to 13 in 2007 and only 2 flocks under recording remained in 2009. A similar downward tendency was observed for the number of goats under milk recording (from 3355 goats in 1996 to 37 ones in 2009). It is only heartening that the number of goats entered in the flock-books increased in relation to goats being evaluated. And so, in 1996, goats entered in the flock-books accounted for 46.1% and in 2009 for 67.6%. Analysing the population of Coloured Improved goats, it turned out that, on average, in the whole country the number of flocks of this breed increased from 18 in 1996 to 25 in 2005 and then decreased to 1 flock in 2009. Similarly, it was observed that the number of goats under milk recording increased from 48 in 1996 to 687 in 2006 and then decreased to 22 goats in 2009, of which 86.4% goats were entered in the flock-books (Table 1). Time trends in the number of goat flocks of both breeds being evaluated and in the numbers of White Improved goats being evaluated as well as bucks entered in the flock-books were negative. Positive trends were found for the traits concerning the evaluation of Coloured Improved goats, except for the number of flocks being evaluated (Table 2).

In the Bydgoszcz region in 1996, 45 goats under recording were noted. Their number increased to 289 in 2007, of which 76.8% goats were entered in the flock-books. In the years 1997–2007, the number of Coloured goats covered by performance recording and entered in the flock-books increased systematically from 17 to 221 in the Kujawy-Pomerania Province as well as in country. However, only 2 flocks of the goats of this breed remained in 2008. They comprised 98 individuals, of which goats entered in the flock-books accounted for approx. 95.5% (Table 1). The developmental tendency lines of traits concerning goat breeding in the Kujawy-Pomerania Province (Table 2) indicate a constant increase in the number of the evaluated goats by 23 animals per year, on average, in the case of White Improved breed and by 16 animals per year, on average, in the case of the Coloured Improved breed in the years 1996–2007. They also show an increase in the number of goats entered in the flock-books by approx. 7 and 9 per cent per year, respectively, and a small increase in the number of breeding bucks entered in the flock-books by 0.18 and 0.24 per cent per year, on average, respectively. The values of the R^2 determination coefficient differed markedly ranging from 0.003 to 0.928 (Table 2).

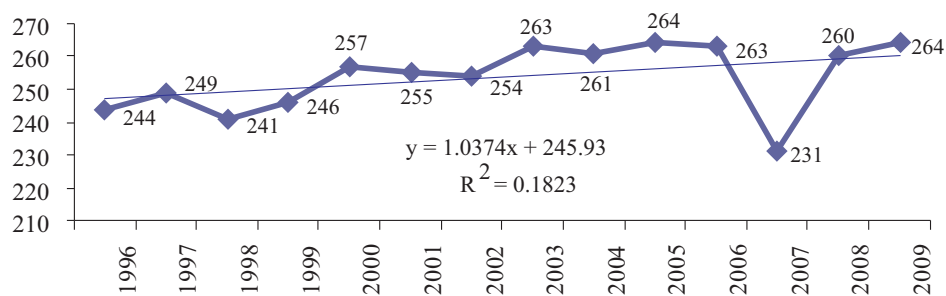
Table 2. Time trends in traits concerning the evaluation of flocks of White and Coloured Improved goats in country and the Kujawy-Pomerania Province

Tabela 2. Trendy czasowe cech dotyczących oceny stad kóz ras białej i barwnej uszlachetnionej w kraju i na terenie woj. kujawsko-pomorskiego

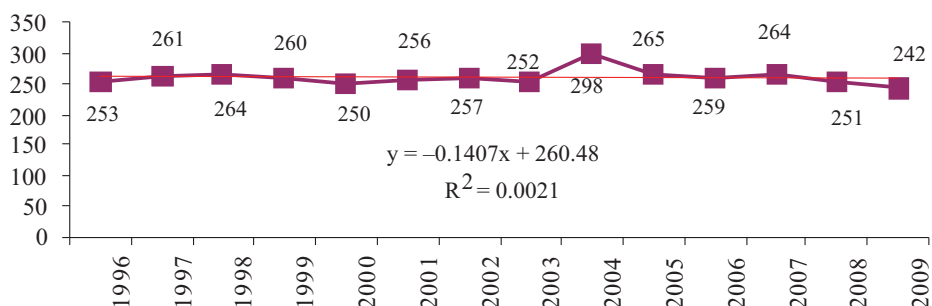
raits Cechy	Country/ region Kraj/ region	Goat breed asa kóz	rend rend	² determination coef cient spółczynnik determinacji ²
umber of evaluated goat flocks Liczba stad kóz pod oceną	Poland Polska	hite mproved biała uszlachetniona	y -10.78 137.07	0.8278
		Coloured mproved barwna uszlachetniona	y -0.848 25.22	0.2314
	region	hite mproved biała uszlachetniona	y -0.188 3.39	0.3254
		Coloured mproved barwna uszlachetniona	y 0.198 1.69	0.3403
umber of goats covered by performance recording Liczba kóz objętych oceną użytkowości	Poland Polska	hite mproved biała uszlachetniona	y -189.49 3119	0.7212
		Coloured mproved barwna uszlachetniona	y 4.809 535.36	0.0031
	region	hite mproved biała uszlachetniona	y 22.92 -13.894	0.9277
		Coloured mproved barwna uszlachetniona	y 15.775 19.269	0.6127
Goats entered in flock-books, % Kozy wpisane do ksiąg zarodowych, %	Poland Polska	hite mproved biała uszlachetniona	y 1.196 61.096	0.2506
		Coloured mproved barwna uszlachetniona	y 2.871 41.723	0.5955
	region	hite mproved biała uszlachetniona	y 6.712 19.535	0.5505
		Coloured mproved barwna uszlachetniona	y 9.126 7.0923	0.9311
umber of breeding bucks entered in flock-books Liczba kozłów rozplodowych wpisanych do ksiąg zarodowych	Poland Polska	hite mproved biała uszlachetniona	y -2.136 156.74	0.8376
		Coloured mproved barwna uszlachetniona	y -0.40 20.857	0.0347
	region	hite mproved biała uszlachetniona	y 0.1818 2.4848	0.0806
		Coloured mproved barwna uszlachetniona	y 0.2418 2.4615	0.1526

For dairy goats, economic effect depends mainly on their milk yield. In Figs 1 and 2 and in Table 3 are presented the data describing the productivity of the evaluated White and Coloured Improved goats in respect of milk yield and its quality with regard to the country's results for these goats. In 1996, mean milk yield of White Improved goats from the Bydgoszcz region was 415.8 kg per 249-day lactation. It was 126.9 kg higher compared to the mean country's productivity of goats of this breed. Milk yield of Coloured Improved goats

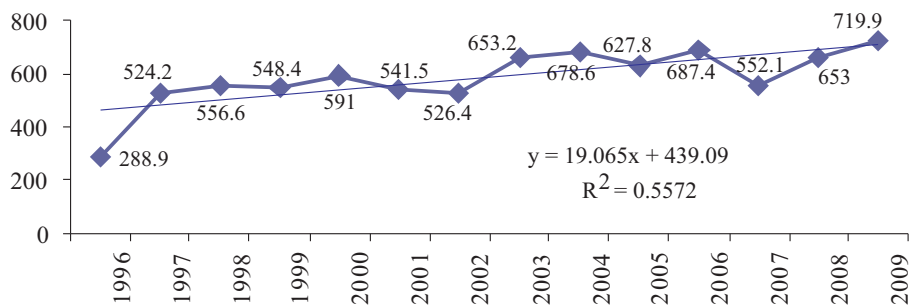
from the Bydgoszcz region in the first years of the performance recording (1998–2000) was similar to the mean country's values with a minimally longer lactation. The highest difference in the length of lactation as well as milk yield was found in 2006 in favour of goats from the Bydgoszcz region, whose lactation lasted for 26 days (White Improved) and 29 days (Coloured Improved) longer and the milk yield was as much as 204 and 235 kg higher, respectively, in comparison with the goats of the evaluated domestic population. Time trends in milk yield per lactation for both breeds were positive (Figs 1 and 2). Trends in milk fat yield of White and Coloured Improved goats of the domestic population and those from Bydgoszcz region showed an increase by 0.50 and 0.89 kg as well as by 0.44 and 0.90 kg per year, on average, respectively. Similar upward tendency was characteristic of the trends in milk protein content (by 0.37 and 0.49 kg and 0.37 and 0.49 kg per year, on average, respectively) and percentage content of protein in goat's milk and fat in milk of Coloured Improved goats (Table 3).



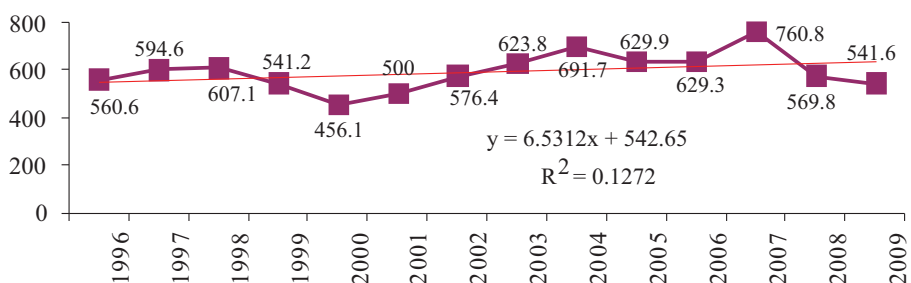
Lactation length in Polish White Improved goats – Długość laktacji u kóz rasy polskiej białej uszlachetnionej.



Lactation length in Polish Coloured Improved goats – Długość laktacji u kóz rasy polskiej barwnej uszlachetnionej.

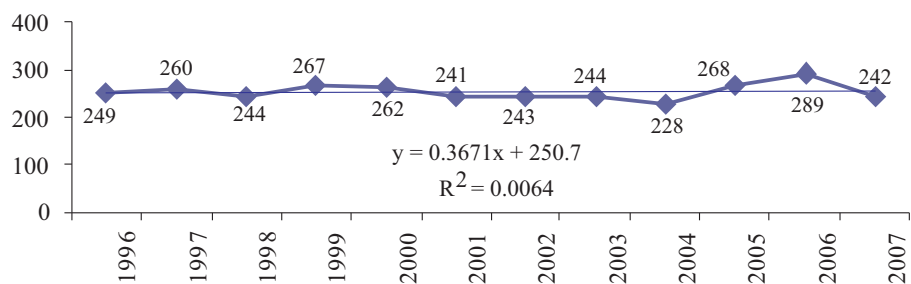


Milk yield of Polish White Improved goats – Wydajność mleczna kóz rasy polskiej białej uszlachetnionej.

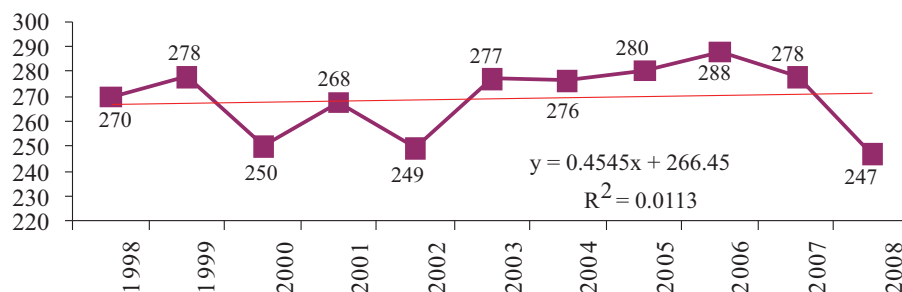


Milk yield per lactation of Polish Coloured Improved goats – Wydajność mleczna za laktacją kóz rasy polskiej barwnej uszlachetnionej.

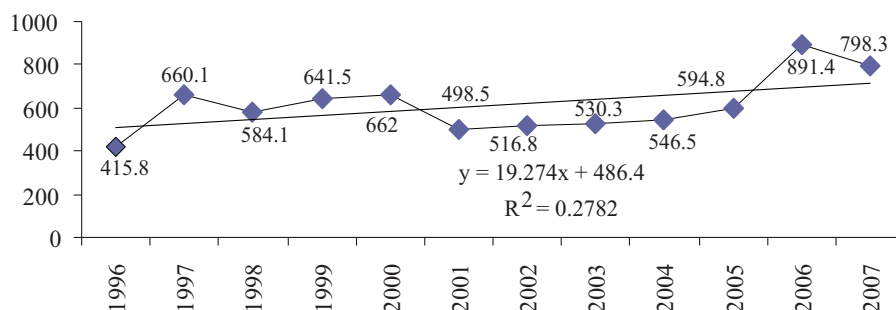
Fig. 1. Time trends in milk performance results of White and Coloured Improved goats in Poland
Rys. 1. Trendy czasowe wyników użytkowości mlecznej kóz ras białej i barwnej uszlachetnionej w Polsce



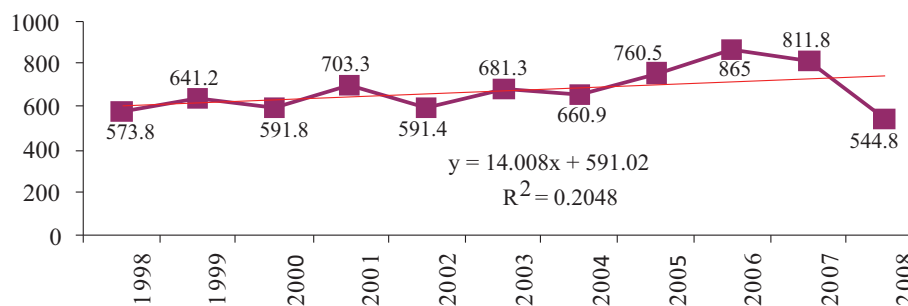
Lactation length in Polish White Improved goats – Długość laktacji u kóz rasy polskiej białej uszlachetnionej.



Lactation length in Coloured Improved goats – Długość laktacji kóz rasy barwnej uszlachetnionej.



Milk yield per lactation of White Improved goats – Wydajność mleczna za laktację kóz rasy białej uszlachetnionej.



Milk yield per lactation of Coloured Improved goats – Wydajność mleczna za laktację kóz rasy barwnej uszlachetnionej.

Fig. 2. Time trends in milk performance results of White and Coloured Improved goats in the Kujawy-Pomerania Province

Rys. 2. Trendy czasowe wyników użytkowości mlecznej kóz ras białej i barwnej uszlachetnionej w woj. kujawsko-pomorskim

Table 3. Trends in traits concerning daily milk yield as well as yield and concentration of fat and protein in milk of White (pb) and Coloured (pa) Improved goats in the years 1996–2009

Tabela 3. Trendy cech dotyczących wydajności dziennej mleka oraz wydajności i koncentracji tłuszczu i białka w mleku kóz ras białej (pb) i barwnej (pa) uszlachetnionej w latach 1996–2009

raits Cechy	Speci cation yszczegól nienie	Breed of goats asa kóz	rend rend	rend	rend	Coef cient of determination ² spółczynnik determinacji ²
aily milk yield ydajność dzienna mleka	Poland Polska	pb	y	0.068	1.992	0.3215
		pa	y	0.031	1.292	0.3325
	region	pb	y	0.068	1.992	0.3125
		pa	y	0.045	2.251	0.3325
at yield, kg ydajność tłuszczu, kg	Poland Polska	pb	y	0.503	17.223	0.1613
		pa	y	0.889	20.765	0.2314
	region	pb	y	0.442	17.089	0.1613
		pa	y	0.889	20.765	0.2314
at content, % awartość tłuszczu, %	Poland Polska	pb	y	-0.055	3.559	0.4453
		pa	y	0.036	3.578	0.1427
	region	pb	y	-0.055	3.559	0.4453
		pa	y	0.036	3.578	0.1427
Protein yield, kg ydajność białka, kg	Poland Polska	pb	y	0.371	14.653	0.1433
		pa	y	0.493	16.902	0.2674
	region	pb	y	0.371	14.653	0.1433
		pa	y	0.494	16.902	0.2674
Protein content, % awartość białka, %	Poland Polska	pb	y	0.015	2.815	0.1349
		pa	y	0.018	2.836	0.5405
	region	pb	y	0.011	2.815	0.1349
		pa	y	0.018	2.836	0.5405

Yield as well as chemical composition of milk depend on many factors and undergo fluctuations. One of them is age of goats, that is, the number of lactation. Analysing the tendency lines of the evaluated goats in respect of milk performance (Table 3) during four consecutive lactations, the constant increase in the number of evaluated goats in the years 1996–2008 was found. However, the shortening of the length of milking period was observed. In White Improved goats, a decrease in the value of this trait ranged from 0.59 (second lactation) to 9.83 days per lactation (fourth lactation) and by 1.28 days in the second lactation for Coloured Improved goats. In the remaining lactations an upward tendency for this trait was found. In White Improved goats, the milk yield as well as yield of fat and protein were characterised by an increase in the first three lactations during the

analysed period, whereas in the fourth lactation by a decrease by 8.3937 kg of milk, by 0.6517 kg of fat and by 0.2497 kg of protein, on average, in lactation. However, Coloured Improved goats were characterised by an increase in the yield of milk (from 6.5909 to 19.806 kg depending on lactation), fat (from 0.4191 to 1.209 kg) as well as protein (from 0.364 to 0.6364 kg). In the milk of White Improved goats irrespective of their age and in the milk of Coloured Improved goats in the second and third lactation, the content of fat decreased in the analysed period, whereas the content of protein in milk showed upward tendencies except for the milk of White goats in the fourth lactation. The value of R^2 ranged between 0.016 and 0.430 (Table 4).

Table 4. Trends in traits concerning milk performance recording of White and Coloured Improved goats in the Kujawy-Pomerania Province in the years 1996–2008
Tabela 4. Trendy cech dotyczących oceny użyteczności mlecznej kóz ras białej i barwnej uszlachetnionej z terenu woj. kujawsko-pomorskiego w latach 1996–2008

traits Cechy	Lactation Laktacja	White improved biała uszlachetniona			Coloured improved barwna uszlachetniona			
		trend	R^2	R^2	trend	R^2	R^2	
Number of evaluated goats Liczba oceny kóz	y	3.073	17.439	0.296	y	0.60	33.40	0.0161
	y	2.692	8.1667	0.3459	y	0.918	27.4	0.0322
	y	2.727	4.727	0.3107	y	1.155	19.164	0.0787
	y	4.423	-0.50	0.3630	y	4.136	11.182	0.3742
Days in milk dni doju	y	3.587	229.35	0.1932	y	1.282	253.86	0.0962
	y	-0.594	258.2	0.0062	y	-1.282	282.24	0.0702
	y	-1.063	260.08	0.0178	y	0.118	271.02	0.0602
	y	-9.832	295.08	0.204	y	1.727	258.45	0.0711
Milk yield, kg wydajność mleka, kg	y	24.934	355.78	0.3088	y	13.115	511.34	0.2235
	y	17.258	597.74	0.1639	y	6.591	629.52	0.0364
	y	11.842	597.74	0.075	y	17.465	611.93	0.1739
	y	-8.393	601.68	0.021	y	19.806	596.09	0.2693
Daily milk yield, kg dobowa wydajność mleka, kg	y	0.069	1.5667	0.2723	y	0.038	2.034	0.1733
	y	0.065	2.0989	0.2970	y	0.037	2.213	0.1490
	y	0.072	2.1939	0.1977	y	0.064	2.254	0.2740
	y	0.042	2.4561	0.0390	y	0.064	2.336	0.3321
Fat yield, kg wydajność tłuszczu, kg	y	0.682	12.995	0.1786	y	1.211	16.68	0.3743
	y	0.552	17.609	0.1214	y	0.916	20.783	0.2070
	y	0.156	20.897	0.0104	y	0.419	24.431	0.0474
	y	-0.6517	21.486	0.1443	y	1.036	20.764	0.2602
Fat content, % wartość tłuszczu, %	y	-0.008	3.361	0.0142	y	0.128	3.323	0.3956
	y	-0.013	3.384	0.0180	y	-0.100	3.945	0.0999
	y	-0.040	3.486	0.2218	y	-0.044	3.989	0.1376
	y	-0.178	4.0818	0.4170	y	0.0236	3.531	0.0426

cont. Table 4 – cd. tab. 4

Protein yield, kg	y	0.686	10.687	0.2521	y	0.414	14.255	0.3170
ydajność	y	0.640	14.164	0.2384	y	0.376	17.842	0.1222
białka, kg	y	0.418	16.542	0.1042	y	0.606	17.762	0.2518
	y	-0.249	17.073	0.0224	y	0.636	17.136	0.3467
Protein content,	y	0.006	2.847	0.0463	y	0.017	2.814	0.4298
%	y	0.019	2.704	0.2691	y	0.021	2.838	0.3833
awartość	y	0.007	2.827	0.0422	y	0.013	2.905	0.1307
białka, %	y	-0.097	3.297	0.153	y	0.004	2.844	0.1225

R^2 – coefficient of determination – R^2 – współczynnik determinacji.

DISCUSSION

Breeding and husbandry of goats in Poland have long tradition. After World War II, the population comprised 800,000 goats. For many families the goat was often the only source of food. Until 1970, the goat population decreased to 40,000 animals and, consequently, the breeding work, performance recording and inclusion of these animals in statistics were ceased [Ryniewicz and Krzyżewski 1997, Strzelec and Niżnikowski 2009]. A new interest in the husbandry of goats appeared in 1980s, which had been caused by an increased demand for milk and by socio-economic changes [Ryniewicz and Krzyżewski 1997]. The resumed performance recording of goats in 1983 was mainly aimed at performing milk recording of goats, selection of kids and juveniles, selection of animals for further breeding, entering animals in flock-books, as well as keeping the breeding documentation of goats. In 1991, the binding standards of the qualitative requirements for pasteurized goat's milk were introduced [Mroczkowski et al. 1997, Bagnicka and Łukaszewicz 2000, Szymanowska and Lipecka 2000]. The year 1995 is regarded as the beginning of the goat breeding in the Kujawy-Pomerania Province. At that time, the population of White Improved goats was covered by performance recording for the first time. These were 3 flocks of 34 goats altogether, in relation to the total number of goats of this breed amounting to 3671. In the following years, a significant increase in the number of goats covered by performance recording (from 45 in 1996 to 289 in 2007) was noted. It should be emphasised that in 2007 in the Bydgoszcz region, White Improved goats accounted for over 50% of the evaluated domestic population, of which 76.8% of goats were entered in the flock-books (Table 1 and 2).

In the Kujawy-Pomerania Province, Coloured Improved goats were covered by the performance recording for the first time in 1997. This was one flock of 17 goats, which accounted for 10% of the evaluated population of goats of this breed. In the following years, similarly as in country, in the area in which the Regional Association of Sheep and Goats Breeders in Bydgoszcz operates, the number of Coloured goats covered by the performance recording as well as entered in the flock-books increased systematically until 2007 (221 and 213 goats, respectively). However, in 2008, two flocks of this breed having

98 individuals remained (approx. 73% of the evaluated domestic population; Table 1). In 2008, the breeders of White Improved goats from the Kujawy-Pomerania Province withdrew from participating in the breeding work on the improvement of the population of White Improved goats and, in the next year, of the Coloured Improved goats. The main reason for this was the unprofitability of this production, which is associated with the lack of the possibility of purchasing and utilizing the goat's milk in this area, as well as necessity of paying for test milkings and chemical analyses of milk of the evaluated goats by the breeders. In the breeding of dairy goats, an important part is played not only by the amount of the milk obtained but also by its quality with particular consideration for the protein content. In the period 1996–2008, time trends for the lactation length, milk yield per full lactation and milk yield per goat turned out to be positive, which testifies to an increase in these traits over the examined years. This probably resulted from significant extension of lactations and increased milk yield of goats of both breeds between 2005–2006 both from the country and from the Bydgoszcz region (Fig. 1 and 2). The mean fat content in the milk of evaluated goats in the Kujawy-Pomerania Province was above 3.5%, whereas milk protein content amounted to 2.8% and was similar to the country's average (Table 3). Similar indices of productivity evaluation of goats from the Lublin region were obtained by Szymanowska et al. [2008]. The milk of Alpine goats in the study by Soryal et al. [2005], contained, on average, 2.76% of fat and 2.53% of protein, whereas the respective values for the Nubian goats were 4.37% and 3.87%. Similarly, the milk of Greek goats in the study by Kondyli et al. [2007] was rich in these components. The concentration of fat ranged from 3.93% to 4.46% and that of protein between 3.18% and 3.70% depending on the calendar month. As can be seen from data presented in Table 4, both for the domestic and regional population, goats of both breeds in the second and third lactation were characterised by longer lactation and higher yield compared to primiparous and older goats. Research conducted previously by Mroczkowski et al. [1997] concerning analysis of the condition of goat breeding in Poland in the years 1983–1996 showed the shortening of milking period, as well as milk yield of White goats in individual lactations. From the current information provided by the milk recording of our goats, it appears that the population of these animals is not uniform in respect of yield and chemical composition of milk [Ryniewicz and Krzyżewski 1997, Strzelec and Niżnikowski 2009]. An increase in the milk yield of goats is possible to achieve through the selection of the already existing population, as well as through the improvement of the native goats with dairy bucks, imported from countries with high breeding culture of these animals. Alpine and Saanen bucks are imported most frequently [Ryniewicz and Krzyżewski 1997, Bagnicka and Łukaszewicz 2000].

CONCLUSIONS

The current condition of goat breeding in Poland results mainly from the lack of breeding programmes and the possibility of performing rational breeding of goats in Poland is limited mainly by the small population of animals covered by the performance recording and its high dispersion.

In the evaluated period, the extension of lactation, increase in the yield of milk, fat and protein and their similar contents in White and Coloured Improved goats were found.

The milk performance results of the examined White and Coloured Improved goats can be used for the development of the regional breeding programme. Regional programmes will be used, in turn, for working out the national programme whose aim should be organizing the breeding and improving the performance level of goats.

REFERENCES

- Bagnicka E., 1998. Wartość hodowlana kóz mlecznych w Polsce [The breeding value of dairy goats in Poland]. *Prz. Hod.* 10, 25–26 [in Polish].
- Bagnicka E., Łukaszewicz M., 2000. Ocena krajowej bazy danych o użytkowości mlecznej i rozplodowej kóz pod względem przydatności do pracy hodowlanej [Evaluation of a national database of milk performance and reproductive performance of goats in terms of value for breeding work]. *Anim. Sci.* 37, 13–20 [in Polish].
- Bernacka H., 2002. Skład chemiczny mleka kóz różnych ras z województwa kujawsko pomorskiego [The chemical composition of milk of different breeds goats of the Cuiavian – Pomeranian Province]. *Pr. i Mater. Zootech.* 14, Zesz. specjalny, 7–13 [in Polish].
- Bernacka H., Dankowski A., Janicki B., Szklarek A., Wybrański M., Zieliński W., 1996. Chów kóz i ocena jakości mleka koziego w bydgoskim okręgu hodowlanym [The breeding of goat and estimate quality of goat's milk of the Cuiavian – Pomeranian Province]. *Zesz. Nauk PTZ Prz. Hod.* 30, 31–38 [in Polish].
- Kondyli E., Katsiari M.C., Voutsinas L.P., 2007. Variations of vitamin and mineral contents in raw goat milk of the indigenous Greek breed during lactation. *Food Chem.* 100, 226–230.
- Mroczkowski S., Baranowski A., Bernacka H., Dankowski A., 1997. Analiza stanu hodowli kóz w Polsce [Analysis of condition n goat breeding in Poland]. *Zesz. Nauk. Zakładu Hodowli Owiec i Kóz* 1, 55–64 [in Polish].
- Park Y.W., Juárez M., Ramos M., Haenlein G.F.W., 2007. Physico-chemical characteristics of goat and sheep milk. *Small Ruminant Res.* 68, 88–113.
- Ryniewicz Z., Krzyżewski J., 1997. Aktualne problemy w hodowli kóz w Polsce [The current problem of goat breeding in Poland]. *Zesz. Nauk. Zakładu Hodowli Owiec i Kóz* 1, 9–28 [in Polish].
- Soryal K., Beyene F.A., Zeng S., Bah B., Tesfai K., 2005. Effect of goat breed and milk composition on yield, sensory quality, fatty acid concentration of soft cheese during lactation. *Small Ruminant Res.* 58, 275–281.
- Strzałkowska N., Jóźwik A., Bagnicka E., Krzyżewski J., Horbańczuk K., Pytel B., Horbańczuk J.O., 2009. Chemical composition, physical traits and fatty acid profile of goat milk as related to the stage of lactation. *Anim. Sci. Rep.* 27, 4, 311–320.
- Strzelec E., Niżnikowski R., 2009. Pochodzenie, znaczenie hodowlane oraz charakterystyka populacji kóz na świecie i w Polsce [The origin, meaning and characteristics of cultured goat population in the world and in Poland]. *Prz. Hod.* 4, 7–12 [in Polish].
- Szymanowska A., Lipecka C., 2000. The state and current situation of goat breeding in Poland [Stan i aktualna sytuacja w hodowli kóz w Polsce]. *Ann. Wars. Agric. Univ., Anim. Sci.* 37, 3–12 [in Polish].

- Szymanowska A., Liśkiewicz M., Bojar W., 2008. Stan pogłowia i produktywność kóz w regionie lubelskim [The racial characteristics of the structure of goats in Lubuskie province]. *Prz. Hod.* 5, 17–19 [in Polish].
- Zajac K., 1988. *Zarys metod statystycznych* [The plot of statistic metod]. PWE, Warszawa, 338–433 [in Polish].

OCENA PRODUKCYJNOŚCI KÓZ RAS BIAŁEJ I BARWNEJ USZLACHTNIONEJ NA TERENIE WOJEWÓDZTWA KUJAWSKO-POMORSKIEGO NA TLE POGŁOWIA KRAJOWEGO

Streszczenie. Celem pracy była analiza stanu hodowli i chowu kóz na terenie woj. kujawsko-pomorskiego i kraju. Wyniki dotyczące użytkowości mlecznej i rozplodowej kóz z tego rejonu mogą być wykorzystane w opracowaniu programu hodowlanego regionalnego. W pracy uwzględniono: stan liczbowy kóz ras białej i barwnej uszlachetnionej objętych kontrolą użytkowości, liczbę kóz wpisanych do ksiąg zarodowych, wyniki użytkowości rozplodowej i mlecznej na terenie województwa kujawsko-pomorskiego, jak również w Polsce w latach 1996–2008, korzystając z informacji opublikowanych przez Centralną Stację Hodowli Zwierząt oraz z dokumentacji Regionalnego Związku Hodowców Owiec i Kóz w Bydgoszczy. Liczba stad kóz rasy białej uszlachetnionej objętych oceną użytkowości na terenie kraju zmniejszyła się ze 170 w 1996 roku do czterech w 2008 roku. Podobną tendencję spadkową zaobserwowano w liczbie kóz będących pod oceną mleczności. W województwie kujawsko-pomorskim liczba kóz pod oceną mleczności wzrosła z 45 osobników w 1996 roku do 289 w 2007 roku, a kozy wpisane do ksiąg zwierząt zarodowych stanowiły ok. 98% kóz ocenianych. Analizując pogłowie kóz rasy barwnej uszlachetnionej okazało się, że średnio w całym kraju nastąpił wzrost liczby stad tej rasy z 17 w 1997 roku do 23 w 2004 roku, a następnie spadek do pięciu stad w 2008 roku, podobnie w liczbie kóz pod oceną mleczności ze 175 osobników w 1997 roku do 917 w 2004 i spadek do 134 w 2008. Podobnie jak w kraju, tak i na terenie Bydgoskiego Okręgu Hodowlanego zaobserwowano wzrost liczby kóz rasy barwnej uszlachetnionej z jednego stada w 1997 roku utrzymującego 17 kóz pod oceną mleczności do 2 stad o liczbie kóz 134 osobniki, z czego kozy wpisane do ksiąg zwierząt zarodowych stanowią ok. 95,5%.

Słowa kluczowe: kozy, pogłowie, użytkowość mleczna

Accepted for print – Zaakceptowano do druku: 14.04.2011