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CORRELATIONS BETWEEN POLYMORPHIC VARIANTS OF MILK PROTEINS, AND MILK YIELD AND CHEMICAL COMPOSITION IN BLACK-AND-WHITE AND JERSEY COWS

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The experiment was performed on 128 Black-and-White cows and 121 Jersey cows. The aim of the study was to analyse the milk performance of primiparas of both breeds during 305 days of milking and over the full lactation period, taking into account the polymorphism of milk proteins, as well as to determine the chemical composition of milk at particular stages of lactation, on the basis of selected parameters. The occurrence of a rare casein variant CSN2 (BB) was recorded in Jersey cows. It was found that in both breeds the A gene variant was more common than the B gene variant. The milk performance of homozygotic primiparas (AA and BB) was higher than the milk performance of heterozygotes. Milk production was higher over the full lactation than during 305 days of milking, especially in terms of the ECM yield. The milk yield was increasing for the first 60 days of lactation, and then decreased. The concentrations of milk protein and milk fat exhibited the opposite tendency, *i.e.* reached the lowest level at 60 days of lactation and then increased. The levels of dry matter and casein were increasing over the lactation period.

INTRODUCTION

A better understanding of the process of inheritance of major milk proteins at the gene level enables improving, by proper selection, the composition and properties of milk, with particular emphasis on technological suitability [Sowiński, 1993].

Six protein fractions, accounting for over 90% of the total protein content of milk, show genetically determined polymorphism. β-Lactoglobulin, performing mainly immune functions, and four casein fractions: α-S_1, α-S_2, β-casein and κ-casein – which constitutes building blocks of the somatic development of progeny [Schmidt, 1964; Larsen & Thymann, 1996], are polymorphic in all cattle breeds. In Holstein-Friesians the α-S_1 casein gene is dominated by the B allele, whereas in Jersey cows the B allele of β-casein is more common [Michalak, 1995; Nowokszonow *et al.*, 2002]. α-Lactalbumin shows polymorphism in Indian cattle breeds and in some African Zebu cattle breeds only [Michalak, 1995; Pytelewski *et al.*, 2000].

The results of most studies indicate that the polymorphic form B of κ-casein is usually associated with a higher concentration of casein proteins in milk. More desirable technological parameters of milk are also attributed to the polymorphic form B of casein. Such milk is characterised, among others, by a shorter (by 10–30%) coagulation time, a higher (by 5–8%) yield of fresh and ripe cheese (Parmesan, Cheddar, Camembert and Gouda), and a higher (by 20–100%) curd firmness [Kamiński, 1994, 1995].

The cheese yield is by approx. 5% higher in cows with the BB genotype for β-lactoglobulin than in those with the AA genotype. Milk from cows with the BB genotype for β-lactoglobulin has a shorter (*i.e.* more desirable) coagulation time, higher thermal stability of proteins and more favorable parameters of the casein curd [Strzałkowska *et al.*, 1998]. Cows with the BB genotype for β-lactoglobulin produce milk with a higher fat content, a higher fat yield, and a higher casein content, while cows with the AA genotype for β-lactoglobulin provide milk with higher concentrations of total protein and whey proteins [Kamiński, 1995; Litwińczuk *et al.*, 1998].

The aim of the study was to estimate the milk performance of primiparous Black-and-White and Jersey cows during 305 days of milking and over the full lactation period, taking into account the polymorphism of milk proteins, as well as to determine the chemical composition of milk at particular stages of lactation.

MATERIALS AND METHODS

The experiment was performed in the years 2003/2004. The analysis concerned 128 primiparous Black-and-White cows (with an average proportion of HF genes exceeding 75%) and 121 Jersey cows. The animals were kept on three farms located in the Warmia and Mazury Province and fattened in the stall-pasture system. The diets were balanced in terms of energy and protein. The PMR feeding system was applied. The basic feed ration contained maize silage, haylage, straw, and a low amount of concentrate. Such a ration enabled producing 15 kg of milk. Each cow with a higher

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milk performance was given concentrate in the amount of 2 kg per kilogram of milk produced.

The following milk performance traits were analysed: milk yield, fat yield, protein yield and their percentages for 305 days of milking and for the full lactation. To objectively compare the productivity of cows, the milk yield was converted into the ECM yield, taking into account the energy value per kilogram of milk, in relation to the concentrations of protein and fat, according to the formula:

$$ECM\ (kg) = milk\ (kg) \times [(0.383 \times \%\ fat + 0.242 \times \%\ protein + 0.7832)/\ 3.140]$$

The values of the above parameters were analysed at the following stages of 305-day lactation: 5–30, 31–60, 121–150, 181–210 and 241–270 days. About 200 mL milk was collected for analysis from each cow during trial milking. Samples were not taken from mastitic cows.

The chemical analysis included the following physicochemical and technological parameters of milk: active acidity, density, rennet coagulation and the percentage of the main protein fraction, *i.e.* casein. Active acidity was measured with a "Piccolo-Plus" pH-meter according to the Polish Standard PN-99/A-86002 [1999]. Milk coagulation was determined by the rennet method, and casein content – by the Wolker method [Budsławski, 1973]. The other components, *i.e.* dry matter, fat, protein and lactose, were determined using a "Milkoscan 104 AB" (FOSS ELECTRIC) analyser, at the laboratory of the National Animal Breeding Center, Branch in Olsztyn.

Milk samples for evaluation of milk protein polymorphism were taken during 100 days of lactation directly from the teats of each cow, and poured into 1.5 mL Eppendorf tubes. They were used to determine the genetic variants of milk protein fractions, by starch gel electrophoresis in the alkaline environment – according to the method developed by Schmidt [1964] and modified by Michalak [1969], and in the acid environment – as described by Peterson & Kopfler [1966].

The results were verified statistically by one-factor analysis of variance, using Statistica 6.1 software. The analysis included arithmetic means, coefficients of variation and significance of differences estimated by the Duncan method.

RESULTS AND DISCUSSION

Table 1 presents the distribution of polymorphic genotypes and genes of milk proteins in Jersey cows. β-Lactoglobulin (LGB) and three casein fractions: αS_1-casein (CSN1S1), β-casein (CSN2) and κ-casein (CSN3) with the following genotypes: AA, AB, BB and BC, were found in this population. Black-and-White cows had the following genotypes: LGB (AA), (AB) and (BB), CSN1S1 – (BB) and (BC), CSN2 – (AA) and (AB), CSN3 – (AA), (AB) and (BB), whereas Jersey cows – (AA), (AB) and (BB), (BB) and (BC), (AB), (AB) and (BB), (AA), (AB) and (BB), respectively. LGB was determined by the A and B alleles. The frequency of their occurrence was 0.535% and 0.467%, respectively, in Black-and-White cows, and 0.533% and 0.467% in Jersey cows. The frequency of CSN1S1 was determined by the B and C alleles, with the domination of B. It was 0.996% in Black-and-White cows and 0.864% in Jersey cows. In the case of caseins CSN2 and CSN3 the A allele was more common – 0.984% and 0.836% in Black-and-White cows, and 0.806% and 0.665% in Jersey cows.

TABLE 1. Distribution of polymorphic genotypes and genes of milk proteins in Black-and-White and Jersey cows.

Milk proteins	Genotypes	Number of cows Head	Frequency (%) Genotype	Gene
		Black-and-White cows		
β-lactalbumin (LGB)	AA	36	0.280	A-0.535
	AB	65	0.510	B-0.465
	BB	27	0.210	
αS_1-casein (CSN1S1)	BB	127	0.992	B-0.996
	BC	1	0.008	C-0.004
β-casein (CSN2)	AA	124	0.970	A-0.984
	AB	4	0.030	B-0.016
	BB	-		
κ-casein (CSN3)	AA	89	0.696	A-0.836
	AB	36	0.281	B-0.164
	BB	3	0.023	
		Jersey cows		
β-lactalbumin (LGB)	AA	32	0.26	A-0.533
	AB	65	0.54	B-0.467
	BB	24	0.20	
αS_1-casein (CSN1S1)	BB	88	0.73	B-0.864
	BC	33	0.27	C-0.136
β-casein (CSN2)	AA	79	0.65	A-0.806
	AB	37	0.31	B-0.194
	BB	5	0.04	
κ-casein (CSN3)	AA	59	0.49	A-0.665
	AB	43	0.35	B-0.335
	BB	19	0.16	

Table 1 shows that the frequency of the LGB (B) gene was lower than the frequency of the LGB (A) gene. This tendency was also observed by Buczyński *et al.* [1973], who recorded slightly higher frequency of the A-0.532 allele than the B-0.468 allele. According to Walawski [1996], the domination of the BB gene variant over the BC gene variant in the protein CSN1S1 is characteristic of all European cattle breeds. Pavljuczenko *et al.* [1983] reported that the BB variant of this fraction is typical of all cattle breeds. Significantly higher frequency of the CSN2 (A) gene, compared with the CSN2 (B) gene, was observed by Sowiński [1993] and Litwińczuk & Barłowska [1992]. In the dairy cattle population examined by Sowiński [1993], the proportion of the CSN3 (BB) phenotype was small, whereas in the research carried out by Litwińczuk & Barłowska [1992] the CSN3 (A) gene noticeably dominated over the CSN3 (B) gene in groups of Black-and-White x Holstein-Friesian crossbreeds. In another experiment Barłowska & Litwińczuk [2001] recorded a similar distribution of the polymorphic fractions of milk proteins in Jersey cows, with a definite domination of heterozygotes within LGB, BB homozygotes within CSN1S1, AA homozygotes within CSN2 and AA homozygotes within CSN3.

Table 2 presents the yield and composition of milk from primiparous Black-and-White and Jersey cows for 305 days of milking. It was found that that the highest yields of milk (also when converted into the ECM yield), milk protein and milk fat were achieved in the case of homozygotic (AA and BB) cows. As for LGB (AA), the yields were as follows: milk – 7048 kg, fat – 273 kg, protein – 238 kg in Black-and-White cows, and milk – 4128 kg, fat – 245 kg, protein – 164 kg in Jersey cows. As for caseins, these levels were: CSN1S1 (BB) – 6595 kg, 261 kg, 220 kg, respectively, in Black-and-White cows, and 4046 kg, 240 kg, 160 kg, respectively, in Jersey cows; CSN3 – 7653 kg, 290 kg, 251 kg (Black-and-White cows and the BB alleles), and 4019 kg, 237 kg, 158 kg (Jersey cows and the AA alleles). Only in the case of casein CSN2 higher values were recorded in heterozygotic (AB) Black-and-White cows, but concerned a low number of animals only (4 head), which may suggest the occurrence of the ontogenetic effect. The following values were obtained, respectively: 8756 kg, 356 kg, 279 kg (Black-and-White cows and the AB alleles), and 3954 kg, 233 kg, 155 kg (Jersey cows and the AA alleles). There were statistically significant ($p \leq 0.05$) and statistically highly significant ($p \leq 0.01$) differences between the above values.

No definite domination of particular genetic alleles and proteins was observed while analysing the levels of milk components (non-significant differences). Identical results were obtained by Sowiński [1993] and Litwińczuk *et al.* [1996] for Holstein-Friesian primiparas. Among the LGB variants, these authors achieved the highest milk yield in AA homozygotes, slightly lower in AB heterozygotes, and the lowest in BB homozygotes These tendencies were confirmed by Barłowska *et al.* [2001], who demonstrated that LGB (AA) homozygotes were the most productive group in all lactations analysed. Czerniewska-Piątkowska *et al.* [2002], who examined milk production levels in Black-and--White cows with a high proportion of HF genes, found that cows with the LGB (BB) genotype were characterised by higher milk and fat yields than cows with the AB genotype.

As for LGB, available literature proves a positive correlation between the BB genotype and the total protein content of milk. In consequence, the yield of cheese produced from milk from cows with the BB genetype is also by about 5% higher, in comparison with cows with the AA genotype [Strzałkowska *et al.*, 1998]. According to Kamiński [1995], cows with the LGB (BB) genotype are highly productive and provide milk with a higher fat content. Changes in the quantitative protein ratios in milk may also increase its processing suitability.

Table 3 gives the milk yield for the first full lactation, as dependent upon milk protein genotypes. These data concern 30 Black-and-White cows, because not all of them completed the full lactation before sample collection. This Table shows that lactations were much longer than 305 days. Generally, long lactations are typical of high-performance cows, successfully mated as late as during the fifth, sixth or even seventh estrus period. The model production and reproduction cycle lasts 365 days. However, Black-and-

TABLE 2. Yield and composition of milk from Black-and-White and Jersey cows for 305 days of milking.

Specification		LGB			CSN1S1		CSN2			CSN3		
		AA	AB	BB	BB	BC	AA	AB	BB	AA	AB	BB
Black-and-White cows												
Number	N	36	65	27	127	1	124	4		89	36	3
Milk yield (kg)	LSM	7048[a]	6347	6139[a]	6595[a]	5301[a]	6485[A]	8756[A]		6542[A]	6272[B]	7653[AB]
	SD	14.10	17.49	17.68	16.33	0,00	14.96	12.54		15.04	15.92	30.45
ECM yield	LSM	6925[a]	6338	6058[a]	6531[a]	5264[a]	6442[A]	8068[A]		6506	6223[a]	7252[a]
	SD	11.33	17.92	14.10	15.06	0.00	14.63	13.67		14.30	16.89	24.15
Fat yield (kg)	LSM	273[a]	256	244[a]	261[a]	212[a]	308[a]	356[a]		261	251	290
	SD	11.04	17.76	13.23	14.56	0.00	14.62	11.87		14.08	17.56	19.86
Protein yield (kg)	LSM	238A[a]	212[a]	200[A]	220[a]	175[a]	217[A]	279[A]		219[a]	208[b]	251[ab]
	SD	12.62	20.36	15.50	17.32	0.00	16.78	17.23		16.70	18.30	25.73
Fat content (%)	LSM	3.90	4.05	4.03	3.99	4.06	4.00v	3.65[a]		4.01	4.00	3.72
	SD	9.52	8.11	10.20	9.05	0.00	8.71	9.06		8.77	9.24	9.96
Protein content (%)	LSM	3.39	3.32	3.30	3.34	3.29	3.34	3.23		3.35	3.30	3.31
	SD	5.43	6.86	5.62	6.25	0.00	6.19	7.34		6.07	7.08	4.62
Jersey cows												
Number	N	32	65	24	88	33	79	37	5	59	43	19
Milk yield (kg)	LSM	4128	3894	3881	4046	3916	3954	3992	3701	4019	3913	3826
	SD	15.36	17.48	12.84	12.23	17.46	18.52	18.52	19.30	18.14	13.70	14.39
ECM yield	LSM	5285	4974	4986	5171	5014	5043	5130	4788	5114	5067	4829
	SD	14.09	16.85	11.57	13.14	16.01	14.93	15.57	18.81	17.21	13.19	12.52
Fat yield (kg)	LSM	245	230	232	240	232	233	239	226	237	236	220
	SD	15.20	17.38	13.10	15.82	16.94	16.40	15.92	19.58	17.95	14.19	12.14
Protein yield (kg)	LSM	164	155	155	160	156	158	158	144	158	157	155
	SD	14.17	17.24	11.47	11.41	16.83	15.09	16.01	16.80	17.87	12.26	13.99
Fat content (%)	LSM	5.96	5.94	5.99	5.93	5.96	5.90	6.04	6.10	5.92	6.05	5.78
	SD	10.26	10.90	6.16	11.10	10.02	10.01	11.53	2.25	10.47	10.22	9.60
Protein content (%)	LSM	3.99	3.98	4.01	3.97	4.00	4.00	3.98	3.91	3.93	4.03	4.07
	SD	5.74	5.94	7.78	5.06	6.27	6.07	7.09	3.57	6.05	5.72	7.96

TABLE 3. Yield and composition of milk from Black-and-White and Jersey cows for the full lactation.

Specification		LGB			CSN1S1		CSN2			CSN3		
		AA	AB	BB	BB	BC	AA	AB	BB	AA	AB	BB
Black-and-White cows												
Number	N	13	12	5	30		30			23	7	
Milk yield (kg)	LSM	8309	7082	7855	7767		7488			7684^{A}	6844^{A}	
	SD	27.24	18.78	25.34	24.67		18.90			18.17	20.13	
ECM yield	LSM	8276	7204	7639	7753		7535			7016^{A}	6839^{A}	
	SD	23.38	18.85	22.82	22.21		18.00			15.57	24.58	
Fat yield (kg)	LSM	328	295	301	310		303			280^{A}	277^{A}	
	SD	22.02	18.88	22.48	21.19		17.94			14.65	27.05	
Protein yield (kg)	LSM	286	239	260	264		255			239^{A}	228^{A}	
	SD	23.94	20.65	22.81	23.57		19.54			17.35	24.82	
Fat content (%)	LSM	4.00	4.17	3.87	4.03		4.07			4.09	4.10	
	SD	10.90	9.73	10.33	10.20		10.11			10.14	10.61	
Protein content (%)	LSM	3.46	3.37	3.33	3.40		3.41			3.44	3.30	
	SD	5.33	6.51	7.42	6.27		6.10			5.19	8.29	
Milking days	LSM	367	380	390	372		350			380	353	
	SD	14.43	12.63	14.10	12.46		13.32			13.66	10.75	
Jersey cows												
Number	N	32	65	24	88	33	79	37	5	59	43	19
Milk yield (kg)	LSM	4594	4173	4418	4353	4261	4473	4258	4172	4542	4184	4036
	SD	25.21	22.78	13.82	24.05	16.68	23.99	21.06	21.53	26.18	15.64	16.74
ECM yield	LSM	5972	5366	5664	5611	5454	5778	5469	5478	5869^{a}	5437	5041^{a}
	SD	27.77	22.68	15.37	24.93	18.69	25.27	21.99	22.33	27.65	15.65	16.69
Fat yield (kg)	LSM	279	249	263	261	254	269	253	259	274^{a}	254	228a
	SD	29.63	23.78	16.89	25.99	20.95	26.78	23.37	23.48	28.99	16.88	17.31
Protein yield (kg)	LSM	185	168	176	175	171	179	171	166	182	168	162
	SD	27.15	23.02	16.53	25.43	16.86	25.12	22.33	20.43	27.74	16.36	17.06
Fat content (%)	LSM	6.05	5.95	5.94	5.98	5.96	6.02	5.93	6.18	5.98	6.09^{a}	6.67^{a}
	SD	11.06	12.07	10.33	11.39	11.60	11.98	11.59	2.78	12.15	10.86	9.11
Protein content (%)	LSM	4.01	4.06	3.97	4.04	4.02	4.00	4.05	3.99	4.09	4.02	4.02
	SD	5.67	10.06	6.29	9.67	4.92	6.51	9.69	2.36	10.61	5.83	7.39
Milking days	LSM	349	341	363	353	336	348	346	366	369^{aA}	334^{a}	318^{A}
	SD	22.96	17.58	18.35	20.57	14.53	23.66	16.52	18.51	22.32	12.63	12.29

-White cows whose genotypes are similar to the genotypes of Holstein-Friesians are characterised by high productivity per lactation, so in the case of the model cycle drying off takes place at relatively high productivity.

In Black-and-White primiparas the longest lactation lasted for 390 days and concerned cows with the LGB (BB) genotype, whereas in Jersey primiparas the longest lactation lasted for 369 and concerned cows with the CSN3 (AA) genotype. The shortest lactations took 350 days (CSN2 AA) and 318 days (CSN3 BB), respectively.

In consequence, the milk yield for the full lactation was higher than for 305 days of milking. This correlation was the most evident when the milk yield was converted into the ECM yield. In Black-and-White cows the difference, in relation to 305-day lactation, was 1351 kg for LGB (AA), 866 kg (AB), 1581 kg (BB); 1222 kg for CSN1S1 (BB), 1093 kg for CSN2 (AA), 1240 kg for CSN3 (AA), and 616 kg for CSN3 (AB). In Jersey cows these values were as follows: LGB (AA) – 687 kg, (AB) – 392 kg, (BB) – 678 kg; CSN1S1 (BB) – 597 kg, (BC) – 283 kg; CSN2 (AA) – 426 kg, (AB) – 648 kg, (BB) – 690 kg; CSN3 (AA) – 755 kg, (AB) – 370 kg, and (BB) – 212 kg.

Table 3 shows that the highest fat and protein yields, regardless of breed, were achieved by homozygotic cows with the (AA) allele. As for milk proteins, the highest yields were recorded in the LGB (AA) group, *i.e.* Black-and-White cows: 328 kg fat and 286 kg protein; Jersey cows: 279 kg fat and 286 kg protein. It was found that the levels of milk components were similar in particular genotypes, and no statistical differences were observed between them, like during 305-day lactation.

Table 4 presents the daily milk yield obtained during trial milking, and milk composition at particular stages of 305-day lactation. The milk yield was gradually increasing for the first 60 days of lactation, to decrease from day 120. The yields of milk fat and milk protein were decreasing to 60 days of lactation, and then increased. The differences between particular stages of lactation were statistically significant or highly significant. No significant differences were recorded between lactation stages in the levels of dry matter and casein, although these values were increasing over lactation. The coagulation time also became longer during lactation. The differences concerning some lactation stages were non-significant. The pH level was normal, and ranged from 6.66 to 6.70. The lactose content ranged between 4.83% and 4.92% in Black-and-White cows, and between 4.95% and 5.26% in Jersey cows. The highest lactose con-

TABLE 4. Daily yield and composition of milk from pimiparas at particular stages of 305-day lactation.

Specification	Statistical measures	Stages of lactation, days				
		5–30	31–60	121–150	181–210	241–270
		Black-and-White cows				
Milk (kg)	LSM	22.61	25.78^{Aab}	20.97^{a}	19.30^{A}	20.27^{b}
	SD	22.15	23.54	24.39	20.76	25.61
Fat (%)	LSM	3.93^{Aa}	3.70^{Bb}	4.15	4.26^{ab}	4.43^{AB}
	SD	14.91	10.37	13.03	12.26	13.08
Protein (%)	LSM	3.04^{Aa}	2.96^{Bb}	3.43	3.46^{ab}	3.53^{AB}
	SD	9.34	8.61	8.12	8.12	9.67
Dry matter (%)	LSM	12.61	12.37	13.15	13.33	13.55
	SD	5.22	4.40	5.01	5.33	5.90
Casein (%)	LSM	2.49	2.38	2.70	2.79	2.79
	SD	9.74	10.08	8.39	9.77	9.22
Coagulation (sec)	LSM	155.70^{a}	167.04	216.59	222.91	258.94^{a}
	SD	49.65	39.53	40.17	49.43	48.95
pH	LSM	6.66	6.68	6.68	6.68	6.70
	SD	0.90	0.63	0.57	0.60	0.58
Lactose (%)	LSM	4.83	4.92	4.85	4.87	4.92
	SD	6.42	2.61	2.83	3.23	2.90
		Jersey cows				
Milk (kg)	LSM	17.52^{ABC}	17.89	13.90^{A}	10.28^{B}	8.95^{C}
	SD	2.87	3.93	2.45	2.22	1.95
Fat (%)	LSM	5.27^{AB}	5.16^{CD}	5.45	5.97^{AC}	6.75^{BD}
	SD	22.91	17.43	15.94	14.86	14.12
Protein (%)	LSM	3.46^{Aba}	3.39^{CDb}	4.2ab	4.47^{AC}	4.42^{BD}
	SD	9.67	13.17	12.67	11.32	9.66
Dry matter (%)	LSM	13.85	13.60	14.48	14.71	15.16
	SD	23.34	34.87	28.22	23.88	20.73
Casein (%)	LSM	2.59	2.69	3.14	3.41	3.38
	SD	7.76	11.89	9.91	8.54	7.43
Coagulation (sec)	LSM	135.71^{a}	132.85	142.76	166.64	171.29^{a}
	SD	39.68	29.53	38.17	45.13	49.90
pH	LSM	6.70	6.69	6.70	6.68	6.68
	SD	0.87	0.65	0.55	0.76	0.86
Lactose (%)	LSM	4.95	5.08	5.15	5.26	4.98
	SD	6.47	8.46	4.55	2.90	3.37

centration was observed at the second and fifth stage of lactation (statistically significant differences). Klupczyński [2002] reported that the mean dry matter content of milk is 11.93% in Black-and-White cows, and 14.73% in Jersey cows. Such milk is more suitable for yogurt production.

CONCLUSIONS

1. The occurrence of a rare casein variant CSN2 (BB) was recorded in Jersey cows, but not in Black-and-White cows.
2. In both breeds the A gene variant was more common than the B gene variant.
3. The milk performance of homozygotic primiparas (AA and BB) was higher than the milk performance of heterozygotes.
4. Milk production was higher over the full lactation than during 305 days of milking, especially in terms of the ECM yield.
5. The milk yield was increasing for the first 60 days of lactation, and then decreased. The concentrations of milk protein and milk fat reached the lowest level at 60 days of lactation and then increased. The levels of dry matter and casein were increasing over lactation.

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ZWIĄZEK MIĘDZY POLIMORFICZNYMI WARIANTAMI BIAŁEK MLEKA A WYDAJNOŚCIĄ I SKŁADEM CHEMICZNYM MLEKA KRÓW RASY CB I JERSEY

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Badania prowadzono na 128 krowach rasy czarno-białej (pow. 75% udziału rasy hf) i 121 jersey. Krowy utrzymywano w trzech gospodarstwach województwa warmińsko-mazurskiego. Celem podjętych badań było wykazanie wydajności mlecznej krów pierwiastek obydwu ras za 305 dni doju oraz za pełną laktację z uwzględnieniem polimorfizmu białek mleka a także określenie składu chemicznego mleka w poszczególnych okresach trwania 305 dniowej laktacji na podstawie niektórych parametrów.

W badaniach odnotowano u krów rasy jersey rzadko występujący wariant białka kazeiny CSN2 (BB) (tab. 1). Stwierdzono, że niezależnie od rasy, największą częstotliwością występowania odznaczył się gen A aniżeli B. Wykazano, że wydajność za 305 dni doju, krów pierwiastek o homozygotycznym układzie genów AA i BB była wyższa aniżeli u heterozygot. W przypadku LGB (AA) wydajność wynosiła: mleko – 7048 kg, tłuszcz – 273 kg, białko – 238 kg (rasa cb) i odpowiednio 4128 kg, 245 kg, 164 kg (rasa jersey). W CSN1S1 (BB) odpowiednio 6595 kg, 261 kg, 220 kg (rasa cb) i 4046 kg, 240 kg, 160 kg (rasa jersey); przy CSN3 (BB) odpowiednio 7653 kg, 290 kg, 251 kg (rasa cb) i przy CSN3 (AA) 4019 kg, 237 kg, 158 kg (rasa jersey) (tab. 2).

Wydajność za laktację pełną, była wyższa aniżeli za 305 dni doju, szczególnie przy wydajności ECM. Różnica w rasie cb wynosiła przy LGB (AA) – 1351 kg, (AB) – 866kg, (BB) – 1581kg; przy CSN1S1 (BB) – 1222kg; przy CSN2 (AA) – 1093kg i przy CSN3 (AA) –1240 kg, (AB) – 616kg. W przypadku rasy jersey wartości te wynosiły odpowiednio: LGB (AA) – 687 kg, (AB) – 392 kg, (BB) – 678 kg; CSN1S1 (BB) – 597 kg, (BC) – 283 kg; CSN2 (AA) – 426 kg, (AB) – 648 kg, (BB) – 690 kg; CSN3 (AA) – 755 kg, (AB) – 370 kg, (BB) – 212 kg (tab. 3).

W pracy stwierdzono, że wydajność mleka krów wzrastała do 60 dnia laktacji, następnie zaczęła maleć, natomiast zawartość białka i tłuszczu wykazała tendencje odwrotną, tj. była najniższa w 60 dniu po czym zaczęła rosnąć. Zawartość suchej masy i kazeiny wzrastała w miarę trwania laktacji (tab. 4).