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THE INFLUENCE OF SELECTED FACTORS ON GROWTH RATE OF CHAROLAIS AND SIMMENTAL CALVES

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ABSTRACT

The aim of presented study was to estimate the influence of calving season, cow body weight, calf body weight at birth on body weights and daily gains of large calibre beef breeds calves, i.e. Charolaise and Simmental. Estimations were made of the effect on the body weight and daily body gain of calves of the following factors: cow genotype (purebred Charolaise or Simmental, 50% of Charolaise or Simmental genes), calving season (summer feeding: May-October, winter feeding: November-April), cow body weight (≤550 kg, >550 kg), calf body weight at birth (≤35 kg, >35 kg). The dam genotype had highly significant influence on calf body weight at birth. Pure-bred Charolaise cows delivered calves over 6 kg heavier than calves from Simmental ones. Mothers with 50% of Charolaise blood ratio delivered calves of higher by about 2 kg body weight than cows with 50% of Simmental blood share. Simmental calves obtained higher body weight at 210 day and higher daily gain between birth and weaning. Probably it is an effect of Simmental cows higher milk production, which directly influences the rearing results. Charolaise calves obtained statistically high-significantly higher body weight in 120 and 210 day of life as well as daily gain in the entire 7 rearing months. It is probably because of not so big differences in milk production between purebred dams and cows with 50% of genotype of reported breeds. In such case superiority of Charolaise breed growth potential was evident. The calves born during the summer season obtained the lower body weight at 210 day than those born in the winter season and the differences were statistically highly significant. The dam body weight had highly significant influence on calf body weight at birth, in 120 and 210 day as well as their daily body gain in every investigated periods.

Key words: beef cattle, calves, growth rate, Charolaise, Simmental

INTRODUCTION

Beef cattle breeding and husbandry is rather new branch in Poland. The breeders starting that activity, apart from production profitability problem, have to choose also the breed. This choice must be made aside from they decided to keep pure-bred animals or build a herd on base of up-grading crossbreeding of dairy cows with beef bulls. Among 8 specialised beef breeds kept in Poland, two of them – Charolaise and Simmental (beef type) belong to the breeds of large calibre predisposed for fattening to the high final body weight [2, 4, 5, 6, 10, 11]. The Charolaise breed is well known in Poland and used for many years especially for commercial crossing with the dairy cows [7, 8, 9]. The Simmental was usually used as a double purpose (beef & dairy) breed so far. For a few years the beef type of Simmental is kept in Poland and selected like the other specialised beef breeds. Both discussed breeds are late maturing, i.e. heifers are covered at 18-24 months of age, and the young animals can be fattened up to high body weight without excessive carcass fat content. There are about 3 thousand Charolaise purebred and crossbred cows and heifers in the herd book in Poland. About 50 thousand of dairy cows are commercially crossed with Charolaise bulls annually. There are about 600 Simmental purebred cows and heifers as well about 550 Simmental crossbreds registered in the Polish herd book. Simmentals are much more used for commercial crossing with dairy breeds. In 2002 over 133 thousand of dairy cows were serviced by Simmental bulls [18, 26]. In the breeding and commercial herds of beef cattle, good results of reproduction and calves rearing decide on profitability of this production branch. Among several factors influencing the proper calves growth and development, beside of housing conditions and management, genotype, cow body weight, calf weight at birth and calving season (closely connected to the type of feeding) should be taken into consideration. Beef recording scheme conducted in Poland, beside the above mentioned traits, registers also body weights at 120 and 210 day of calves life. The aim of presented study was to estimate the influence of calving season, cow body weight, calf body weight at birth on body weights and daily gains of large calibre beef breeds calves, i.e. Charolaise and Simmental.

MATERIALS AND METHODS

The analysis was performed on the basis of records from performance testing of Charolaise and Simmental cattle conducted by the Polish Beef Breeders and Producers Association over the years 1997-2002. The data comprised the following information: cow genotype, live body weight of calves at birth, on day 120 and day 210 of life, live body weight of dams, calving date. The number of examined calves fluctuated from 856 to 1 915 heads depending on analysed trait. The data were analysed by way of the least square means method and single-factor analysis of variances (SPSS ver. 10.0 pl) [25]. Estimations were made of the effect on the body weight and daily body gain of calves of the following factors: cow genotype (purebred Charolaise or Simmental, crossbreds Charolaise x Friesian – 50:50% or Simmental x Friesian – 50:50% genes), calving season (summer feeding: May-October, winter feeding: November-April), cow body weight (≤550 kg, >550 kg), calf body weight at birth (≤35 kg, >35 kg).

RESULTS AND DISCUSSION

The least square means for purebred calves body weight at birth, in 120, 210 day and body weight daily gain in dependence on cow genotype, calving season, cow body weight and calf body weight at birth are shown in Table 1. Mother genotype had highly significant influence on calf body weight at birth. Purebred Charolaise cows delivered calves over 6 kg heavier than calves from Simmental mothers (39.96 vs. 33.31 kg). It should be noticed, that Simmental calves obtained higher body weight at 210 day and higher daily gain between birth and weaning. Probably it is an effect of Simmental cows higher milk production, which directly influences the rearing results. The direct connection of cow milk production and calves performance during rearing period was observed also in many other studies [3, 11, 13]. Average body weight of calves of both breeds at birth, 120 and 210 day were lower than stated by other authors. The average weight at birth of Charolaise calves was 43.32 kg according to Goszczyński et al. [7], and 43 kg Pogorzelska et al. [22]. The data delivered by the Polish Beef Breeders and Producers Association show the average weight at birth as 40 kg for Charolaise and 34 kg for Simmental bull calves [18]. Piasecki [20] observed for Charolaise calves 40.4 kg at birth, 141.7 kg in 120 day and 239.5 kg in 210 day. The French studies [27] indicate for beef recorded Charolaise calves in France the weight of 46.5 kg at birth, 172.5 kg and 274.5 kg, in 120 and 210 day respectively. Kamieniecki et al. [12, 13] only report lower Charolaise calves weight at birth (36.51 kg) than showed by this paper.

Table 1. Body weight and daily gains of purebred calves

		Genotype		Calving season		Cow body weight (kg)		Calf body weight at birth (kg)		Total
		CHAR	SIM	summer	winter	≤550	>550	≤35	>35	
Body weight at birth (kg)	N	1411	408	626	1193	196	1623	-	-	1819
	LSM	39.96^{A}	33.31^{A}	36.87	36.40	34.90^{A}	38.37^{A}	-	-	36.63
	SE	0.25	0.38	0.33	0.24	0.40	0.18	-	-	0.23
Body weight in 120 day (kg)	N	1024	71	459	636	123	972	197	898	1095
	LSM	131.93	129.45	129.00	132.88	127.35	134.52	132.16	129.71	130.94
	SE	1.67	3.67	2.52	2.06	2.84	2.31	2.18	2.84	1.78
Body weight in 210 day (kg)	N	925	364	323	966	131	1158	348	941	1289
	LSM	233.62^{A}	252.21^{A}	230.92^{A}	254.91^{A}	224.68^{A}	261.15^{A}	241.98	243.86	242.92
	SE	3.03	3.45	3.24	2.32	3.96	1.83	2.81	2.67	2.30
Body weight gain 0-120 days (kg)	N	1024	71	459	636	123	972	197	898	1095
	LSM	94.93	95.91	93.42	97.22	92.55	98.09	100.83^{A}	89.82^{A}	95.32
	SE	1.65	3.63	2.49	2.03	2.80	2.81	2.15	2.80	1.75
Body weight gain 120-210 days (kg)	N	790	66	257	599	108	748	171	685	856
	LSM	100.67	92.51	94.14	100.67	95.01	99.81	93.52	101.29	97.41
	SE	2.60	5.75	3.89	3.07	4.21	3.48	3.22	4.43	2.78
Body weight gain 0-210 days (kg)	N	925	364	323	966	131	1158	348	941	1289
	LSM	196.59^{A}	218.16^{A}	195.18^{A}	219.57^{A}	190.38^{A}	224.37^{A}	210.17	204.58	207.38
	SE	3.00	3.41	3.21	2.29	3.91	1.81	2.78	2.64	2.27
Daily body weight gain 0-120 days (g)	N	1024	71	459	636	123	972	197	898	1095
	LSM	792.10	799.21	778.51	810.18	771.26	817.44	840.21^{A}	748.48^{A}	794.35
	SE	13.72	30.22	20.72	16.94	23.37	19.01	17.95	23.34	14.63
Daily body weight gain 120-210 days (g)	N	790	66	257	599	108	748	171	685	856
	LSM	1118.55	1027.90	1046.00	1118.57	1055.81	1108.96	1039.08	1125.49	1082.29
	SE	28.85	63.87	43.17	34.13	46.77	38.61	35.76	49.22	30.86
Daily body weight gain 0-210 day (g)	N	925	364	323	966	131	1158	348	941	1289
	LSM	936.14^{A}	1038.88^{A}	929.45^{A}	1045.57^{A}	906.58^{A}	1068.44^{A}	1000.82	974.20	987.51
	SE	14.26	16.22	15.26	10.91	18.63	8.61	13.25	12.58	10.80

A – values marked by the same capital letter differ high-significantly (p≤0.01).
a – values marked by the same small letter differ significantly (p≤0.05).

Breeding period and consequent delivery time should not exceed 2 months [14, 15, 17, 19, 21]. In case of round-the-clock pasture technology the beef cows should deliver in the winter time (January, February optimally). Calves born during those months, after the suckling period, are well prepared for grazing (better alimentary system development). They grow faster, are of better health and consequently their body gain is obtained at reduced costs. In addition it should be mentioned, that the winter calving season causes the deliveries when the grass quality is getting lower during autumn, and drying-off period is just natural. In the presented study slightly higher body weight at birth had the calves born in the summer season, but the differences appeared to be statistically not significant. Similar results are reported by Stadnik and Louda [23]. Chladek and Kucera [1] observed significant influence of calving season on calf body weight at birth. The heaviest calves were born between January and April whereas the lightest ones in the period from October to December. Stadnik et al. [24], on the base of 3 903 recorded Charolaise calves data, found the highest body weight at birth in the winter calving season.

The calves born during the summer season obtained the lower body weight at 210 day than those born in the winter season and the differences were statistically highly significant. Calving season had also statistically highly significant influence on the daily body gain of calves during the entire rearing period. Calves born in the winter feeding season had average daily body gain higher by over 100 g than those born in the summer feeding season. Miciński et al. [16], referring to many other authors, report that calves born in the spring and summer season obtained lower daily gain during the rearing period than those born in the winter. The live body weight of the dam affected ($p \leq 0.01$) the birth weight of the calf. Cows weighting less than 550 kg gave calves with a mean birth weight about 34.90 kg, while the mean birth weight of calves out of the heavier dams (over 550 kg) was almost 4 kg higher. The live body weight of the dam had also affected ($p \leq 0.01$) the body weights of calves at weaning and their daily gain during rearing. The purebred calves born out of the heaviest cows weighted in 210 day more than those of the same age delivered by the lighter ones. The highest body weight daily gain were observed for calves out of the heavier dams. The influence of body weight at birth on further body weights and daily gains was not statistically significant.

The least square means for body weight at birth, in 120, 210 day and daily gain of calves with 75% of Charolaise or Simmental genes in dependence on cow's genotype, calving season, cow body weight and calf body weight at birth are shown in Table 2. The dam genotype statistically highly influenced calf body weight at birth. Cows with 50% of Charolaise blood ratio delivered calves of higher by about 2 kg body weight than cows with 50% of Simmental blood share (35.30 and 33.45 kg respectively). Charolaise calves also obtained statistically high-significantly higher body weight in 120 and 210 day of life as well as daily gain in the entire 7 rearing months. Thus the results shown above are in inverse to those presented at the beginning of this paper (for calves out of pure-bred cows). It is probably because of not so big differences in milk production between pure-bred dams and cows with 50% of genotype of reported breeds. In such case superiority of Charolaise breed growth potential was evident. Calves born during summer feeding season obtained lower body weight at weaning (at 210 day) than those born in the winter feeding season, but the observed differences were not statistically significant.

The dam body weight had highly significant influence on calf body weight at birth. Cows with lower body weight (≤550 kg) delivered calves weighting 32.59 kg in average, whereas calves weight delivered by heavier cows was 36.17 kg. The dam body weight also high-significantly influenced the calf body weight in 120 and 210 day as well as their daily body gain in every investigated periods. A significant effect ($p \leq 0.01$) was demonstrated of the birth weight of the calf on its later live body weight and live weight gains in all the time intervals examined. The calves that were lightest at birth were lighter also during subsequent rearing periods and showed lowest daily weight gain.

Table 2. Body weight and daily gain of calves from cows with 50% of Charolaise and Simmental genotype

		Genotype		Calving season		Cow body weight (kg)		Calf body weight at birth (kg)		Total
		CHAR	SIM	summer	winter	≤550	>550	≤35	>35	
Body weight at birth (kg)	N	620	1295	915	1000	915	1000	-	-	1915
	LSM	35.30^{A}	33.45^{A}	33.43^{A}	35.33^{A}	32.59^{A}	36.17^{A}	-	-	34.38
	SE	0.18	0.13	0.17	0.14	0.18	0.14	-	-	0.11
Body weight in 120 day (kg)	N	305	777	436	646	644	438	720	362	1092
	LSM	140.17^{A}	121.95^{A}	129.11^{a}	133.02^{a}	126.48^{A}	135.65^{A}	125.31^{A}	136.81^{A}	131.06
	SE	1.49	1.18	1.35	1.13	1.45	1.23	1.09	1.51	0.95
Body weight in 210 day (kg)	N	391	927	441	877	615	703	718	600	1318
	LSM	230.63^{A}	219.42^{A}	223.35	226.70	212.06^{A}	238.00^{A}	214.46^{A}	235.59^{A}	225.03
	SE	2.15	1.44	1.99	1.51	2.09	1.65	1.63	1.97	1.29
Body weight gain 0-120 days (kg)	N	305	777	436	646	644	438	720	362	1092
	LSM	104.58^{A}	87.81^{A}	94.66^{a}	97.72^{a}	92.23^{A}	100.15^{A}	94.13^{a}	98.25^{a}	96.19
	SE	1.43	1.13	1.29	1.08	1.39	1.18	1.04	1.45	0.91
Body weight gain 120-210 days (kg)	N	239	664	279	624	541	362	579	324	903
	LSM	88.30	90.05	88.86	89.49	85.21^{A}	93.14^{A}	82.45^{A}	95.90^{A}	89.17
	SE	1.83	1.41	1.74	1.28	1.70	1.52	1.34	1.77	1.15
Body weight gain 0-210 days (kg)	N	391	927	441	877	615	703	718	600	1318
	LSM	195.07^{A}	185.57^{A}	188.97	197.66	177.95^{A}	202.68^{A}	183.08^{A}	197.55^{A}	190.32
	SE	2.09	1.40	1.94	1.47	2.03	1.60	1.59	1.91	1.26
Daily body weight gain 0-120 days (g)	N	305	777	436	646	644	438	720	362	1092
	LSM	871.46^{A}	731.71^{A}	788.82^{a}	814.36^{a}	768.57^{A}	834.60^{A}	784.44^{a}	818.73^{a}	801.59
	SE	11.91	9.44	10.76	9.02	11.59	9.79	8.70	12.07	7.60
Daily body weight gain 120-210 days (g)	N	239	664	541	362	279	624	579	324	903
	LSM	981.14	1000.51	987.31	994.34	946.74^{A}	1034.91^{A}	916.11^{A}	1065.54^{A}	990.83
	SE	20.36	15.63	19.36	14.20	18.94	16.85	14.90	19.69	12.83
Daily body weight gain 0-210 day (g)	N	391	927	441	877	615	703	718	600	1318
	LSM	928.88^{A}	883.66^{A}	899.86	912.68	847.39^{A}	965.15^{A}	871.81^{A}	940.74^{A}	906.27
	SE	9.96	6.66	9.24	7.02	9.68	7.63	7.55	9.10	5.99

A – values marked by the same capital letter differ high-significantly (p≤0.01).
a – values marked by the same small letter differ significantly (p≤ 0.05).

CONCLUSIONS

1. The dam genotype had highly significant influence on calf body weight at birth. Pure-bred Charolaise cows delivered calves over 6 kg heavier than calves from Simmental ones. Mothers with 50% of Charolaise blood ratio delivered calves of higher by about 2 kg body weight than cows with 50% of Simmental blood share.
2. Simmental calves obtained higher body weight at 210 day and higher daily gain between birth and weaning. Probably it is an effect of Simmental cows higher milk production, which directly influences the rearing results.
3. Charolaise calves obtained statistically high-significantly higher body weight in 120 and 210 day of life as well as daily gain in the entire 7 rearing months. It is probably because of not so big differences in milk production between purebred dams and cows with 50% of genotype of reported breeds. In such case superiority of Charolaise breed growth potential was evident.
4. The calves born during the summer season obtained the lower body weight at 210 day than those born in the winter season and the differences were statistically highly significant.
5. The dam body weight had highly significant influence on calf body weight at birth, in 120 and 210 day as well as their daily body gain in every investigated periods.

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