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THE EFFECT OF SELECTED FACTORS ON BODY WEIGHT AND BODY CONFORMATION SCORING IN LIMOUSINE COWS

Summary. The aim of the study was to investigate the effect of origin, age at first calving and calving season on body weight and conformation traits in limousine cows. A highly significant dependence was found between the origin of cows and their general appearance (constitution, type), and a significant dependence between the country where the animals had been purchased and their body weight. The most advantageous results were recorded for cows coming from the Czech Republic. Calving season was found to have an effect on body weight, height at the sacrum and the total score in conformation judging in a 100-point scale. More valuable values for the analysed traits were recorded for the animals which calved in the spring-summer season, which was most probably the result of more effective pasture feeding in that period. It was found that the age at first calving has a highly significant effect on body weight and scores of general appearance (constitution, type), limb locomotion score, as well as a significant effect on the forequarters (depth, width), barrel (back, loins, abdomen) and rump (the sacrum, pelvis, shape). However, the results collected within this study suggest that the most significant factor determining service date of limousine heifers is their body weight, and not their age.

Key words: limousine cows, body weight, conformation

Introduction

Breeding and rearing of beef cattle in Poland is a new direction in animal production, initiated in the late 1990's. In 1994 a breeding development program of beef cattle breeds was started. Among several breeds imported to Poland in the years 1994-1996 the population of limousine cattle has been growing in size the fastest. This is a consequence of high production value of this breed. These animals mature early, live long and calve easily. Cows of this breed are characterised by good milk yields and maternal care for their offspring. When fed adequately during fattening they exhibit high weigh gains

and are characterised by excellent dressing percentage and their meat has desirable cooking and eating value (LITWIŃCZUK and SZULC 2005). In the opinion of JASIOROWSKI and PRZYSUCHA (2005) obtaining a considerable selection response in beef cattle breeds is difficult due to the short duration of the program and limited population size.

At present search for increased efficiency in the production of cattle on hoof is fully justified. Many of factors affecting growth traits can be found: herd, region, year and month of calving, calving number, type of mating, sex born calves, muscularity of calves, weaning age, dam's body conformation and dam's age (JAKUBEC et AL. 2003).

An issue of interest, not only for breeders of limousine cattle, is to investigate the dependence between selected factors and obtained body weight conformation score of cows of this breed. These premises were the reason why the authors of this study decided to investigate the topic, aiming at the determination of the effect of origin, age and season at first calving on body weight and conformation traits of limousine cows.

Material and methods

Analyses were conducted on limousine cows kept in the years 2006-2007 at the Rudki farm belonging to Potato Processing Company "Trzemeszno". Experimental animals (38 heads) were after their first calving. Results of body measurements, as well as scores of conformation, calibration, fleshiness and production traits were collected from the certificate of entry to herdbooks. The following data were collected: body weight (kg), height at the withers (cm), height at the sacrum (cm) and girth's circumference (cm). The other traits were expressed in a 100-point scale, the following body quarters were evaluated (the maximum available number of points is given in brackets): general appearance (15), head and neck (5), forequarters – depth, width (15), barrel – back, loins, abdomen (15), rump – the sacrum, pelvis, shape (20), limb locomotion (10) and performance parameters (20).

In the summer period cows were kept on a pasture with access to housing facilities or covered shelters, while in the winter season animals were kept in a free stall barn on deep litter with access to an outside run.

Feeding of cows was based on feeds produced on the farm. Feed was fed twice during the day. In the summer season feeding was based on pasture grazing. In winter the following feeds were fed: maize silage, potato peeling silage, haylage, hay, straw and concentrate.

Calvings were distributed uniformly throughout the year.

Cows were divided in terms of their country of origin into a group from the Czech Republic and a group from Germany. Within age at first calving three classes were distinguished: ≤ 32 months, 33-38 months and > 38 months. The season of calving was divided into two periods: autumn-winter (October, November, December, January, February and March) and spring-summer (April, May, June, July, August and September).

The study analyzed the effect of origin of cows, age and season at first calving on body weight, results of body measurements as well as conformation scoring conducted at the age of first calving.

In the statistical analyses SAS® ver. 9.13 (SAS®... 2007) software was used. Means and standard deviations were calculated using the MEANS procedure, while in the analysis of variance the GLM procedure was used. Detailed comparisons between object means were conducted using the LSD test. In statistical models the following effects were considered: origin of cows, year, age and season of first calving.

Results and discussion

Table 1 presents mean body weight and average results of conformation scoring for limousine cows at the age of their first calving. Mean body weight of animals and height at the withers, the sacrum and girth's circumference were 568.9 kg, 132.1, 135.9 and 192.7 cm, respectively. In the study by STANEK et AL. (2007) the population of pure-bred primiparous limousine cows had the height at the withers of 126.6 cm and height at the sacrum of 132.8 cm, while mean girth's circumference in those animals was 184.8 cm. In our study in the body conformation scoring in a 100-point scale the population of animals received 80 points. LITWIŃCZUK and SZULC (2005) reported that

Table 1. Mean body weight and average conformation scores of limousine cows at the age of their first calving

Tabela 1. Średnia masa ciała oraz przeciętne wyniki oceny budowy krów rasy limousine w wieku ich pierwszego wycielenia

Trait	N	Min	Max	\bar{x}	SD	CV
Body weight	38	510.0	610.0	568.9	25.0	4.4
Height at the withers	38	126.0	139.0	132.1	3.8	2.9
Height at the sacrum	38	128.0	140.0	135.9	3.4	2.5
Girth's circumference	38	184.0	199.0	192.7	4.5	2.3
General appearance (constitution, type), max. 15 points	38	12.0	14.0	12.3	0.5	4.4
Head and neck, max. 5 points	38	3.0	4.0	3.9	0.2	6.9
Forequarters (depth, width), max. 15 points	38	12.0	14.0	12.6	0.5	4.2
Barrel (back, loins, abdomen), max. 15 points	38	12.0	14.0	12.7	0.5	4.1
Rump (sacrum, pelvis, shape), max. 20 points	38	15.0	17.0	16.0	0.3	2.0
Limb locomotion, max. 10 points	38	7.0	9.0	8.1	0.5	6.8
Performance parameters, max. 20 points	38	16.0	17.0	16.9	0.2	1.6
Total score, max. 100 points	38	80.0	86.0	82.8	1.3	1.6

the conformation standard and body weight standard of Limousine cattle assumes that cows should weigh 650-800 kg and reach height at the withers of 137 cm. The barrel in animals of this breed is long, the skeleton should be delicate and the head is of medium size. Animals should also exhibit good fleshiness of the back and rump sections. In the study by PILARCZYK and WÓJCIK (2007) the cows of the five beef breeds (red angus, salers, hereford, limousine and simmental) managed under the same conditions in north-western Poland, had similar body weights after each calf weaning. Similar results were obtained by SZABOLCS et AL. (2007). ARANGO et AL. (2002) showed that limousine cows, as well as other continental European breeds tended to be heavier than breeds of British origin.

Table 2 contains results concerning the effect of the country of origin of primiparous cows on body weight and conformation score. The conducted analysis showed only two statistically significant dependencies between the origin and analysed factors. They were

Table 2. The effect of origin on body weight, selected body measurements and conformation score of cows

Tabela 2. Wpływ pochodzenia na masę ciała, wybrane pomiary zoometryczne i ocenę budowy ciała krów

Trait	Significance of effect	Origin							
		Czech Republic				Germany			
		N	\bar{x}	SD	CV	N	\bar{x}	SD	CV
Body weight	*	16	579.3 a	28.9	4.9	22	559.5 a	18.5	3.3
Height at the withers	NS	16	131.8	4.4	3.3	22	132.1	3.5	2.7
Height at the sacrum	NS	16	135.6	4.2	3.1	22	135.9	3.0	2.2
Girth's circumference	NS	16	191.8	4.1	2.1	22	193.1	4.7	2.4
General appearance (constitution, type), max. 15 points	**	16	12.7 A	0.5	4.6	22	12.1 A	0.4	3.3
Head and neck, max. 5 points	NS	16	3.8	0.3	9.1	22	3.9	0.2	5.5
Forequarters (depth, width), max. 15 points	NS	16	12.8	0.5	4.0	22	12.5	0.5	4.0
Barrel (back, loins, abdomen), max. 15 points	NS	16	13.0	0.3	2.9	22	12.6	0.5	4.5
Rump (sacrum, pelvis, shape), max. 20 points	NS	16	16.1	0.3	2.1	22	15.9	0.3	1.8
Limb locomotion, max. 10 points	NS	16	7.9	0.4	5.7	22	8.3	0.5	6.9
Performance parameters, max. 20 points	NS	16	16.8	0.3	2.0	22	16.9	0.2	1.2
Total score, max. 100 points	NS	16	83.4	1.7	2.0	22	82.5	1.0	1.3

* $P \leq 0.05$, ** $P \leq 0.01$, NS – non significant.

Means marked in rows with identical letters differ significantly; large letters: $P \leq 0.01$, small letters: $P \leq 0.05$.

a highly significant effect of origin of cows on their general appearance (constitution, type) expressed in a point scale and a significant dependence between the country where animals had been purchased and their body weight. Cows coming from the Czech Republic received 12.7 points for general appearance, while those from Germany were given 12.1 points. The average body weight of animals from the Czech Republic was by 19.8 kg higher in comparison to the results obtained at the age of first calving by cows coming from Germany. PRZYSUCHA and GRODZKI (2007) analysed the effect of origin of the herd on growth rate of calves and juvenile animals of the limousine breed. Those authors showed a statistically significant dependence between the origin of animals and body weight, as well as weight gains in juvenile animals to the age of 365 days. More advantageous results were found for animals coming from Finland in comparison to Polish cows.

Table 3 presents results of analyses on the effect of calving season on investigated beef performance traits in limousine cows. A dependence was found at significance

Table 3. The effect of calving season on body weight, selected body measurements and conformation score of cows

Tabela 3. Wpływ sezonu wycielenia na masę ciała, wybrane pomiary zoometryczne i ocenę budowy ciała krów

Trait	Significance of effect	Calving season							
		autumn-winter				spring-summer			
		N	\bar{x}	SD	CV	N	\bar{x}	SD	CV
Body weight	**	22	555.4 A	22.8	4.1	16	587.5 A	13.4	2.2
Height at the withers	NS	22	131.2	4.3	3.3	16	133.3	2.7	2.0
Height at the sacrum	**	22	134.7 A	3.8	2.8	16	137.6 A	2.0	1.4
Girth's circumference	NS	22	192.3	4.6	2.4	16	193.1	4.4	2.3
General appearance (constitution, type), max. 15 points	*	22	12.2 a	0.4	3.5	16	12.6 a	0.6	4.9
Head and neck, max. 5 points	NS	22	3.9	0.2	7.5	16	3.9	0.2	6.3
Forequarters (depth, width), max. 15 points	NS	22	12.5	0.5	4.0	16	12.7	0.5	4.5
Barrel (back, loins, abdomen), max. 15 points	NS	22	12.7	0.4	3.5	16	12.8	0.6	4.8
Rump (sacrum, pelvis, shape), max. 20 points	*	22	15.9 a	0.2	1.8	16	16.1 a	0.3	2.1
Limb locomotion, max. 10 points	NS	22	8.1	0.5	7.1	16	8.1	0.5	6.6
Performance parameters, max. 20 points	NS	22	16.9	0.2	1.7	16	16.9	0.2	1.4
Total score, max. 100 points	*	22	82.5 a	1.1	1.3	16	83.4 a	1.5	1.9

* $P \leq 0.05$, ** $P \leq 0.01$, NS – non significant.

Means marked in rows with identical letters differ significantly; large letters: $P \leq 0.01$, small letters: $P \leq 0.05$.

level $p \leq 0.01$ between season of calving and body weight, as well as height at the sacrum. Moreover, a significant dependence was found between the period of calving and total score in conformation trait evaluation in a 100-point scale, while only a significant effect was observed for calving season on the obtained number of points for general appearance and the rump (the sacrum, pelvis, shape). More advantageous scores for analysed traits were recorded for animals which calved in the spring-summer season, which was most probably determined by more effective pasture utilization in that period. WROŃSKI et AL. (2000) found considerably better effects of maternal nursing of bull calves born in the spring-summer than in the autumn-winter season. In the opinion of PRZYSUCHA and GRODZKI (2007), at round-the-clock pasture management beef cows should calve in the first months of the year to be fully prepared to use the pasture after nursing. In turn, LITWIŃCZUK et AL. (2002) when investigating the effect of selected factors on results of maternal nursing of calves in the hereford and limousine breeds showed that the most advantageous calving period for cows is the autumn-winter season, since calves born in that period were characterised by significantly higher rearing levels. Similarly good rearing results of calves born in the autumn-winter season were reported by LITWIŃCZUK et AL. (1999, 2001) and MAKULSKA et AL. (2002). CHOROSZY et AL. (1994) and DOBICKI (1995) were of an opinion that pasture utilization needs to be maximized in the period of calf nursing and an appropriate calving date makes it possible to obtain the best breeding material at the lowest possible costs.

Results concerning the effect of age at first calving on body weight, body measurements and conformation traits of primiparous limousine cows are presented in Table 4. It was shown that age at first calving has a highly significant effect on body weight. The highest body weight (579.3 kg) was recorded for animals which calved for the first time the latest (> 38 months), although it was lowest in those aged 33-38 months at first calving. Means for this trait between analyzed groups of animals differed at significance level $p \leq 0.01$. It was shown that cows of youngest age at first calving (≤ 32 months) were characterised by similar body weights in comparison to animals which calved the latest. In the study by DÁKAY et AL. (2006) age at first calving of the cows limousine were 33.8 months. In the own investigations, it was found that age at first calving had a highly significant effect on the obtained score for general appearance (constitution, type) and limb locomotion as well as a significant effect on the forequarters (depth, width), the barrel (the back, loins, abdomen) and rump (the sacrum, pelvis, shape). For the above mentioned conformation traits the most advantageous results were found for primiparous cows which calved the latest (> 38 months), while the worst for those which age at first calving was 33-38 months. The group of animals calving the earliest (≤ 32 months) received an intermediate number of points for evaluated body parts, for which statistically significant dependencies were obtained. Results of investigations conducted by the authors of this study show the biggest role of optimal body weight, and not age, when making the decision on the service date in heifers. DOBICKI (1998) reported that the minimum body weight of heifers qualified for mating should be 360 kg and if the animal does not reach this weight at the age of 15-16 months of age, then its production cycle has to be extended by approximately 10 months and mating should occur at an age of approximately 25 months. In the opinion of PRZYSUCHA et AL. (2009) the ratio of different calving courses of limousine cows depending on their body weight and condition.

Table 4. The effect of age at first calving on body weight, selected body measurements and conformation score of cows

Tabela 4. Wpływ wieku przy pierwszym wycieleniu na masę ciała, wybrane pomiary zoometryczne i ocenę budowy ciała krów

Trait	Significance of effect	Age at first calving											
		≤ 32 months				33-38 months				> 38 months			
		N	\bar{x}	SD	CV	N	\bar{x}	SD	CV	N	\bar{x}	SD	CV
Body weight	**	8	573.7	15.0	2.6	15	556.0 A	19.9	3.5	15	579.3 A	28.9	4.9
Height at the withers	NS	8	133.1	2.7	2.0	15	131.8	3.9	3.0	15	131.8	4.4	3.3
Height at the sacrum	NS	8	137.7	1.9	1.4	15	135.3	3.2	2.3	15	135.6	4.2	3.1
Girth's circumference	NS	8	195.2	4.9	2.5	15	192.2	4.5	2.3	15	191.8	4.1	2.1
General appearance (constitution, type), max. 15 points	**	8	12.3	0.5	4.1	15	12.0 A	0.2	2.1	15	12.7 A	0.5	4.6
Head and neck, max. 5 points	NS	8	3.8	0.3	9.1	15	4.0	0.0	0.0	15	3.8	0.3	9.1
Forequarters (depth, width), max. 15 points	*	8	12.6	0.5	4.1	15	12.4 a	0.5	4.1	15	12.8 a	0.5	4.0
Barrel (back, loins, abdomen), max. 15 points	*	8	12.8	0.6	4.9	15	12.5 a	0.5	4.1	15	13.0 a	0.3	2.9
Rump (sacrum, pelvis, shape), max. 20 points	*	8	16.0	0.0	0.0	15	15.8 a	0.3	2.2	15	16.1 a	0.3	2.1
Limb locomotion, max. 10 points	**	8	8.1	0.6	7.8	15	8.4 A	0.5	6.1	15	7.9 A	0.4	5.7
Performance parameters, max. 20 points	NS	8	16.8	0.3	2.1	15	17.0	0.0	0.0	15	16.8	0.3	2.0
Total score, max. 100 points	NS	8	82.6	1.4	1.7	15	82.5	0.8	1.0	15	83.4	1.7	2.0

* $P \leq 0.05$, ** $P \leq 0.01$, NS – non significant.Means marked in rows with identical letters differ significantly; large letters: $P \leq 0.01$, small letters: $P \leq 0.05$.

Conclusions

1. The results showed a highly significant effect of origin of cows on their general appearance (constitution, type) and a significant dependence between the country where the animals had been purchased and their body weight. The most advantageous results were recorded for cows coming from the Czech Republic.

2. A dependence was shown between calving season and: body weight, height at the sacrum and total score in conformation evaluation using a 100-point scale. More valuable results of the analysed traits were recorded for animals which calved in the spring-summer season, which was probably determined by better utilization of pasture in that period.

3. It was found that age at first calving has a highly significant effect on body weight and scores for general appearance (constitution, type) and limb locomotion, and it has a significant effect on forequarters (depth, width), hindquarters (back, loins, abdomen) and rump (sacrum, pelvis, shape). However, results collected within this study suggest that the most significant factor determining the date of service for limousine heifers is their body weight and not age.

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WPLYW WYBRANYCH CZYNNIKÓW NA MASĘ CIAŁA ORAZ OCENĘ BUDOWY KRÓW RASY LIMOUSINE

Streszczenie. Celem pracy było zbadanie wpływu pochodzenia, wieku i sezonu na masę ciała i cechy budowy krów rasy limousine przy pierwszym wycieleniu. Stwierdzono wysoce istotną zależność między pochodzeniem krów a ich wyglądem ogólnym (konstytucja, typ) oraz istotną między krajem zakupu zwierząt a masą ich ciała. Najkorzystniejszymi wynikami charakteryzowały się krowy pochodzące z Czech. Wykazano wpływ sezonu wycielenia na: masę ciała, wysokość w krzyżu, sumaryczną liczbę punktów w ocenie cech budowy w skali 100 pkt. Wartościowszymi rezultatami analizowanych cech charakteryzowały się zwierzęta, które cielili się w sezonie wiosenno-letnim, najprawdopodobniej było to uwarunkowane lepszym wykorzystaniem pastwiska w tym okresie. Stwierdzono, że wiek przy pierwszym wycieleniu wpływa wysoce istotnie na masę ciała oraz ocenę: wyglądu ogólnego (konstytucja, typ), nóg i chodu oraz istotnie na: partię przodu (głębokość, szerokość), tułowia (grzbiet, lędźwie, brzuch) oraz zadu (krzyż, miednica, kształt). Jednak uzyskane wyniki badań własnych sugerują, że najistotniejszym czynnikiem decydującym o terminie krycia jałówek rasy limousine jest ich masa ciała, a nie wiek.

Słowa kluczowe: bydło limousine, masa ciała, ocena budowy

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