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COMPARATIVE STUDIES OF REPRODUCTIVE AND MEAT PERFORMANCE OF THE LOCAL BREED OF POLISH RED CATTLE AGAINST THE BACKGROUND OF THE LIMOUSINE BREED OF POLISH AND FRENCH HERITAGE

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Abstract. The aim of the study was to compare of the reproductive and meat performance of meat breeds, such as the local Polish Red cattle and the Limousine cattle breed, which is dominant in Poland. The examined individuals of the Limousine breed, which were divided into two groups depending on the origin of the parents, the so-called Polish and French. The criterion for assigning the animals to the group of Polish origin was that the tested bulls did not have in their pedigree a descendant of the French line for two generations. Three groups of fatteners with 138 Polish Red bulls and 447 French and 478 Polish Limousin bulls were used to assess meat performance. All animals were kept in an extensive production system, using the pasture at will throughout the year, during the so-called peak season. At the end, they were fed additionally with haylage and concentrated feed. Reproductive parameters (type of calving and viability of calves) were assessed in 348 Polish Limousin cows, 367 French cows and 289 Polish Red cows. Calves were observed and measured throughout their life cycle from birth to slaughter. In the assessment of the utility value of meat, reference features were taken into account, e.g. body weight after calving, body weight at 210 and 420 days of age and gains, height at withers and chest circumference, and conformation assessment. The PRC group showed significantly greater ease of calving and vitality of calves compared to both groups of limousines. Calf and adult body weight measurements at 210 and 420 days were significantly higher in French Limousine cattle. Differences in body weight and gain were significant. There was a slight difference in height between Polish and French bulls. Native breed cattle were characterized by very good reproductive parameters and satisfactory meat performance characteristics in relation to the use of grassland fodder. Beef producers can be successfully recommended to use Polish Red cattle for meat purposes in an extensive production system.

Key words: polish red cattle, Limousine, calving, vitality, calf, fattening.

INTRODUCTION

A key role in beef cattle herds is played by the reproduction and rearing of calves. The tradition of using beef cattle in Poland is about 40 years old. The Limousine breed currently dominates the population of beef cattle in Poland. Since 2017, more and more breeders of native Polish Red

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cattle are switching from dairy cattle breeding to only beef cattle. The aim of beef cattle breeding is economically effective meat production based on the most rational methods of feeding and keeping (Barwick et al. 2018). In the context of economic efficiency and consumer preferences, this type of cattle use poses great challenges to breeders. This goal can be achieved through the implementation of breeding programs aimed at improving the fattening value (higher daily gains, higher feed conversion ratio, better degree of musculature) and improving the carcass value (higher slaughter yield, higher proportion of meat, lower proportion of fat and bones in the carcass, better quality meat, higher evaluation of the degree of musculature and lower fatness when evaluating half-carcasses using the EUROP system) (Terry et al. 2020).

Slaughter efficiency is the basic criterion for evaluating the value of meat performance and an indicator of the possibility of obtaining the most valuable culinary meat and processing elements from the carcass (Clinquart et al. 2022). These features are determined by the working type, breed, sex and age of the animals (Sakowski et al. 2022). In Poland, body weight (standardized) is measured at 210 and 420 days of age and the thickness of the longissimus dorsi muscle (Nogalski 2003). The breeder should focus primarily on the elements of the production system that affect the economics of beef cattle breeding. Problems related to the reproductive performance of animals play a fundamental role in the beef cattle population. The effectiveness of breeding work is evidenced by the proper maintenance of reproduction at an appropriate level, and these are such features as: breed, health, the course of conception and childbirth, and the calving season (Moorey and Biase 2020). According to Orihuela and Galina (2021), reproduction and rearing of calves as well as factors reducing labour input play a key role in meat herds. For the first time in 1994–1995, the Beef Cattle Breeding Development Program in Poland was developed, which was adopted by the Ministry of Agriculture and implemented in breeding practice (Bał-Filipek 2021). One of the main tasks presented was to expand breeding of pure beef breeds for the production of breeding material. In the first period, breeders developing beef cattle breeding received a subsidy for the purchase of breeding animals – heifers and imported cows. State financial aid resulted in an influx of imported purebred farm animals. Beef cattle breeding in Poland began to develop dynamically, despite the liquidation of the state subsidy in 2006. Established in 1995, the National Association of Beef Cattle Breeders, and since 2003, the Polish Association of Beef Cattle Breeders and Producers (PABCBP) was tasked with, among others, keeping herd books, assessing the performance value of animals and selecting breeding material. President Wilson's words, as a passionate breeder, are telling that only this nation deserves state independence that has bred at least one breed of farm animals. In Poland, under the protection of genetic resources, we have four breeds of cattle with the type of dairy or bi-directional use, i.e.: milk and meat – Polish Red (protected since 1999), White-Backed (since 2003), Polish Red-and-White (since 2006) and Polish Black-and-White (since 2007) (Litwińczuk et al. 2015). The oldest of them is Polish Red cattle, commonly kept for milk production (Majewska 2019). However, individuals of this breed are not distinguished by such a high milk yield as cows of the Holstein Friesian breed. The population of Polish Red cattle in Poland is 4108 (as of December 2022, data from the Institute of Animal Production in Balice Kraków), with a noticeable growth trend in the last decade. Polish Red cattle is undoubtedly an indigenous breed. It is characterized by high resistance and excellent adaptation to difficult environmental conditions in the foothills and mountains, but it is also very popular among breeders from other regions of the country (Majewska and Jakiel 2019). In addition, animals of this breed have a number of biological properties of great economic importance, such as good fertility, light births, high viability of calves and a higher survival rate than in other breeds (Szarek et al. 2004). Polish Red cattle are characterized by a very good use of farm fodder (especially dry roughage in the winter, and pasture grass in the summer) and indiscretion in their selection. In addition, it is resis-

tant to infectious diseases (tuberculosis, brucellosis, mastitis). According to Adamczyk et al. (2008) and Gajos and Dymnicki (2012) Polish Red cattle provide not only milk, but also excellent quality meat. It is undeniable that the meat of this breed is characterized by delicacy, proper marbling and juiciness (Choroszy and Choroszy 2005). The above-mentioned meat quality features are also characteristic of outstanding beef cattle breeds; therefore, they can be used to develop a new direction of use, which is the meat direction for breeds used in two directions. The direction of meat use of local breeds of cattle in recent decades has been forgotten and few agricultural producers paid attention to the good meat characteristics of these breeds. Meanwhile, it is a great advantage and untapped potential. Due to the relatively low milk yield, cows of these breeds can be used as wet nurses. Drawing our attention to this direction of use can increase the attractiveness of old cattle breeds and contribute to increasing their population. Such an effect can be achieved especially in relation to the Polish Red breed. Farmers keeping cattle of this breed indicate that the meat direction of use may be the future of breeding Polish native breeds of cattle. This is not surprising if one remembers that it is the southern varieties of this breed that have clearly marked meat characteristics, and mountain and foothill areas are protected by landscape and intensive agricultural production cannot be carried out in these areas.

Nursery farming is becoming more and more popular and attempts are already being made to use cows of this breed in this way (Gajos and Dymnicki 2012). Currently, this direction has a chance to become an attractive alternative to dairy production. Hence the special interest of scientists together with breeders to create indigenous breeds of beef cattle in Poland. The first breeding of Polish Red cattle for meat purposes was established in 2001 by Rydel together with Prochal on the Rumian farm (Warmia and Masuria region). In the years 2019–2023, as part of its own implementation project, there are already 94 breeders who keep Polish Red cattle only for meat purposes. The most numerous and at the same time the most popular breed of beef cattle in Poland is the Limousine breed, which accounts for 75.8% of the national population. This breed is characterized by a good ratio of meat to fat and bones, a high percentage of culinary elements and, what is very important, it has a light colour and good sensory quality. An important feature is also its great usefulness in obtaining well-muscled individuals, which results in high slaughter efficiency (Joo et al. 2013). The Limousine breed was described in publications from the last century as a medium-sized breed, but today it can be classified as a large breed (PZHiPBM 2016). The body weight of cows is between 650–800 kg with a height at the withers of 137 cm, and bulls 1000–1200 kg with a height at the withers of 145 cm. The body weight of newborn heifers is about 35 kg, and bulls about 40 kg. The ease of calving cows of this breed is also widely promoted, but the results of national observations indicate that all births should be monitored by the breeder. According to French data, 93% of births are considered easy, without the help and assistance of breeders, 5% are births with little help from the staff, and only 2% of births can be classified as complicated. Armengol et al. (2021) claims that cattle of this breed are suitable for rearing in an extensive system in the open air. The cows are characterized by very good fertility (pregnancy index over 95%, caesarean sections occur sporadically), as well as special protectiveness. However, the common opinion of breeders is that heifers and Limousine cows often react aggressively to unfamiliar situations (moving, weighing, veterinary treatments, etc.).

In many publications, a very strong maternal instinct is given as a great advantage of this breed. In addition to the resulting undoubted benefits, there are often problems related to the daily handling of the herd. Cows of this breed often protect their own calves in such a way that they even make it impossible to perform simple zootechnical and veterinary procedures, such as: vaccination, weighing, etc. Muscle hypertrophy, commonly referred to as “big luteus” is common in this breed, due to a mutation in the myostatin coding sequence (Rodgers and Garikipati

2008). Pogorzelska-Przybyłek et al. (2021) indicates that the slaughter efficiency of the crossing Holstein-Friesian cows with Limousine bulls for the five most valuable primary cuts (including shoulder, front rib, prime rib, loin, round) was 63.31; 64.3 and 67.29%, respectively for steers, heifers and bulls. In the case of the Limousine breed, both young and old animals had a very good slaughter performance.

MATERIAL AND METHODS

The studies were carried out on live animals in accordance with the relevant guidelines of Directive 2010/63/EU in Europe and because no activities interfering with animal welfare were performed without the need to obtain the approval of the ethics committee. This study was part of the “Implementation Doctorate” program of the Ministry of Science and Higher Education DWD/3/53/2019 in cooperation with the Polish Association of Beef Cattle Breeders and Producers in 2019–2023, the project initially described in Wiśniewski and Kuczyńska (2022a), whose aim was the development of a meat utility model for the local breed of Polish red cattle. Purebred farms representing three different beef cattle farms in extensive production systems were selected. Traditional farms were characterized by the presence of free-range animals and grazed on pastures and fed with local fodder (mainly hay and concentrates). All animals were kept in an extensive production system, used free-range pastures throughout the year, and were finally fed a ration based on previous studies (Wiśniewski et al. 2021) composed of grass silage, hay, and concentrates. Calving in the studied herds was spring (March/April), calves were kept with suckler cows for 7 months, then in early winter they were weaned and fed with fat for up to 24 months. Cattle on each farm were measured and weighed monthly during the experiment, and only one herd was visited daily. The research was carried out on offspring, which allowed for a more accurate assessment of the working value of individuals used for breeding for further breeding. Together with PABCBP, ten farms were selected for the study, where the following are kept: Polish Red cattle (PRC); Limousine cattle with a bull of Polish origin (LIM PL); Limousine cattle with a bull of French origin (LIM FR). The research included evaluation of reproductive performance and evaluation of meat performance. The assessment of reproductive performance consisted in determining for each female in the herd: the type of delivery by qualifying it to the appropriate category, the vitality of the calf born by qualifying it to the appropriate category. The type of calving and calf vitality were assessed on the basis of tables developed by the National Research Institute of Animal Production in Balice (Poland) (Tables 1 and 2).

Table 1. Type of calving

Type of calving	Code
Easy, done by the forces of nature without human help	1
Easy, with little human or mechanical assistance	2
Difficult with the help of 2 or more people, the use of mechanical means of the intervention of a veterinarian	3
Caesarean delivery	4
Embryotomie	5
Miscarriages	6

Table 2. Vitality of calf

Vitality of calf	Code
Living body, without structures defects	1
Living body, with structural defects	2
Dead at birth or dead within 24 hours of birth	3
Calf monstrosity	4

The evaluation of the meat performance of cattle was carried out in accordance with the regulations for the evaluation of the performance value of beef cattle (2016). For the meat evaluation studies, the research material consisted of 942 calves of Limousine bulls, 492 of Polish origin and 450 of French origin, as well as 138 of Polish Red bulls and heifers, which were subject to breeding evaluation only. Limousine cows: 348 of Polish origin, 367 of French origin and 289 of Polish Red, were the research material for the reproductive evaluation study. Calves from the above-mentioned parents were observed and measured throughout the life cycle from birth to slaughter in the years 2019–2023, 1004 individuals were tested in total, and the numbers of measurements were 57.228 records. The assessment of meat performance included the determination of the degree of musculature and development of the animal, the rate of body weight gain. Determination of the degree of musculature and development of the animal was made on the basis of a visual assessment of the animal's build, consisting in the assessment of individual conformation features on a 100-point scale. In bulls, visual assessment of the animal's conformation was performed after weighing at 420 days of age. Determination of the rate of weight gain consisted in determining the weight of the animal in the following periods of its life: from the 1st day of birth to 48 hours. after birth, for the second time between 165 and 255 days of age, and then between 375 and 465 days of age – for bulls. Then, the standardized body weight of the animal was calculated on the 210th day of life and on the 420th day of life. The calculation of the standardized body weight of the animal (MCS) for a specific day of its life was made according to the formula:

$$MCS = [(MCB - MCU)/WW] \times WS + MCU$$

where:

MCS – standardized animal body weight [kg],

MCB – mean body weight of the animal at the actual weighing [kg],

MCU – actual body weight set for 48 h, at birth [kg],

WW – mean age of the animal at the weighing [days],

WS – standardized age of the animal [s].

Calculations of the average daily weight gain of the animal in the periods from the 1st day to the 210th day of life and from the 210th to the 420th day of life were also included. Calculation of the average daily weight gain of the animal (PDMC) was made according to the formula:

$$PDMC = (MCK - MCP) \times [1000/(WK - WP)]$$

where:

PDMC – mean of the increase in daily body weight [g],

MCK – final body weight of the animal on the weighing day [kg],

MCP – initial body weight of the animal at the weighing [kg],

WK – mean age of the animal at the final weighing [days],

WP – mean age of the animal at the initial weighing [days].

The assessment of conformation was made on individuals up to 24 months of age. The conformation of the animal was determined by 19 linear features characterizing musculature, bone, functional features and additional features. Muscle assessment included the following parts of the animal's body: width between the shoulder blades, width of the back, thickness of the back-muscle x 2, arching of the thigh muscles, length of the thigh muscles and width of the croup. The functional features included: the posture of the forelegs, the width of the snout, the line of the back and the posture of the hind legs. However, when evaluating the skeleton, the following were considered: calibre, overshoot circumference, chest width, chest depth, back length, rump length and hip width. Additional features: ischia width and condition assessment of the animal. Each of the features was assessed on a scale of 1–10 points, with an optimum of 10 points, except for the circuit of overvoltage and condition, where the adopted optimum is 6 points. Appropriate weights assigned to a specific group of features, i.e., 0.50 for musculature, 0.30 for skeleton and 0.20 for functional features, do not change.

$$OPZ = 0.50 \times OM + 0.30 \times OK + 0.20 \times OF$$

where:

OM – sum of points after transformation for musculature,

OK – sum of points after bone transformation,

OF – sum of points after transformation for functional features.

The obtained data were processed using statistical methods using the SPSS 29.0 package using the GLM, CORR procedure. Significance of differences between the groups was determined based on multivariate analysis of variance. Factors such as year of calving, season of calving, breed and paternal group were considered in the model.

$$Y_{ijk} = \mu + A_i + B_j + C_k + e_{ijk}$$

where:

Y_{ijk} – measurement of a given feature,

A_i – year of calving effect,

B_j – breed,

C_k – paternal group,

e_{ijk} – random error,

μ – overall average.

Recording model for bulls. Check whether the effect on growth characteristics is additionally calves by multiple regression. As part of the scientific objective of the work, linear regression was used to check changes in the average values of the analyzed traits in individual years of birth of calves according to the formula:

$$Y = a + b \cdot x$$

where:

Y – average value of the tested feature,

a – feature size change,

b – regression coefficient,

x – year of birth of the calf.

In suckler herds participating in the performance assessment scheme from birth for weaning, where the performance characteristic is body weight corrected for day 210, the following calculation method is recommended (ICAR 2018):

At – age at the time of weighing, expressed in days,

Wt – body weight expressed in kilograms,

WB – estimated birth weight or breed standard.

Then the usability rating is calculated as:

$$RW = ((W_t - W_B)/A_t) \times 200 + W_B$$

RESULTS

Tables 3 and 4 present a comparison of the type of farrowing and viability of calves in Polish Red Limousine cows of Polish and French origin. Due to the autochthonous characteristics, Polish Red cattle are characterized by light births and high viability of calves, which was confirmed in the study. In the conducted research, this breed was characterized by higher parameters of ease of delivery and vitality of calves in relation to the Limousine breed (Table 3). In turn, Limousine cows of French origin were characterized by a greater ease of calving than cows of Polish origin, while Limousine cows of Polish origin were characterized by higher vitality of calves.

Table 3. Comparison of the calving type in cows Polish Red cattle and Limousine of Polish and French heritage

Calving type code	Polish Red [N]	Limousine Polish [N]	Limousine French [N]
1	287	323	346
2	1	15	12
3	0	4	3
4	0	2	3
5	0	0	0
6	1	4	3

Table 4. Comparison vitality calf of Polish Red, Limousine Polish and French

Calving type code	Polish Red [N]	Limousine Polish [N]	Limousine French [N]
1	289	344	363
2	1	0	0
3	0	2	2
4	0	0	1

Table 5 presents the birth weights of Polish Red, Polish Limousine and French Limousine calves and at the age of 210 and 420 days for bulls. The study covered exclusively male calves intended for further fattening. The birth weight of the calf should be 7–9% of the weight of an adult cow. Polish Red cows are of smaller calibre compared to Limousine mothers. The lowest birth weight was found in Polish Red calves (30.72 kg) and was significantly lower than calves from Limousine bulls. Differences for Limousine calves were significant and lower by 8.36 and 9.31 kg for Lim PL and Lim FR, respectively. All of the calves in the experiment were born during the winter months of December to March. The time of birth has a significant impact on the vitality and growth rate of reared calves, directly affecting the economic effects of rearing. The average weight of calves at birth: 34.7 kg, and 210 days – 239.7 kg. Imported Limousine herd with an average calf weight at birth of 38–39 kg (min. 28 to max. 41 kg). The average weight of the calves at weaning during the calving period ranged from 255 to 274 kg.

Table 5. Comparison of birth weight at 210- and 420-days bulls of Polish Red, Limousine Polish and French origin

Breed	Birth weight [kg]	Body weight at 210 days [kg]	Body weight at 420 days [kg]
Polish Red	30.72 ^{AB}	212.29 ^{AB}	302.95 ^{AB}
Limousine Polish	39.08 ^{Ac}	284.86 ^{Ac}	537.41 ^{Ac}
Limousine French	40.03 ^{ABc}	297.60 ^{ABC}	553.11 ^{ABC}

A, B, C Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.01$ in the post hoc analysis.

a, b, c Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.05$ in the post hoc analysis.

Table 6 includes a list of daily origin and standardized body weight for 210 and 420 days of Polish Red, Limousine bulls of Polish and French heritage. The lowest start falls on the 210th and 420th day for Polish Red cattle, therefore these values are attributed to Limousine bulls of French origin. The 210-day standardized body weight of Polish Red bulls was 233.26 kg, which was lower by 48.36 kg compared to Limousine bulls of Polish origin and by 53.85 kg for Limousine sires of French origin. The highest standardized body weight for 420 days was also found in Limousine bulls of French origin and it was 17.45 kg higher than Limousine bulls of Polish origin and 152.22 kg higher than Polish Red bulls.

Table 6. Comparison of daily gain and standardized body weight for 210- and 420-days bulls of Polish Red, Limousine Polish and French origin

Breed	PDMC from birth to 210 days of age [g]	PDMC from birth to 420 days of age [g]	Standardized body weight at 210 days [kg]	Standardized body weight at 420 days [kg]
Polish Red	900.54 ^{AB}	880.04 ^{AB}	233.26 ^{AB}	397.13 ^{AB}
Limousine Polish	1154.98 ^{Ac}	1196.32 ^{Ac}	281.62 ^{Ac}	531.90 ^{Ac}
Limousine French	1176.50 ^{ABc}	1257.41 ^{ABc}	287.11 ^{ABc}	549.35 ^{ABc}

A, B, C Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.01$ in the post hoc analysis.

a, b, c Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.05$ in the post hoc analysis.

Table 7. Comparison of chest circumference, height at the withers and evaluation of conformation (muscles, bones, functional features) bulls of the Polish Red, Limousine Polish and French origin

Breed	Chest circumference [cm]	Height at the withers [cm]	Musculature	Skeleton	Functional features	Overall rating
Polish Red	150.4 ^{AB}	98.77 ^{AB}	73.6 ^{AB}	73.5 ^{AB}	73.3 ^{AB}	73.5 ^{AB}
Limousine Polish	196 ^{Ac}	127 ^{Ac}	78.4 ^{Ac}	78.2 ^{Ac}	78.5 ^{Ac}	78.4 ^{Ac}
Limousine French	205 ^{ABc}	130 ^{ABc}	81.6 ^{ABC}	81.2 ^{ABC}	81.4 ^{ABC}	81.4 ^{ABC}

A, B, C Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.01$ in the post hoc analysis.

a, b, c Least-square means within a country origin with same superscript letters in the same row indicate pairwise differences at $p < 0.05$ in the post hoc analysis.

Table 7 presents a comparison of chest circumference, height at the withers and evaluation of conformation (muscles, bones, functional features) of the Polish Red, Limousine of Polish and French origin. Limousine bulls showed a larger chest circumference than Polish Red bulls.

DISCUSSION

Body weights at 210 and 420 days, 296.52 kg and 554.47 kg, respectively, also favoured French Limousine sires (Wiśniewski and Kuczyńska 2022b). Sablik et al. (2018), describing a herd of purebred imported Limousines, found that the birth weight of the bulls was 39.0 kg, while the body weight at the age of landing (210 days) averaged 251.0 kg. This trend was not observed in our research. According to the observations of Liu and Makarechaian (1993), calves that are heavier at birth perform better and end up rearing at a higher body weight, which is the main goal of breeders, but results in calving problems. Previously, Wiśniewski and Kuczyńska (2022b) found that the average at the age of 210 days was 230.3 kg, which was similar to that reported by other Polish researchers. In an earlier study, Wiśniewski and Kuczyńska (2022b) found that the average birth weight of Limousine calves of both sexes from an intensive production system was 34 kg at birth, which was significantly lower. According to many studies, among all the factors that determine the birth weight of calves are breed, genotype, sex, type of calving and calving time (Bartoň et al. 2003; Johanson and Berger 2003; Alberti et al. 2005; Nogalski et al. 2018; Pilarczyk et al. 2022). Limousine calves from French bulls were heavier by 0.95 kg compared to Polish ones. López-Paredes et al. (2018) indicate that the season of birth significantly affects the growth of reared calves. With regard to the measurement of linear features, especially the height at the withers, the lowest values were found for Polish Red bulls. Pogorzelska et al. (1998) reported that Limousine cattle were imported on the basis of a ruling that the daily weight of Limousine bulls from birth to weaning was over 1000 g. The largest chest circumference of 205 cm was found in Limousine bulls of French origin and was 54.6 cm larger than in Polish Red bulls. Domestic bulls had the lowest height at the withers, 98.77 cm, which is 28.23 cm lower than the bulls of the Polish Limousine and 31.23 cm lower than the bulls of the French Limousine. Conformity assessment of all bull groups performed on day 420 of weighing. The Limousine bulls of French origin were rated the highest, and the Polish Red bulls the lowest. Also, the same group was characterized by the best musculature, bone and functional characteristics. The seasonality of calving in beef cattle breeding herds is significant due to the regularity of calving, which allows for obtaining excellent quality livestock in the future at the lowest rearing costs (maximum use of pastures). The mating period and the resulting calving time should not be longer than 2–3 months. Beef cows kept on pasture all year round should produce offspring, preferably at the end of winter. At the end of the first milking period, calves born during this period are ready to take full advantage of the pasture, resulting in a rapid increase in the index, healthy and well-developed calves and the lowest rearing costs for the farmer. French data (Institute de L'Élevage 2021) show that the average birth weight of bulls was 43.4 kg and 295 kg at the age of 210 days, while for heifers the average birth weight was 41.1 kg and 268 kg at the age of 210 days. Przysucha (2009) found that an exciting, but still not fully understood, factor that influenced calf body weight at birth, and thus the frequency of difficult births, was geographic location. Heavier calves are born in harsher, cooler climates than calves born in mild and warm temperatures. An example was an experiment conducted in the United States in which a herd of Hereford cows was moved from the warm climate of Florida to the harsh conditions of Montana. A second related herd of Hereford cows has been shifted in the opposite direction. The average weight of calves born to cows moved from a cold to a warm climate decreased from

40.5 to 32.0 kg, and the weight of calves born to cows moved from a mild to a harsh environment increased from 33.0 to 38.5 kg (Ritchie and Anderson 1994). Many authors have shown a significant effect of birth weight on weaning at 210 days. Calves with the highest birth weight tend to have the highest body weight at the end of the rearing period (Johanson and Berger 2003). The Polish Association of Beef Cattle Breeders and Producers in the assessment for 2021 reported that the birth weight of the heifer was 35.7 kg, while the bull was 38.8 kg. After birth to a Polish father, the average body weight of bulls was 39.08 kg and was 0.95 kg ($p \geq 0.01$) lower than that of males of French origin (Wiśniewski and Kuczyńska 2022b). A similar situation was observed in the case of Polish red bulls, where body weight in our own research was lower than in the available statistics. In the case of Limousine bulls, the body weight for 210 days in our own research was higher by an average of 9 kg compared to the data from Polish Federation of Beef Cattle Breeders (PFBCB), while in the case of Limousine bulls of French origin, the values were comparable to the data from the Institute de L'Élevage, and in the case of Polish bulls the values for the Polish Red breed were also comparable to the data from PFBCB. The daily gain for 210 days in the case of Limousine bulls of Polish origin was comparable in our research with the PFBCB data, while higher values were obtained in Polish Red bulls, where in our research the difference was 56.46 g.

CONCLUSION

Significantly greater ease of calving and vitality of fattening calves compared to Limousine has been confirmed by observations. To create a separate line of beef cattle, a pasture breed fed with a native breed should be recommended, characterized by high health and economically satisfactory daily gains compared to the use of fodder. It has been shown that the Polish Red breed is perfect for extensive farms with access to meadows and pastures, where smaller-calibre cattle of this breed make better use of fodder compared to the Limousin breed. Native breed cattle have satisfactory reproductive parameters, but significantly lower performance characteristics of meat in comparison with typical beef cattle of the Limousin breed. Beef producers with small and medium-sized farms can be successfully recommended to use Polish Red cattle for meat purposes, taking into account the simplification of the procedure for assessing the utility value of meat to basic parameters without the need to measure as many as 19 linear features.

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BADANIA PORÓWNAWCZE UŻYTKOWOŚCI ROZPŁODOWEJ I MIĘSNEJ LOKALNEJ RASY BYDŁA POLSKIEGO CZERWONEGO Z RASĄ LIMOUSIN POCHODZENIA POLSKIEGO I FRANCUSKIEGO

Streszczenie. Celem pracy było porównanie użytkowości rozrodczej i mięsnej ras mięsnych, takich jak miejscowe bydło rasy polskiej czerwonej oraz dominująca w Polsce rasa bydła limousine. Badane osobniki rasy limousine podzielono na dwie grupy w zależności od pochodzenia rodziców, tzw. polskie i francuskie. Kryterium przydzielenia zwierząt do grupy polskiego pochodzenia było, że buhaje nie miały w swoim rodowodzie potomka linii francuskiej od dwóch pokoleń. Do oceny użytkowości mięsnej wykorzystano trzy grupy opasów liczących odpowiednio 138 polskich buhajów bydła polskiego czerwonego oraz 447 francuskich i 478 polskich buhajów rasy limousine. Wszystkie zwierzęta były utrzymywane w ekstensywnym systemie produkcji, korzystały do woli z pastwiska przez cały rok, a w okresie tzw. finiszu żywiono je dodatkowo sianokiszonką i paszą treściwą. Ocenie parametrów rozrodczości (typ wycieleń i żywotność cieląt) poddano 348 polskich krów limousine, 367 krów francuskich i 289 krów rasy polskiej czerwonej. Cielęta obserwowano i mierzono przez cały cykl życia od urodzenia do uboju. W ocenie wartości użytkowej mięsa brano pod uwagę cechy wzorcowe, m.in. masę ciała po wycieleniu, masę ciała w 210. i 420. dniu życia i przyrosty, wysokość w kłębie i obwód klatki piersiowej oraz ocenę budowy. W grupie bydła rasy polskiej czerwonej wykazano istotnie większą łatwość wycielenia i witalność cieląt w porównaniu z obiema grupami limousine. Pomiarzy masy ciała cieląt i dorosłych osobników w 210. i 420. dniu były znacznie wyższe u bydła limousine pochodzenia francuskiego. Różnice w masie ciała i przyroście były znaczące. Między polskimi i francuskimi buhajami była niewielka różnica wzrostu. Bydło rasy rodzimej charakteryzowało się bardzo dobrymi parametrami rozrodczymi i zadowalającymi cechami użytkowości mięsnej w odniesieniu do wykorzystania pasz z użytków zielonych. Producentom wołowiny można z powodzeniem polecić wykorzystywanie bydła rasy polskiej czerwonej na cele mięsne w ekstensywnym systemie produkcji.

Słowa kluczowe: bydło polskie czerwone, limousine, wycielenie, witalność, cielęta, opas.