

*Tomasz PRZYSUCHA, Marcin GOŁĘBIEWSKI, Jan SLÓSZARZ, Beata KUCZYŃSKA, Kamila PUPPEL, Małgorzata KUNOWSKA-SLÓSZARZ, Aleksandra KALIŃSKA*

## **COMPARISON OF RECORDING RESULTS OF PUREBRED AND CROSSBRED CHAROLAISE CATTLE IN POLAND**

Department of Animal Breeding, Warsaw University of Life Sciences, Poland

**Abstract.** The aim of the study was to compare purebred and crossbred Charolaise cattle in respect to their compliance with the breeding goals and standards adopted by the Polish Association of Breeders and Producers of Beef Cattle. The study was based on data for the years 2002–2015 from the PABPBC and for the years 1996–2001 from the National Center of Animal Breeding (NCAB). The properties that were evaluated were the average weight of cows [kg], average body weight of calves after birth [kg], average daily weight gain of calves from birth to 210 days [g], average body weight of calves at 210 days [kg] and average milk yield of cows [kg]. Gradual decline in the share of the national Charolaise beef cattle population was observed as well as significant decrease in the number of crossbreds with Charolaise breed. The average weight of cows in 2005–2006 amounting to 559.4 and 570.2 kg (for purebred) and 556.6 and 561.1 (for crossbred) meet the breeding standards for cows entered in the initial part of the herd book, which define the minimum weight of Charolaise cows after first calving as 550 kg. The average daily weight gain of calves increased considerably in the last years of analysis. The daily body gain of purebred calves was usually higher in purebred population. The daily gains of heifers and bulls were high and usually exceeded 1000 g. For both populations growing trend of daily body gain could be observed. According to breeding standards, body weight at weaning for both heifer and bull calves were at a medium level. The average weight of bull calves was approx. 20 kg higher than the average weight of heifer calves of the same age in both purebred and crossbred populations.

**Key words:** beef cattle, Charolaise, beef cattle recording.

## **INTRODUCTION**

In Poland, there are currently 15 registered beef breeds which are recorded and evaluated in terms of their breeding value. Herd books and records are kept by the Polish Association of Breeders and Producers of Beef Cattle (PABPBC). The PABPBC breeding goals for the Charolaise breed are maintaining high slaughter parameters, good weight, and easy calving courses as well as maintaining and improving the daily weight gain of calves as an indicator of maternal milk production. The goal for adult cows is a body weight of 850 kg with a height of 135 cm to the sacrum, and for bulls – a body weight of 1300 kg with a height of 145 cm to the sacrum. In the national breeding program for Charolaise cattle, the breeding standards entered in the introductory part of the book include the following: the minimum weight gain from birth to 210 days of age should be 950 g, and the minimum weight after the first calving

should be 550 kg. The share of purebred and crossbred Charolaise cattle in the national beef cattle population is important and in 2015 constituted 10.3%. The aim of this study is to compare selected recorded results of purebred and crossbred Charolaise populations with respect to their compliance to the breeding goals and standards adopted by the PABPBC.

## MATERIAL AND METHODS

Recorded results for purebred and crossbred Charolaise cattle in Poland were analyzed in this study. A comparison in respect to their compliance to the breeding goals and standards adopted by the PABPBC was made. The study was based on data for the years 2002–2015 from the PABPBC and for the years 1996–2001 from the National Center of Animal Breeding (NCAB). The data set included: N – number of animals tested, min. – minimum values of the studied traits, max. – maximum values of the studied traits, average – average values of the studied traits, SD – standard deviation. The studied traits were weight of cows (kg), body weight of calves after birth (kg), daily weight gain from birth to 210 days (g), body weight of calves at 210 days (kg), milk yield (kg).

The standardized animal body weight for a given day in an animal's life was calculated according to the following formula:  $MCS = [(MCB - MCU) / WW] \times WS + MCU$ , where MCS is the standardized animal body weight (kg); MCB is the average body weight of the animal on the weighing day (kg); MCU is the birth body weight (measured within 48 hours post-partum) (kg); WW is average age of the animal when weighed (days); and WS is the standardized age of the animal.

The average daily weight gain of the animal from birth to 210 days of age was calculated according to the formula:  $PDMC = (MCC - MCP) \times 1000 / (WK - WP)$ , where PDMC is the increase in daily body weight (g); MCC is the final body weight of the animal on the weighing day (kg); MCP is the initial body weight of the animal on the weighing day (kg); WK is the age of the animal on the final weighing day (days); and WP is the age of the animal on the initial weighing day (days).

Milk yield in beef cows is expressed in kg of milk in conversion to calf's body weight, according the formula  $WMM210 = McOds (kg) \times 1700 / \text{calf age (days)}$ , where WMM210 is the amount of milk which was used during the 210 day lactation by calf of the initial birth weight of 35 kg, which consumed 10 kg milk / day during the first three months, and 8–9 kg / during 4–8 months; McOds (kg) is the actual weight of the calf at weaning; calf age (days) is the actual age of the calf at the time of weaning.

## RESULTS AND DISCUSSION

Figure 1 presents the quantitative changes of the female purebred and crossbred population of Charolaise cattle in the years 1996–2015. It should be noted that in 2000–2006 the data included both cows and heifers, and since 2007, the data relate only to cows and excluding heifers. One can observe a gradual decrease in the breed discussed in the national cattle population, also shows a significant decrease in the number of crossbreds with Charolaise breed.

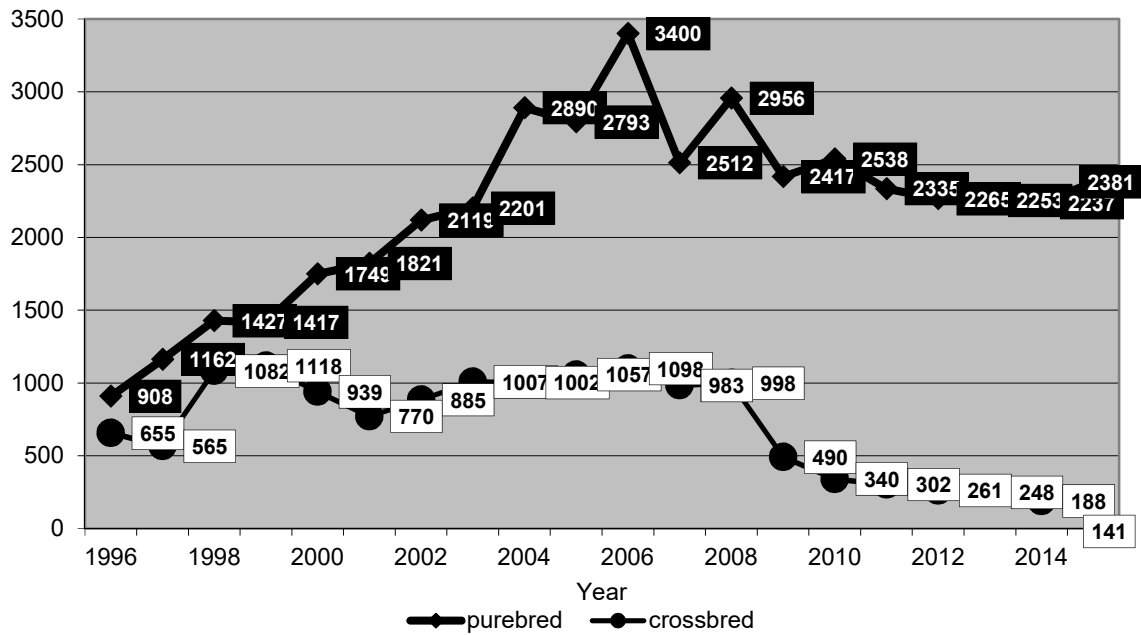


Fig. 1. Changes in Charolaise female population in Poland

The average body weight of purebred and crossbred cows is shown in Fig. 2. The optimum weight of a cow depends mainly on the cattle production system (Fitzhugh 1978; Nogalski et al. 2000; MacNeil 2003; Funston and Deutscher 2004; Drennan 2008).

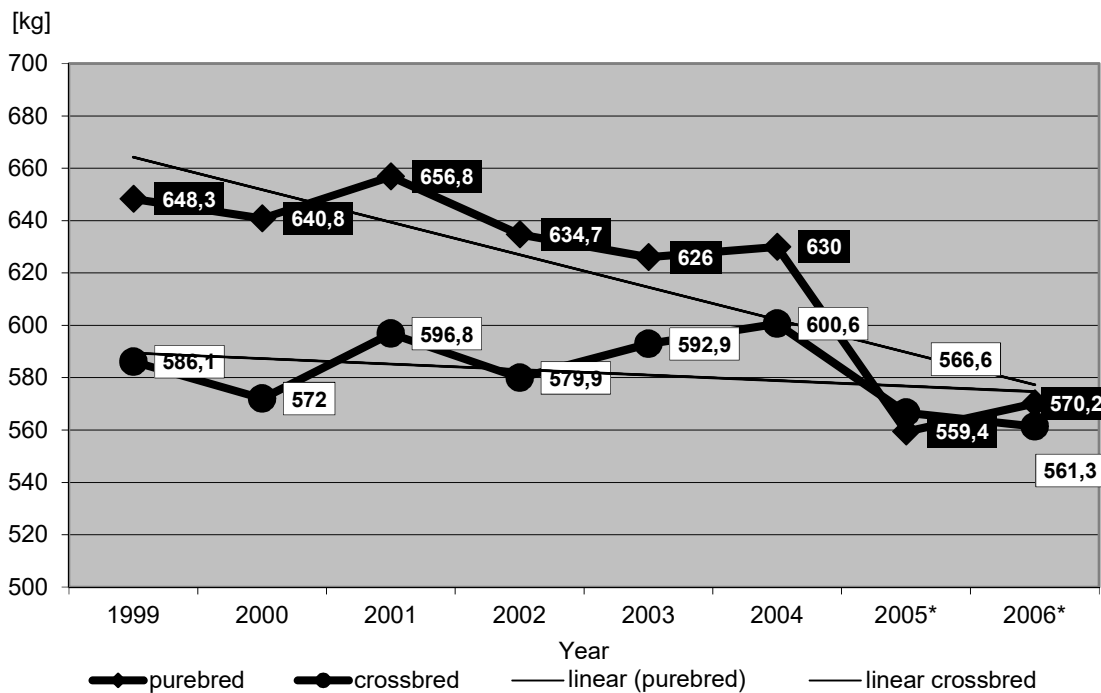


Fig. 2. Average cow body weight  
\*after the first calving.

The genotype and weight of mother cows are always given as two of many factors responsible for the normal growth and development of calves. Many studies have shown that the weight of the cow has a significant impact on calf birth weight, as well as calves' daily

weight gain during rearing (Przysucha et al. 2002b). Therefore, the weight of a cow in adulthood is an important aspect to be considered in breeding programs (Funston and Deutscher 2004). According to the breeding goal given by the PABPBC, the body weight of adult Charolaise cows should be 850 kg. According to breeding standards, the minimum weight after the first calving is 550 kg. The average body weight of adult cows were much smaller than the predefined by PABPBC. Average weight of cows in 2005 and 2006 meet the standards for breeding of cows entered in the initial part of the herd book for both purebred and crossbred populations. It should be noted that the average weight of the cow did not change significantly over 8 years of evaluation of this trait, but rather high standard deviations indicate the wide variety of cows of the breed body weight.

Figures 3 and 4 show the average calf body weight at birth for heifer and bull calves. The birth weight of calves has a significant effect on weaning weight of calves and usually the calf is heavier at birth, the greater the weight at the time of weaning (Przysucha et al. 2002ab). Nogalski et al. (2000) reported a greater mortal rate of small, less vital calves. They also noticed that the mothers of dead calves had been significantly lighter and in worse condition during pregnancy, and consequently created worse conditions for the development of the fetus, and were less prepared to make effort in delivery. The dam genotype had significant influence on calf body weight at birth. Purebred Charolaise cows delivered calves about 2–3 kg heavier than calves from crossbreds ones. For both populations growing trend of cow body weight at birth could be observed. The other authors state the higher data. The average weight at birth of Charolaise calves was 43.32 kg according to Goszczyński et al. (1996), and 43 kg Pogorzelska et al. (1998). The French studies (1996) 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. (2000) only report lower Charolaise calves weight at birth (36.51 kg) than showed by this paper.

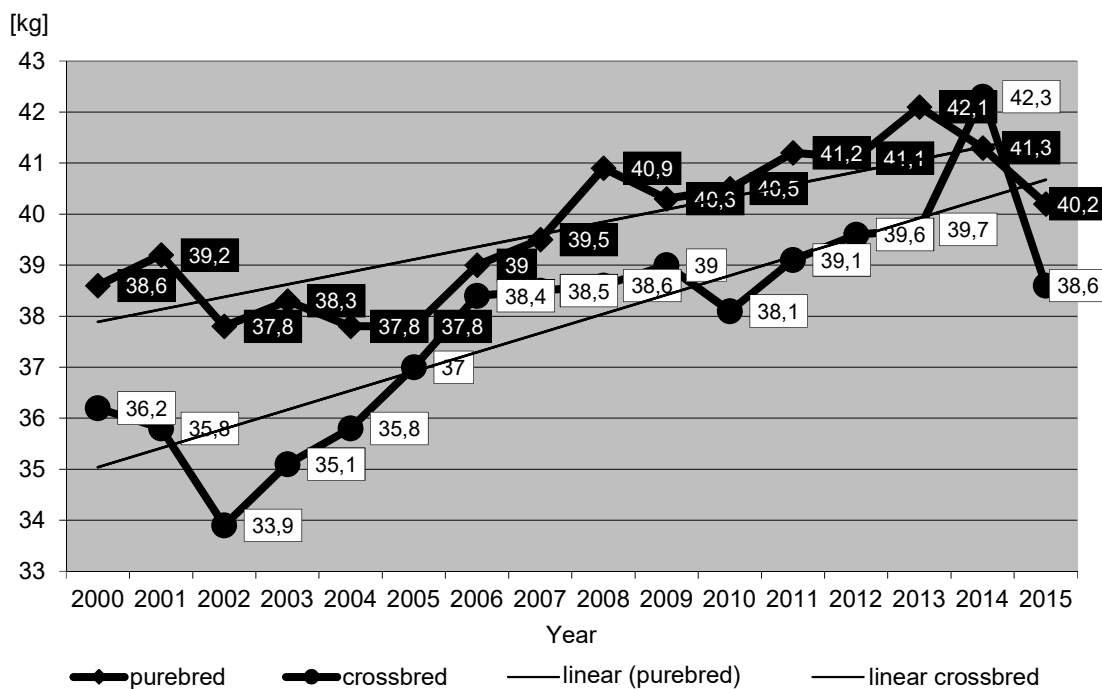


Fig. 3. Average calf body weight at birth (heifer calves)

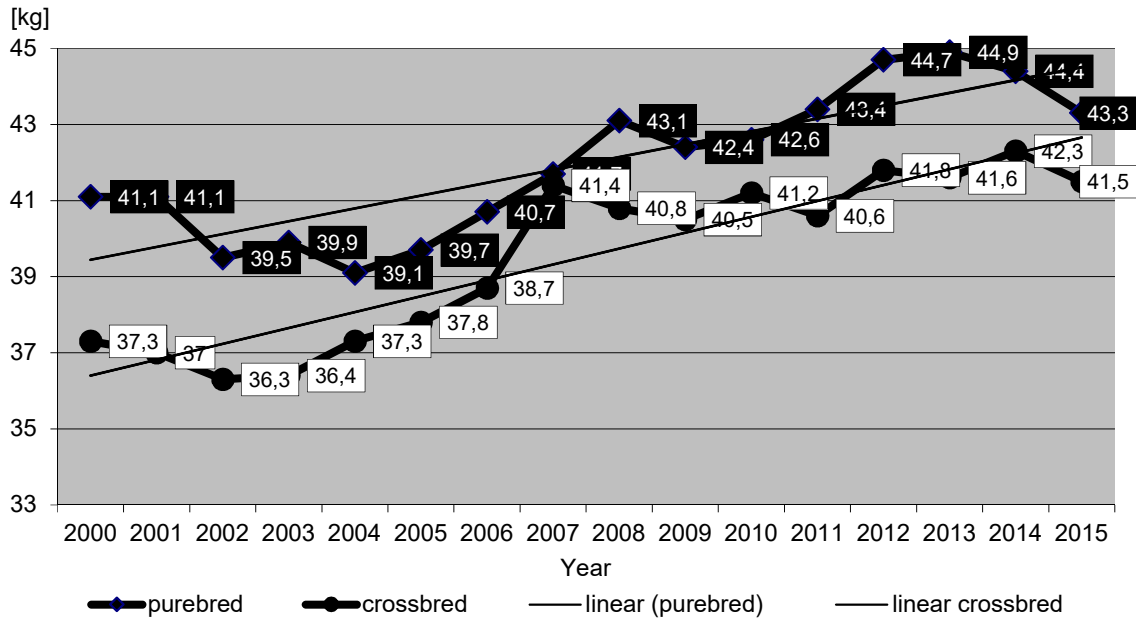


Fig. 4. Average calf body weight at birth (bull calves)

Figures 5 and 6 show the average daily body gain to 210 days of age for heifer and bull calves. It should be emphasized that the average daily weight gain of calves increased considerably in the last years of analysis. The daily body gain of purebred calves was usually higher in purebred population. The daily gains of heifers and bulls were high and usually exceeded 1000 g. For both populations growing trend of daily body gain could be observed. High average daily weight gains of bulls to 210 days of age, at short extra supplementary fattening period of about one month allow to export the animals weighing about 300 kg at a good price. Przysucha et.al. (20021) study showed that the average daily gains of heifers (550–560 g), guarantee obtaining at 15 months of age body weight allowing the commencement of breeding.

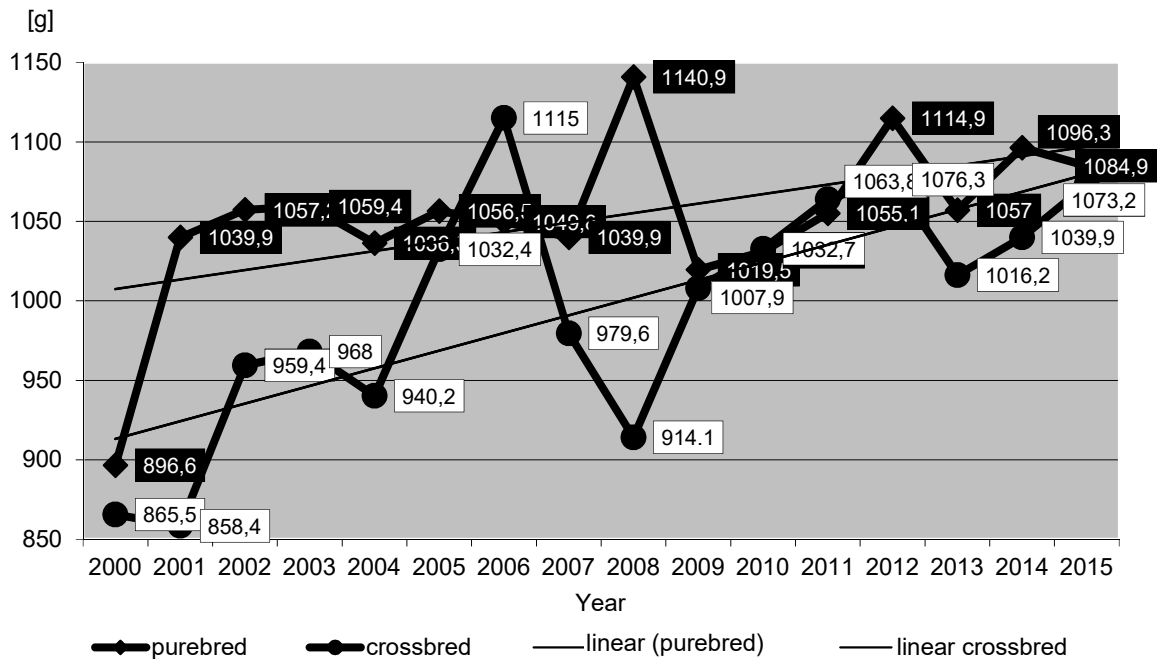


Fig. 5. Average daily body gain to 210 days of age (heifer calves)

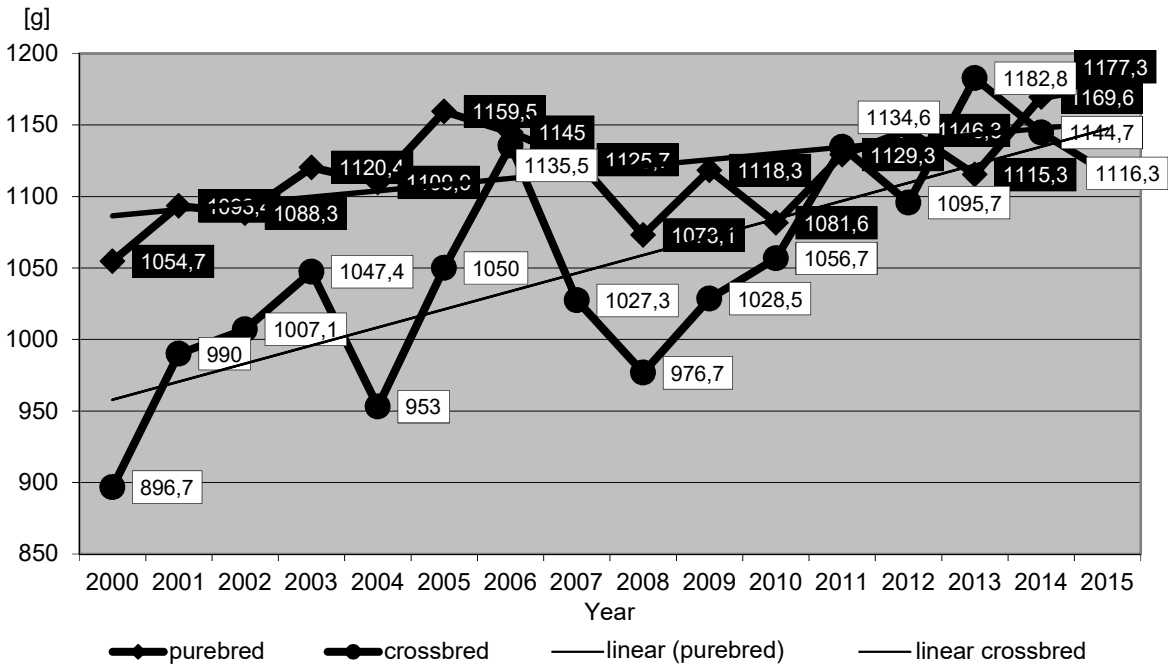


Fig. 6. Average daily body gain to 210 days of age (bull calves)

Figures 7 and 8 show the average daily body gain to 210 days of age for heifer and bull calves. Purebred Charolaise calves obtained higher body weight at 210 day of age than those delivered by crossbred cows. It is probably because of not so big differences in milk production between purebred dams and cows with 50% of genotype of reported breed. In such case superiority of Charolaise breed growth potential was evident. This means that according to breeding standards, body weight at weaning for both heifer and bull calves were at a medium level. The average weight of bull calves was approx. 20 kg higher than the average weight of heifer calves of the same age in both purebred and crossbred populations.

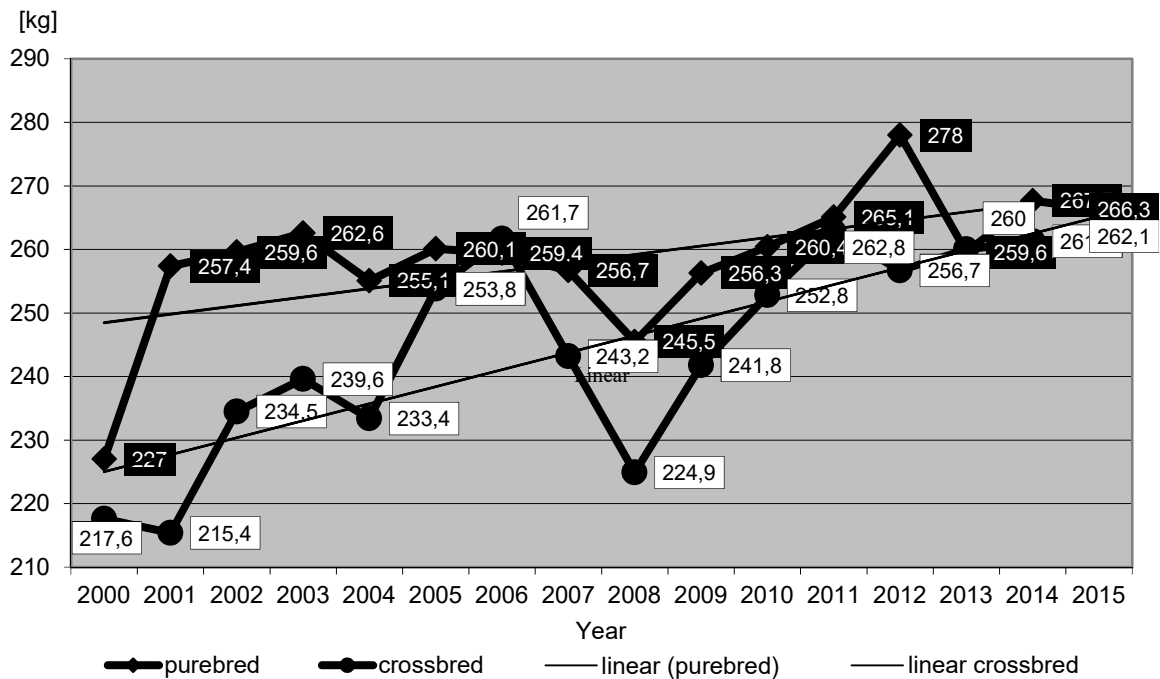


Fig. 7. Average body weight of heifer calves at 210 days of age

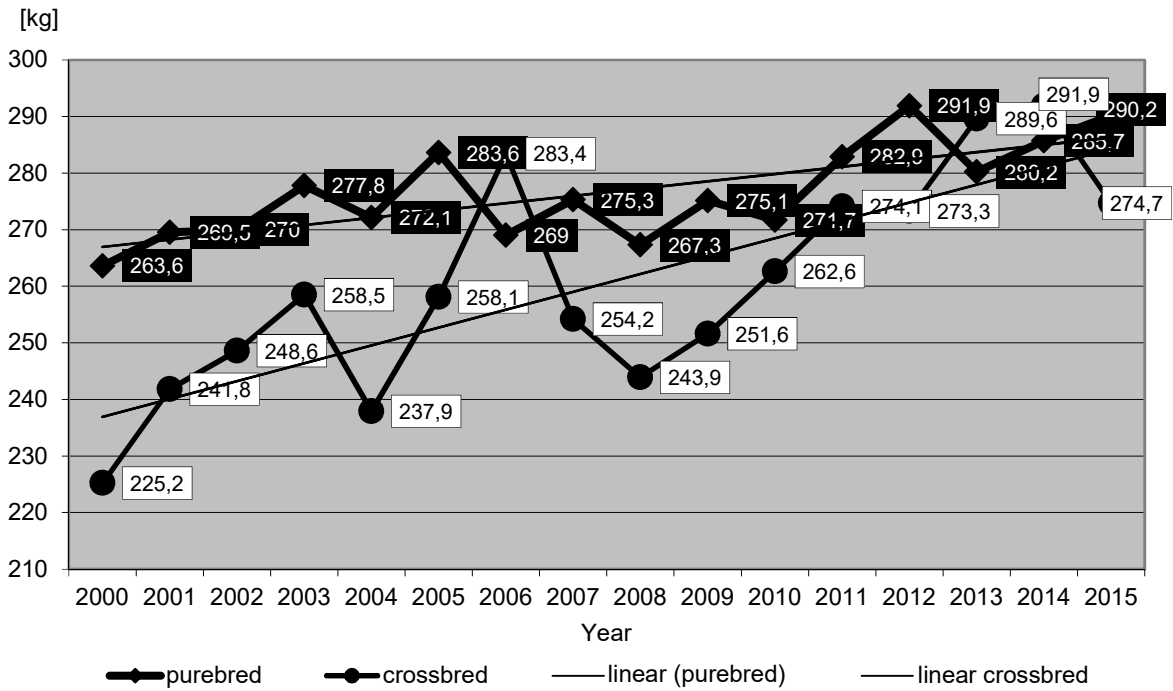


Fig. 8. Body weight of bull calves at 210 days of age

Figure 9 shows the average milk yield of cows over the analyzed years. Milk is the primary food consumed by calves from birth to weaning.

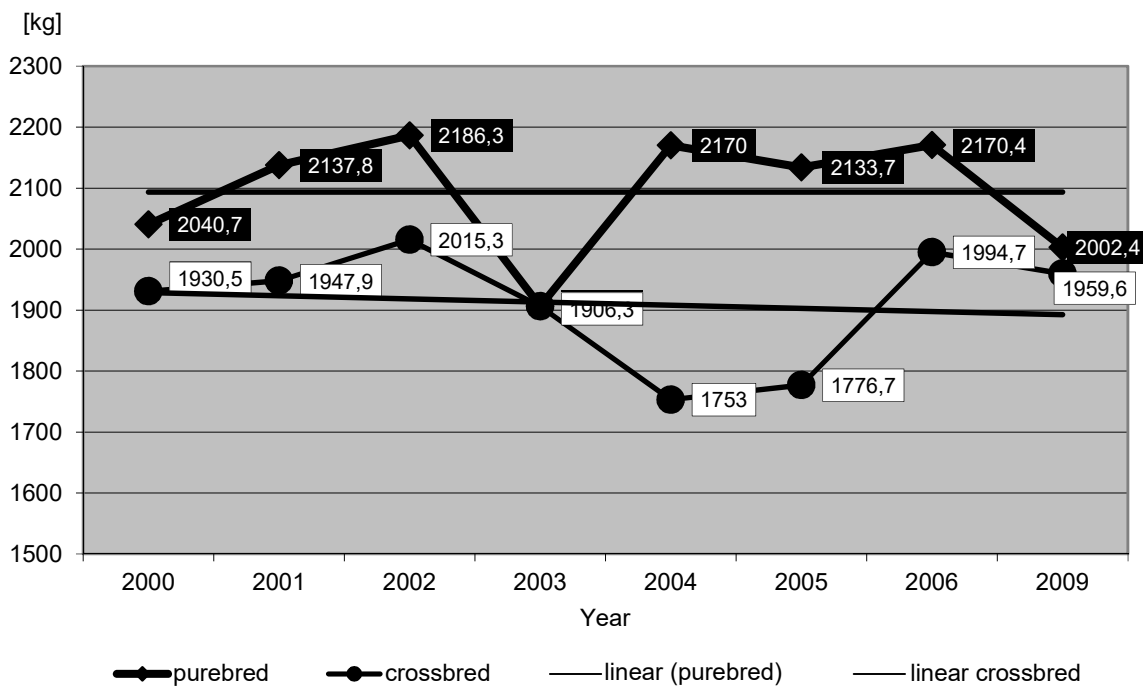


Fig. 9. Average milk yield

Therefore, milk production is considered a key component of maternal ability and in beef cattle milk production is a main factor influencing pre-weaning growth (Clutter and Nielsen 1987; Meyer et al. 1994; Grings et al. 2008). A knowledge of milk production by beef cows might

provide additional information which could be useful in improving calf weaning weights. According to Minick et al. (2001), Quintans et al. (2010) and Cortés-Lacruz et al. (2017) suckler cows' dairy performance is responsible for 60% of daily calves' growth during that period. Many studies indicate that the highest milk yield is provided by Simmental cows, the average milk yield by Limousine and Charolaise cows, and the lowest by Hereford (Gregory et al. 1995; Quintans et al. 2010; Silva et al. 2015). As can be seen (Fig. 9), the average milk yield of purebred cows was always higher than crossbred Charolaise cows. In 2004–2005 period the significant drop in milk performance of suckler cows was noticed, which could be explained by forage shortage caused by poor weather conditions and lack of water. However, the data should be approached with great caution because milk yield is calculated based on the weight gain of calves, and as we know, calves in a herd may approach the udders of cows other than their mothers or may be fed by the breeder. For this reason, from 2010, evaluation of this feature was ceased.

## CONCLUSIONS

One can observe a gradual decline in the share of the national Charolaise beef cattle population, it also shows a significant decrease in the number of crossbreds with Charolaise breed. The average weight of cows in 2005–2006 amounting to 559.4 and 570.2 kg (for purebred) and 556.6 and 561.1 (for crossbred) meet the breeding standards for cows entered in the initial part of the herd book, which define the minimum weight of Charolaise cows after first calving as 550 kg. The average daily weight gain of calves increased considerably in the last years of analysis. The daily body gain of purebred calves was usually higher in purebred population. The daily gains of heifers and bulls were high and usually exceeded 1000 g. For both populations growing trend of daily body gain could be observed. According to breeding standards, body weight at weaning for both heifer and bull calves were at a medium level. The average weight of bull calves was approx. 20 kg higher than the average weight of heifer calves of the same age in both purebred and crossbred populations.

## REFERENCES

- Clutter A.C., Nielsen M.K.** 1987. Effect of level of beef cow milk production on Pre- and Postweaning calf growth. *J. Anim. Sci.* 64, 1313–1322.
- Cortés-Lacruz X., Casasús I., Revilla R., Sanz A., Blanco M., Villalba D.** 2017. The milk yield of dams and its relation to direct and maternal genetic components of weaning weight in beef cattle. *Livestock Sci.* 202, 143–149.
- Drennan M.** 2008. The value of muscular and skeletal scores in the live animal and carcass classification scores as indicators of carcass composition in cattle. *Animal* 2(5), 752–760.
- Fitzhugh H.A.** 1978. Animal size and efficiency, with special reference to the breeding female. *Anim. Prod.* 27, 393–401.
- Funston R.N., Deutscher G.H.** 2004. Comparison of target breeding weight and breeding date for replacement beef heifers and effects on subsequent reproduction and calf performance. *J. Anim. Sci.* 82, 3094–3099.
- Goszczyński J., Reklewski Z., Witkiewicz A.** 1996. Wybrane dane o użytkowaniu rozplodowym krów rasy charolaise i hereford [Some data about reproduction performance of Charolaise and Hereford cows]. *Pr. Mater. Zootech., Zesz. Spec.* 6. [in Polish]



- Gregory K.E., Cundiff L.V., Koch R.M.** 1995. Genotypic and phenotypic (co)variances for production traits of intact male populations of purebred and composite beef cattle. *J. Anim. Sci.* 73, 2227–2234.
- Grings E.E., Roberts A.J., Geary T.W., MacNeil M.D.** 2008. Milk yield of primiparous beef cows from three calving systems and varied weaning ages. *J. Anim. Sci.* 86, 768–779.
- Kamieniecki H., Wójcik J., Rzewucka E.** 2000. Ocena wzrostu oraz przebieg wycieleń importowanych z Francji jałowic rasy Charolaise z uwzględnieniem niektórych wskaźników fizjologicznych krwi [The estimation of growth and course of calving with regard to some physiological indices of blood of heifers of Charolaise breed imported from France]. *Zesz. Nauk. AR Wroc.* 375, 173–177. [in Polish]
- MacNeil M.D.** 2003. Genetic evaluation of an index of birth weight and yearling weight to improve efficiency of beef production. *J. Anim. Sci.* 81, 2425–2433.
- Meyer K., Carrick M.J., Donnelly B.J.** 1994. Genetic parameters for milk production of Australian beef cows and weaning weight of their calves. *J. Anim. Sci.* 72, 1155–1165.
- Minick J.A., Buchanan D.S., Rupert S.D.** 2001. Milk production of crossbred of high- and low milk EPD Angus and Hereford bulls. *J. Anim. Sci.* 79, 1386–1393.
- Nogalski Z., Klupczyński J., Miciński J.** 2000. Przebieg porodu, wielkość i żywotność cieląt w zależności od wymiarów ciała krów [Calving course and calves vitality depending on cows body measurements]. *Rocz. Nauk. Zoot.* 27(3), 43–57 210. [in Polish]
- Pilarczyk R., Wojcik J.** 2007. Comparison of calf rearing results and nursing cow performance in various beef breeds managed under the same conditions in north-western Poland. *Czech J. Anim. Sci.* 52(10), 325–33.
- Pogorzelska J., Romanowski A., Puchajda Z.** 1998. Analiza użytkowania rozplodowego i rozwój importowanego z Francji bydła Limousin i Charolaise [An analysis of the breeding performance and the development of Limousine and Charolaise cattle imported from France]. *Zesz. Nauk. AR Wroc.* 336, 143–148. [in Polish]
- Przysucha T., Grodzki H., Charłampowicz A., Zdziarski K.** 2002a. The effect of selected factors on growth rate of Limousine calves. *Anim. Sci. Pap. Rep.* 20, Suppl. 1, 221–228.
- Przysucha T., Grodzki H., Nałęcz-Tarwacka T., Zdziarski K.** 2002b. Analiza wpływu wybranych czynników na masę ciała i przyrosty cieląt rasy charolaise [Analysis of influence of chosen factors on body weight and daily gain of Charolaise calves]. *Zesz. Nauk. Przegl. Hod.* 62, 203–210. [in Polish]
- Quintans G., Banchemo G., Carriquiry M., Lopez-Mazz C., Baldi F.** 2010. Effect of body condition and suckling restriction with and without presence of the calf on cow and calf performance. *Anim. Prod. Sci.* 50, 931–938.
- Resultats du controle des performances bovins allaitants.** 1996. Rennes, Institut de L'Elevage, France, 48–54.
- Silva L.N., Gasparino E., Torres Júnior R.A.A., Euclides Filho K., Silva L.O.C., Alencar M.M., Souza Júnior M.D., Battistelli J.V.F., Silva S.C.C.** 2015. Repeatability and genotypic correlations of reproductive and productive traits of crossbred beef cattle dams. *Genet. Mol. Res.* 14, 5310–5319.

## **PORÓWNANIE WYNIKÓW OCENY UŻYTKOWOŚCI CZYSTORASOWEJ I MIESZAŃCOWEJ POPULACJI BYDŁA RASY CHAROLAISE W POLSCE**

**Streszczenie.** Celem pracy było porównanie wybranych wyników oceny użytkowości czystorasowej i mieszańcowej populacji rasy Charolaise w odniesieniu do ich zgodności z celem hodowlanym i ze standardami rasowymi przyjętymi przez Polski Związek Hodowców i Producentów Bydła Mięsnego (PZHiPBM). Przedmiotem analiz były wyniki oceny użytkowości francuskiej rasy bydła mięsnego Charolaise w Polsce. Opracowanie oparte jest na danych PZHiPBM z lat 2002–2015 oraz Krajowego Centrum Hodowli Zwierząt (KCHZ) z lat 1996–2001. Zbiór danych obejmował: N – liczbę badanych zwierząt, min. – minimalne wartości w badanej cechy, max. – maksymalne wartości badanej cechy, średnią – uśrednione wartości badanej cechy, SD – odchylenie

standardowe. Oceniane cechy to: średnia masa ciała krów [kg], średnia masa ciała cieląt po urodzeniu [kg], średnie przyrosty dobowe do wieku 210 dni [g], średnia masa ciała cieląt w wieku 210 dni [kg], średnia mleczność krów [kg]. Można zaobserwować stopniowy spadek udziału rasy Charolaise w krajowej populacji bydła mięsnego, zauważa się również znaczący spadek liczby mieszańców z rasą Charolaise. Średnia masa krów w latach 2005–2006, wynosząca odpowiednio 559,4 i 570,2 kg (czystorasowe) i 556,6 i 561,1 kg (mieszańcowe), spełnia standardy hodowlane dla krów wpisywanych do części wstępnej księgi hodowlanej, które określają minimalną masę ciała krowy rasy Charolaise po pierwszym ocieleniu, która wynosi 550 kg. Średni dobowy przyrost masy ciała cieląt zwiększył się znacznie w ostatnich latach oceny. Dobowe przyrosty masy ciała cieląt czystorasowych były zazwyczaj wyższe niż mieszańców. Przyrosty jałówek i buhajków były duże i najczęściej przekraczały 1000 g. W obu populacjach widać wyraźny wzrostowy trend wartości tej cechy. Według standardów hodowlanych masa ciała jałówek i buhajków była na średnim poziomie. Średnia masa ciała buhajków po odsadzeniu była o ok. 20 kg większa niż jałówek w obu analizowanych populacjach.

**Słowa kluczowe:** bydło mięsne, Charolaise, ocena użytkowości.