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Merinos in Poland – an analysis of breeding condition, selected performance traits and perspectives for the protection of genetic resources in relation to the country's total sheep population

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SUMMARY

The purpose of the study was to analyse the breeding condition and performance traits of Merino sheep belonging to three breeds in 2008–2022. The experimental material consisted of data derived from annual reports published by the Polish Sheep Breeding Association on the breeding of three Merino breeds – Polish Merino, Coloured Merino, and Old-type Polish Merino, as well as data on the number and distribution of flocks and on the implementation of the sheep genetic resources protection programme from the database of the National Research Institute of Animal Production, covering the last 15 years.

Analysis of population size over the last 15 years revealed significant changes in the breed structure of the Merino sheep population. The implementation of conservation programmes and the opportunity to obtain subsidies for conservation breeds have had an impact on the breeding of these breeds in Poland. Currently, the Old-type Polish Merino makes up the largest share of the Merino sheep population. Merino breeding is regional, and the flocks are large. They are concentrated in the areas where they were raised historically, i.e. the Wielkopolska and Kujawy regions, usually in flocks of about 100 ewes.

Reproductive rates, expressed as maternal prolificacy, were found to be in line with the breed standard. The Polish Merino and the Old-type Polish Merino had similar reproductive parameters, with higher fertility and rearing indices than the Coloured Merino. The Coloured Merino was shown to have the highest fertility and breeding performance, whereas the body weight of lambs was higher for the white varieties. Reproductive and meat performance parameters show the potential of Merino sheep in the context of lamb production, which is currently the main focus of sheep production in Poland.

KEY WORDS: sheep, Merino, breeding, functional characteristics, conservation of genetic resources

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INTRODUCTION

Merinos represent one of the oldest breed groups among sheep. They originated in the Iberian Peninsula, where crossbreeding of local stock with North African and Italian sheep from the Puglia region began as early as Roman times. Spanish Merinos became the first livestock breed with an international distribution, which has had a significant impact on sheep breeding, both historically and in modern times (Granero et al., 2023). Centuries of selection and breeding in a variety of environmental conditions and climate zones have resulted in animals admirably adapted to the local climate (Ceccobelli et al., 2023). Merinos are known for their good wool and meat yield. Their wool is one of the finest among all sheep breeds, with an average fibre thickness of 16–24 μm. The aseasonality of reproduction in breeds belonging to this group enables regular production of lambs throughout the year.

Merino sheep breeding has a long tradition in Poland, and its development has been influenced by Merinos imported from Germany, France, and to a lesser extent, Austria. The date when the first Merino sheep were brought to Poland is disputed. In 1725, Merino sheep appeared near Łomża, Kolno, Zambrów and Ostrów Mazowiecki, while the first legally imported Merinos were brought to Lublin in 1785. A year later, animals of Hungarian origin found their way to Bażków near Kłodzko, and in 1787 Adam Czartoryski imported Saxon Merinos from Saxony to Końskowola and Nieborów. According to other sources, the first Merinos did not appear in Poland until 1811, when they were donated by the Elector of Saxony and placed in the royal estates in the Kielce region (Greulich, 1981). After 1860, Merinos of the Rambouillet and Merino-Precoce types were imported from France, which initiated the breeding of wool and meat Merinos.

In the inter-war period, the surviving Merinos were improved for the purpose of meat production, using Île-de-France and Berrichon du Cher rams. The outbreak of World War II halted breeding, and its most tragic effect was the considerable depletion of the flock – of the 727 000 sheep that survived the turmoil of war, only 100 000 were Merinos (Jełowicki, 1971, Greulich, 1981).

In the period after World War II, wool regained its original importance in Eastern European countries. To improve the wool performance of Merino sheep, domestic German Merinos (Fleishmerino and Landmerino) were imported to Poland from Germany (1949–1950), Caucasian Merinos were imported from the former USSR (from 1951), and woolly Bulgarian Merinos were brought in from Bulgaria. In the 1980s, increased attention began to be paid to meat and breeding performance in selection work.

In the 1980s, breeding work began at the Experimental Station of the National Research Institute of Animal Production in Kołuda Wielka to produce a coloured variety of Polish Merino with coloured fine wool and coloured skins. The goal was to obtain natural utility and ornamental products while retaining good meat performance and the possibility of milking after the lambs were weaned (Osikowski and Pakulski, 1997). The coloured Merino was included in the conservation programme in 2000. In 2008, the genetic resources conservation programme was extended to include the Old-type Polish Merino found in the Kujawy and Wielkopolska regions, which had not been subject to improvement by means of crossing with prolific, meat, and wool breeds for generations (Gut et al., 2008). Subsidies for indigenous breeds contributed to the dynamic growth of their populations, which

translated into the structure of sheep breeding in Poland. These changes also affected the Merino sheep themselves.

Photo 1. Merino sheep in Poland – Polish Merino ram (A), Old-type Merino ewe (B), Coloured Merino ewe (C) [photo. A. Kawęcka, M. Puchała, B. Borys]

The purpose of the study was to analyse the breeding condition and performance traits of Merino sheep of three breeds in Poland – Polish Merino, Coloured Merino, and Old-type Polish Merino – over a period of 15 years, in relation to the country's total sheep population in the context of conservation of genetic resources.

MATERIALS AND METHODS

The experimental material consisted of data derived from annual reports published by the Polish Sheep Breeding Association (PZO, 2009–2023) on the breeding of Merinos of three breeds, i.e. Polish Merino (PM), Coloured Merino (CM), and Old-type Polish Merino (OM), as well as data on the number and distribution of flocks of sheep included in the genetic resources conservation programme from the database of the National Research Institute of Animal Production covering the last 15 years, i.e. from 2008, when Old-type Merino was first included in the programme.

Performance parameters included reproductive results and meat performance. The reproductive results (%) of the population were calculated as fertility, prolificacy, lamb rearing, and reproductive performance for all flocks assessed in a given year for the 15-year period. Meat performance was defined as the average body weight of lambs (kg) at 56 days of age.

The results of the performance parameters are shown in tables as means and standard deviation. Statistical analysis of the results was performed by one-factor analysis of variance using the STATISICA ver. 10 package. The significance levels were set at $p \leq 0.05$ and $p \leq 0.01$. When a factor was shown to have a significant effect on a given trait, Duncan's chi-square test was applied.

RESULTS

Polish Merino is a breed traditionally associated with the Wielkopolska and Kujawsko-Pomorskie Provinces; in addition, two flocks are located in the Opolskie Province. In the case of the Coloured Merino, the breeding region is exclusively the breed's area of origin, i.e. the Kujawsko-Pomorskie Province (Fig. 1). More than half of the ewes of the Old-type Merino breed entered in the books are kept in the Wielkopolskie Province, and a significant proportion are found in the Kujawsko-Pomorskie Province. Due to the implementation of the conservation programme and to great interest, breeding of this breed also spread to the Mazowieckie, Łódzkie and Lubelskie provinces.

Figure 1. Distribution of Merino flocks in the country (PZO, 2022).

The number of Merino ewes entered in the books was 12 700 in 2008 and 11 485 in 2022 (Fig. 2). Major changes took place in the Merino breed structure during this interval (Fig. 2). The number of Polish Merino sheep, which was the dominant breed in 2008, decreased nine-fold, and the number of flocks of this breed decreased by 100. There was a gradual increase in the Coloured Merino population, which from a single original flock of 200 animals developed to over 900 ewes in nine flocks. The Old-type Polish Merino population tripled to 9 531 ewes in 2022.

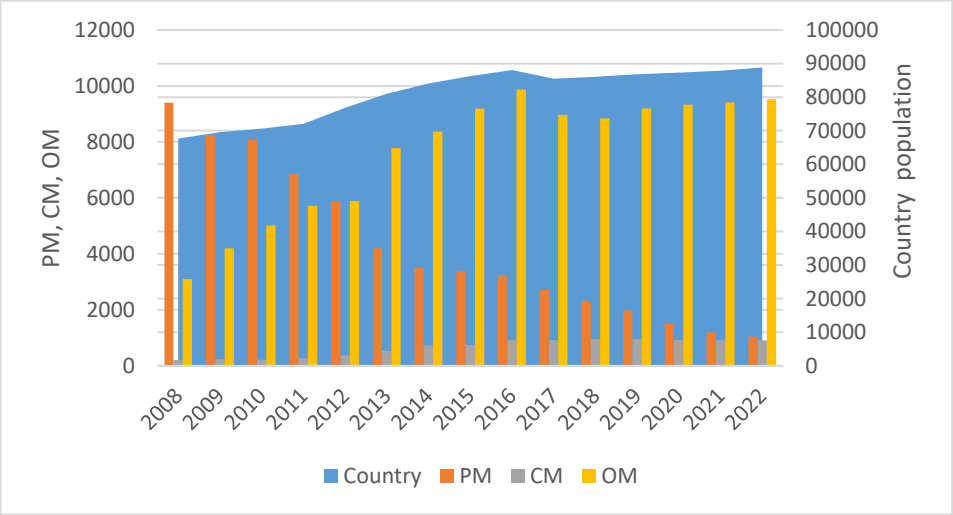

Figure 2. Changes in numbers of Merino sheep registered in flock books in 2008–2022 compared to the total sheep population in Poland.

The average size of Merino flocks in Poland is 95 ewes for Polish Merinos, 102 ewes for Coloured Merinos, and 130 ewes for Old-type Merinos (PZO, 2023). The average flock size for the remaining sheep population in Poland is 75 ewes (Fig. 3).

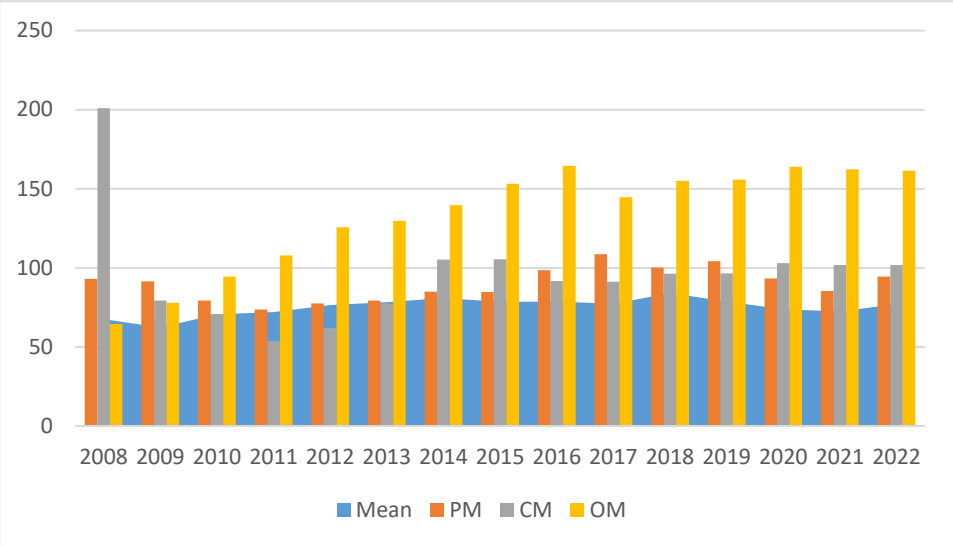

Figure 3. Flock size of Merino ewes entered in the books in 2008–2022 compared to the total sheep population in Poland.

The reproductive parameters of the population for the 15-year period are presented in Table 1. The values differed between breeds, with the highest fertility found for the Old-type Merino (95.34%). The lamb rearing rate, expressed as the percentage of weaned lambs among lambs born, was also significantly higher for this breed (91.17%). The highest prolificacy was found for the Coloured Merino (146.28%); it was significantly higher than for the other breeds. The breeding performance of the Coloured Merino was 119.53%, which was also higher than for the white varieties.

Table 1.
Performance parameters (%) of Merino sheep in the years 2008–2022 (means ± SD).

Parameter	PM	CM	OM
Fertility	$93.56^{a} \pm 1.52$	$92.16^{bA} \pm 2.69$	$95.34^{cB} \pm 0.61$
Prolificacy	$125.75^{A} \pm 3.20$	$146.28^{B} \pm 9.50$	$125.28^{A} \pm 5.87$
Lamb rearing	$90.50^{a} \pm 2.49$	$88.71b^{A} \pm 2.59$	$91.17^{B} \pm 1.06$
Reproductive performance	$106.46^{A} \pm 3.51$	$119.53^{B} \pm 7.73$	$108.94^{A} \pm 5.32$

PM – Polish Merino, CM – Coloured Merino, OM – Old-type Polish Merino; x – mean;
SD – standard deviation; a, b, c – $P \leq 0.05$, A, B, C – $P \leq 0.01$ – means in rows with different letters differ statistically significantly.

Changes in the breeding performance index against the total sheep population in Poland are illustrated in Fig. 4. The last years of evaluation show a significant decrease in this parameter for the total sheep population, comparable values for the Polish Merino and Old-type Merino, and high values for the Coloured Merino, but with significant fluctuations for this breed during the study period.

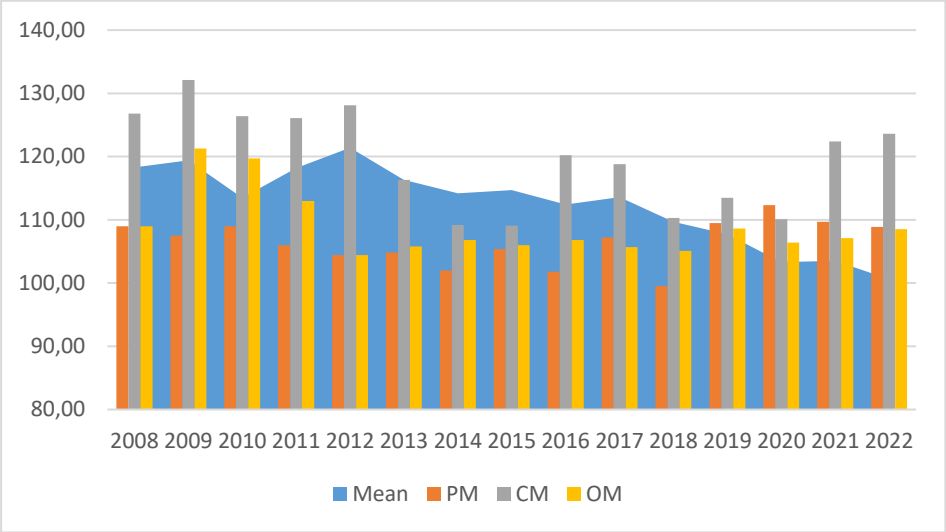

Figure 4. Fluctuations in the reproductive performance index of Merino sheep breeds assessed in the years 2008–2022 against the average for the total sheep population in Poland (PZO, 2009–2023).

The analysis revealed differences between breeds for the body weight of lambs. The body weights of Polish Merino and Old-type Merino ram and ewe lambs were similar and higher than for Coloured Merino lambs. Litter weight, however, was higher for Coloured Merino.

Table 2.
Performance parameters – body weight (kg) of Merino sheep at 56 days of age in the years 2008–2022 (means ± SD).

Parameter	PM	CM	OM
Body weight of ram lambs	$19.28^{A} \pm 0.41$	$18.52^{B} \pm 0.57$	$19.58^{A} \pm 0.22$
Body weight of ewe lambs	$18.67^{A} \pm 0.41$	$17.92^{B} \pm 0.57$	$19.01^{A} \pm 0.31$
Litter weight	$23.20^{A} \pm 0.65$	$24.83^{B} \pm 0.98$	$23.21^{A} \pm 0.41$

PM – Polish Merino, CM – Coloured Merino, OM – Old-type Polish Merino; x – mean;
SD – standard deviation; a, b, c – $P \leq 0.05$, A, B, C – $P \leq 0.01$ – means in rows with different letters differ statistically significantly.

DISCUSSION

Merino sheep currently make up less than 13% of the registered sheep population (PZO, 2023). In 2008, Merino sheep accounted for 18.7% of breeding animals. In the 1990s, the share of Polish Merinos was over 46%. In 1992, the Coloured Merino was registered as well (entered as a black Merino); in addition, there were also over 900 German Merino ewes in the books (CSHZ, 1993). The crisis in Polish sheep breeding led to a drastic decline in stock, which affected all domestic breeds. In May 2000, the Minister of Agriculture and Rural Development approved programmes for the conservation of genetic resources of individual livestock populations, including sheep. The implementation of conservation programmes and the possibility of receiving subsidies for conservation breeds had an impact on sheep breeding in Poland (Kawęcka et al., 2022). Analysis of the number of native sheep against the total active population in the country revealed that it now represented almost 80% of the breeding population (PZO, 2023). In 2023, the number of native sheep kept in Poland was 75605, including 71847 ewes. Native sheep were kept in 867 flocks throughout Poland (Kawęcka et al., 2023). In 2008, their share was at 30% (PZO, 2009).

Changes also occurred in the breed structure of the population. In the 1990s, the Polish Merino accounted for 42% of the population of ewes entered in breeding animal books. When the conservation programme for the Old-type Merino began, its share in the structure of Polish breeding was 14%; currently, it is less than 1.2% (PZO, 2023). The largest group is the Old-type Polish Merino, with a 10.8% share. According to Gut et al. (2008), when sheep were selected for the programme, the number of ewes in the Wielkopolska and Kujawsko-Pomorskie regions whose pedigrees recorded no mating with rams of the meat Merino type or with other breeds (including prolific ones) for at least four generations back was estimated at about 3000 (3% of the country's total sheep population). The Coloured Merino still has a small share in the total sheep population (1%). The increase in numbers is slower than for other native breeds, due to the limited region of introduction and the lower availability of breeding material. A similar situation occurred in the case of mountain sheep, whose

inclusion in the conservation programme caused a change in the population size of the three breeds belonging to this group (Kawęcka, 2019).

Although merino wool is considered to be the most valuable wool obtained from native breeds, competition from imported material and the resulting decline in interest in Polish wool has resulted in a dramatic decrease in its prices; suffice it to say that the average purchase price of wool was 4.33 PLN/kg in 2010, but only 1.47 PLN/kg in 2022 (Agricultural Statistical Yearbook, 2023). This resulted in the almost complete abandonment of wool sourcing as the main purpose of production in favour of meat production. The efficiency of slaughter lamb production is determined by reproductive traits such as fertility and prolificacy, as well as the rearing of lambs and their growth rate. According to zootechnical practice, the fertility index, i.e. the proportion of lambed ewes among breeding ewes, is satisfactory at 90%, good at over 95% and very good when it approaches 100%. Therefore, the value for Merinos can be regarded as satisfactory, while the value for the country's total sheep population, analysed over a shorter period of time, was higher, at 96% (Milewski, 2017). Analysis of the prolificacy of the three breeds revealed that that of the Old-type Merino was in line with the standard recorded in the conservation programme (125%). For the Coloured Merino, it was much higher than the standard (135%), as was breeding performance. (http://owce.bioroznorodnosc.izoo.krakow.pl/programy-ochrony). A similar phenomenon, i.e. significantly higher scores for selected breeding parameters of coloured wool varieties relative to white sheep, has been described in sheep breeds such as the West African Dwarf, with black ewes found to be more prolific than red and white animals and to have more litters (Fadare, 2015). Adalsteinsson (1975) showed a negative effect of the A^{wt} allele, which is responsible for uniform pheomelanin coat colour (including white), on the fertility of Icelandic ewes. Furthermore, differences between ewes with white coats and those with other coat colours were observed in Swedish Finewool and in Berrichon du Cher and Romanov crossbreds in favour of coloured animals (Jónmundsson and Adalsteinsson, 1985). Niżnikowski et al. (2012) analysed the reproductive traits of Polish Merinos at several leading breeding centres and found that all flocks had a prolificacy index in line with the breed standard, while other reproductive indices required improved housing conditions and preparation of animals for the mating season.

One of the most important factors affecting the profitability of sheep production is the rate of lamb losses, which should not exceed 5%. These losses are often much higher in practice, and in extreme cases can exceed 20%. The most important causes of lamb losses include low birth weight, difficult birth, adverse weather conditions, and inadequate expression of maternal behaviour (Stevens et al., 1982). The first hours after birth are critical to the survival of lambs, particularly access to colostrum, which is crucial to the development of immunity in the young animal. Particular attention should be paid to lambs from multiple pregnancies; Stevens et al. (1982) report 9.6% mortality among lambs from single pregnancies, while it was even 37.4% in the case of twin pregnancies. The main causes of death were low viability of one of the lambs and separation of the lamb from its mother.

Reproductive performance is a combination of fertility, prolificacy, and lamb rearing. It is an important measure of the efficiency of breeding performance in sheep. The values found in our analyses were low, given that the level of breeding performance adopted for Polish conditions, guaranteeing the profitability of sheep breeding, is 150% (1.5 lambs/mother). Milewski (2017) evaluated the reproductive performance of the country's total sheep population and concluded that its low value (113%) was the result of low prolificacy and high lamb losses. Niżnikowski et al. (2012)

summarized the reproductive indices of Polish Merino breed flocks as showing sufficient prolificacy indices, while fertility and lamb survival rates should be attributed to environmental aspects (care, prophylaxis or nutrition) and to the effects of overbreeding or mating times. In summary, it can be concluded that reproductive efficiency, measured by the breeding performance index, was low. The more favourable results in the case of Coloured Merinos, resulting from good prolificacy, were reduced by low fertility and poor rearing of lambs. Problems with lamb rearing can be addressed by paying more attention to the housing conditions of young animals, especially after parturition. Ensuring the good condition of ewes and rams during the mating season is the easiest way to improve reproductive rates.

Litter weight is extremely important information for the sheep farmer, e.g. in determining the growth rate of the young. Weighing lambs at specific, fixed points during the animal's life provides information that can be used to optimize feeding, to determine when the animal reaches its target slaughter weight, and to predict sexual maturity (Kelman et al., 2022). A higher growth rate makes it possible to reduce production costs, as the lambs reach the weight standard in a shorter time. Stankov (2020) compared the economic efficiency of breeding of three breeds representing different production types – the autochthonous Srednostaroplanin sheep, the North-Eastern Bulgarian Merino, and Île-de-France – and found that in the absence of subsidies, both primitive and Merino sheep breeding have negative efficiency, while the specialized meat breed has zero efficiency. The author sees dairy production as one way to improve economic efficiency. In Poland, attempts have been made to use Merino milk for cheese production, e.g. at the Experimental Station of the National Research Institute of Animal Production in Kołuda Wielka. According to Pakulski et al. (2006), the milk of the Polish Merino was of good technological quality, similar to that of East Friesian sheep, but low yield is a limiting factor for the economic effect.

CONCLUSIONS

There have been significant changes in the breed structure of the Merino sheep population over the last 15 years. The implementation of conservation programmes and the opportunity to obtain subsidies for conservation breeds have had an impact on the breeding of these breeds in Poland. Currently, the Old-type Polish Merino makes up the largest share of the Merino sheep population, which is linked to its inclusion in the conservation programme. Merino breeding is regional and involves large flocks, concentrated in the areas where they have historically been raised, i.e. in the Wielkopolska and Kujawy regions, usually in flocks of about 100 dams.

Reproductive rates, expressed as maternal prolificacy, were found to be in line with the breed standard. The Polish Merino and the Old-type Polish Merino had similar reproductive parameters, with higher fertility and rearing indices than those of the Coloured Merino. The Coloured Merino was shown to have the highest fertility and breeding performance, whereas the body weight of lambs was higher for the white varieties. Reproductive and meat performance parameters show the potential of Merino sheep in the context of lamb production, which is currently the main focus of sheep production in Poland.

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