Bulgarian Journal of Agricultural Science, 32 (No 3) 2026, 693–701

Reproductive and meat characteristics and distribution of the Japanese Wagyu breed around the world, in Europe and Bulgaria – Overview

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Abstract

Ivanova, T., Mondeshka, L. & Markov, Ts. (2026). Reproductive and meat characteristics and distribution of the Japanese Wagyu breed around the world, in Europe and Bulgaria – Overview. *Bulg. J. Agric. Sci., 32*(3), 693–701

The name of the Wagyu breed comes from Japanese – "Wa"-Japanese and "gyu"-beef. In the past, animals of this breed were used for draft. Japanese Wagyu consists of 4 cattle breeds – Japanese Black, Japanese Brown, Japanese Shorthorn and Japanese Large. Japanese black cattle are the predominant breed. It produces meat with the highest degree of marbling. After Japan, the most animals of this breed are bred in Australia. The ration of Japanese Black cattle is rich in concentrate and rice straw. Fattening begins at 11 months of age and ends at 30 months of age. During this period, the accumulation of the most intramuscular fat happens, which is the main goal of Japanese breeders. Reproductive and genetic traits of Japanese Black cattle are important breeding objectives as they directly affect meat productivity and should be used in selection schemes. Wagyu meat has the highest marbling intensity compared to other meat breeds. The high content of intramuscular fat improves the tenderness, juiciness and overall taste of the meat. The percentage of intramuscular fat of Japanese black cattle averages greater than 30%. The average body and carcass weights of the Japanese black cattle at slaughter were 756 kg and 476 kg at 29.2 months of age respectively. Average daily gain to slaughter weight is 0.770 kg. The price of meat from this breed is the highest compared to meat from other beef breeds /the average price of calves is about 6 226 USD and the average price of carcasses is about 12 511 USD.

Keywords: Wagyu breed; reproductive traits; meat; marbling

Inroduction

The name of the Wagyu breed comes from the Japanese language and has two roots – "Wa" – Japanese and "gyu" – beef. For centuries, animals of this breed have been used for harness. Historically, animal husbandry has played an important role in mixed farming as a tool for cultivating different crops. The Japanese Wagyu cattle breed is primarily used for raising, processing and harvesting rice.

About 50 years ago, farmers gradually began to replace animal power with agricultural machinery, natural with industrial fertilizers, and in recent years, Japanese Wagyu cattle have been bred specifically for beef production (Gotoh et al., 2014).

In the period 1635 – 1868, the import and export of animals of the Wagyu breed was prohibited in Japan. After 1868 beef consumption increased and Brown Alpine, Shorthorn, Devon, Simmental, Ayrshire, Angus and Korean cattle were imported into the country. Crossbreeding Japanese cattle with imported breeds leads to a decline in meat quality, an increase in body weight, which slows down movements and reduces their working potential in harness. For these reasons, crossbreeding with foreign breeds was discontinued in 1910 and domestic breeding was adopted to improve meat qual-

ity. In 1937 the Japanese black breed is officially recognized (Morita et al., 2000).

According to Wagyu international, today Wagyu are bred and bred in varying degrees of purity around the world. There are 3 million Wagyu in the world with 50% or higher genetics, 96% of all animals are bred in Japan. Japanese Wagyu consists of 4 breeds of cattle – Japanese Black, Japanese Brown, Japanese Shorthorn and Japanese Large. The Japanese Black Cattle breed is a predominant breed. It produces meat with the highest degree of marbling compared to the other three breeds of cattle and makes up over 90% of all cattle in Japan. Australia is the country that ranks second in population of Wagyu after Japan. Wagyu cattle raised in Australia are of the Japanese Black breed, with a population of 100 000 cattle, of which 18% are Thoroughbreds, 12% are Purebreds and 50% are F1 crosses with other breeds. Almost 85% of the production is exported worldwide. For Australians, Wagyu meat is a preferred product for consumption.

According to /Wagyuinternational.com/, Wagyu cattle are raised in many parts of the world (Figure 1). Such are South Africa, America, Brazil, Canada, Costa Rica, Mexico, Asia, China, Indonesia, New Zealand, Philippines, Vietnam, Europe, etc. Beef from every continent, country and farm has its own flavor profile and qualities. The Wagyu industry in Europe is still quite small. After the year 2000, it began to develop in member states of the European Union – Denmark, Germany, the Netherlands, Hungary, Ireland, Spain and Sweden. This breed of cattle is also raised in Great Britain, but the majority of the population is not purebred, but consists of crosses with conventional European cattle. The largest is the Wagyu association in Germany. The breed is also widespread in the Balkans – Greece, Turkey and Romania. In 2022, 19 purebred female animals were imported into Bulgaria, fertilized by embryo transfer.

Animals of the Wagyu breed are extremely tame, with a calm (peaceful) temperament and adapted to grazing. They show good adaptability to the atmospheric influences of the external environment. Cattle are medium-sized, well-muscled with a fine bone system. (Markov et al., 2022)

Mishima is a breed of cattle originating from Japan, bred on Mishima Island in Yamaguchi Prefecture. Animals of this breed have retained the characteristics of the Japanese black breed. Cows had a body weight of 517 ± 20 kg at 35.8 ± 0.5 months of age (Morita et al., 2000). Mishima males generally weighed less compared to fattened Japanese Black bulls at 26 months of age (Gotoh et al., 2009; Albrecht et al., 2011). The height at the withers of cows is 100–125 cm, and of bulls 135–140 cm. The breed has horns but no humps. The horns are straight, slightly curved forward and start /end/ with a white tip. They have black skin and fur and black, shiny nostrils (Figure 2).

The Japanese brown breed has two distinct breeds and is mainly bred in Kumamoto and Kochi Prefectures. Kumamoto cattle are red in color, originally imported from Korea. After the end of 1900, this breed is crossed with imported foreign breeds such as Simmental etc. Animals increase their

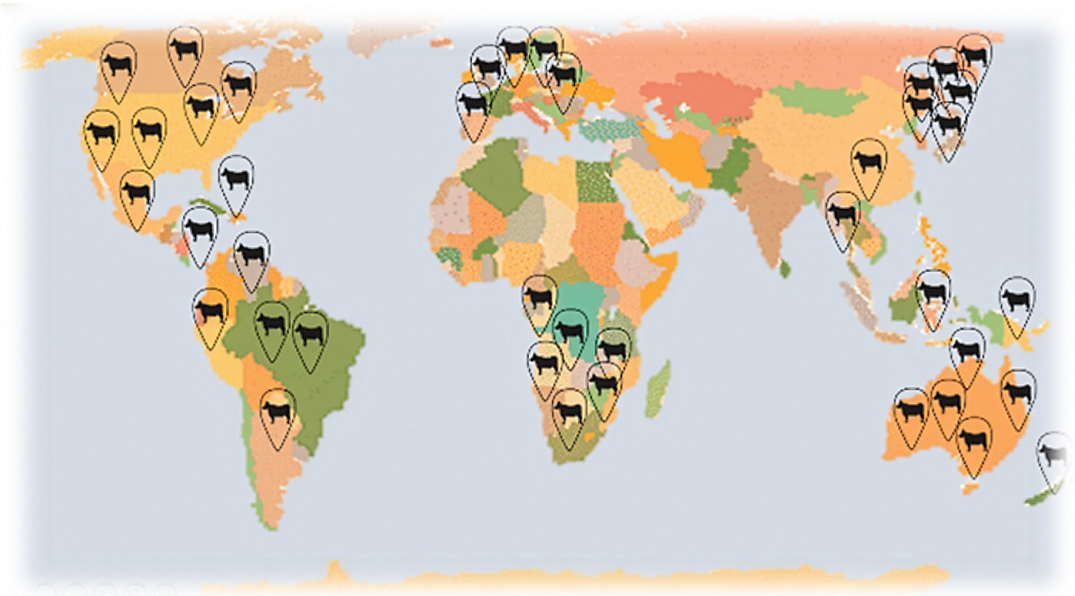

Fig. 1. Wagyu around the world
(Development of the authors)

Fig. 2. The Japanese Black breed (Motoyama et al., 2016; National Beef Cattle Advancement Fund Association/Wagyu Registry Association)

weight very quickly. The body weight of adult females and males is 600 kg and 950 kg, respectively. Kochi cattle were obtained by crossing Simmental with Korean cattle introduced from the island of Kyushu. This crossbreeding period is significantly shorter than that for Kumamoto cattle. Kochi cattle have a yellow-brown coat that is much lighter than that of Kumamoto cattle. The cattle have black horns, hooves, eyelids, muzzle, tongue and anus, and are more valuable due to their similarity to the original Korean breed (Minezawa, 2015) (Figure 3).

The Japanese cattle breed was created in 1916 by crossing local cows with Aberdeen Angus beef bulls imported from Scotland to improve meat quality in 1975. Currently, there are not many purebred Japanese cattle left. The animals

Fig. 3. The Japanese brown breed (Motoyama et al., 2016; National Beef Cattle Advancement Fund Association/Agriculture Research Center of Komamoto Prefecture)

of this breed have black fur, no horns, and the height at the withers is 122 cm for cows and 137 cm for bulls, and the body weight is 450 kg and 800 kg for mature cows and bulls, respectively (Minezawa, 2015) (Figure 4).

Fig. 4. The Japanese cattle breed (Motoyama et al., 2016; National Beef Cattle Advancement Fund Association/National Livestock Breeding Center)

The Japanese Shorthorn cattle breed is the result of a cross that began in 1871 between imported Shorthorn dairy cattle and local cattle in the northern parts of the island of Honshu (Tohoku region). It is said that this breed can utilize the rough summer grazing available in the mountainous parts of this region better than other breeds. They are mainly distributed in Tohoku and Hokkaido regions. The coat color of this breed is a deep red-brown, which is darker than the Japanese brown. The Japanese Shorthorn outperforms the Japanese Black for milk production, feed intake and growth

Fig. 5. Japanese Shorthorn cattle breed (Motoyama et al., 2016; National Beef Cattle Advancement Fund Association)

rate. Withers height and body weight of mature females and males are 128 cm, 500 kg and 140 cm, 800 kg (Tsuda et al., 2013) (Figure 5).

Results and Discussion

Feeding systems

In order to produce beef that meets the requirements of the Japanese market, proper feeding systems and management are essential. A feeding management algorithm should include factors such as growth rate, feed digestibility, general body condition, animal welfare and disease tolerance, which in turn promote intramuscular fat accumulation (Gotoh, et al., 2018).

In each prefecture, Wagyu are raised with a unique fattening system. The ration of Japanese black cattle, for example, is high in concentrate and rice straw. Fattening begins at 11 months of age and ends at 30 months of age. During this period, the greatest accumulation of intramuscular fat is observed, which is also the main goal of Japanese breeders. Cattle are fed a high-energy diet two or three times a day during the fattening period. From 11 to 18 months of age, the diet includes increasing amounts of concentrate (from 36.8% to 86.4%), and decreasing amounts of roughage (brewer's bran, hay and rice straw). During the final stage from 18 months of age to slaughter, the diet consists of 84.2% to 86.4% concentrate and 13.6% to 15.8% roughage. All cattle had constant access to water and blocks containing minerals, salt and a diuretic (Johnston et al., 2004). In their study, Sithyphone et al., (2011) found that feeding systems consisting mainly of hay and grass can reduce feed costs by approximately 60% and 78%, respectively. A study by Lunt et al. (1993) used ten purebred Angus and ten crossbred (3/4–7/8) American Wagyu steers. The oxen were fattened on corn and barley-based rations for 552 days, after which they were slaughtered. Angus males have a higher gain of 0.9kg/day than American Wagyu, which gained 0.7 kg/day. From the difference in average daily gain, it is clear that Angus steers have a higher weight at the end of the fattening period. Angus steers require less feed per unit of gain than American Wagyu steers.

Japanese Black cattle crossbred with Holstein cattle slaughtered at 26 to 30 months of age had an average body weight and carcass meat at slaughter of 725 kg and 470 kg, respectively (Gotoh et al., 2014).

Reproductive traits

During breeding, beef producers pay increasing attention to the influence of reproductive traits on the meat quality of cattle. Oyama et al. (2002) studied the reproductive traits of Japanese black cows by analyzing information from 174 005 calvings and 31 364 carcass analyses. From the study conducted, the author collective points to concerns that intensive selection for slaughter traits may reduce the reproductive capacity of female animals. In the same study, the authors analyzed the genetic parameters between six carcass traits and age at first calving (AFC), gestation length (GL), lactation days (DO) and calving interval (CI) under artificial insemination. The heritability values of the reproductive traits (AFC, GL, DO and CI) were found to be lower /0.05–0.40/ compared to the slaughter marks, ranging from 0.38–0.56. The genetic correlations of CI with AFC and GL were 0.25 and 0.16, respectively, while no association was observed between AFC and GL. Genetic correlations for AFC were -0.27 with carcass weight and -0.24 with marbling. In contrast, the other reproductive traits (GL, DO and CI) were genetically independent of carcass characteristics. Genetic correlations between reproductive and cadaver traits are generally low. The results suggest that selection for slaughter traits would not compromise genetic progress in reproductive traits.

The same authors (Oyama et al., 2002), in another study analyzed reproductive characteristics obtained from more than 20 000 Japanese black cows from Hyogo and Shimane prefectures. Average values for age at first calving – 25.1 months, length of pregnancy – 289 days, lactation period – 112 days and interval between calving – 401 days were established. The heritability estimate for age at first calving was 0.22. For gestation length, the heritability estimate was 0.40, and the heritability and repeatability of calving interval were 0.05 and 0.09, respectively. Genetic and phenotypic correlations between age at first calving and calving interval were 0.27 and 0.39, respectively. In conclusion, the authors indicate the reproductive and genetic traits of Japanese Black cattle as important breeding objectives, as they directly affect the productive efficiency of the herd and should be used in selection schemes. In this study, it is clear that environment largely influences some of the breed's reproductive traits and is an important source of variation for calving intervals in Japanese Black cattle.

The relationship between reproductive traits and economic performance is reviewed by Setiaji and Oikawa (2019). They believe that the decline in reproductive ability directly affects the cost of producing calves in beef production. The aim of their study was to evaluate the heritability, repeatability and genetic correlation between female reproductive traits and to determine the most suitable trait for improving reproductive performance in Japanese Black cows. The signs of non-reversibility (NRR), number of inseminations (IN), days from first to successful insemination (FS), length of pregnancy (GL), days from calving to first

insemination (CF), days in milk (DO), percentage of pregnancy (PR), calving interval (CI) and age at calving (AC). AC includes age at first calving (AFC), age at second calving (ASC) and age at third calving (ATC). The heritability of AC is higher than that of other traits, although it is lower in later parities; 0.158, 0.107 and 0.088 for AFC, ASC and ATC respectively. The highest repeatability was observed for CF (0.142) and the lowest for FS (0.036). Genetic correlations between the same traits in parities were generally high, ranging from 0.72 to 0.99. The lowest genetic correlation in absolute values was observed between CF and IN (-0.075) and the highest between DO and CI (0.957). After the studies done, the authors concluded that AFC is the most promising trait for genetic evaluation of female reproductive traits, as it demonstrated higher heritability and moderate to high genetic correlations with NRR, GL, CF, DO, PR, CI, IN and FS. AFC breeding will provide higher genetic improvement in the reproductive performance of Japanese Black cows. Setiaji and Oikawa (2020) confirmed their previous study by concluding that the low heritability of most reproductive traits in Japanese black heifers was strongly influenced by farm management practices. Among reproductive traits, AFC is potentially more useful for genetic improvement of heifer reproductive traits because it has high heritability.

The traits carcass weight (CWT), beef marbling score (BMS), birth weight (BWT), 9-month weight (WT9), mature cow weight (MWT) and calving interval (CI; interval between first and second calving) of Japanese Black cattle were investigated by Hirooka and Oishi, (2018). The authors found that CI is a very important trait from an economic point of view, although this trait has a low heritability. Among the production traits, BMS was still the most important in Japan. The extremely high economic values of CI in the present study compared to previous studies may reflect the effect that additional days in CI lead to a reduction in reproductive performance (conception rate) and therefore in the number of calves born. CI was therefore suggested to be included in the breeding objectives of future Wagyu breeding schemes due to its high economic efficiency.

Baco et al. (1998) investigated the genetic relationships of body measurements at registration with several reproductive traits in Japanese black cows. Body measurements and three reproductive traits of 14 881 Japanese black cows were analyzed. Body measurements included height at withers, chest girth, chest depth, rump length, rump width, and body weight, and reproductive traits included age at first calving, first calving interval, and gestation length. Heritability estimates for body measurements were moderate (0.33 for breast girth, 0.35 for chest depth, 0.39 for rump length, 0.34 for rump width, and 0.39 for body weight) to high (0.45 for withers height), while those for reproductive traits were low (0.04 for initial calving age to 0.17 for gestation length). High and positive genetic correlation coefficients of 0.50 to 0.87 were found for body measurements. Most body measurements have a negative genetic association with reproductive traits. Spine width had the closest genetic correlation (-0.38) with age at first calving, while rump length had the closest correlation (-0.34) with calving interval. Withers height had only a low and negative genetic correlation with age at first calving (-0.19) and a negative and closest correlation with gestation length (-0.48). Body weight has a close genetic correlation with reproductive traits (-0.12 to -0.16). All body measurements at registration are not always good indicators of potential reproductive performance to predict breeding values of reproductive traits such as age at first calving, calving interval and longevity of heifers and cows.

Genetic parameters for first calving reproductive traits and growth curve traits in Japanese Black cattle were reported by Inoue et al. (2020). Records of 3 204 animals of the breed were used in the experiment. The authors estimated genetic parameters using a linear univariate and bivariate animal model. A Gompertz growth function was fitted to the body weight and age data to obtain the mature weight (MWT) and rate of maturation (ROM) of the cows. Data were collected on reproductive traits including first conception rate (CR) for heifers, age at first calving (AFC) and length of pregnancy for first calving. Heritability scores were moderate (0.29 for ROM) and high (0.57 for MWT) for growth curve parameters and low (0.03–0.11) for reproductive traits. There is a negative genetic correlation between MWT and ROM (-0.26), suggesting that an animal with a faster ROM will show a lower MWT. CR was negatively correlated with MWT (-0.42) but significantly and positively correlated with ROM (0.91). There was a negative genetic correlation between AFC and MWT (-0.49). These results suggest that a heifer with a faster ROM and lower MWT will show a higher CR. Meanwhile, a heifer with a lower MWT would show a higher AFC.

Due to the paucity of information on the relationship between season, parity and herd size with reproductive performance in Japanese Black cattle, Sasaki et al. (2016) investigated the relationships of these factors with parameters of reproductive performance such as calving to first insemination interval (CFSI) and first insemination conception rate. The authors used data from 34 763 calvings of 13 186 animals from 826 farms in Miyazaki Prefecture. This region has a temperate climate with warm, humid summers and cold winters. The cattle are reared under intensive systems and housed in free stalls throughout their lives. Herds were classified into three groups based on the number of animals in

them: small, medium and large – ≤10 cows, 11 – 50 cows and ≥51 cows, respectively, with the average number of cows per farm being 18 (range 1 – 454). Cows were inseminated by artificial insemination and calving to first insemination interval CFSI and first insemination conception rate were monitored. From this observation, the researchers found that cows that calved in spring (March to May) and winter (December to February) had the longest CFSI. Cows in large herds have approximately 10 days shorter average CFSI than those in small herds. Cows inseminated in winter or spring have lower conception rates than those inseminated in summer (June to August) or fall (September to November). In conclusion, the authors note that reduced reproductive performance in intensively reared Japanese black cattle is associated with winter and spring calving and artificial insemination at small herd sizes.

Meat composition

Beef is an important source of protein necessary for human health. High-quality beef contains all the essential amino acids (Oh et al., 2016). The optimal intake of protein in the human body helps to maintain the flexibility of blood vessels and prevent cerebrovascular disease, it also improves our immune system. The lack of proteins in the human body can lead to anemia, increased stress levels and the development of various diseases (Pencharz, 2012). Myofibrils, which define muscle type, are an important factor in meat quality because they are involved in many ante- and postmortem biochemical processes in muscle (Klont et al., 1998). Basically, myofibers are divided into three main categories depending on histochemical, physiological, and biochemical properties: type I slow oxidative, type II A – fast contracting oxidative glycolytic and II B – fast contracting glycolytic. In mammals and birds, more than 200 skeletal muscles have different functions in different parts of the body, for example locomotion, postural maintenance and respiration. Their heterogeneity is recognized in fast- and slow-twitch muscles, contraction using energy from oxidative and glycolytic metabolism (Peter et al. 1972; Pette and Staron, 1990). Regarding meat quality, a relationship between myofibril type/fatty acid composition and breed differences remains unclear. Wagyu, for example, is a type of beef from cattle that has a high potential for intramuscular fat (IMF) accumulation (Gotoh et al., 2011).

Increased interest in beef consumption in Japan began in the 1860s. The selection of Wagyu is aimed at increasing the quality of the meat to satisfy the taste preferences of consumers. Wagyu meat is distinguished from other breeds by its intense marbling (Figure 6). The fatty acid profile of Wagyu meat is significantly different from that of other cattle breeds. The high content of intramuscular fat improves the tenderness, juiciness and overall taste of the meat. Kobe beef has become more polarized in global markets and is perceived by consumers as one of the most luxurious food products in the world (Motoyama et al., 2016).

Fig. 6. Difference in marbling between Angus Wagyu beef (Holland, 2023)

Recently, the content of fatty acids and their percentage content relative to other tissues in carcasses has attracted the interest of a number of researchers. For example, Horii et al. (2009) and Albrecht et al., (2011) found that the percentage of intramuscular fat in *m. Longissimus dorsi* from Japanese black cattle is more than 30%.

Gotoh et al., (2009) studied intramuscular fat content in *m. Longissimus dorsi* in Japanese Black (JB), Belgian Blue, German Angus, Holstein–Friesian breeds and observed different patterns of muscle and intermuscular fat accumulation in JB compared to cattle breeds that are most reared in Europe. These results indicated that JB demonstrated the best ability to deposit intramuscular fat. When cutting the carcasses of the Japanese Black cattle slaughtered at 26 months of age, the following tissue percentages were observed in the carcass – 47.7% muscle, 41.7% fat and 10.6% bone, being the largest amount of total fat compared to carcasses of Belgian Blue, German Angus and Holstein–Friesian cattle.

In conventional fattening of Japanese black cattle, the meat obtained from them has the following percentages of moisture, crude fat and crude protein in the muscle of m. Longissimus thoracis at the 12th thoracic vertebra 47.1%, 38.4% and 13.9%, respectively. In recent years, the percentage of intramuscular fat in beef from Japanese black cattle has averaged greater than 30% (Horii et al., 2009; Albrecht et al., 2011).

The average body and carcass weights of the Japanese black cow at slaughter were 756 kg and 476 kg at 29.2 months of age respectively. Average daily gain until slaughter weight is 0.770 kg. In 2017, the average price of calves (average 9.1 months) in the market was about 6 226 USD, while the average price of carcasses in the beef market was about 12 511 USD. The average total production cost per

carcass is about 10 045 USD /Ministry of Agriculture, Forestry and Fisheries (MAFF) [Internet], Statistics VIII. 2018/.

Due to the high quality, marbled, beef, Wagu are the most preferred breed for breeding in Japan, the largest share of the population is occupied by the offspring of Japanese black cattle. It is their meat quality that makes them the largest proportion of all four Wagu broods (Gotoh et al., 2009; Albrecht et al., 2011).

Sturdivant et al. (1992) analyzed the ratio of monounsaturated: saturated fatty acids (MUFA: SFA) in samples of *m. Longissimus dorsi* (ribsteaks) of purebred Wagu cattle from three regions of Japan – Gunma, Kagoshima and Miyazaki. The authors reported that samples from the Gunma region had a highly reliable MUFA:SFA ratio (2.10) compared to samples from the Kagoshima (1.·82) and Miyazaki (1.·65) regions. The obtained results show that the beef of the studied breed is rich in monounsaturated fatty acids and the degree of their content depends on the region of Japan where they are grown.

Zembayashi et al. (1995) investigated the effect of breed and sex on the fatty acid composition of subcutaneous and intramuscular lipids and phospholipids in m. Longissimus lumborum in purebred Japanese Black and Holstein cattle, as well as crosses between Japanese Black, Holstein, Japanese Brown and Charolais. All animals are fed a high-quality ration of concentrate fodder and rice straw. In conclusion of the obtained results, the authors report that Japanese Black cattle are genetically predisposed to accumulate fat containing a higher concentration of monounsaturated fatty acids (MUFA) than Holstein, Japanese Brown and Charolais cattle.

Gotoh et al., (2011) compared the intramuscular fatty acid composition of *m. Longissimus dorsi* in 26-month-old Japanese black and Holstein steers. The steers are reared and fattened using a standard fattening system with significant amounts of concentrate based on a conventional Japanese fattening system, although the normal fattening period for Holstein cattle is shorter (until 20–22 months of age). The results showed a higher percentage of unsaturated fatty acids in Japanese Black males than in Holstein males. The authors compared intramuscular fat content and intramuscular fatty acid composition of 21 major skeletal muscles from the same animals. Muscles from Japanese Black cattle contained a higher proportion of various fatty acids, especially C16:1, C18:1 and C20:1, and MUFAs, compared to those from Holstein cattle. Recently, it has become clear that oleic acid (C18:1) is responsible for the specific flavor of Wagyu meat. In Japanese Black cattle, the proportions of C18:0 and saturated fatty acids are much lower than in Holstein cattle (Gotoh et al, 2011). Yang et al. (1999) confirmed the high marbling level of Wagyu beef and the content of a high percentage of MUFAs compared to other cattle breeds. The higher percentage of MUFAs leads to a lower melting point of the fat, which contributes to the tenderness of the beef and improves its taste. The content of MUFA and their predominant amount in the ratio (MUFA: SFA) can reduce the concentration of lipoprotein cholesterol, which is beneficial to human health (Melton et al., 1982; Smith, 1994; Rudel et al., 1995). Therefore, fatty acid composition has been established as a major trait in the beef industry, especially in Japanese black cattle. Fatty acid composition in cattle is much less dependent on diet, because rumen microorganisms hydrogenate most of the dietary unsaturated fatty acids, which are absorbed mostly as saturated fatty acids. Jenkins (1993) and Oka et al. (2002) demonstrated that in different Japanese lines, sires have significantly different fatty acid composition, suggesting that fatty acid composition is controlled by genetic factors such as lipid synthesis and fatty acid metabolism genes. Genes responsible for fatty acid composition were recently identified in Japanese Black cattle (Gotoh, et al., 2018).

Supply and demand dynamics. Pricing

The limited supply of authentic Wagyu beef, combined with ever-increasing global demand, exerts constant pressure on prices. Since bans on Japanese Wagyu exports to the US and Europe were lifted in mid-2010 (a lingering result of mad cow fears), wagyu has taken the industry by storm; thanks in large part to the Japan Overseas Food Promotion Center. At that time, the center, also known as JFOODO, was established to enhance the global competitiveness of Japanese agriculture, forestry, fisheries and general food products through branding, promotion and export support efforts (London, 2023). Effectively managing this delicate balance between supply and demand is critical to price stability in the Wagyu meat market. Two price strategies are observed – premium prices and differentiated pricing. Given its exceptional quality and distinctive taste, many Wagyu beef brands have chosen a premium pricing strategy, positioning their products as a luxury and highly desirable choice (Kotler et al., 2019). This approach takes advantage of the perceived high value of Wagyu beef. Some producers may use differentiated pricing strategies, offering different cuts of Wagyu beef at different price points to cater to different consumer segments (Kotler et al., 2019). This strategy is in line with the diverse preferences and budgets of consumers. The price of a weaned 9-month-old male Wagyu calf varies between 5 000 and 6 000 euros, and the price of a carcass between 10 000 and 12 000 euros. The price of one cow on the free market reaches up to 40 000 euros, and 1 kg of fillet up to 300 euros

(Markov et al., 2022). The growth of the Wagyu beef market is emblematic of a shift in consumer preferences towards premium food products. Aspects that influence Wagyu beef pricing are supply and demand, production costs, distribution channels and competitive pressures. They are essential for stakeholders in this industry. As global demand continues to increase, pricing strategies tailored to consumer preferences will be central to maintaining the appeal of Wagyu beef.

Conclusions

Reproductive and genetic traits of Japanese Black cattle are important breeding objectives as they directly affect the productive efficiency of the herd and should be used in selection schemes. Breeding for age at first calving will provide higher genetic improvement in the reproductive performance of Japanese Black cows. Wagyu meat is distinguished from other breeds by its intense marbling. The percentage of intramuscular fat of beef from Japanese black cattle averages more than 30%. The average body and carcass weights of the Japanese black cow at slaughter were 756 kg and 476 kg at 29.2 months of age, respectively. Average daily gain until slaughter weight is 0.770 kg. The average price of calves in the market is about 6 226 USD, while the average price of carcasses in the beef market is about 12 511 USD. The average total production cost per carcass is about 10 045 USD.

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Received: **October, 08, 2024**; *Approved*: **January, 23, 2025**; *Published*: **June, 2026**