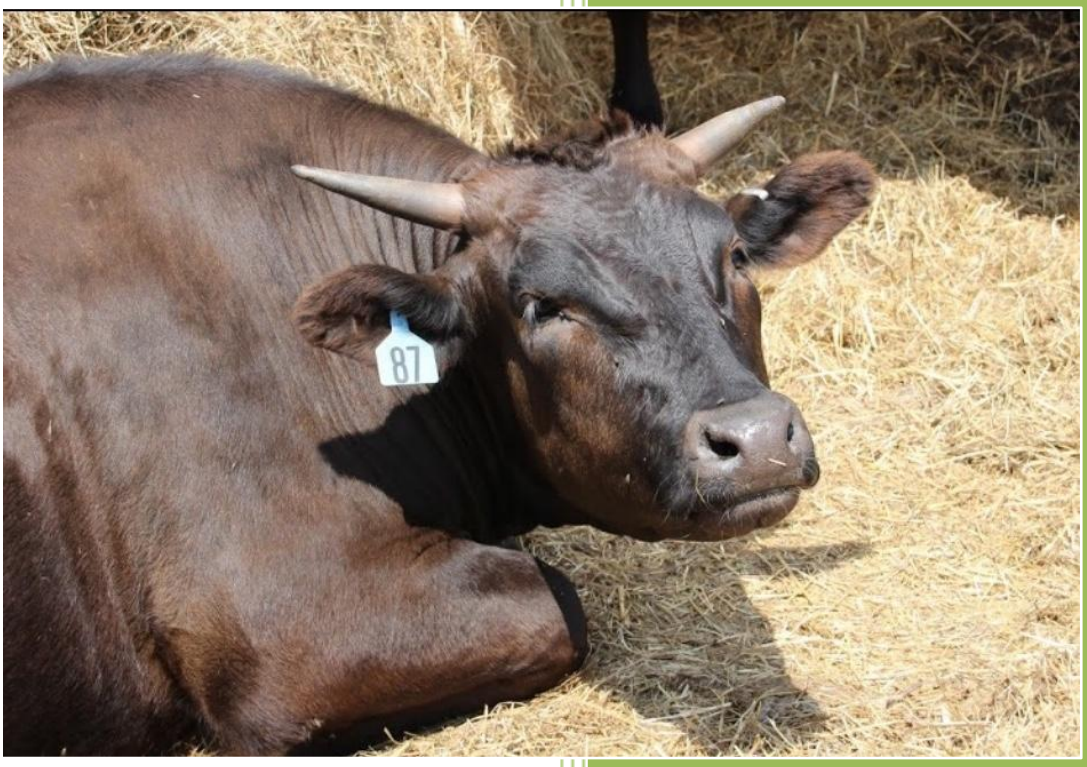
2018

WAGYU BREEDERS HANDBOOK

An introduction to Wagyu.



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FOREWARD

Many people consider Wagyu beef to be the most tender and flavorful beef in the World. The cattle used to make this beef are docile with good temperaments, and they are known for their intense intramuscular marbling, high fertility rates and calving ease traits. Why wouldn't a cattle farmer want to raise Wagyu? The internet is flush with information about Wagyu, some of it is accurate and some of it is misleading. This handbook is designed to help breeders decide whether or not raising this breed is the right choice for them. Peer-reviewed journals and academic textbooks were used to create this handbook, and world-renowned Wagyu experts were consulted. There are good opportunities for producers who are informed, careful and realistic. There are many variances within the Wagyu breeds and bloodlines; as well as differences in short and long-fed animals, and results of feeding protocols. Wagyu are very special animals, they are considered a national treasure in Japan. I hope you enjoy and appreciate them as much as I do.

Pam Armstrong, LVT

(Pam and MRS Kitaguni Shigatsu "April").

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ORIGIN OF WAGYU

What are Wagyu?

The Japanese word Wagyu (pronounced wah-gyou) translated into English means Japanese cattle. When these cattle are bred, raised and fed properly, they are capable of producing some of the most tender and marbled beef in the world. These cattle evolved during the Meiji era (1898 – 1912), when an extensive, government-guided crossbreeding program occurred. The native working cattle were crossbred with European breeds to dilute the gene pool and expand the population. Once the initial dilution was complete, breeders within prefectures (jurisdictions in Japan) began improving their lines without crossbreeding. The resulting breeds were certified in the mid-1900s, and they are now sought-after worldwide for their tremendous marbling capabilities. The 90th Statistical Yearbook of Ministry of Agriculture, Forestry and Fisheries shows 1.6 million non-crossed beef cattle and 1.8 million crossed and dairy cattle in Japan in 2015. The Japanese non-crossed or fullblood breeds include: Japanese Black (90%), Japanese Brown (9%), Japanese Shorthorn (<1%) and Japanese Polled (rare). In the United States, these four Japanese cattle breeds are referred to as Wagyu.

What are Japanese Black Cattle?

Japanese Black cattle were certified as an indigenous Japanese breed in 1944 after crossbreeding the native work cattle with Brown Swiss, Shorthorn, Devon, Simmental, Ayrshire and Holstein. There are three major bloodlines of Japanese Black that are grouped according to the prefecture where they were bred. Until recently, cattle were only bred within their prefecture, so each prefecture's bloodline developed its own set of attributes.

1. The Hyogo Prefecture is known for Tajima or Tajiri cattle. Within this group are four bloodlines that have slightly different attributes.
    a. The Yasumi Doi line tends to produce very high marbling and meat flavor. They tend to be smaller in size with narrow hips and shoulders. These animals work well when crossed with larger type Wagyu to improve marbling and make good F1 terminal sires. (See Purchasing Wagyu for description of F1.) Japanese exports include: Yasufuku, Kikutsuru Doi TF146, Michifuku, Fukutsuru 068, and Kitakikutsuru Doi ETJ007.
    b. The Kikuteru Doi line produces good marbling and meat color. They tend to produce a body type that is deep and long with narrow hips. They have good maternal traits and a good volume of milk. The mature later. Some animals from this line have temperament problems. Japanese exports include: Kitateruyasu Doi.
    c. The Kikuyasu Doi line has shown good marbling but varied meat quality. Japanese exports include: Kikuyasu.
    d. The Shigekanenami or Kumanami line tends to have very good marbling ability and good growth with well balanced structures. Japanese exports include: Itoshigenami TF148, Okutani, Suzutani and Rikitani.
2. The Okayama and Shimane Prefectures boasts two major bloodlines.
    a. The Shimomae line tends to have large frames with very good structure, length and depth. The meat quality is good. Japanese exports include: Dai 6 Seizan ETJ006.

b. The Fujiyoshi line has very good structure, length and depth to their bodies. They have very good marbling, mature early, fatten well, and are very fertile. Cows from this line produce an adequate amount of milk. Japanese exports include: TF Itohana2, Kenhanafuji, TF Kikuhana, TF Itomichi ½, Itoshigefuji TF147, Itozuru Doi TF 151, and Itomoritaka ETJ002. Ithohana, Kitaguni 7-8 and Kitaguni Jr. are from this bloodline.

3. The Tottori Prefecture is known for the Kedaka line of cattle.
   a. The Kedaka animals are large-framed that have moderate to late maturity rates. They have good temperament, fertility and calving ease traits, and the cows produce an adequate amount of milk. The carcasses have good marbling that develops through to the rump, but tend to have a small eye muscle. Japanese exports include: Hirashigetayasu and Shigefuku.

What are Japanese Brown Cattle?

Japanese Brown cattle are also known as Red Wagyu. This indigenous breed also received its certification in 1944 after crossbreeding native cattle with Korean Hanwoo, Devon and Simmental. They are raised primarily in Kumamoto and Kochi Prefectures. These cattle typically yield larger carcasses with meat that has a pleasantly firm texture and tasty, intramuscular marbling.

What are Japanese Shorthorn Cattle?

Japanese Shorthorn cattle are raised in the Prefecture of Aomori, Iwate and Akita. They were derived from crossbreeding Nanby cattle to Shorthorn, Devon and Ayrshire and approved as a native breed in 1957. Their meat is lean and flavorful, similar to other breeds of cattle in the world. Production of this breed plummeted with the liberalization of beef imports in 1991. The cost to import similar beef was much less than to raise cattle domestically for beef.

What are Japanese Polled?

Japanese Polled cattle originate from Yamaguchi Prefecture where the domestic cattle were crossed with Aberdeen Angus, which resulted in polled offspring. This breed makes up the smallest population of Japanese cattle.

What is the origin of Wagyu in the United States?

”A total of 167 Black Wagyu is known to have been exported. 21 Calves registered from Japanese AI sires were born after the arrival of the heifers. 16 Red Wagyu bulls and heifers were exported and 6 registered births resulted. A total of 221 Wagyu cattle brought genetics from the Japanese Black and Japanese Brown and they formed the basis of all Wagyu and Akaushi in USA, Canada and Australia.” (Wagyu International)

Foundation Black Wagyu Exports from Japan

Year	Importer	Black Bull	Black Heifer	Black Calf Born
1976	Morris Whitney	Mazda Mt Fuji		
1993	Mannett ->World Ks	Haruki II Michifuku	Okutani Rikitani Suzutani	
1994	Japanese Venture Partners	Fukutsuru 068 Kikuyasa 400 Yasutanisakura 931	Chisahime 662 Chiyofuku 992 Fukutomi 990 Kikuhana 298 Shigehime 208 Tokuhime 486 Yasufuji 1/4 Yoshifuku 2 Yuriko 1 + 1	
1994	Mannett ->World Ks	Kenhanafuji Takazakura	Kanetani Nakagishi Nakayuki Okahana	Tanisuru (H) Nakazukura (H) Kitaguni Jr (B) Reiko (H)
1995	Takeda Farms	Itohana 2 Itomichi 1/2 Kikuhana Kinto Terutani	2 Kinto 1/2 Aizakura 5/1 Chiyotake 10 Chiyotake 8 Chiyotake 8/1 Chiyotake 8/1A Chiyotake 8A Chiyotake 9 Dai 2 Kintou 12 Dai 2 Kinntou 3 Dai 2 Kintou 4 Hikohime 3/4 Hikohime 3/4A Hikohime 3/4B Hikohime 8 Hikokura 1/11 Hikokura 2/25 Hikokura 3/11 Hikokura 3/15 Hikokura 3/15A Hikokura 3/16 Hikokura 3/24 Hikokura 7/12 Hikokura 8/3 Itochiyo 3 Kintou 3/2 Kinu 1 Takechiyo 2/4 Takefukumori 23 Tetufuku 3/15 + 5	Yukiharunami 4 (B) Chiyotake 14/1 (H) Chiyotake 27/1 (H) Chiyotake 22/1 (H) Terutani 40/1 (B) Yukiharunami 41 (B) Hikohime 44/1 (H) Hikohime 19/1 (H) Yukiharunami 24 (B) Hikokura 21/1 (H) Itomichi 42 (B) Hikokura 15/1 (H) Yukiharunami 7/1 (B) Yukiharunami 13 (B) Takechiyo 25/1 (H) Mitsuhikokura 43 (B)
1997	Westholme	Hirashigetayasu Itomoritaka Kitateruyasu Doi + semen from Dai 6 Seizan Kitatsurukiku Doi Shigefuku	Hatsuko Itoreiko Kazuaki Kitahikari 97/1 Kitakazu Kitaokumi Kitasakaedoi Kitasekitori Kitatizuru 2 Kunikiku 95 Masako Masatoshi 2 Sakaehikari	

			Sekinakada 22 Sekiyuhou Takakuni Takashigedoi Yamafuji Yamaketafuji 3 Yuriyuhou + 64	
1997	Takeda Farms	Itoshigefuj Itoshigenami Itozuru Doi Kikuterushige Kikutsuru Doi Mitsuhikokura		
1997	Mannett -> World Ks	Yasufuku Jr	Hanateru 9 Hisako Mitsutaka Nakahana 5 Okuito 9 Rabito Taguchi 9	 Kotomichan (H) Kousyun (B) Eikichi (B)

(Wagyu International & Wagyu Sekai. (H)Heifer, (B) Bull).

Foundation Red Wagyu Exports from Japan

Year	Importer	Red Bull	Red Heifer	Red Calf Born
1976	Morris Whitney	Judo Rueshaw		
1994	JVP		27 Homare Kunisakae	
1994	Bruce Hemmingsen Yukio Kurosawatsu	Hikari Shigemaru Tamamaru	Akiko Dai 3 Namiaki Dai8 Marunami Dai 9 Koubai 73 Fuyuko Haruko Namiko Naomi Ume	Big Al (B) Kaedemaru (H) Ringo (H) 505 (B) Momigimaru (H) 504 (H)

(Wagyu International & Wagyu Sekai. (H)Heifer, (B) Bull).

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PURCHASING WAGYU

Where can I purchase Wagyu?

Wagyu may be purchased at one of many Wagyu auctions held in the United States throughout the year. Most auction purchases are "as is" and don't come with a guarantee, so make sure you know what you are purchasing. For newcomers to the breed, this is the most risky method of purchasing animals. Private treaty sales allow more opportunity to interact with the seller and research your purchase. Wagyu embryos may be purchased from breeders and implanted into recipient cows by an embryologist or veterinarian who specializes in theriogenology.

How do I find and select Wagyu breeders?

In the United States, there are two Wagyu Associations. The American Wagyu Association (AWA, www.wagyu.org) maintains a registry for Japanese Black, Japanese Brown and crossbred Wagyu, while the American Akaushi Association (AAA, www.akaushi.com) only registers Japanese Brown and their crossbreds. They can be contacted to obtain information about their members. As far as selecting a breeder, you will have to rely on word-of-mouth, reputation and references. Ask to speak with the breeders' previous clients, inspect the cattle and ask for any data available on their animals.

What breed of Wagyu should I purchase?

Using your business plan, decide which breed you would like to purchase, Japanese Black, or Japanese Brown (known as Akaushi or Red Wagyu in the United States). The Japanese Shorthorn and Japanese Polled are not available outside of Japan. There are also crossbred animals available. The Wagyu Associations differ from many other cattle associations in that they refer to 100% non-influenced Wagyu as Fullbloods, while Purebreds only contain a percentage of Wagyu. DNA verified by an AWA approved lab or other AWA accepted facility is required to register animals to verify the parentage.

Fullblood (FB) Black Wagyu: 100% Japanese Black

Fullblood Red Wagyu: 100% Japanese Brown

Fullblood Red/Black: 100% Japanese Black and Brown Cross

Purebred (PB) Black Wagyu: 93.75% Japanese Black

Purebred Red Wagyu 93.75% Japanese Brown

Purebred Red/Black Wagyu: 93.75% Japanese Black or Brown

Percentage Wagyu: Females must have at least 50% Wagyu blood, males 87.5%

Recorded Wagyu: Females must have 37.5% - 49.9% Wagyu blood, males 50% - 87.4%

To complicate matters even more, males that are 93.75% Wagyu are considered to be 100% when calculating the percentage of a cross-bred animal. This explains why the USDA allows cattle that are eligible for approved Wagyu branded beef programs to contain only 46.875% Wagyu. The registered sire or dam must be at least 93.75% Wagyu (i.e. Fullblood or Purebred).

*Controversy: The American Akaushi Association and the Japanese recognize that Japanese Black and Japanese Brown are two separate breeds of cattle, with different genotypes. Thus, breeding a FB Black Wagyu with a FB Red Wagyu would result in a Percentage Wagyu or F1 hybrid.

What is an F1 hybrid?

F1 hybrid or filial 1 hybrid is a genetic term used to describe the first filial generation of offspring of distinctly different parental types. Subsequent generations are called F2, F3, etc. (Runge, p. 58). This term is commonly used to describe Wagyu bred to another breed with different traits. For example, a 100% Wagyu bred to a 100% Angus would produce an F1 (50% Wagyu/50% Angus). If that F1 was bred to a 100% Wagyu, the result would be an F2 (75% Wagyu/25% Angus). If that F2 was bred to a 100% Wagyu, the result would be an F3 (87.5% Wagyu/12.5% Angus). Finally, if the F3 was bred to a 100% Wagyu, the result would be an F4 (93.75% Wagyu/6.25% Angus).

Are all Wagyu solid red or black in color?

Fullblood and Purebred Wagyu must be black or red in color and may not be registered if they have any white coloring above the flank or in front of the navel, except for birthmarks.

*Controversy: Wagyu are known to develop "fairy rings" or white circular-shaped markings that aren't present at birth. Also, some Wagyu are born with a gray coat.

Fairy ring that appeared on a FB Black Wagyu steer at 20 months.

These calves are all fullblood black Wagyu. Notice the difference in color when they are young. The lightest and the darkest calves are full siblings. They have all matured to a similar dark brown/black coat color that is associated with Japanese Black Wagyu.

Which Japanese Black Bloodlines should I look for?

A brief description of the Japanese Black bloodlines is listed above. There are very few pure bloodline animals available. Frozen semen from some pure bloodline bulls exists, and there are only a few pure bloodline cows outside of Japan. A study of an animal's pedigree can help determine the percentages of each bloodline. This can be an arduous task for even the experienced Wagyu breeder. Takao Suzuki from Blue Mountains Wagyu in Australia uses 16/16 analysis for calculating the bloodline percentages in Japanese Black. Most bloodlines have been mixed in an effort to obtain the best attributes from each one. For example, a small-framed but high-marbling Tajima may be crossed with a Shimane to yield a larger animal, with greater milk production. If the goal is create an F1 with a prime carcass, a high Tajima-line bull should be used. Not all Wagyu are capable of producing high levels of marbling. Do your research, and look for data and carcass photos.

What is a 16/16 analysis?

A 16/16 analysis is a Japanese pedigree analysis model that uses four generations of a pedigree to group Fullblood Black Wagyu breeding stock by prefectural origin. The breeding in each prefecture during the

times when Wagyu were exported from Japan was controlled and concentrated to maintain prefectural strains, so the results of the analysis will give a predication of the traits that the animals has inherited as they pertain to the prefecture of origin.

Example of 16/16 analysis

Sire	Sire/ Dam	G Sire/Dam	GG Sire/ Dam	Line	16/16
			HOUSAN J5150 - KURO KOH (H)	Tottori	2
		KEDAKA J7212 - KURO IKU (H)			
			TAKEMOTO	Kedaka	2
	Sire: DAI 20 HIRASHIGE J287 - KURO IKU (H)				
			KEDAKA J7212 - KURO IKU (H)	Kedaka	2
		DAI 13 HIRASHIGE J1137022 - KURO KOH (H)			
			DAI 10 HIRASHIGE	Kedaka	2
Animal: HIRASHIGETAYASU J2351 HONGEN (IMP JAP) (H)					
			TAYASU DOI US7208 J7208 -KURO IKU (H)	Tajima	2
		TAYASUFUKU J157 - KURO IKU (H)			
			Tajima Dam	Tajima	2
	Dam: DAI 5 YURUHIME J187250 - KURO KOH (H)				
			DAI 5 NAKAYAMA J10095 - KURO KOH (H)	Okayama	2
		YURIKO J28677 - KURO KOH (H)			
			Okayama Dam	Okayama	2

Bull Name	Tajima	Kedaka	Tottori	Itozakura	Shimane	Okayama	Hirosima	Other	Total
Hirashigetayasu	4	6	2			4			16
	25%	37.5%	12.5%			25%			100%

The analysis above indicates that "Hirashigetayasu" is highly influenced by the Kedaka/Tottori traits of growth and large frame. Only 25% is from the Tajima line known for high marbling traits. The remaining 25% Okayama bloodline is known for traits such as good maternal instincts, growth and variable meat quality. This type of analysis may help guide your purchasing/breeding decisions, especially if there is a lack of data on an animal. Takao Suzuki can be contacted via email takaos@bluemountainswagyu.com.au for 16/16 analysis.

If bloodlines are so diluted, how can I make purchasing/breeding decisions?

Identify the traits that are important to you and look for those. Physical traits (size, phenotype, udder size, testicle size) are seen by looking at the animals, but you need data to see carcass traits (marbling, rib eye area, back fat, etc.) and other traits (calving ease, birth weight, growth rate, etc.). A reputable breeder will collect and share truthful data and carcass photos. Early Progeny Differences (EPDs) are not readily available on most animals registered in the US, however a new system has been implemented by the AWA to collect and analyze data to produce the highly, sought-after numbers. The Australian Wagyu Association has a large database of Estimated Breeding Values (EBVs), but only on those animals registered with their Association.

EPDs: An animal's genetic value as a ***PARENT*** for a particular trait.
EBVs: An estimate of an animal's ***OWN*** genetic value for a particular trait.

*Theoretically, an EPD is half an EBV, as a parent contributes 50% of its genes to its progeny. In reality, the differences used in the analysis of the two genetic estimates vary significantly, which doesn't allow for easy conversion from one value to the other.

I found the cattle that I would like to purchase, what else should I know before I purchase them?

Obtain a certificate of veterinary inspection (CVI) for the animals you will be purchasing. You will need this if you will be transporting the animals across state lines. Ask for a vaccination history. Some states require cows to be tested for Brucellosis or to have a brucellosis vaccination (female calves should be vaccinated between 4 months and 1 year old) prior to change of ownership and/or interstate travel. Some states also require cattle to be tested for Bovine Tuberculosis prior to a change of ownership and/or interstate travel. It is good practice to test all new animals for BVD, Johne's and BLV. This should be done prior to purchase.

If you are purchasing a breeding cow, you may want to have a breeding soundness exam performed by a veterinarian and verify the pregnancy status at the same time. Ask the seller how many calves the cow has had, and if the cow has had embryos flushed (if so, how many times and yield).

If you are purchasing a bull, you may want to have a breeding soundness exam performed by a veterinarian. Are the semen rights being negotiated?

If you are purchasing unregistered animals and want to register them, they must be registered by the owner of the animal at the time of birth prior to transferring ownership to you.

If you are purchasing registered animals, make sure you inspect the registration papers and match them to the tattoo on the animal. Verify that the owner name listed on the papers is the seller. Either the buyer or seller should prepare a bill of sale detailing: the date of sale, buyer and seller name and address, animal names and registration numbers, sale price and signatures from both parties. Also, include any extra agreed upon details, such as, trucking details, veterinarian inspections, and when the seller will transfer the papers to the new owner. Keep a copy of the form of payment.

If you are purchasing embryos, obtain an "Embryo Recovery Certificate" from the seller. You will need this along with an Embryo Transfer Certificate to register embryo calves.

Do I have to purchase registered Wagyu?

That depends on your business plan. If you plan to sell parent-verified Wagyu animals or meat, then the only way to prove it is to register them. DNA may be submitted for analysis independently of an Association, but you must own the DNA for the registered sire and dam of the animal you want to parent-verify. Highly-marbled carcasses may sell themselves and not require DNA-verification. It depends on your buyer.

A benefit to purchasing registered Wagyu is that many of the animals that are registered with an association have information about recessive genes. This may be important to know when making breeding decisions, as breeding two animals with the same recessive gene may result in offspring that express the undesirable trait or disease. (See the Breeding Wagyu Section for more information.)

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BREEDING WAGYU

What should I know about breeding my new FB Wagyu heifers and cows?

Wagyu tend to grow at a slower rate than many other cattle breeds. Evaluate your heifers carefully to determine if they are large enough to breed, and use bulls with calving-ease traits to breed small heifers and cows. The earliest heifers should be bred is at 15 months and only if they weigh approximately 65% of their expected mature weight. Ex. A 15-month-old heifer that weighs 715 lbs and is expected to weigh 1,100 lbs. at maturity may be bred with few potential complications.

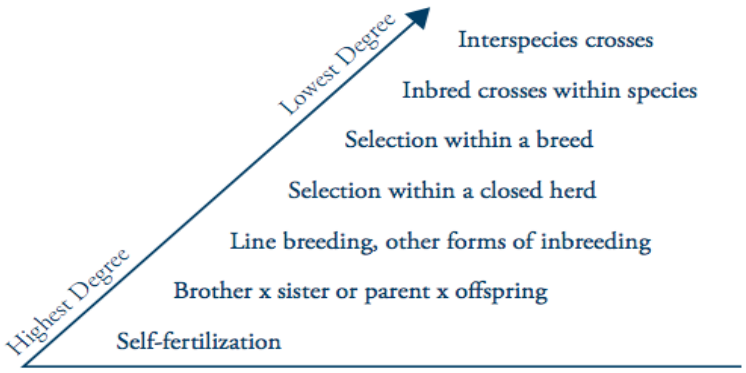
Their gestation length is 283 days, which is similar to British breeds, and the twinning rate for Japanese Black is low at 0.11%.

When making breeding decisions, uses 16/16 analysis, EPDs or EBVs if available and any other data you can obtain to select for the traits you desire. (See Purchasing Wagyu.)

What should I know about inbreeding?

Inbreeding is the mating of animals that are related. Close attention should be paid to this subject when breeding Wagyu, as the gene pool is small due to the low numbers of imported animals. There are varying degrees of inbreeding that arise from different mating strategies.

Figure 1. Varying Degrees of Inbreeding



(Juan Du).

"Linebreeding is the deliberate mating of closely related animals with the perceived objective to concentrate desirable characteristics of the progeny and to breed "consistency"." (SBTS). Care should be taken when linebreeding Wagyu, as inbreeding may exist in the pedigree of the animals you are planning to breed, which will compound inbreeding coefficients.

Higher degrees of "inbreeding can potentially lead to three main negative outcomes being: (1) inbreeding depression in production traits, (2) increased homozygosity of recessive genetic conditions,

and (3) a reduction in genetic diversity. There is a higher risk of negative health effects when breeding cattle that are too closely related." (SBTS).

> "A literature review undertaken by Burrow (1993) investigated the effects of inbreeding in beef cattle. The review revealed that inbreeding of the individual has a consistent adverse effect on growth traits from birth to maturity and on maternal traits. More specifically, for every 1% increase in inbreeding coefficient a decrease of 0.06, 0.44, 0.69 and 1.30 kg in live weight at birth, weaning, yearling and maturity respectively. Additionally, inbreeding in the dam decreased weaning and yearling weights by 0.30 and 0.21 kg respectively for every 1% increase in inbreeding coefficient, probably as a result of decreasing milk yield and reduced maternal value of the inbred dams.
>
> The review also reported inbreeding as having a depressive effect (although the magnitudes of effect were small in some cases) on heifer conception rates, female fertility, conformation/ structure, feed intake, feed conversion efficiency, carcass traits and male reproductive traits." (SBTS).

How do I calculate an inbreeding coefficient and what is an acceptable number?

The AWA herdbook shows the coefficient of inbreeding (COI) number for each registered animal. The COI includes all inbreeding in the animal's pedigree that is included in the herdbook. The standard inbreeding coefficient (SIC), which is used in the progeny calculator, is a calculation of inbreeding from a proposed mating. It includes only the subjects' inbreeding percentages from the first five generations. The percentage of inbreeding for an animal mated to its own parents (ex. Sire/daughter), or full sibling matings (parents have a common sire and dam) is 25%. The percentage of inbreeding for half sibling matings (parents have a common sire or dam) is 12.5%. These are minimum values and will be higher if ancestors in the pedigree have any amount of inbreeding. The Wright's Equation mathematical method is used to calculate the COI to determining an accurate value.

"There is no defined limit as to what is an acceptable level of inbreeding in domestic animal populations. However, inbreeding depression [the reduced survival and fertility of offspring of related individuals] is likely to be more apparent once inbreeding levels get to above 10%. As a very rough guide, there is often a 2-20% decrease in performance of the trait per 10% of inbreeding coefficient." (ABRI).

What are recessive traits?

A recessive trait is a characteristic that appears in an individual only if the dominant form of the gene governing the characteristic is not present. If an animal inherits two copies of the same recessive gene, one from each parent, the trait will manifest and the animal will be affected by the recessive disorder.

What are the inherited recessive disorders that can affect Black and Red Wagyu?

From the AWA Fact Sheet and Guide for Producers (Rev. 2014):

> •Erythrocyte Membrane Protein Band III Deficiency (Spherocytosis) (Band 3)
>
> Affected cattle (cattle with two copies of the causative mutation) are morbidly anemic. The mutations affect a protein necessary for proper shape and function of red blood cells. Calves are

typically born weak and small (40-55 lbs birth weight) with severe anemia, labored breathing, palpitations, and not able to stand or suckle at birth. This disorder is often lethal, but some affected cattle survive to adulthood, although with severely retarded growth.

•Claudin 16 Deficiency (CL16)

This mutation causes a buildup of fibrous tissue in the kidneys as well as other tissues. Affected cattle suffer from a severe risk of kidney failure throughout their lives. Other symptoms include growth retardation, increased blood urea nitrogen and creatinine values, diarrhea and overgrowth of hooves. It may or may not be lethal, but affected cattle tend to have atypically short lives.

•Chediak-Higashi Syndrome (CHS)

Affected cattle have a deficiency in cells that make up a functional immune system. As a result, these calves are often more susceptible to disease and infection. These cattle may also have a light coat color, and slight coagulation problems (hemorrhaging). This disorder is usually not lethal.

•Bovine Blood Coagulation Factor XIII Deficiency (F13)

This disorder is where one of the proteins needed to form blood clots is missing or reduced. Symptoms include severely prolonged bleeding time, bruising from castration/branding, and severe anemia. Death occurs in most cases.

•Factor XI Deficiency (F11)

This mutation affects the efficiency of the clotting factor F11. Affected cattle suffer from mild hemophilia-like bleeding tendencies, either spontaneously or following trauma and surgical procedures. It is also possible that Carrier x Carrier mating have increased difficulty producing viable fertilized embryos and full-term pregnancies and are often Repeat Breeders1. Normal repeat breeding may be considered 40% with 60% conception being an industry average. It has been reported that factor 11 increased rebreeding by 50% in the Canadian Holstein breed, so now instead of 60% conception we will get 40% conception with 60% of the animals open to be rebred.

Is it safe to breed animals that carry recessive genes?

It is safe to breed animals that carry recessive genes to animals that are free of the same gene. The offspring may also carry the recessive gene but will not be affected by the disorder. Breeding a carrier to another carrier or an affected animal increases the risk of the animal being affected by the disorder.

Mating	Offspring Distribution		
	Free	Carrier	Affected
Free x Free	100%		
Free x Carrier	50%	50%	
Carrier x Carrier	25%	50%	25%
Free x Affected		100%	
Carrier x Affected		50%	50%
Affected x Affected			100%

Do recessive genes affect the meat of an animal?

"Beef products from Carrier and/or Affected cattle have no impact on the quality, safety, and health of the end product." (AWA).

What other genetic tests are run on Wagyu?

GH (Growth Hormone) Exon 5 is a test that looks for characteristics of growth rate and marbling. This test is no longer offered by the AWA.

The SCD (Stearoyl CoA desaturase) test looks for the gene that affects the fatty acid composition of beef. The gene contributes to a higher monounsaturated fatty acid (MUFA) percentage and a lower melting point in intramuscular fat. The SCD enzyme converts stearic acid (saturated fatty acid) into oleic acid (MUFA). Stearic acid, which corresponds to the amino acid Valine (V), makes deposited fat harder. Oleic acid, which corresponds to the amino acid Alanine (A), makes the deposited fat softer, [which is more palatable]. "There are three possible genotypes for SCD, these are AA, VA and VV. AA is the preferred type." (Zoetis). A SCD study on Japanese Black steers performed by Taniguchi, et al at the Laboratory of Animal Breeding & Genetics at Kobe University in Japan produced the following results:

Table 2. Comparison of MUFA content and melting point in fat tissue between two SCD genotypes and sire groups.

Effect	*n*	*MUFA (%)*	*Melting point (°C)*
Genotype			
AA	278	58.8 ± 0.1^{a}	25.4 ± 0.2^{a}
VA	635	58.2 ± 0.1^{b}	26.1 ± 0.1^{b}
VV	90	57.1 ± 0.3^{c}	27.6 ± 0.3^{c}
Sire group			
I	709	58.6 ± 0.1^{a}	25.7 ± 0.1^{a}
II	294	57.5 ± 0.1^{b}	26.8 ± 0.2^{b}

Mean values with different superscripts in the same column differ significantly ($P < 0.001$).
MUFA indicates the percentage of mono-unsaturated fatty acids including C14:1, C16:1, and C18:1.

The head of the Laboratory of Animal Gene Function at the National Institute of Agrobiological Sciences, Dr. Tadayoshi Mitsuhashi states:

"At this time no gene tests should be used as the single selection criteria that a cattle farmer would use. Rather they should be seen as part of the selection process when choosing cattle for breeding. Cattle that show preferred genotypes for both GH Exon 5 and SCD provide the most likely animals to improve a cattle herds performance BUT ONLY if all other factors are satisfactory."

What is the tenderness test?

The tenderness test looks for favorable alleles (mutated genes) that increase tenderness in beef. Researchers measured the decrease in shear force required to shear meat that was associated with three alleles. The scores assigned to the results of the test are 1-10, with 10 being the preferred type. Scientists at Iowa State University validated a commercial genetic test that concluded: "Among genotypes with sufficient information there was a 2.3 lb. difference in WBSF [Warner-Bratzler Shear Force] between the best and worst. Breeders should not expect gains this large because no herd will consist 100% of the 'least tender' genotype."

What other health concerns should I know about?

There are three internal diseases that are frequently seen in Japanese Black cattle: multifocal necrosis in the liver (MNL), bovine abdominal fat necrosis (BFN), and inflammation of the large intestine (ILI). BFN is

the most prevalent, causes the most economic losses, and has the highest mortality rate. In a 2015 Japanese study, data from 5,788 Japanese Black fattened cattle was used to study the disease. 23% of the animals developed BFN. (Inoue, 2015). BFN is a metabolic lipid disorder, in which excess masses of fat accumulate in the abdomen, and subsequently, necrose and harden. The masses themselves are not harmful, but can cause clinical disease if they adhere to internal surfaces or become large enough in size to cause an obstruction of the abomasum, small intestine, colon, birth canal or ureters. The pathogenesis of BFN is unknown. It may be related to ingestion of endophyte-infected fescue and rye grasses, obesity and/or genetics. Studies have shown positive and significant correlations of BFN to beef marbling score (BMS). (Inoue, 2015). Clinical signs include rectally-palpable masses, abdominal pain, constipation, anorexia, depression and diarrhea. BFN caused by ingestion of mycotoxins may be treated with isoprothiolane, which is an agricultural fungicide not widely used in the United States. Researchers in Japan have found that feeding clay mined on Awaji Island may reduce the size of the masses without affecting the carcass. (Oka, 2015). Unfortunately, there is no cure for this disease. It is suggested that it may be prevented in breeding stock by avoiding obesity. BFN may be difficult to avoid in long-fed, fattened cattle with high BMS.

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What is the average calf size?

Newborn calves have low birth weights that average 65 pounds. Small calves have a large surface area in relation to their total body mass, which puts them at a higher risk of developing hypothermia when born in cold weather. Be prepared to offer assistance.

Several Japanese Black breeders have experienced newborns that are born "weak". Weak calves are unable to stand, walk or nurse without assistance. Here are some possible reasons this may occur: vitamin and trace mineral deficiencies, muscle damage due to calving difficulty, high inbreeding coefficients, hypothermia, and skeletal deformities. Be present at the time of calving to prevent calf losses.

At what age should I wean my calves?

The age at which calves are weaned should be based on the body condition of the cow and calf and the forage available. Generally, calves are weaned between 4-8 months, which is the mid-lactation stage of the cow. The chart below shows the four phases of the cow's lactation cycle. The majority of the milk produced by the cow occurs in the early and mid-lactation phases, which uses up the cows energy and body reserves. Leaving the calf with the cow past these phases might impede the cow's ability to regain body reserves for the next lactation and take away nutrition from a developing fetus. If the cow is in good condition and forage is available, it wouldn't hurt to wean later than 8 months. The calf, however, will need to have access to good quality forage and possibly supplemental feed. Daily weight gains in the calf should average 1.5 - 2 pounds per day. See the Feeding Wagyu section for more information on the "Marbling Window".

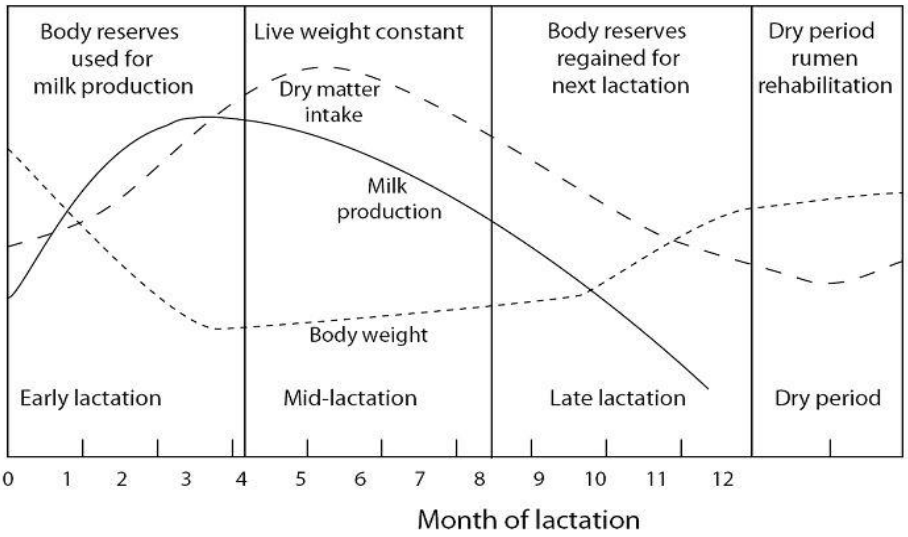

Figure 1. Dry matter intake, milk yield and live weight changes in a cow during her lactation cycle

(J. Moran).

Some Wagyu cows and heifers have small udders and don't produce much milk. Their calves may need to be supplemented with feed or weaned early if the calf isn't showing the appropriate daily gains.

Bottle-fed calves can be weaned from milk after their rumens become functional and they can digest whole foods. This usually occurs between four and eight weeks of age. Even though a young calf will not be able to utilize concentrates and forage prior to this time, encouraging them to eat these solid foods as early as one week of age will help the rumen, reticulum and omasum to develop quicker. Calves will then become less dependent on milk, the risk of scours is reduced and they can be weaned earlier.

Consider using low-stress methods of weaning, such as fence-line weaning or the use of anti-suckling devices on their noses. Japanese cattle farmers are diligent about keeping stress levels low in their Wagyu.

Note: Wagyu are known for early sexual maturity, so separate your young bulls if you plan on weaning past 6 months of age.

When should my calves be disbudded/dehorned and castrated?

These procedures should be performed as early in the animals' lives as possible. As the animal gets older, pain and stress levels from these procedures increase, and average daily gains decrease. The common theme among Japanese farmers for raising their cattle is to decrease the animal's stress as much as possible. They reason that stress reduces marbling in their animals. Causing undue pain and its associated stress to animals is also a welfare issue. Countries such as England, Canada, Australia and New Zealand have welfare laws that address these procedures, and it is just a matter of time before laws regulating these procedures are in place in the United States. It is our responsibility as caretakers of Wagyu to perform these procedures in a manner that causes the least amount of pain and stress to the animal, without being mandated. Two to three weeks of age or less is an ideal age to disbud calves. At two months of age, the horn cells attach to the skull. When this occurs, removal of the horn cells requires removal of a section of the frontal bone, which can leave the frontal sinus exposed to infection.

How should my calves be castrated?

"All physical methods of castration cause pain." (AVMA). Types of physical castration, the age of the animal at the time of the procedure, and stress and pain endured by the animal during the castration procedure were studied. Stress and pain were measured by blood cortisol levels, electroencephalogram (EEG) readings, and blood pressure readings. The studies showed that banding, the procedure involving placement of a tight band around the testicles, caused very little pain in 2-4 week old calves; however, as the cells became damaged by lack of blood flow and the tissues begin to necrose, blood pressure and heart rate increased, indicating pain. Calves that are castrated using the banding method are very susceptible to *Clostridium tetani* infection and should receive a tetanus vaccination. "So, although banding may cause less immediate discomfort than surgery, the overall impact of banding may be greater (e.g. delayed chronic pain and greater overall reduction in food intake and daily gain)." (AVMA).

The procedure to castrate that causes the least amount or pain, and doesn't cause a decrease in daily gains is surgical castration with sedation and analgesia. A small dose of xylazine administered to the calf along with a long-acting nonsteroidal anti-inflammatory drug (NSAID) like meloxicam tablets, reduces behavioral indications of distress and pain. Use of sedation also makes the procedure much safer for those who are performing the procedure. Disbudding and tattooing can all be performed at the same time, while the animal is sedated to reduce stress from handling for multiple procedures.

How should my calves be disbudded/dehorned?

Ideally, calves should be disbudded before 1 month of age, in which case, a hot-iron disbudding device may be used to remove the horn bud and cauterize the wound. An injection of local anesthetic (lidocaine) around the cornual nerve prior to removal will desensitize the area. Oral NSAIDs (meloxicam tablets) will help control pain after the local anesthetic wears off. Using sedation during this procedure has two advantages: the animal experiences less stress, and it is safer for the person performing the procedure.

Dehorning (mechanically cutting/removing horns at the base) is discouraged due to the increased risks of sinusitis, bleeding, prolonged wound healing and infection. If it must be done, anesthesia, analgesia, cauterization and tetanus vaccination are strongly recommended. Methods of dehorning include the use of an embryotomy wire, a saw, and a Barnes-type scoop dehorner. Banding horns causes the most pain, which persists the longest, and therefore, is not recommended.

An option for animals that are between 10-14 months of age is horn tipping or sloping. One-third of the horn at the tip end is cut at an angle using a saw. The horn then grows down, away from the scar that forms where the cut was made. Minimal blood loss occurs with this procedure, but is easily controlled with pressure applied below the base of the horn or cauterization with a hot iron.

Raising Wagyu References

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FEEDING WAGYU

*Important: There are as many feeding protocols for cattle as there are cattle farmers. If your feeding program is working well, you are happy with the carcass results and the animals are healthy, then you have the right program. The feeding recommendations below are based on nutritional research; follow typical, long-term, high-concentrate, Japanese feeding protocols; are designed to optimize marbling in Wagyu for the high-end market; and reflect Wagyu's slightly different feeding requirements, which are due to their slow growth, and the way they store lipids. Forages and grains vary in type and nutrition, and certain nutrients must be offered in the appropriate ratios, so ***it is important to consult with a bovine nutritionist in your area*** to develop a feeding program for your animals, in your environment, and with the feed you have available. Hay and grains should be analyzed every year to check the nutritional value, as it will vary due to weather conditions, harvest time and soil health.

What do the Japanese feed their Wagyu?

The Japanese import nearly 75% of their livestock feed ingredients, including corn, wheat, barley and sorghum, so they are essentially feeding the same ingredients that we are feeding in the United States.

What should I feed my Wagyu cows and heifers?

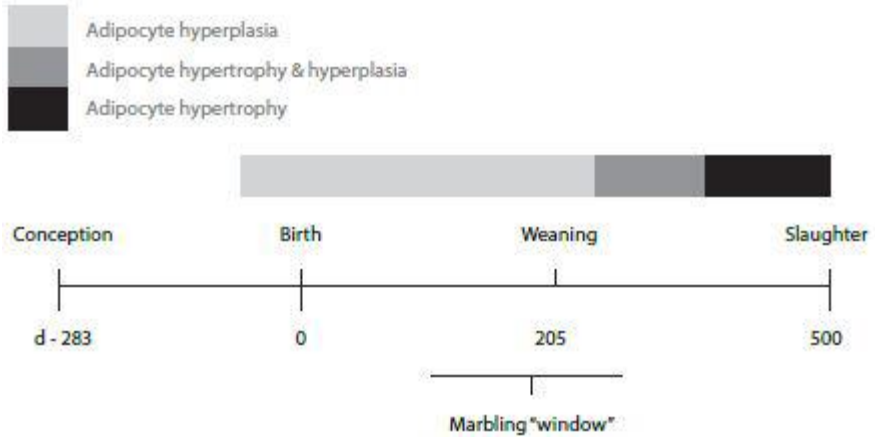
Wagyu cows and heifers require a nutritionally balanced forage ration to maintain good health. Many factors determine what and how much to feed cows and heifers. Heifers that are growing, pregnant or nursing will need more nourishment than mature cows. Depending on the quality of forage and the use of supplementation cows and heifers should be fed between 1.7-2.2% of their body weight. See the table below. Minerals are essential to maximize their growth potential of heifers.

	DMI	Protein	TDN	Ca	P
	% of BW	%	%	%	%
Dry Mature Cows	1.7-1.9	6.9-7.1%	48.8%	0.17-0.20%	0.17-0.20%
Dry Pregnant Cows 2nd Trimester	1.7-1.9	6.9-7.1%	48.8%	0.17-0.20%	0.17-0.20%
Dry Pregnant Cows 3rd Trimester	1.8-2.1	7.6-8.2%	52.5-54.5%	0.26-0.27%	0.20-0.21%
Cows Nursing Calves	1.8-2.2	9.0-10.2%	54.7-58.2%	0.27-0.30%	0.22%
Pregnant Yearling Heifers	2.0-2.3	8.0-9.8%	54.1-67.0%	0.26-0.37%	0.19-0.23%
Pregnant Yearling Heifers 3rd Trimeste	2.0-2.3	8.0-9.8%	54.1-67.0%	0.26-0.37%	0.19-0.23%
2 Y.O. Heifers Nursing Calves	2.1-2.2	10.0-11.3%	61.9-65.1%	0.31-0.36%	0.23-0.24%

(Source: Adapted from National Research Council. 1984. Nutrient Requirements of Beef Cattle. National Academies Press, Washington, DC.).

Do my pregnant Wagyu cows and heifers have special feed requirements?

A nutritionally-balanced ration with minerals is essential for normal body function, but it is critical to the pregnant cow or heifer, especially in the third trimester of gestation. The calf grows at an exponential rate during this period and its nutritional requirements are the greatest. Intramuscular adipogenesis (marbling) occurs prior to birth and as late as 250 days of age. Adipocyte hyperplasia is the ***increase in number*** of intramuscular fat cells the calf will have, and adipocyte hypertrophy is the ***increase in cell size***.



(J. K. Ahola).

Adipogenesis can be negatively affected by poor nutritional intake by either the pregnant cow or the growing calf. To maximize the calves' marbling potential, proper nutrition in utero and in vivo is critical. This can be achieved by offering creep feed as early as possible and keeping stress levels low. Stress can be caused by heat, cold, illness, parasites, flies, overcrowded conditions, confinement, weaning, and fear, to name a few.

What type of concentrate should I use for a creep feed?

A ration fed to a calf must be palatable or the calf won't eat it. The other thing to consider is the quality of forage the calf will be eating and the type of feeding system (free choice or limit fed) being used. If 50% of the calf's diet consists of cow's milk with 13% protein, 25% of the calf's diet consists of hay with 9% protein and 25% of the diet consists of creep feed with 18% protein; the calf will be ingesting a diet with an average protein level of 13.25% ((0.5 X 13) + (0.25 X 9) + (0.25 X 18)= 13.25). When purchasing a creep feed, select one with high-quality ingredients. They are more efficient and will end up being more cost-effective in the long run. Lighter-weight Wagyu calves require higher levels of crude protein for growth and development. Aim for total protein in the diet to average 14-16%. Depending on the quality and amount of forage and milk they will be eating (see above), a good creep feed should contain 20% protein or more. The protein content in feed for larger-framed calves can be reduced to 14-16%. Look for an energy content or TDN (total digestible nutrients) of 65-75%, and acid detergent fiber (ADF) level of 14%. Prior to weaning, gradually increase the ration of creep feed to 4 pounds per calf. High protein, beef cattle, creep feeds aren't readily available. Consider using a dairy calf creep feed, such as Purina's AmpiCalf or a protein supplement, such as Purina's Rangeland Protein Tub.

What should I feed my post-weaned calves?

After the calves are weaned, they can be gradually switched to a grower feed, with a lower protein level of 16%. The TDN doesn't need to change but the ADF can be lowered to 12%. Gradually increase their intake of grower grain until it makes up approximately 60% of their daily ration at 18 months of age. Depending on the weight of the animal, the ration can reach up to 13 pounds per calf. The concentrate ration should be split into two daily feedings, and free-choice grass hay should be available.

What should I feed the animals I am finishing to get the best marbling?

Once the calves reach 18 months of age, they can gradually be switched to a finisher formula of grain. The goal is to slow down growing and gradually increase the intramuscular marbling. Protein level in

your grain formula can be lowered to 12%, the TDN should be closer to 75%, and the ADF can remain the same at approximately 12%. By 28-30 months of age, the animals' diet should consist of 80% grain (15-22 lbs.) and 20% forage. The concentrate should be split into two meals, and the quality of the forage should gradually decrease, so the animals will be hungry enough to finish the concentrate. Straw or low-quality hay is usually fed to meet fiber requirements and limit the amount of Vitamin A intake.

Why should Vitamin A be limited in the finishing phase?

Vitamin A is an important nutrient in the development of the calf, and it is necessary for pregnant and or lactating heifers and cows, and breeding bulls. However, in the finishing phase, feeding too much Vitamin A will inhibit fat deposition of adipocytes and reduce marbling. Studies have shown that finishing animals with Vitamin A amounts of 450-600 IU/lb of dry matter fed (1/2 of the recommended amount) produced a higher marbled carcass. 243-day feeding periods with limited Vitamin A showed a 33% increase in marbling without affecting backfat or subcutaneous fat. Shorter restricted feeding periods did not have the same results. (Gotocica-Buenfil, 2007). Be aware that some Vitamin A is required and a deficiency may cause loss of appetite, edema, compromised immunity and blindness.

How long does it take to finish Wagyu?

Wagyu mature slowly and won't develop their full potential of intramuscular marbling if they are harvested too early. The fattened cattle in Japan are fed for at least 28-30 months.

What does it cost to finish an animal using this method?

The amount of feed required to finish an animal to 28-30 months using the Japanese method is approximately 3 tons of grain per animal. Multiply that times the cost of grain in your area. Hay and minerals are not included in that amount.

What supplements should be added to the grain?

Probiotics or yeast additives can help stabilize the gastrointestinal microbial population, and help the animal utilize feed more efficiently. This is particularly beneficial to Wagyu being fed a high-grain diet, which tends to upset the pH content of the rumen and promote overgrowth of bacteria such as *Clostridium perfringens* and *Escherichia coli* (*E. coli*).

Sodium bicarbonate (baking soda) is another feed additive that helps stabilize the rumen pH by reducing acidic conditions. It will help prevent bloat and ketosis from occurring.

Can I grass-finish my Wagyu?

Many people grass-finish Wagyu and some get very favorable results with high amounts of marbling. High-marbling genetics must be used and the feeding time may need to be extended past 30 months. Also, if the animals are ingesting fresh grass (vs. dry grass hay) during the finishing phase, marbling may be inhibited because of the high levels of Vitamin A found in grass. (See Vitamin A above).

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HARVESTING WAGYU

If I raise Wagyu for beef, am I guaranteed a premium, high-marbled product?

No. There are many factors required to produce a premium product: high-marbling genetics, proper nutrition especially during the "marbling window," a low-stress environment, and a long-fed grain diet formulated for Wagyu.

Can I advertise or label my beef as Kobe?

No. Kobe is a brand of beef from Tajima cattle certified by the Kobe Beef Distribution & Promotion Council in Japan. The cattle must be bred and raised by a designated farmer and slaughtered at a designated slaughterhouse in Hyogo Prefecture. It must also pass strict grading for BMS (Beef Marbling Standard), weight limitations and other criteria. Of the 7,000 head of Tajima cattle taken to market each year, only 5,000 are certified as Kobe beef, which is 0.16% of total beef consumption in Japan. Small amounts are exported to Singapore, Germany, Canada, Hong Kong, USA, Thailand, Netherlands, Taiwan, Switzerland and UK. A 10-digit individual ID number is assigned to the carcass and can be used to tell the animal's lineage, origin and where it was sold, and verifies the certification.

How is beef graded In the United States?

In the United States, the Department of Agriculture (USDA) uses a grading system based on quality and yield scores. There are eight quality grades for beef: canner, cutter, utility, commercial, standard, select, choice and prime. Those grades are based on marbling, which is determined by a cross-section of the ribeye between ribs 12 and 13; and the age of the animal, A (9-30 months), B (30-42 months), C (42-72 months), D (72-96 months) and E (more than 96 months). Cows are not eligible for Prime grade. Carcasses with poor color may be downgraded.

Relationship Between Marbling, Maturity and Carcass Quality Grade[1]

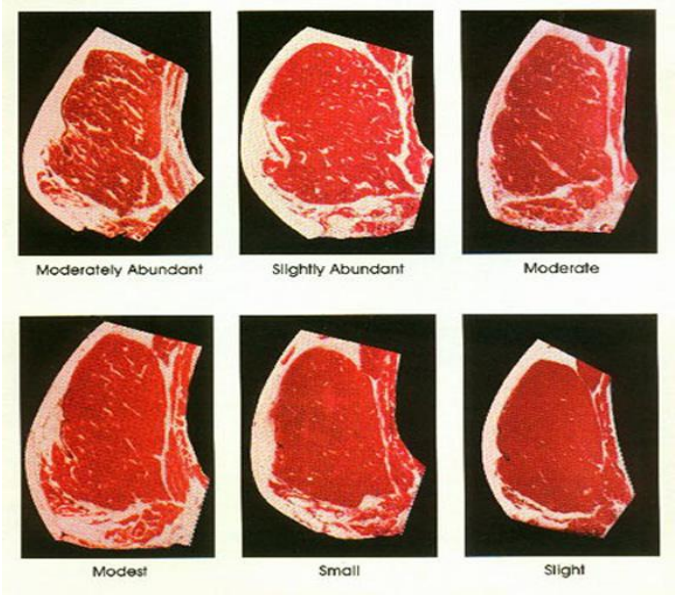
Degrees of Marbling	Maturity[2]				
	A[3]	B	C	D	E
Slightly Abundant	PRIME				
Moderate			COMMERCIAL	COMMERCIAL	
Modest	CHOICE				
Small					
Slight	SELECT		UTILITY	UTILITY	
Traces					
Practically Devoid	STANDARD			CUTTER	

[1]Assumes that firmness of lean is comparably developed with the degrees of marbling and that the carcass is not a "dark cutter."
[2]Maturity increases from left to right (A through E).
[3]The A maturity portion of the Figure is the only portion applicable to bullock carcasses.

Figure 2: USDA Beef Grading Chart

Degrees of marbling are broken down into 100 subunits.

Grade	Marbling Score
Prime +	Abundant 00-100
Prime °	Moderately Abundant 00-100
Prime –	Slightly Abundant 00-100
Choice +	Moderate 00-100
Choice °	Modest 00-100
Choice –	Small 00-100
Select +	Slight 50-100
Select –	Slight 00-49
Standard +	Traces 34-100
Standard °	Practically Devoid 67-100 to Traces 00-33
Standard –	Practically Devoid 00-66



(Hale, 2013).

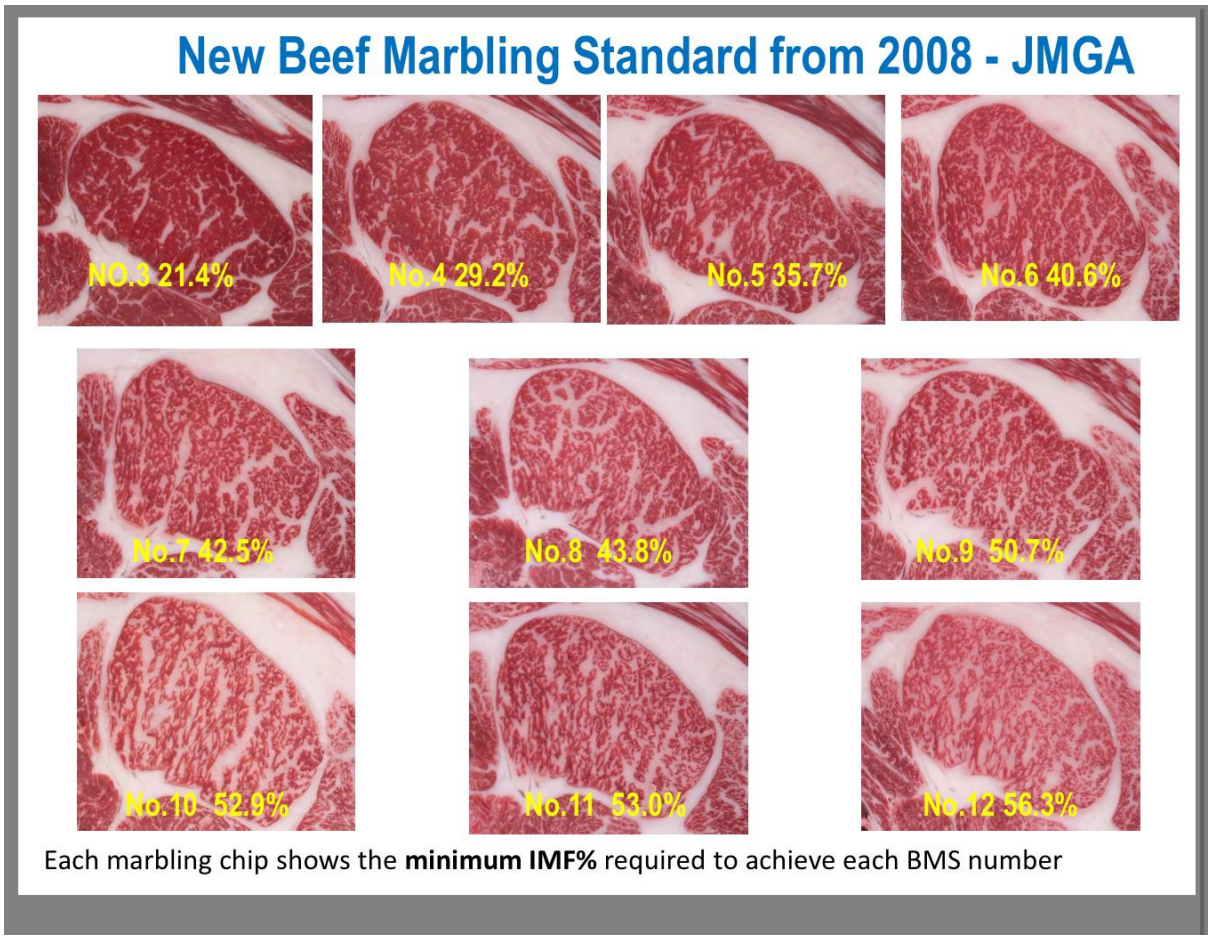
Beef is also given a yield grade between 1-5. “The Yield Grade of a beef carcass is determined by evaluating: (1) external fat thickness over the ribeye, (2) ribeye area, (3) estimated percentage of kidney, pelvic and heart fat (%KPH), and (4) hot carcass weight.” (Tatum, 2007). The formula is YG = 2.5 + (2.5 x adjusted fat thickness, in.) + (0.20 x KPH%) + (0.32 x ribeye area, sq. In.) + (0.0038 x hot carcass weight, lbs.). (Tatum, 2007).

Yield Grade	%CTBRC
1	>52.3
2	50.0 to 52.3
3	47.7 to 50.0
4	45.4 to 47.7
5	<45.4

Table 1: Expected Yields of Closely Trimmed Boneless Retail Cuts (%CTBRC) for Each USDA Yield Grade

How is beef graded in Japan?

In Japan, the Japanese Meat Grading Association (JMGA) uses a grading standard based upon meat quality and yield scores. The meat quality score is determined by the (1) amount of intramuscular marbling; (2) color and brightness of the meat; and (3) color, luster and quality of the fat. The Japanese grading system allows for much higher degrees of marbling than the US grading system. There are 12 levels of marbling that are measured from the ribeye between the sixth and seventh rib. Numbers 1 and 2 have been eliminated from their marbling standard.



The 12 levels of marbling are divided into 5 grades:

Grade 5 (very abundant): BMS 8-12

Grade 4 (somewhat abundant): BMS 5-7

Grade 3 (standard): BMS 3-4

Grade 2 (somewhat scarce): BMS 2

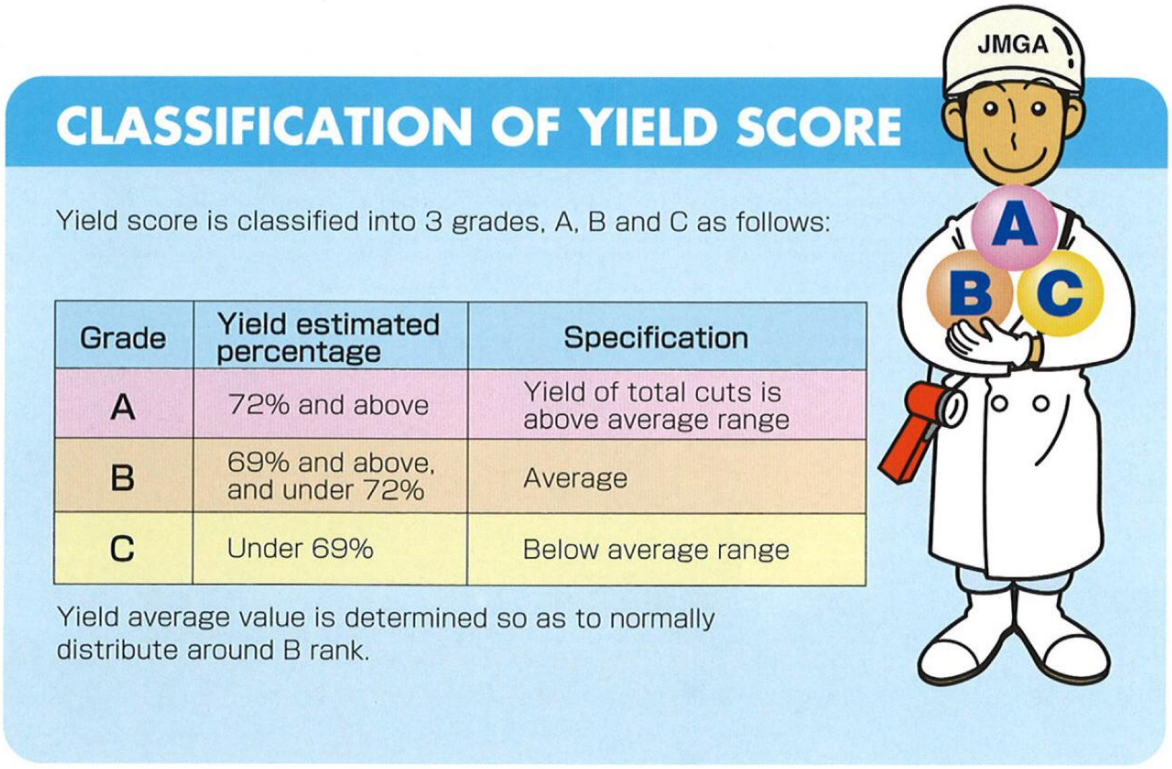
Grade 1 (very scarce): BMS 1

The Yield Grade is determined using the following equation:

EQUATION FOR YIELD ESTIMATION

$$\text{Estimated percentage (\%)} = 67.37 + (0.130 \times \text{Rib eye area } cm^2) + (0.667 \times \text{Rib thickness cm}) - (0.025 \times \text{Cold left side weight kg}) - (0.896 \times \text{Subcutaneous fat thickness cm})$$

NOTE: Add 2.049 for Wagyu carcass.



(JMGA).

The quality grades are then cross-referenced with the yield grades to determine the final grade between A5 and C1.

Standard Grading and Indicators

Yield Grade	Quality Grade				
	5	4	3	2	1
A	A 5	A 4	A 3	A 2	A 1
B	B 5	B 4	B 3	B 2	B 1
C	C 5	C 4	C 3	C 2	C 1

(JMGA).

How do the US and Japanese grading systems compare?

(*Developed by Lone Mountain Wagyu and posted with their permission.)*

Note: The rib cut used to determine the BMS for the entire carcass is between the 6th/7th ribs in Japan and the 12th/13th ribs in the US. Carcasses tend to have more marbling toward the front of the animal, so the Japanese graded carcasses will automatically have a marbling advantage.

Do Wagyu carcasses have to be processed differently?

A butcher may want to make sure the processing area is kept cold, as Wagyu fat has a low temperature melting point and becomes soft and slippery at 75-80 degrees Fahrenheit.

Since many Wagyu are long-fed to achieve the maximum amount of marbling, the slaughter age may become an issue. An animal of any breed of cattle that is butchered past 30 months of age, as determined by dentition, skeletal evidences of maturity or documentation of actual age, is considered to be at-risk of having bovine spongiform encephalopathy (BSE). Specified risk materials must be removed from the animal and must be properly disposed: "brain, skull, eyes, trigeminal ganglia, spinal cord, vertebral column, (excluding the vertebrae of the tail, the transverse processes of the thoracic and lumbar vertebrae, and the wings of the sacrum), dorsal root ganglia." (USGPO, 9 CFR 310.22). Carcasses from animals over the age of 30 months will not be able to produce, T-bone steaks or Porterhouse steaks because the spine must be removed. Equipment used to process carcasses over 30 months of age will need to be sanitized prior to being used on younger animals, so there may be an extra fee charged by the slaughterhouse. BSE, also known as mad cow disease, is a neurological disease transmitted by ingestion of BSE-infected meat and bone meal. It is caused by a type of protein called a prion that has an incubation time of 2.5-5 years and affects adult cattle around 4 years of age. This is the reason why specified risk materials from cattle over the age of 30 months must be condemned. When the disease is transmitted to humans it is known as Creutzfeldt-Jakob disease.

Why does Wagyu fat have a low melting point?

The molecular weight of unsaturated fats is lower than that of saturated fats which results in a lower melting point. Intramuscular marbling, of which Wagyu have an abundance, primarily consists of unsaturated fat. Also, Wagyu have an enzyme, Stearoyl CA desaturase (SCD), that changes stearic acid (saturated fatty acid, SFA) into oleic acid (monounsaturated fatty acid, MUFA), resulting in a higher ratio of MUFA:SFA and a lower melting point.

What are fatty acids?

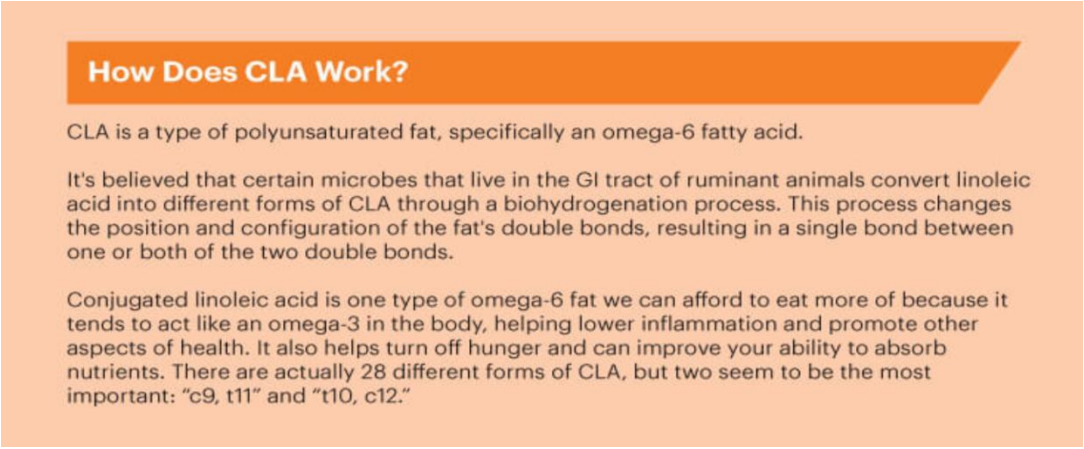
Fatty acids are produced when fats are broken down, and are used for energy. They may be monounsaturated, polyunsaturated or saturated and are an important part of a healthy diet. They aid in cell membrane development, strength and function, keep skin healthy, help the body process cholesterol, help regulate weight... Essential fatty acids (EFAs) are not produced by the body and must be ingested. Omega-3 and Omega-6 are polyunsaturated EFAs that help retain healthy lipid levels in the blood, are necessary for proper clotting and blood pressure, control inflammation and help the immune system to react properly. Omega-9 fatty acids are MUFAs that beneficially lower "bad" cholesterol

> Omega-3 Fatty acids: alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA)
>
> Omega-6 Fatty acids: linoleic acid (LA) & arachidonic acid (AA).
>
> Omega-9 Fatty acids: oleic acid (OA).

A diet that consists of a high omega-6:omega-3 fatty acid ratio can promote cardiovascular disease, cancer and inflammatory and autoimmune diseases. Whereas, a low omega-6:omega-3 fatty acid ratio shows suppressive effects of those diseases. The average Western diet has a ratio of 16:1. Research has suggested that lower ratios of 2.5:1 - 5:1 are much more optimal.

What is the fatty acid composition of Wagyu?

Wagyu beef has 3 times the amount of oleic acid (omega-9, MUFA) than salmon and 1.5 times that of chicken. Wagyu has a higher MUFA:SFA ratio than non-Wagyu grain-fed and grass-fed beef, and the SFA in Wagyu is different than other beef. 40% of it is stearic acid, which can be converted by SCD to oleic acid (MUFA) and has a beneficial impact on cholesterol levels. Wagyu also has the highest amount of conjugated linoleic acid (CLA) per gram of any other food and 30% more than other beef cattle breeds. Even though CLA is an omega-6 fatty acid, we can eat more of it because it acts like an omega-3 in the body.



(D. Axe).

A study was conducted by the University of Nevada to seek information on how to produce healthier beef. Of Wagyu fed a high concentrate diet: the "Wagyu group had over 4 times the omega-3 fatty acid content of another cohort grain fed group (1.60% vs. 0.36%). The omega-6 fatty acids were the highest (4.27%) for the high concentrate Wagyu group which computed to a favorable omega 6:3 ratio of 2.61. The high concentrate Wagyu group had the highest amount of polyunsaturated fatty acids (5.9%) and therefore lowest (48.6%) saturated fatty acids.

How do I market my Wagyu?

This is a question that should be asked and answered prior to purchasing and raising Wagyu. You should have a business plan, which includes a market for selling your animals and/or beef. This will help you determine whether you should be raising cross-bred Wagyu or fullblood Wagyu and small or large numbers. Some smaller operations market directly to restaurants, individuals and farmer's markets. Other operations will raise larger numbers and sell them to beef supplier corporations.

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If you have additional questions that are unanswered in this handbook, please email them to pam@newyorkwagyu.com and I will include them in future updated versions of the handbook.

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