USDA United States Department of Agriculture
Foreign Agricultural Service

GAIN Global Agricultural Information Network

Voluntary Report – Voluntary - Public Distribution **Date:** March 24, 2021

Report Number: JA2021-0040

Report Name: Utilization of Food-Grade Soybeans in Japan

Country: Japan

Post: Tokyo

Report Category: Oilseeds and Products

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Report Highlights:

This report provides an overview of food-grade soybean use and market trends in Japan. Manufacturing requirements for traditional Japanese foods (e.g. tofu, natto, miso, soy sauce, simmered soybean) largely determine characteristics of domestic and imported food-grade soybean varieties consumed in Japan.

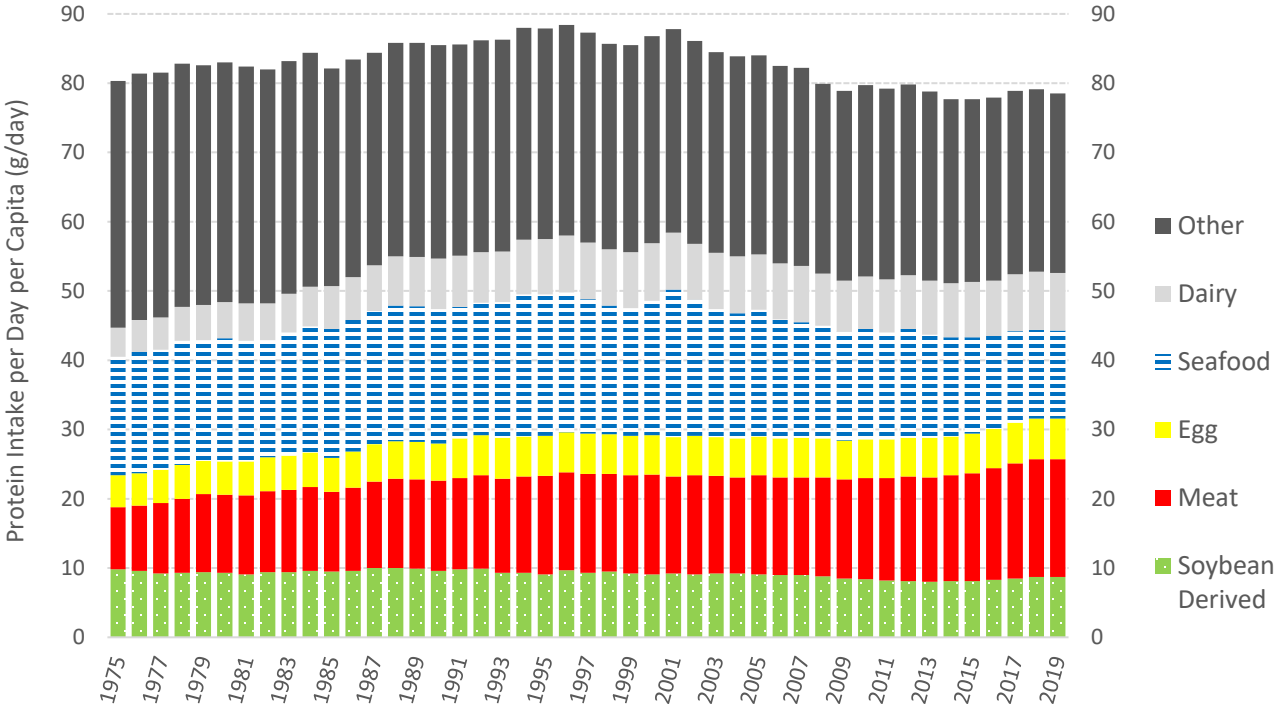
Food-Grade Soybeans

Soybeans (*Glycine max*) can be classified into two distinct categories based on use: (i) food-grade, primarily used for direct human consumption and (ii) feed-grade, primarily used for crushing and animal feed. In comparison to feed-grade soybeans, food-grade soybeans used in Japan have a higher protein and sugar content, typically lower yield and are not genetically engineered (GE). Japan is a key importer of both feed-grade and food-grade soybeans (2020 Japan Oilseeds Annual).

History of food soy in Japan

Following introduction of soybeans from China, the legume became a staple of the Japanese diet. By the 12th century, the Japanese widely cultivate soybeans, a key protein source in the traditional largely meat-free Buddhist diet. Soybean products continue to be a fundamental component of the Japanese diet even as Japan's consumption of animal products has dramatically increased over the past century. During the last 40 years, soy products have steadily represented approximately 10 percent (8.7 grams per day per capita) of the overall daily protein intake in Japan (Figure 1).

Figure 1. Daily Protein Intake per Capita by Food Source in Japan (1975-2019)



Source: Ministry of Agriculture, Forestry and Fisheries (MAFF)

Consumption of fermented soybean products, such as miso, soy sauce and natto, facilitated year-around stable protein intake and the development of uniquely Japanese food processing traditions. Flavors and characteristics of fermented soybean foods depend on soybean variety[1], processing technique, fermentation agents (bacteria and mold), ambient conditions and aging process.

[1] "Variety" in this report refers to a cultivated soybean variety (cultivar), rather than botanical variety.

Food soybean supply in Japan

Domestic

Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF) oversees the production and distribution of domestically produced soybeans, which are all food-grade. As of 2019, MAFF identified 89 primary food-grade soybean varieties cultivated in Japan (MAFF's list of soybean cultivars and their uses, available only in Japanese). The top five varieties account for approximately three quarters of Japanese soybean sales in 2019 (Table 1). To improve pest resistance, yield and mechanization, six major research centers around Japan conduct research to develop soybean varieties for different climatic conditions in the country. There is no commercial application of GE techniques to food-grade soybeans in Japan.

Table 1: Top Japanese Soybean Cultivars and their Characteristics

Variety	Estimated 2020 Production Share	Region	Tofu	Simmered	Miso	Natto	Characteristics
Toyomasari	28%	Hokkaido	△	○	○	△	Sweeter, lower protein. Chewy texture.
Fukuyutaka	22%	West, Central	○				High protein. Strong taste.
Sato no Hohoemi	9%	South Tohoku	○	○	○		New high protein variety. Resistant to mosaic virus.
Ryuho	8%	Tohoku	○	△			Sweeter and high protein.
Yukishizuka	7%	Hokkaido				○	Small bean
Enrei	4%	Hokuriku, Central	○	△	△		High protein and mild taste.
Miyagi White	4%	Tohoku	△	○	△		White color. Large and sweet.
Oosuzu	3%	North Tohoku	○	△			Large white. Aromatic with soft texture.
Tachinagaha	3%	Kanto, Tohoku	△	○	△		Large bean
Tanrei	2%	Tohoku, Hokuriku	○				Dense planting is possible. Rich flavor.
Others	10%	-	-	-	-	-	-

Source: MAFF
Note: ○ refers to preferred varieties and △ to suitable.

Japan Agricultural Cooperatives (JA) through JA prefectural offices typically sell approximately 80 percent of Japan's soybean production with the remainder consumed locally or used as planting seeds. According to MAFF's notification (available in Japanese only) most recently revised in 2018, food processors or wholesalers must procure domestic soybeans through (i) pre-planting contracts with the JA to secure quantity and variety; (ii) post-harvest buyer-bid auctions for at least a third of the production volume of major varieties (i.e. at least 1,700 MT annually in the producing prefecture); (iii) post-harvest bilateral contracts, which do not go through auctions; or (iv) the newly introduced pre-planting buyer-bid auction for about one-tenth of total production. Soybeans that do not pass through one of the four MAFF-prescribed distribution channels are ineligible for the Income Stabilization Program, which covers the difference between production costs and sale price (see MAFF Cropland Support Payment Programs). The timing of price determination varies among the distribution channels. For example, for pre-planting contracts, JA and buyers agree on the price after harvest.

Imported

Since the 1960s, Japanese food processors, trading houses and wholesalers have imported food-grade soybeans. Initially, the soybeans came from Indiana, Ohio, and Michigan ("IOM Soybeans") due to high protein content and were shipped in bulk. Gradually, the development of new food-grade varieties has expanded the production of food-grade soybeans into more northern regions of North America and replaced exports of IOM soybeans. These new specialty varieties are mostly exported in containers to avoid commingling with GE feed-grade soybeans. The United States, Canada, and China are the top food-grade soybean suppliers of Japan with approximately 53 percent, 44 percent, and 3 percent, respectively, of the 2020 market share of imported food-grade soybeans.

Japanese food manufacturers evaluate soybeans based on four parameters, which are related to the end use (e.g., tofu, miso, natto). The first parameter is the physical characteristics of the food-grade soybean (e.g., bean size, skin color, appearance, intactness, foreign materials, and splits). The physical aspect is particularly important for producers of natto and simmered soybean (*nimame*) because beans are not mashed during processing. The second parameter is the nutritional profile of the soybean, which will impact the taste of and potentially health claims for the resulting soy products. The specific characteristics of interest include sugar, protein, isoflavone, oligosaccharide, lipoxygenase (i.e. beany odor), bitter taste, oleic acid, and other mineral content. The third parameter represents characteristics related to processing efficiency (e.g., seed uniformity for steaming or fermentation, ease of dehulling). As most soy processors begin processing by submerging soybeans in water, the ability of soybeans to absorb water quickly and uniformly facilitates processing. The final parameter is the availability of a stable supply, especially for large Japanese manufacturers.

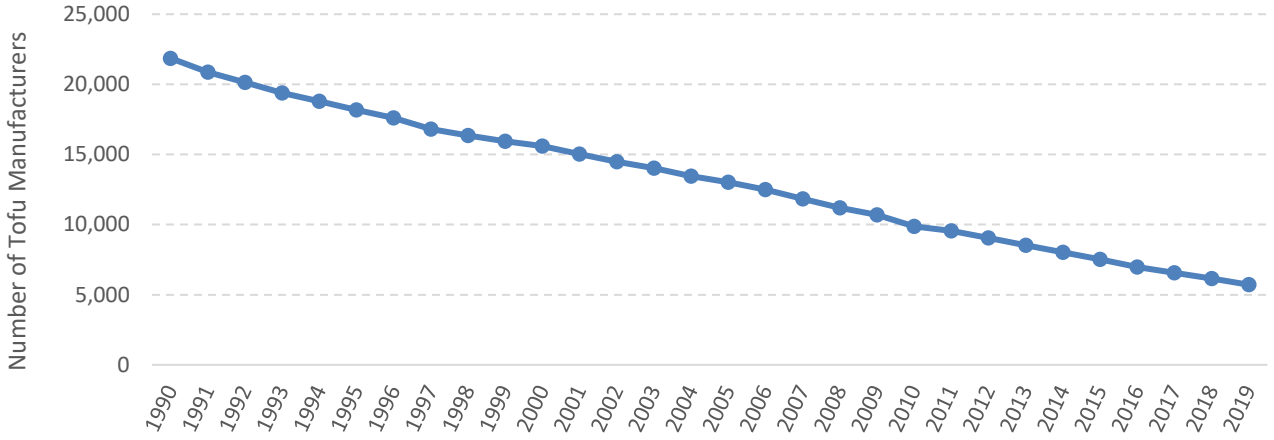
In April 2001, MAFF (that authority has since been transferred to the Consumer Affairs Agency (CAA)) began to require GE labeling on food products that contain at least 5 percent of GE-derived agricultural crops. At the same time, MAFF also allowed the use of a voluntary "non-GE" label, which food soybean manufacturers readily adopted. To use the voluntary "non-GE" label, all business entities handling the soybeans must certify that ingredients were "identity-preserved" (IP)[2] at each step of the production and distribution processes (2020 Japan Biotechnology Annual). Imported food-grade soybeans are by and large non-GE. Given the difficulty in completely ruling out commingling with a GE crop, from April 2023, CAA will virtually ban the use of the voluntary "non-GE" label (see "Japan Finalizes Revisions to GE Food Labeling System").

Trends in Soybean Manufacturing

Along with sourcing, the structure of the soybean processing sector has undergone substantial changes. The traditional regionally diversified manufacturers have largely given way to factories that reach their customers through supermarkets. Although the Act for Securing Business Opportunities for Small and Medium-Sized Enterprises by Adjusting the Business Activities of Large Enterprises (hereafter referred to as the "Adjustment Act," only available in Japanese) has kept large companies from manufacturing tofu, the total number of tofu producers has fallen by over 70 percent in the last 30 years (Figure 2). The consolidation has resulted in soybean products becoming more standardized.

[2] For the English translation of the CAA's manual for the IP handling of soybeans, see https://www.caa.go.jp/policies/policy/food_labeling/information/guideline/pdf/guideline_190225_0002.pdf.

Figure 2. Number of Tofu Manufacturers



Source: Ministry of Health, Labour and Welfare (MHLW)

To survive in the highly competitive soybean product market in Japan, some small and mid-sized producers seek unique food-grade soybean varieties to differentiate their products and attract consumers. Furthermore, soybean food manufacturers are expanding their production beyond traditional Japanese products (e.g. alternative meat, see JA2020-0024) and targeting tourists and export markets (JA2020-0201).

Soybean products

Tofu (bean curd) and Freeze-Dried Tofu

The tofu industry is the largest consumer of food-grade soybeans in Japan. MAFF does not publish production statistics for tofu. According to the General Incorporated Foundation National Federation of Tofu ("Zentoren"), to estimate the volume of tofu production, the volume of utilized soybeans should be quadrupled (Table 2).

Most tofu producers, even larger medium-sized companies, rely on Japanese soybean wholesalers to procure their soybeans. Small tofu producers tend to rely on long-standing relationships with wholesalers and source domestic soybeans. On the other hand, medium-sized tofu manufacturers usually purchase high-protein U.S. or Canadian food-grade soybean varieties based on price and supply size considerations. High protein content and larger seed typically lead to a higher yield of soymilk, an intermediate product in tofu production (Figure 3). Other desirable characteristics for tofu soybean varieties are linked to color and water absorption. Tofu producers prefer clear or light-colored hilum because that color carries into *okara*, a by-product of tofu production. Consumers prefer white *okara*. Unlike IOM, the new food-grade soybean varieties typically do not have a black hilum. Higher speed and uniformity of water absorption increase tofu quality and production efficiency. *Fukuyutaka*, *Sato no Hohoemi*, *Ryuho* and *Enrei* are popular varieties of domestic soybeans for tofu.

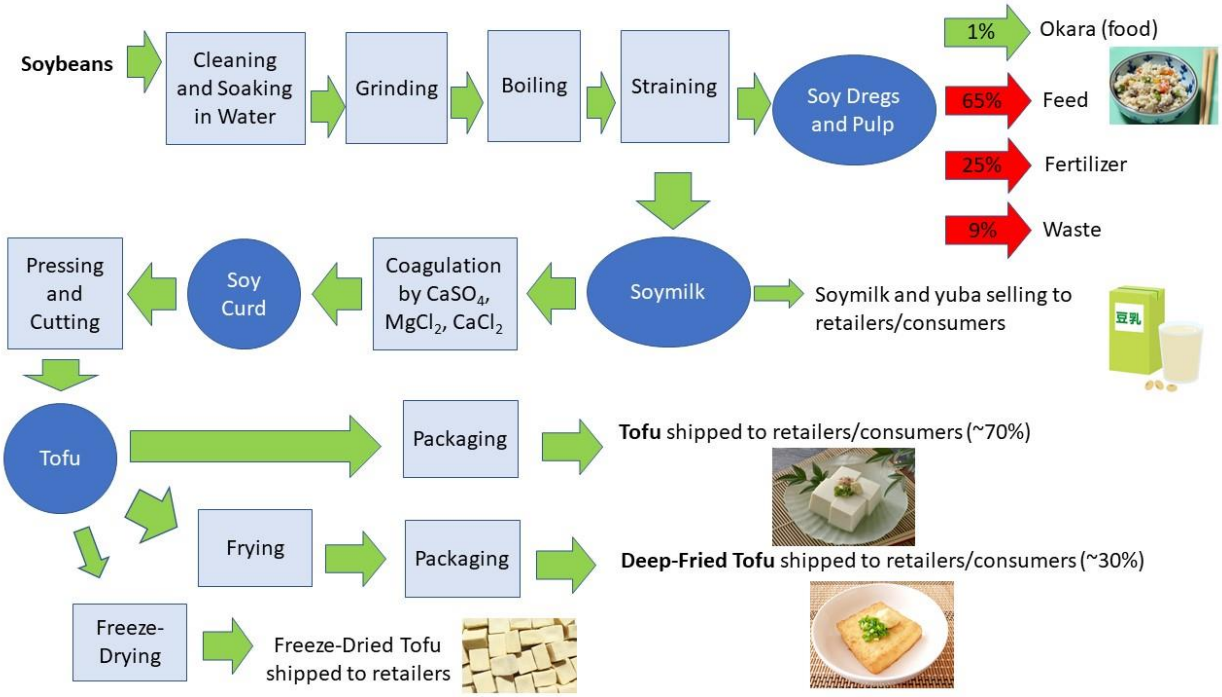
Table 2. Soybean Consumption in Tofu and Freeze-Dried Tofu Sector (in metric tons (MT))

Year	Tofu and Deep-Fried Tofu				**Freeze-Dried Tofu**	**Total**
	U.S.	Canada	Domestic	**Tofu Sub-Total**		
2004	276,000	130,000	90,000	**496,000**	**31,000**	**527,000**
2005	270,000	180,000	40,000	**490,000**	**29,000**	**519,000**
2006	270,000	155,000	60,000	**485,000**	**29,000**	**514,000**
2007	250,000	165,000	70,000	**485,000**	**27,500**	**512,500**
2008	225,000	170,000	80,000	**475,000**	**26,000**	**501,000**
2009	195,000	185,000	90,000	**470,000**	**26,000**	**496,000**
2010	165,000	210,000	90,000	**465,000**	**26,000**	**491,000**
2011	130,000	230,000	90,000	**450,000**	**25,000**	**475,000**
2012	120,000	240,000	90,000	**450,000**	**24,000**	**474,000**
2013	125,000	240,000	95,000	**460,000**	**23,000**	**483,000**
2014	160,000	220,000	80,000	**460,000**	**23,000**	**483,000**
2015	190,000	200,000	80,000	**470,000**	**23,000**	**493,000**
2016	200,000	180,000	90,000	**470,000**	**19,000**	**489,000**
2017	185,000	180,000	100,000	**465,000**	**17,000**	**482,000**
2018	195,000	175,000	100,000	**470,000**	**18,000**	**488,000**
2019	191,000	174,000	100,000	**465,000**	**19,000**	**484,000**
2020e	189,000	*176,000*	*95,000*	***460,000***	***19,000***	**479,000**

Source: Daily Soybeans and Oil Seeds Journal (*Daizu Yuryo Nippo*)

Note: The freeze-dried tofu column includes both domestic and imported soybeans as more detailed data on the breakdown is not available.

Figure 3. Typical Tofu and Soymilk Processing Steps



Sources: Zentoren

Tofu factories typically utilize all of the soymilk they produce to make tofu, but small tofu producers sometimes sell a portion of soymilk and tofu skin (*yuba*) directly to consumers. According to Zentoren, about 70 percent of tofu is packaged and sold as tofu, while the remaining 30 percent of tofu are further processed (i.e. deep-fried tofu (e.g., *atsu-age*, *abura-age*, *ganmodoki*) or freeze-dried (e.g., *koya-dofu*, *kori-dofu*). Traditionally, there are two tofu types sold in Japan: firm (*momen* meaning cotton) and soft (*kinu-goshi* meaning silken). *Kinu-goshi* has a higher water content and is consumed as is, while *momen* can be further processed into deep-fried tofu or freeze-dried tofu. In 1974, MHLW established Tofu Specifications and Standards (available in Japanese only) to guide the production and storage of tofu. As of 2021, MAFF has not established a Japan Agricultural Standard (JAS) for tofu.

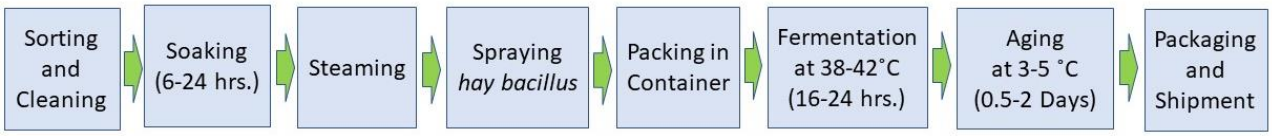
To extend the shelf-life of tofu, industry has utilized different approaches. Recently, industry has shifted to producing packaged tofu (*juten tofu*)[3], which still requires refrigeration, but has nearly doubled the shelf life of traditionally manufactured tofu. In 2018, MHLW approved the use of aseptic packaging (i.e., *mukin juten tofu*) that no longer requires refrigeration for tofu.

In recent years, several medium-sized companies have come to dominate regional tofu retail markets: Sagamiya Foods Co. (Gunma prefecture), Taishi Food Inc. (Aomori prefecture), Satonoyuki Co. (Tokushima prefecture), Takano Foods Inc. (Ibaraki prefecture), and Yamami Company (Hiroshima prefecture). OK Food Industry (Fukuoka prefecture) and Misuzu Co. (Nagano prefecture) are the top producers of deep-fried tofu.
In addition, Nagano prefecture producers (e.g. Asahimatsu Corporation, Misuzu Corporation) specialize in freeze-dried tofu (*koya dofu*), which has to be soaked in hot water prior to cooking. Freeze-dried tofu has a spongy texture and is most commonly simmered.

Natto (fermented soybeans)

Natto, a traditional breakfast food consumed in eastern Japan, has been gaining popularity in western Japan due to its perceived health benefits, convenience and affordability. Typical natto packages include a soy sauce-based MSG sauce and a packet of *karashi* mustard. The ready-to-eat natto is whipped and placed on warm rice before consumption. Natto demand in Japan has surged during the COVID-19 stay-at-home directive, though production volume increased only slightly due to limited production capacity and forward contracting for soybeans.
Unlike the tofu industry, the natto sector is highly consolidated. Six companies (Takano Foods Inc. (Ibaraki prefecture), Mizkan Inc. (Aichi prefecture), Azuma Foods Inc. (Tochigi prefecture), Yamada Foods Co. (Akita prefecture), Marukin Foods Inc. (Kumamoto prefecture), Marumiya Inc. (Kumamoto prefecture)) account for over 75 percent of total natto production in Japan. Small natto producers largely target local and/or high-end markets.

Figure 4. Typical Natto Process Diagram



Natto makers seek characteristics in the soybeans that reflect the specifics of the natto manufacturing process (Figure 4). Thin seed coats facilitate faster water absorption. Small seed size reduces processing time. Soybean size uniformity is key to even fermentation. *Yuki-Shizuka* (Hokkaido), *Suzumaru* (Hokkaido), and *Natto Shouryu* (Kanto) are popular domestic soybean varieties for natto. Japanese natto manufactures also utilize large quantities

[3] The manufacturing process extends the shelf life because coagulation and solidification take place in each individual sealed container.

of imported small-seed soybean varieties. There is also demand for specialty soybean varieties, such as large-seeded or black soybean, to produce more unique looking natto (Figure 5).

In October 2006, MAFF implemented the mandatory Country of Origin Labeling (COOL[4]) for soybeans used to produce natto.

Figure 5. Examples of Natto products

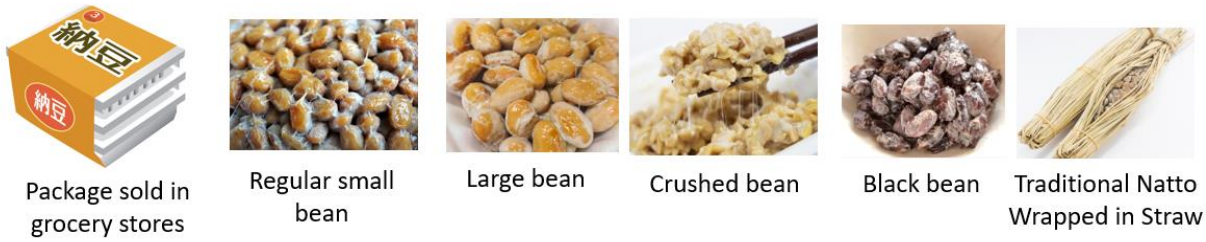


Table 3. Soybean Consumption by Origin in the Natto Sector (in MT)

Year	US	Canada	China	Domestic	**Total**
2013	98,000	9,000	5,000	13,000	**125,000**
2014	97,000	9,000	4,000	15,000	**125,000**
2015	99,000	9,000	4,000	20,000	**132,000**
2016	100,000	10,000	3,000	25,000	**138,000**
2017	101,000	9,000	3,000	30,000	**143,000**
2018	104,000	9,000	2,000	33,000	**148,000**
2019	104,000	9,000	2,000	34,000	**149,000**
2020e	106,000	9,000	2,000	34,000	**151,000**

Source: Daily Soybeans and Oil Seeds Journal

Miso (fermented soybean paste)

Japan boasts over a thousand types of miso typically used as a condiment to flavor food. Retailers usually offer three types of miso that differ in texture, flavor and color. Red miso (*aka-miso*) is salty and has a strong flavor. White miso (*shiro-miso*) is characterized by a sweet and delicate flavor. Finally, mixed miso (*awase-miso*) is a combination of red miso and white miso. Producers typically achieve variation in miso flavor through the use of different ingredients[5] and variation in the duration of the fermentation stage (Figure 6). While white miso has less salt and is typically fermented for up to a month, red miso is produced with more salt and fermentation may take years.

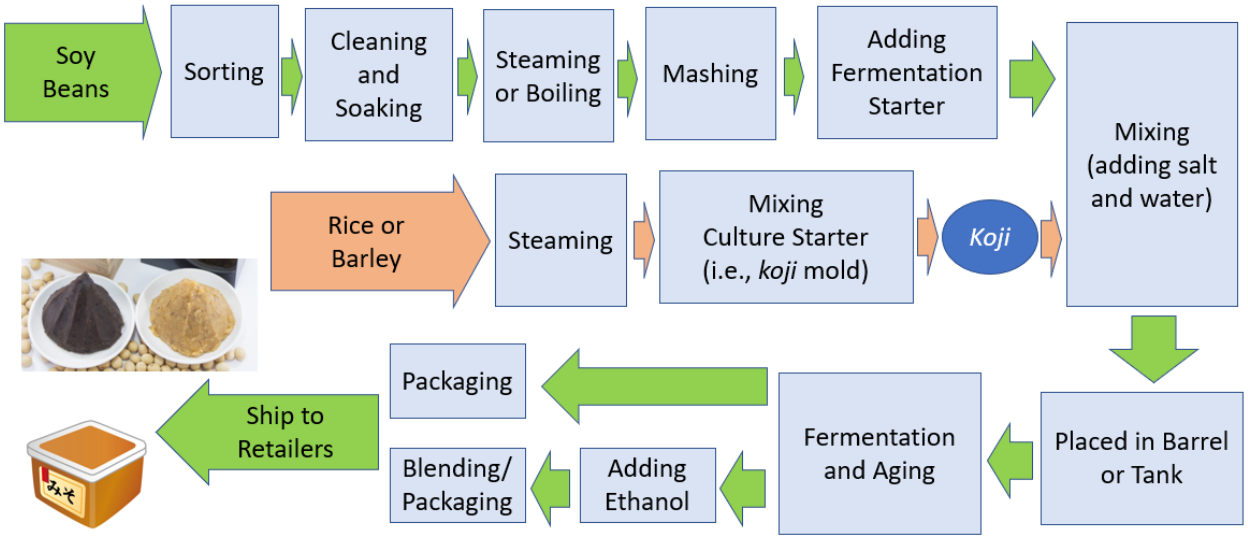
Miso manufacturers prefer medium to large soybeans with high protein content and water-absorption capacity, more soluble carbohydrates, and lower oil and calcium contents. The white miso manufacturers prefer soybeans with a light-yellow seed coat and a clear hilum. *Akimaro* is a popular Japanese soybean variety for miso.

[4] In 2017, CAA expanded the COOL requirement to all processed food (JA7132). New COOL requirement will fully enter into force from April 2022.

[5] In most parts of Japan, rice is added to soybeans during miso production (*kome-miso*). In Kyushu, Yamaguchi and Ehime prefectures, it is common to add barley to soybeans resulting in *mugi-miso*. On the other hand, in Nagoya and surrounding areas, there is a preference for *mame-miso*, a darker miso produced only from soybeans.

According to the Japan Food Journal, in 2018, nearly all top miso producers are based in Nagano prefecture (Marukome (24 percent market share), Hanamaruki (12 percent), Hikari Miso (9 percent), and Shinsyu-ichi Miso Co. (4 percent)), with the exception of Aichi-based Marusan-Ai Co. (5 percent).

Figure 6. Typical Miso Process Diagram



Notes:
- The "Steaming or Boiling" step indicates a difference in the production of red miso (steamed) and white miso (boiled).
- The ethanol addition toward the end serves to neutralize the *koji* mold and ensure product consistency in pre-packaged miso.

As Japanese lifestyle and diet have changed, the consumption of miso soup, once an everyday food, has declined. In 2019, MAFF estimated that the Japanese consumed 3.7 kg of miso per capita, a 12 percent drop from 2002 (4.2 kg per capita). To counter the trend, miso producers are introducing innovative products such as instant freeze-dried miso soup, selling at convenience stores, and targeting overseas markets (Table 4).

Table 4. Miso Production and Associated Soybean Consumption by Origin (in MT)

	Soybean Inputs					Miso	
Year	US	Canada	China	Domestic	**Total**	Production	Exported by Japan
2012	35,000	42,500	25,000	15,000	**117,500**	442,020	10,083
2013	41,000	40,000	25,000	14,000	**120,000**	425,627	11,807
2014	40,000	44,000	24,000	12,000	**120,000**	461,097	12,301
2015	60,000	37,000	11,000	9,500	**117,500**	461,652	13,044
2016	53,500	44,500	11,500	9,000	**118,500**	476,057	14,760
2017	51,000	49,000	10,000	9,000	**119,000**	482,045	16,017
2018	52,000	42,500	9,000	12,500	**116,000**	478,068	17,010
2019	62,000	35,000	9,000	12,000	**118,000**	481,574	18,434
2020	62,000	37,000	9,000	10,000	**118,000**	474,700	15,995

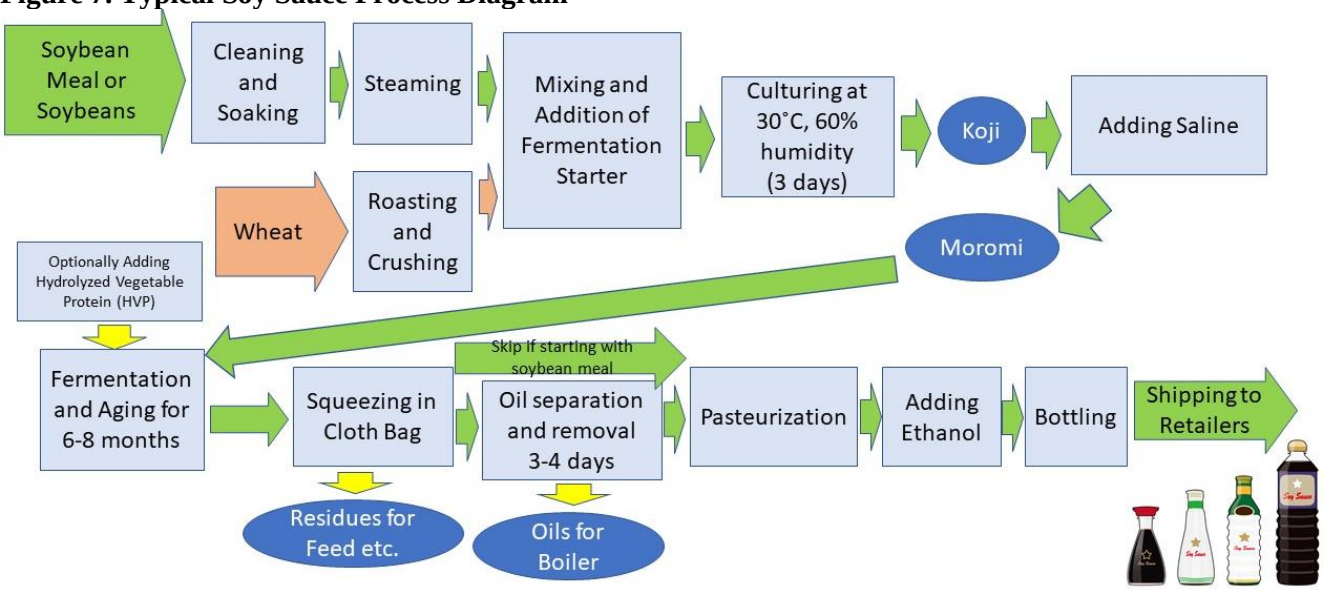
Sources: Daily Soybeans and Oil Seeds Journal, Food Marketing Research and Information Center (FMRIC)

Soy sauce

Soy sauce is a salty and savory liquid condiment of Chinese origin, extracted from soybean meal or fermented soybeans. Soy sauce and soy sauce-based condiments are an essential seasoning for the Japanese cuisine. MAFF estimated Japanese per capita consumption at 5.5 kg of soy sauce (≈ 1.2 gallon) in 2019, a 28.6 percent decline from 2002 (7.7 kg). To differentiate and add value, soy sauce producers have introduced specialty products, such as low-sodium soy sauce, organic soy sauce, and *maru-daizu* soy sauce (made from soybeans rather than soybean meal).

MAFF established voluntary JAS standards (available in Japanese) for the five common types of soy sauce, which are distinguished by the duration of the fermentation step (Figure 7). The dark-colored soy sauce (*koi-kuchi*) represents approximately 80 percent of total soy sauce production. At 13 percent of Japan's total soy sauce production, the light-colored soy sauce (*usu-kuchi*) is popular in western Japan and has a higher sodium content and mild taste. Other specialty soy sauces include *tamari* (2 percent), *sai-shikomi* (1 percent) and *white* (1 percent).

Figure 7. Typical Soy Sauce Process Diagram



Source: Soy Sauce Information Center

Notes:
- Following the "Culturing" step in a specialized room called *koji muro*, the soy-wheat-starter mixture is called *koji*.
- After the addition of saline, the mixture is called *moromi*.
- If the starting ingredient is soybeans, rather than soybean meal, then after the filtration step, oil is removed from the surface of crude soy sauce. The oil is not fit for human consumption and is typically used for factory boilers.
- HVP, separately derived from soybean meal, is added to enhance the umami taste.
- To prevent mold growth on the pasteurized soy sauce, ethanol is added prior to bottling.

The soy sauce industry has been undergoing substantial consolidation. According to Japan Soy-sauce Brewers' Association, there were 6,000 soy sauce manufactures in 1960 and by 2019, the number fell to 1,141. The six

largest soy sauce companies[6] account for roughly 60 percent of Japan's soy sauce production, followed by 9 second-tier manufactures at 16.8 percent, and 1,126 small manufacturers supply the rest.

Overall soy sauce production has been declining in the very competitive condiment market in Japan and producers are increasingly looking at overseas markets (Table 5). Soybean meal utilized by soy sauce manufacturers is typically imported IP soybean meal.

Table 5. Soy Sauce Production and Related Consumption of Soybean Meal and Soybeans

	Ingredient Inputs (MT)					Soy Sauce (kiloliters (KL))	
	Soybean Meal	Soybean			**Total Soybean Equivalent***		
		Domestic	Imported	Sub Total		Production	Exported
2005	140,288	3,569	36,525	40,094	**215,454**	938,763	17,768
2006	134,029	3,405	35,338	38,743	**206,279**	941,570	17,100
2007	131,580	3,442	37,432	40,874	**205,349**	927,112	17,781
2008	132,353	4,162	37,171	41,333	**206,774**	904,813	19,774
2009	125,240	4,854	33,446	38,300	**194,850**	867,934	18,356
2010	130,911	4,453	30,742	35,195	**198,834**	848,925	17,682
2011	124,967	4,495	29,716	34,211	**190,420**	825,854	16,596
2012	120,414	5,521	27,890	33,411	**183,929**	807,060	17,337
2013	121,601	5,252	28,755	34,007	**186,008**	793,364	19,114
2014	121,564	5,916	26,797	32,713	**184,668**	790,166	23,037
2015	118,467	4,534	24,676	29,210	**177,294**	780,411	26,001
2016	118,216	6,063	27,666	33,729	**181,499**	776,408	29,911
2017	121,216	5,669	26,328	31,997	**183,517**	768,766	33,564
2018	119,607	5,012	24,924	29,936	**179,445**	757,237	35,546
2019	119,104	4,768	26,530	31,298	**180,178**	744,263	37,101
2020e	*111,364*	Not Available	Not Available	*31,000*	***170,205***	703,000	33,998

Source: Soy Sauce Information Center

Note: The data in the table includes soy sauce use across different soy sauce-based condiments. The selection of condiments at grocery stores has expanded in recent years, and many of them are soy sauce-based, such as ponzu, teriyaki sauce, noodle soup base, and BBQ sauce.
* Total Soybean Equivalent is calculated as (soybean meal volume)/0.8 + soybean volume, assuming 0.8 MT of soybean meal can be produced from 1 MT of soybean.

Soymilk

Unlike tofu production, with which soymilk shares the initial processing steps (Figure 3), the Adjustment Act does not restrict the company size of soymilk manufacturers. Soymilk production is dominated by large companies, such as Kikkoman, Marusan Ai, Sujahta Meiraku, Pokka Sapporo, Otsuka Holdings, and Yakult. The Japan Soymilk Association represents producers of pre-packed soymilk drinks, of which about 20 percent are mixed with juice or coffee. MAFF established three soymilk JAS standards (available in Japanese), based on the

[6] According to the Kikkoman Fact Book (available in Japanese): Kikkoman (28.2 percent), Yamasa (11.8 percent), Shoda Shoyu (6.6 percent), Higeta Shoyu (5.1 percent), Marukin Shoyu (4.0 percent), Higashimaru Shoyu (4.0 percent).

proportion of soybean content: (i) 8 percent on higher, (ii) 6-8 percent, and (iii) 2-6 percent, typically in combination with a beverage, such as juice or coffee.

According to the Japan Soymilk Association, the production of soymilk has increased from 314 million liters in 2016 to 430.5 million liters in 2020. Initially a niche product, soymilk demand has increased as (i) some consumers switch from dairy-based drinks to plant-based drinks, and (ii) the number of foreign residents from countries, where soymilk consumption is traditional, increases.
Soymilk manufacturers have similar soybean specifications to tofu manufacturers. To appeal to health-conscious consumers, some soymilk manufacturers prefer soybean varieties, which are rich in isoflavones, saponins, lecithin and other nutritional components. These soybean characteristics are then reflected in marketing campaigns. Suzusayaka is a Japanese variety preferred by soymilk producers because of its less beany flavor characteristics due to a lack of lipoxygenase. Soymilk manufacturers largely source soybeans from North America (Table 6).

Table 6. Soybean Consumption in Soymilk Production

	Soybean Inputs (MT)	Soymilk Production (KL)			
		Soy >8%	Soy 6-8%	Soy 2-6%	Total
2004	**28,944**	15,911	134,370	46,899	197,180
2005	**31,512**	23,734	142,204	51,104	217,042
2006	**30,403**	23,013	126,299	50,433	199,745
2007	**25,305**	20,022	99,888	45,302	165,212
2008	**25,641**	20,999	95,832	46,148	162,979
2009	**29,489**	25,947	118,452	52,719	197,118
2010	**32,166**	30,483	121,433	57,201	209,117
2011	**34,058**	35,056	125,687	58,910	219,653
2012	**39,947**	44,063	145,140	66,702	255,905
2013	**39,930**	48,366	147,665	68,689	264,720
2014	**42,867**	55,002	153,195	71,767	279,964
2015	**41,117**	67,062	164,521	71,899	303,482
2016	**48,870**	75,933	170,587	67,479	313,999
2017	**53,297**	90,304	181,890	67,087	339,281
2018	**57,667**	97,385	190,570	74,839	362,794
2019	**64,455**	108,320	205,072	95,527	408,919
2020	**69,118**	125,035	209,289	96,210	430,534

Source: Japan Soymilk Association
Note: Based on JAS soymilk standards, soymilk is categorized into three types based on soybean content.

Ready-to-eat Soybeans

Simmered soybeans (*nimame*) are popular as ready-to-eat food products. Cooked soybeans are also frequently sold in pre-cooked meals (*sozai*). Ready-to-eat soybean producers prefer large, sugar-rich and intact soybeans. In addition to the standard yellow *nimame*, there is demand for white, black and red soybeans (Figure 8). MAFF estimates that about 30,000 MT of soybeans, of which 75 percent are domestically grown, go toward ready-to-eat soybean production. *Yukihomare* (yellow), *Tamba kuro-mame* (black) and *Iwai-kuro* (black) are popular domestic varieties.

Fujicco (Hyogo prefecture), Maruyanagi Foods Inc. (Hyogo prefecture), Kanehatsu (Aichi prefecture) and Kikuchi Foods Industry (Tokyo) dominate the packaged simmered soybean market. Numerous small niche producers sell simmered soybeans and *sozai* with soybeans directly to consumers.

Figure 8. Different Types of Simmered Soybeans (*Nimame*) and Soybeans in Sozai

Regular Simmered Soybeans | Simmered Large Black Soybeans | Simmered Black-Eyed Green Soybeans | Simmered Chamame Soybeans | Simmered Soybeans with Sea Kelp | Gomoku-Mame (Sozai)

In addition to ready-to eat soybeans, approximately 27,000 MT of soybeans, largely imported food-grade, are utilized for processed foods, such as roasted soybean powder, roasted soybeans, sweets, and others.

Isolated Soy Protein and Derived Products

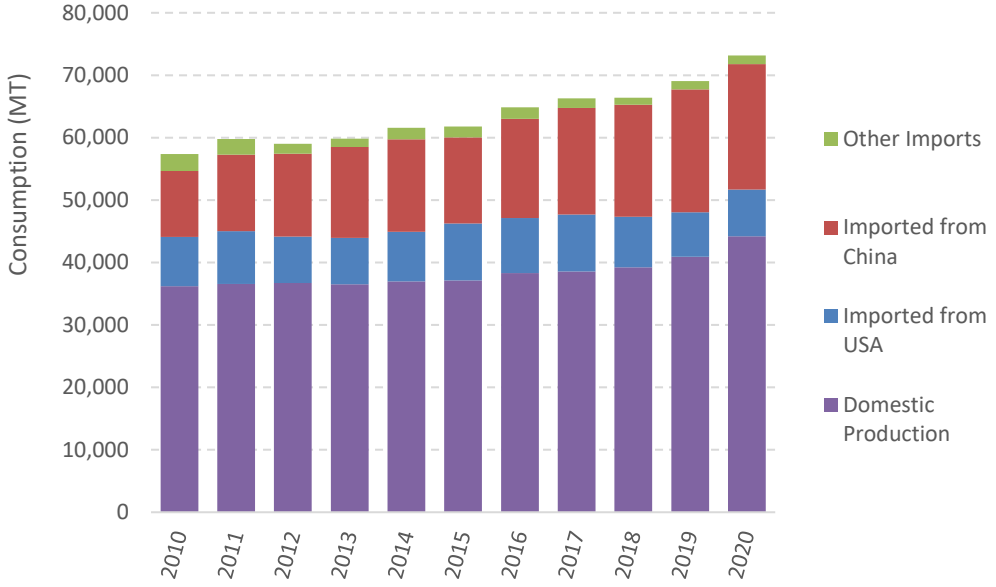
According to the Japan Plant Protein Food Association, Japan's annual production of plant-based proteins reached 47,107 MT (40,949 MT of soy protein isolates[7] and 6,158 MT of wheat gluten) in 2019, a four percent from 2018 (Figure 9). Plant protein has a JAS quality standard (available only in Japanese). Fuji Oil (Osaka prefecture) is the largest isolated soy protein producer.

Traditionally viewed as an affordable and healthy alternative to animal-derived proteins, products containing soy protein isolates have been growing in popularity. Witnessing the recent global success of plant-based meat substitutes, Japan's large meat-processing companies and hamburger chains have turned their attention to the development of "alternative meats" (JA2020-0024) manufactured from soy protein. Since late 2019, large convenience store chains have begun to sell ready-to-eat meals containing "alternative meat" products. MAFF is developing a new alternative meat JAS standard (JA2020-0153).

DAIZ, a Kumamoto-based start-up company, has focused on the development and production of plant-based meat ingredients from non-GE high oleic soybean variety developed by the Saga University. Although soybean products derived from GE high-oleic soybeans must be labeled as GE (JA2020-0173), DAIZ imports conventionally bred high-oleic soybeans, which do not require GE labeling.

[7] Most of Japan's soy protein isolates are derived from imported IP soybean meal, rather than soybeans (see JA2020-0067).

Figure 9. Consumption of Imported and Domestically Produced Plant-Derived Isolated Proteins[8]



Source: Japan Plant Protein Food Association and Japan Customs
Note: Harmonized System (HS) codes for plant-based protein imports are HS: 2106.10-221 and HS: 3504.00-021.

Edamame, Soybean Sprouts and Planting Seeds

Edamame, which MAFF classifies as a vegetable, are soybeans harvested prior to maturity. According to MAFF's latest available data, in 2019, Japan planted 13,000 hectares (ha) and harvested 66,100 MT of edamame. Japanese farmers used approximately, 650 MT of domestic and imported food-grade soybean seeds to cultivate commercial edamame.[9] Edamame cultivation is popular in the northwestern region that faces the Sea of Japan (e.g., Niigata, Yamagata, Akita), the Kanto area (e.g., Gunma, Chiba, Saitama, and Kanagawa), Hokkaido and Hyogo.

Edamame growers prefer edamame varieties that have high sugar content and large bean size before ripening. MAFF identified more than 400 edamame cultivars, including the very popular *Yuagari Musume*. Some growers plant simmered soybean varieties and harvest them while soybeans are still green. In addition to domestically produced edamame, Japan imports mostly frozen edamame primarily from Taiwan, Thailand, and China. In recent years, Japan has imported between 70,000 MT to 80,000 MT of fresh and frozen edamame.

Producers of soybean sprouts rely on soybean varieties that sprout quickly and evenly, while maintaining a specific taste profile. Most soybean sprout producers import soybean seeds.

Attachments:

No Attachments.

[8] Data on protein isolated from wheat is not included in the table as gluten has a separate HS code (HS: 1109.00-000) and production statistics values.
[9] Farmers use about 50 kg of soybeans to plant every 1 ha field of soybeans and edamame.