



**JOINT FAO/WHO FOOD STANDARDS PROGRAMME  
FAO/WHO COORDINATING COMMITTEE FOR ASIA**

**Twenty-first Session**

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**DISCUSSION PAPER ON THE DEVELOPMENT OF A REGIONAL STANDARD FOR SOYBEAN  
PRODUCTS FERMENTED WITH MICROORGANISM *BACILLUS* SPECIES**

Prepared by Japan with the cooperation of  
Bhutan, China, India, Indonesia, Nepal, Republic of Korea and Thailand

**Background**

CCASIA19<sup>1</sup>

1. Japan introduced the discussion paper proposing new work on the development of a regional standard for *Natto*, Japanese traditional fermented soybean food. CCASIA19 agreed that a revised discussion paper on the development of a regional standard for *Natto* should provide information on:

- Similar products in the region
- Possibility to revise existing standard to include *Natto*
- Justification for the development of the standard (why is necessary and which issue is intended to be addressed)

CCASIA20<sup>2</sup>

2. Japan introduced revised discussion paper for *Natto* and recalled the request of CCASIA19. .

3. Japan further proposed to expand the scope of the new work proposal from the single commodity "*Natto*" to "soybean products fermented with the bacterium *Bacillus subtilis*" in order to develop a more overarching standard. Japan clarified that the broaden scope did not include *Tempe* and fermented soybean paste as these products were fermented with other microorganism and regional standards had been developed by Codex.

4. CCASIA members, while welcoming the approach of broadening the scope of the proposed new work, asked for more time to consult with their stakeholders, including industry, as the revised proposal had been made available only at the session. It was noted that the proposal needed to be further clarified as products such as *Douchi* might be fermented not only with *Bacillus subtilis* and to include other products.

5. CCASIA20 agreed to request that Japan further revise the discussion paper and the project document for new work, with the assistance of interested CCASIA members, for submission to the next Session of CCASIA. The revised discussion paper and project document should clearly provide the information listed in the "Criteria for establishment of work priorities" such as impediments to trade, diversification of national legislation and amenability to standardization.

After CCASIA20

6. Japan established an informal electronic working group in December 2016 with interested members: Bhutan, China, India, Indonesia, Nepal, Republic of Korea and Thailand and held two rounds of comments in September 2017 and in April 2019, respectively.

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<sup>1</sup> REP15/ASIA paras 115-119

<sup>2</sup> REP17/ASIA paras 108-111

7. The first round was to seek comments on a proposed project document for soybean products fermented with microorganism *Bacillus subtilis* (one species of genus *Bacillus*) and information on such products as may fall within the scope. Comments/information were provided by Nepal, Republic of Korea and Thailand. Japan revised the scope to the broader one based on a finding of the first round that species of genus *Bacillus* (not specified as *Bacillus subtilis*) are used solely or together with other microorganisms for the fermentation of soybean products in the Asian region while aging method and ingredients are of great variety. The second round was to seek comments on a project document with the revised scope. Comments were provided by Republic of Korea and Thailand.

8. Taking into account all comments/information provided by members through two rounds, Japan finalized a project document so as to cover such soybean products as are fermented by solely any *Bacillus* species or together with other microorganisms, retain the shape of whole soybeans and are not a paste type while some of them may be partly crushed during the manufacturing process. *Natto*, *Cheong-Gukjang*, *Douchi* and *Kinema* are categorized into these products.

#### **Differences between the scopes of the proposed soybean products fermented with microorganism *Bacillus* species and the other two existing regional standards**

9. Two regional standards related to fermented soybean products in the Asian region have been developed: *Regional Standard for Fermented Soybean Paste* (CXS 298R-2009) and *Regional Standard for Tempe* (CXS 313R-2013). However, there are clear differences in microorganisms used for fermentation and the form between these two soybean products (fermented soybean products and Tempe) and the soybean products fermented with microorganism *Bacillus* species. Japan sorted out the differences as Table 1.

Table1 Differences between fermented soybean products in the Asian region

	Soybean Products Fermented with Microorganism <i>Bacillus</i> species: <i>Natto</i> , <i>Cheong-gukjang</i> , <i>Douchi</i> and <i>Kinema</i>	Fermented Soybean Paste (CXS 298R-2009)	Tempe (CXS 313R-2013)
Product Definition	Soybean products fermented with microorganism <i>Bacillus</i> species. The products retain the shape of whole soybeans and are not a paste type while some of them may be partly crushed during the manufacturing process.	Fermented food whose essential ingredient is soybean. The product is a paste type which has various physical properties such as semi-solid and partly retained shape of soybean.	Compact, white, cake-form product, prepared from dehulled boiled soybeans through solid state fermentation with <i>Rhizopus</i> spp.
Microorganism for fermentation	<i>Bacillus</i> spp solely or together with other microorganisms	Naturally occurring or cultivated microorganisms <i>Bacillus</i> spp. and/or <i>Aspergillus</i> spp, which are not pathogenic and do not produce toxins	<i>Rhizopus</i> spp ( <i>R. oligosporus</i> , <i>R. oryzae</i> and/r <i>R. stolonifer</i> )

#### **Necessity to develop the Standard**

10. There are various soybean products fermented with microorganism *Bacillus* species in the Asian region including *Natto*, which are well recognized for nutritional benefits these days.

11. *Natto*, a traditional fermented soybean product in Japan, is produced by fermenting steamed soybeans with the bacterium *Bacillus subtilis* var. *natto* and by aging it in cold/freezing condition after fermenting. *Natto* contains a variety of nutrients such as high-quality protein, vitamins, minerals and dietary fiber in a balanced manner (see table 2). It is widely recognized as a healthy food and traded and consumed mainly in Asian region.

Table 2 Composition of *Natto* (per 100g)

		Natto	Unit
Energy		200	kcal
Protein		16.5	g
Lipid		10	g
Carbohydrate		12.1	g
Minerals	Sodium	2	mg
	Potassium	660	mg
	Calcium	90	mg
	Iron	3.3	mg
Vitamins	K	600	µg
	B <sub>2</sub>	0.56	mg
	Niacin	1.1	mg
	Folate	120	µg
	Pantothenic acid	3.6	mg
Dietary fiber (water soluble)		2.3	g

Source: Standard Tables of Food Composition in Japan, 2015  
Ministry of Education, Culture, Sports, Science and Technology, Japan

12. Recently, the trade volume of *Natto* has been steadily increasing intra-regionally and internationally (see Appendix II. 3). The volume of export and its value of *Natto* from Japan is increasing; from 601 tons in 2012 to 745 tons in 2015, 24% increase in the volume. *Natto* is mainly being exported to China (mainland and Hong Kong SAR), Republic of Korea, Singapore and Thailand. The rate of increase is especially high in China (mainland and Hong Kong SAR) and Republic of Korea. *Natto* has potential for growth in trade in Asian region.

13. While initially Japan proposed the regional standard for *Natto* given growing consumption and trade of *Natto*, information and data provided by other member countries revealed similarity of some fermented soybean products in Asia, which strongly support a more overarching standard with extended scope as soybean products fermented with *Bacillus* species. Appendix II lists the information of these commodities.

14. Therefore, the development of a standard providing appropriate product name, definition and quality factors is imperative to ensure fair practices in food trade. Since production and trade of soybean products fermented with microorganism *Bacillus* species are mainly centered in the Asian region, it is appropriate to develop a regional standard for those products, rather than an international standard.

### Recommendation

15. CCASIA is invited to consider the new work proposal for developing a regional standard for soybean products fermented with microorganism *Bacillus* species solely or together with other microorganisms. Project document is attached as Appendix I to this document.

## PROJECT DOCUMENT

**Proposal for the Development of a Regional Standard for  
Soybean Products Fermented with Microorganism *Bacillus* Species**

**1. The purposes and the scope of the standard**

The scope of this work applies to soybean products which are fermented with microorganism *Bacillus* species solely or together with other microorganisms, retain the shape of whole soybeans and are not a paste type while some of them may be partly crushed during the manufacturing process, for direct human consumption and industrial food production including for catering purposes, Products in this scope include *Natto*, *Cheonggukjang*, *Douchi* and *Kinema*.

The purpose is to establish a regional standard for the production of soybean products which are fermented with microorganism *Bacillus* species solely or together with other microorganisms, retain the shape of whole soybeans, and are not a paste type while some of them may be partly crushed during the manufacturing process, in accordance with the purpose of Codex, namely protecting the health of the consumers and ensuring fair practices in the food trade.

**2. Its relevance and timeliness**

Recently, it is noticeable that the production and trade volume of *Natto*, a traditional product fermented with microorganism *Bacillus* species in Japan, has been steadily increasing steadily increasing intra-regionally and internationally. Although there are various fermented soybean products in the Asian region, the products fermented with microorganism *Bacillus* species, i.e., *Natto*, *Cheonggukjang*, *Douchi* and *Kinema* have similarity in not only microorganisms used for fermentation but the form. Therefore, it is necessary to establish a regional commodity standard for soybean products fermented with microorganism *Bacillus* species covering safety, quality, hygiene and labelling requirements in order to protect health of consumers and ensure fair trade practices. The standard is intended to be regional, rather than international, given that the present trend of consumption and trade of soybean products fermented with the microorganism *Bacillus* species mostly extends to Asian countries.

**3. The main aspects to be covered**

The main aspects to be covered in the standard of soybean products fermented with microorganism *Bacillus* species solely or together with other microorganisms are requirements for quality and safety, which include product definition (including the product form), scope, essential composition and quality factors such as food additives, contaminants, hygiene, labelling as well as methods of analysis and sampling.

**4. An assessment against the Criteria for the establishment of work priorities**General Criterion

The standard will meet general criterion with regard to consumer protection and fair trade practice by:

- Promotion of consumer protection by stipulating requirements for quality of soybean products fermented with microorganism *Bacillus* species; and
- Ensuring fair food trade practice, referring to proper product name and definition.

Criteria applicable to commodities

(a) Volume of production and consumption in individual countries and volume and pattern of trade between countries

The production of soybean products fermented with microorganism *Bacillus* species has been increasing steadily (see Tables 1 and 2).

Table 1 Domestic production and consumption of *Natto* in Japan (2016-2018)

(Unit: ton and JPY respectively)

	2016	2017	2018
Amount of production of Natto (thousand ton)	248	257	261
Expenditure for Natto (thousand yen)	3,135	3,229	3,537

Source: Ministry of Agriculture, Forestry and Fisheries of Japan and Ministry of Internal Affairs and Communications of Japan

Table 2 Weight of soybean products fermented with microorganism *Bacillus* species produced in Japan and Republic of Korea (2012-2015)

(Unit: tons)

	2012	2013	2014	2015
Japan	221,000	225,000	225,000	238,000
Republic of Korea	10,598	10,423	9,477	10,392
total	231,598	235,423	234,477	245,392

Source: Ministry of Agriculture, Forestry, and Fisheries of Japan and Ministry of food and Drug Safety of Republic of Korea

The export of soybean products fermented with microorganism *Bacillus* species has been increasing steadily in producing countries in Asia as well (see Tables 3 and 4). In addition, it is reported that there is growing demand of *Natto* in Republic of Korea<sup>3</sup>.

Table 3 Weight and value of Japan's export of soybean products fermented with microorganism *Bacillus* species(2012-2015)

(Unit: tons and US dollars respectively)

	2012		2013		2014		2015		
	weight	value	weight	value	weight	value	weight	value	
<b>Natto</b>									
Asia	142	996,491	161	933,402	190	987,146	201	921,488	
North America	360	2,226,817	390	1,939,549	424	1,972,596	467	1,900,826	
Europe	73	476,190	54	241,496	66	231,569	84	308,264	
Latin America, Oceania	26	169,137	24	148,566	23	116,257	24	106,612	
Total	601	3,868,672	629	3,263,012	702	3,307,561	745	3,237,190	

Source: Research by Japan *Natto* Cooperative Society Federation

Table 4 Weight and value of Republic of Korea's export of soybean products fermented with microorganism *Bacillus* species (2012-2015)

(Unit: ton and US dollars respectively)

	2012		2013		2014		2015	
	Weight	value	weight	value	weight	value	weight	value
<i>Cheonggukjang</i>	61	156,039	33	156,113	40	187,770	39	295,553
Other fermented food	0	6,858	1	9,486	3	24,558	0	293

Source: Ministry of food and Drug Safety of Republic of Korea

Note that the export weight and value of *Cheonggukjang* by importing region/country are not specified.

(b) Diversification of national legislation and apparent resultant or potential impediments to international trade

Absence of uniform quality requirements for soybean products fermented with *Bacillus* species among producing countries in the Asian region can cause trouble for fair trade of those commodities.

(c) International or regional market potential

As illustrated in Tables 3 and 4 above, there has been steady increase in the international trade for soybean products fermented with microorganism *Bacillus* species in recent years.

<sup>3</sup> Retrieved from Sankei Shimbun (Jan. 31, 2019) ( in Japanese)  
<https://www.sankei.com/premium/news/190131/prm1901310003-n1.html>

## (d) Amenability of the commodity to standardization

The standard for soybean products fermented with microorganism *Bacillus* species is supposed to include factors as to quality and hygiene, which contributes to protect consumers' health and ensure fair trade. Moreover, definitions regarding essential compositions and production methods enable to distinguish commodities covered by the standard from others.

## (e) Coverage of the main consumer protection and trade issues by existing or proposed general standards

There are no existing standards.

## (f) Number of commodities which would need separate standards indicating whether raw, semiprocessed or processed

None is identified.

## (g) Work already undertaken by other international organizations in this field and/or suggested by the relevant international intergovernmental body(ies)

None is identified.

**5. Relevance to Codex strategic objectives**

Establishment of a Codex standard for soybean products fermented with microorganism *Bacillus* species is in line with the Codex strategic objectives as follows:

It meets the Goal 1 of the Strategic Plan 2020-2025 to address current, emerging and critical issues in a timely manner, and in particularly, outcome- "Timely Codex response to emerging issues and the needs of members."

**6. Information on the relation between the proposal and other existing Codex document**

The work will take into consideration:

- *General Principles of Food Hygiene* (CXC 1-1969)
- *General Standard for the Labelling of Prepackaged Foods* (CXS 1-1985)
- *General Standard For Food Additives* (CXS 192-1995)
- *Recommended Methods of Analysis and Sampling* (CXS 234-1999)
- *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CXG 21-1997)
- Databases related to the maximum limits for pesticides residues issued by Codex Committee on Pesticides Residues in Food (CCPR).
- *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193-1995)
- *Regional Standard for Fermented Soybean Paste (Asia)* (CXS 298R-2009)
- *Regional Standard for Tempe (Asia)* (CXS 313R-2013)

**7. Identification of any requirement for and availability of expert scientific advice**

None is required.

**8. Identification of any need for technical input to the standard from external bodies so that this can be planned for**

None is required.

**9. The proposed time-line for completion of the new work**

It is expected the development of this standard to be conducted in two CCASIA meetings depending on the agreement reached by CCASIA and the standard is scheduled for adoption by CAC47 in 2024.

Procedures	Date
Approval of the new work	July 2020
Preparation of draft standard and circulation for comments (Step3)	2020-2021
Consideration of the Proposed Draft (Step 4)	2021

Adoption of the Proposed Draft (Step 5)	2022
Consideration of the Draft Regional Standard (Step 7)	2023
Final Adoption of the Regional Standard (Step8)	2024

**Soybean Products fermented with the microorganism *Bacillus* Species, Commodities Information**

Table: Existing Soybean Products fermented with the microorganism *Bacillus* Species in Asia

Country	Product name (Commodity)	Microorganism name	Host plant of microorganism	Outline of the product	Production method	Appearance Cooking method
Japan	<i>Natto</i>	<i>Bacillus subtilis</i> var. <i>natto</i>	Dry grass such as rice straw and/or air.	No secondary process aside from freezing. Emits odour by over fermentation.	<i>Bacillus subtilis</i> var. <i>natto</i> is added to steamed soybeans. Generally fermented at 38-42°C for 16 -24 hours. After fermentation, aged in a refrigerator at 10°C or less	Soybeans are placed neatly in a container and whitish bacterial film can be seen on the surface. Natto is generally stirred right before served, resulting in sticky form, and then eaten raw with white rice adding soy sauce.
Republic of Korea comment	<i>Cheonggukjang</i>	<i>Bacillus</i> species including <i>B. subtilis</i>	Dry grass such as rice straw and/or air	Assumes a brownish amber solid form with most of the soybeans retaining their shape, while some of them may be crushed during the manufacturing process. Salt and/or other seasonings may be added for increase in preservation and better taste. Consumed widely also in forms such as powder or small pellets.	Soybeans that have been soaked in water for a certain amount of time are boiled or steamed, and then fermented mainly by <i>Bacillus</i> species including <i>B. subtilis</i> in a case with a well-ventilated for about 3 to 4 days at 40 degrees Celsius under natural condition. Other seasonings may be added according to intended use.	The final product looks brownish amber and forms mucilage. And also whitish bacteria film can be seen on the surface. The product is commonly cooked for consumption since it is used as a main ingredient for stew. However, according to personal preference, it may be consumed raw along with other optional ingredients, or may be manufactured and consumed in other forms such as powder or small pellets.
China	<i>Douchi</i>	<i>Bacillus subtilis</i> . Other genus such as <i>Aspergillus</i>	Leaves of broadleaf trees. Aspergilli included.	Some have brownish mycelium film on the surface of black soybeans. Bean shape is maintained.	Black soybeans are steamed and fermented by adding salt. After fermentation, dried in the shade to reduce moisture. Takes over a month to complete.	Black brown mycelium is on the surface. Used as ingredient and seasoning for cooking, especially in Chinese dishes.
Nepal and East India	<i>Kinema</i>	<i>Bacillus subtilis</i>	Airborne bacteria. Leaves of broadleaf trees, such as bananas and ferns.	Made mainly from black soybeans and stringiness is confirmed.	Boiled soybeans are lightly ground by mortar. Place in a bamboo basket lined with fern leaves. Bacteria on the leaves are used. Basket is kept in a warm place such as a fireplace for two days to ferment.	Sticky similar to <i>Natto</i> . Some are sun-dried. Sun-dried Kinema is soaked in water and used as seasoning for soup and fried dishes. Salt-free fermentation. Lactic acid, <i>Enterococcus</i> , yeast fungi, <i>Candida</i> , mold and <i>Geotrichum</i> are also included. Cooking method varies among different tribes.



**Cheong-Gukjang**  
(Korea)



*Bacillus* species  
including *Bacillus subtilis*

**Douchi**  
(China)



*Bacillus subtilis*,  
Others  
(Aspergilli)

**Kinema**  
(Nepal)



*Bacillus subtilis*

1. Photo images of Natto



product in retail container



content of product



product on rice

## 2. Cheonggukjang Recipe examples

 A white bowl containing raw, dark red fermented soybeans, garnished with green onions and bean sprouts.	 A black ceramic pot filled with a thick, yellowish-orange stew made of fermented soybeans, topped with green onions and red chili peppers.	 A wooden spoon holding a mound of fine, light brown powder made from fermented soybeans.	 A wooden bowl filled with small, round, light brown pellets made from fermented soybeans.
Raw Cheonggukjang	Cheonggukjang stew	Cheonggukjang powder	Cheonggukjang pellets

Raw Cheonggukjang (salt-free Cheonggukjang): Mixed with other seasoning and vegetables and consumed raw

Cheonggukjang stew: Used as the main ingredient along with vegetables and consumed as stew/paste soup

Powder: When the fermentation is completed, Cheonggukjang is dried and grinded into powder

Pellets: Cheonggukjang powder is mixed with brown rice or sticky rice powder and kneaded into dough, which is made into small pellets and then dried at low temperature.

3. Japan's export weight and value of *Natto*

COUNTRY	2017		2018	
	WEIGHT UNIT:(KG)	VALUE UNIT:(1,000YEN)	WEIGHT UNIT:(KG)	VALUE UNIT:(1,000YEN)
TOTAL	1,751,620	956,574	1,827,374	981,765
REPUBLIC OF KOREA	226,008	104,172	229,453	99,758
CHINA	214,119	109,197	207,067	97,567
CHINESE TAIPEI	114,135	66,999	113,620	66,529
HONG KONG	57,424	45,344	78,457	60,234
VIET NAM	7,290	5,755	11,995	9,226
THAILAND	50,253	30,351	60,256	35,800
SINGAPORE	44,068	29,023	47,208	31,100
MALAYSIA	6,302	4,832	10,188	6,366
PHILIPPINE	9,120	5,152	7,761	4,603
INDONESIA	20,262	17,199	18,625	15,942
CAMBODIA	848	647	323	309
LAOS	410	252	-	-
MYANMAR	2,892	2,568	2,892	2,567
INDIA	-	-	457	258
BAHRAIN	-	-	264	214
UNITED ARAB EMIRATES	2,521	1,897	-	-
SWEDEN	734	648	-	-
UNITED KINGDOM	47,920	19,564	50,980	19,702
NETHERLANDS	8,258	7,499	9,362	8,311
BELGIUM	8,950	4,866	8,556	4,870
FRANCE	3,598	2,460	3,106	2,072
GERMANY	35,260	20,446	35,199	19,330
SWITZERLAND	2,853	3,590	3,134	3,265
PORTUGAL	-	-	291	221
SPAIN	1,860	1,413	875	666
ITALY	751	669	777	692
POLAND	-	-	240	593
RUSSIA	-	-	612	576
CANADA	74,425	38,852	74,757	38,663
USA	694,669	364,308	747,314	388,084
MEXICO	3,958	2,512	3,770	4,037
BRAZIL	18,514	9,279	14,009	6,409
DJIBOUTI	360	215	-	-
AUSTRALIA	71,388	43,086	68,721	41,797
NEWZEALAND	15,895	7,385	9,351	4,707
GUAM	5,041	4,891	6,272	5,674
MARIANA	843	908	683	914
PALAU	691	595	835	709

Source: Trade Statistics of Japan Ministry of Finance