

HISTORY OF SOYBEANS AND SOYFOODS IN KOREA,
AND IN KOREAN COOKBOOKS, RESTAURANTS, AND
KOREAN WORK WITH SOYFOODS
OUTSIDE KOREA (544 CE TO 2021):
EXTENSIVELY ANNOTATED
BIBLIOGRAPHY AND SOURCEBOOK

Compiled

by

William Shurtleff & Akiko Aoyagi



2021

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Bibliography of Soybean in Korea
Bibliography of Soy in Korea
Bibliography of Soya in Korea
Bibliography of Soyfoods in Korea
Bibliography of Tofu in Korea

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Timeline of Soybeans in Korea
Timeline of Soyabeans in Korea
Timeline of Soy in Korea
Timeline of Soya in Korea
Timeline of Soyfoods in Korea
Timeline of Soyafoods in Korea

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Chronology of Soybeans in Korea
Chronology of Soyabeans in Korea
Chronology of Soy in Korea
Chronology of Soya in Korea
Chronology of Soyfoods in Korea
Chronology of Soyafoods in Korea

Contents

	Page
Dedication and Acknowledgments.....	4
Introduction and Brief Chronology, by William Shurtleff	5
About This Book	10
Abbreviations Used in This Book	11
How to Make the Best Use of This Digital Book - Search It!	12
Full-Page Graphics	14-33
Introducing Soyinfo Center	34
History of Soybeans and Soyfoods in Korea: 2,092 References in Chronological Order	35
Contains 144 Photographs and Illustrations	
Subject/Geographical Index by Record Numbers	897
Last Page of Index	978

DEDICATION AND ACKNOWLEDGMENTS

**This book is dedicated Cheri-Ho Lee and Shin-Han Kwon.
And to the many generations of soybean growers and soyfoods makers in Korea.**

Part of the enjoyment of writing a book lies in meeting people from around the world who share a common interest, and in learning from them what is often the knowledge or skills acquired during a lifetime of devoted research or practice. We wish to give deepest thanks...

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■ Finally our deepest thanks to Tony Cooper of San Ramon, California, who has kept our computers up and running since Sept. 1983. Without Tony, this series of books on the Web would not have been possible.

This book, no doubt and alas, has its share of errors. These, of course, are solely the responsibility of William Shurtleff.

■ This bibliography and sourcebook was written with the hope that someone will write a detailed and well-documented history of this subject.

ABOUT THIS BOOK

This is the most comprehensive book ever published about the history of soybeans and soyfoods in Korea. It has been compiled, one record at a time over a period of 42 years, in an attempt to document the history of this ancient and interesting food. It is also the single most current and useful source of information on this subject.

This is one of more than 100 books compiled by William Shurtleff and Akiko Aoyagi, and published by the Soyinfo Center. It is based on historical principles, listing all known documents and commercial products in chronological order. It features detailed information on:

- 63 different document types, both published and unpublished.
- 1798 published documents - extensively annotated bibliography. Every known publication on the subject in every language.
- 198 unpublished archival documents.
- 147 original Soyinfo Center interviews and overviews never before published, except perhaps in our books.
- 93 commercial soy products.

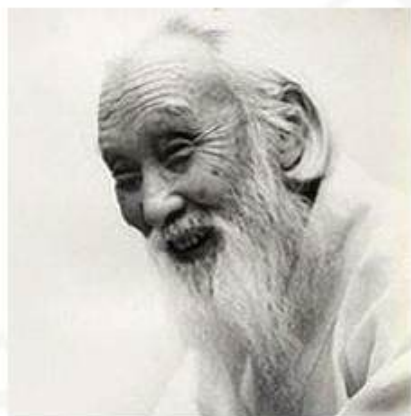
Thus, it is a powerful tool for understanding the development of this subject from its earliest beginnings to the present.

Each bibliographic record in this book contains (in addition to the typical author, date, title, volume and pages information) the author's address, number of references cited, original title of all non-English language publications together with an English translation of the title, month and issue of publication, and the first author's first name (if given). For most books, we state if it is illustrated, whether or not it has an index, and the height in centimeters.

All of the graphics (labels, ads, leaflets, etc) displayed in this book are on file, organized by subject, chronologically, in the Soyinfo Center's Graphics Collection.

For commercial soy products (CSP), each record includes (if possible) the product name, date of introduction, manufacturer's name, address and phone number, and (in many cases) ingredients, weight, packaging and price, storage requirements, nutritional composition, and a description of the label. Sources of additional information on each product (such as advertisements, articles, patents, etc.) are also given.

A complete subject/geographical index is also included.



HISTORY OF SOYBEANS AND SOYFOODS IN KOREA (544 CE TO 2021)

1. Jia Sixie. 544 CE. *Qimin yaoshu* [Important arts for the people's welfare]. China. Passage on soy reprinted in C.N. Li 1958 #66, p. 66-67, and #295, p. 216-20. Translated by Shih Sheng-han 1958, 1962. [Chi]

• **Summary:** Wade-Giles reference: *Ch'i Min Yao Shu* (QMYS) by Chia Ssu-hsieh. Northern dynasties–Northern Wei (386-534 CE; established by nomadic people from the northern steppes). This is the world's earliest encyclopedia of agriculture. H.T. Huang (2002) adds: "This is the most important book on agriculture or food technology ever published in China. At a remarkably early date it gives both general information and great detail about agriculture and food processing." The QMYS is divided into 10 books / fascicles (*juan*), and subdivided into more than 91 consecutive parts.

In his Preface, Jia Sixie states that the material in his book comes from four sources: (1) The Chinese classics; (2) Contemporary books, proverbs, and folk songs; (3) Information gathered from experts; and (4) His personal experience ("original material").

A partial English-language translation of the "original material" and commentary by Shih Sheng-han was published in 1958 (2nd ed. 1962). The numbered text below is based on the 1962 translation titled "A preliminary survey of the book *Ch'i Min Yao Shu*: An agricultural encyclopaedia of the 6th century." 2nd ed. Peking, China: Science (Kexue) Press. x + 107 p.

Book 2. General comments. The best time to plant soybeans (*dadou*) and oilseed hemp (*youma*) depends on the climate and soil condition. "Realization of the importance of proper choice of season and soil." These two factors are the key to agricultural success. A table (p. 33) shows: Best, medium, and latest time for various operations: Planting spring soybeans: Best time–First ten days of the 2nd month. Medium–First ten days of the 3rd month. Latest time–First ten days of the 4th month. Also gives such times for azuki beans, male and female hemp, and sesame seeds. For making *jiang*: Best time–12th and 1st month. Medium–2nd month. Latest–3rd month. Making *shi* (fermented black soybeans): Best–4th and 5th month. Medium–20th day of 7th month until 8th month. Latest–None. In addition: Large dark-red beans (*da chidou*) should be planted in the 3rd lunar month, and harvested in the 6th month (See Li 1958 #385).

Note 1. This is the earliest document seen that uses the verb "harvest" as a verb in connection with soybeans.

beans.

Chapter 4. Millets. It is best to plant millets on new fields (without a previous crop), or on a field where the previous crop was soybeans. Best, medium, and least suitable soil / ground for planting various crops. Spiked millet: Least suitable–Following turnips or soybeans. Panicle millets–Medium soil–Following soybeans. 1.3 Amount of seeds to be sown at different seasons: Soybeans: Best time–8 *sheng/mou* (= 220 ml/508 square meters). Medium time–10. Latest time–12.

Chapter 6. "Soybeans" (*dadou*):

Note 3. The first third (approximately) of this section is quotations from four early Chinese works and commentaries on them: (1) The *Erya* (Literary expositor) (ca. 150 BCE) says: "*rongshu* is the same as *renshu*." Sun Yan's commentary on the *Erya* explains that *rongshu* is the soybean (*dadou*).

(2) According to the *Guangya* by Zhang Yi (Ancient dictionary: Enlargement of the *Erya*) (230 CE), soybeans (*dadou*) are called *shu*; azuki beans (*xiaodou*) are also called *da*. *Hudou* is *jiangdou*. Dr. Huang adds: The true identity of *hudou* is unknown.

(3) The *Guangzhi* by Guo Yigong (Extensive records of remarkable things) (390 CE) says: When you plant the azuki bean (*xiaodou*), you can get three crops a year. The flavor is good. *Baidou* ("white bean") is coarse, large, and edible. *Cidou* ("prickly bean") is also edible. *Judou* ("millet bean") has a seedling which is like that of the azuki bean (*xiaodou*). The flowers are purple. It can be used for flour (*mian*). It is grown in a place called Zhuti within Jianin (in today's Sichuan). Of soybeans (*dadou*), we have the yellow *luodou* ("drop bean"), the *yudou* ("imperial bean," in which the bean is elongated), the *yangdou* ("poplar bean"), whose leaves are edible, and the *hudou* ("foreign bean"), which comes in green (*qingdou*) and yellow (*huangdou*) varieties.

(4) According to the *Bencao* (probably *Shennong Bencao Jing*; *Benjing*) (Classical pharmacopoeia of Shennong, the Heavenly Husbandman) (100 CE), when Zhang Qian (W.-G. Chang Ch'ien) traveled to foreign lands, he brought *hudou* ("foreign bean") seeds back to China.

Note 4. Zhang went west along what is now called the Silk Road during the Former / Western Han dynasty, was gone for 11 years, and returned to China in 126 BCE. The *hudou* is now generally thought not to be a soybean.

The *Qimin Yaoshu* then begins: So now (i.e., Later

15. Lee, Ik. 1761. *Seongho Saseol*, Compendium of Seongho Lee Ik (1681-1763). Korea: [Chi]

• **Summary** : An early description of the soybean appears in this book. The following was translated by Dr. Cheryl-Ho Lee of Korea:

Soybean is one of the five grains, which people do not value. But if you claim that grain saves people, the power of soybeans is the greatest. The people of later generations have few living well, and many poor, so that all the good food made of good grain is given to the rich, and only soybean is passed to the poor to

sustain their life.

The price is equal to unhulled rice when soybeans are in cheap rice. When you mill 10 pounds of unhulled rice, you'll have four pounds of polished rice. So you can change 10 pounds of soybean with four pounds of polished rice. In terms of losses, 3/5 is added, which is a big gain.

Grinding soaked soybean with a stone mill will result in soymilk to make dubu [tofu], and there are also abundant amount of residues [biji = okara] left. If you boil it (biji) and make soup, it tastes delicious. Sprouting soybeans to make soybean sprouts adds a few doubles. Poor people can fill their stomachs by grinding beans, cutting bean sprouts, and combining them to make porridge. I know these things as I live in the country, so I will write them down so that I can see and understand them for those who teach and rule the people.

Dr. Cherl-Ho Lee of Korea writes: Seongho Saseol [4 Chinese characters] is a manuscript consisting of 30 volumes in 30 books, written by Lee Ik (1681-1763), a scholar of the Korean Practical Science or Realist School of Confucianism, Silhak. This book is an encyclopedia, compiled by his nephews in 1761, in which he wrote about his country's politics, economy, society, culture, geography, customs, thoughts, history, books, and answers to his disciples' questions. It was written in Chinese and translated into Korean in 1977. The Korean alphabet, Hangeul, was invented in King Sejong's period in the 15th century, but used mainly by women. Scholars in the Joseon Kingdom preferred to use Chinese characters, much as European scholars preferred to use Latin in medieval times. The Korean alphabet has been used as the official way of writing since the Republic of Korea was founded in 1948. Seongho is Lee Ik's nick name or pen name, and Saseol means compendium or editorial. So, Seongho Saseol can be translated into English as 'A compendium of Seongho Lee Ik (1681-1763).' Address: Korea.

1602. Kwon, Tai-wan; Kwon, S.H.; Lee, C.H.; Hong, E.H. 2001. Kukjekyumoeru kongbakmulkwon konripe kwanhan tadangsung josayeonku [Studies on the justification for constructing a soybean museum in Korea]. Korea Soybean Digest (Hankuk Kong Yeonguhoe) 18(1):1-25. [39 ref. Kor]*

• **Summary** : Dr. Cherl-Ho Lee (2016, p. 9) states: Botanical and historical research indicates that it was the region covering South Manchuria and the Korean Peninsula where soybeans originated with the most abundant wild varieties.

The Korean soybean museum opened in April 2015. It was paid for by The city of Youngju, Kyungsang bukdo, which paid ca. 6 billion won (US \$5 million). The basic message of the museum is that soybean cultivation originated on the Korean Peninsula-not in Manchuria or in China.

In the book Soybean Storytelling (2017, Foreword) we read: "The cultivation and usage of soybeans began in Korea, but because most ancient histories of Korea are intermingled with Chinese culture, this fact has not been properly disseminated

to the world. Dr. Kwon Tai-wan, the founding director of the Korea Food Research Institute, formed the Committee for the Establishment of a Korean Soybean Museum in 2001 in order to begin the work on a museum that would inform visitors of the true history and use of soybeans. Below is the letter of intent penned at the Promotion Committee's inception:

"Purpose of Promoting the Establishment of a Korean Soybean Museum: "We wish to illuminate the research we have done, which indicates that in the history of humanity, Koreans were the first to plant soybeans and use them for food. Soybeans were used as food in Northeast Asia more than 3000 years ago; from the 3rd century BC soybeans were disseminated to the southern region of China, Southeast Asia, and Japan; they were introduced to Europe in the 18th century; and during World War II they were cultivated as a cash crop in the United States. Today soybean cultivation has spread all around the world:

"It is known that soybeans supplemented with rice comprise a nutritionally complete meal but recently it has come to light that soybeans also help prevent and cure cancer, heart disease, and other adult-onset diseases. Some cultures have already been supporting their health by consuming soybeans as a staple in their diets, and now in the West, where soybeans have long been used for oil or fodder, the cytological value of soybeans is being revealed; thus quickly ushering in an era of dietary soybean consumption. Due to the spread of cultivation and the variety of its uses, the soybean, though it originated in Northeast Asia, has now become a global-crop as well as a food item for people all around the world.

"Soybeans, which helped sustain the health of our ancestors where they lived on the Korean Peninsula and in Manchuria, as well as that of their descendants through a long passage of time, have now been introduced on the world stage. The 21st century can be called the culture century, or an era in which culture is judged to be the conscience and capacity of nations. Many museums have been established here and there on this earth, each a symbol of its given culture, and yet nowhere is there a museum about soybeans. Is it not appropriate that a museum specializing in soybeans should be established in the origin nation of soybeans? By establishing a museum on an international scale that focuses on soybean culture and utilization techniques, we hope to broadly inform the global village of soybean culture and development, and by so doing contribute to humanity's health.

"Going beyond simply amassing and exhibiting artifacts relating to soybean culture from days long past, research and analysis will be done on global data and literature relating to soybeans, thus creating a forward-looking, creative museum that provides informational exchange on an international scale and focuses on research education. There will be an all-weather greenhouse, a soybean products manufacturing lab, and even a soybean specialty café, such that everything about soybeans can be seen, learned, pondered, eaten, and experienced all in one place.

In this way the museum will be self-supporting in its operations and development.

“From this viewpoint we wish to establish a soybean museum that will revive our culture of the past thousand years and thereby bequeath the wise and creative spirit of our ancestors to future generations in the 2000s. We will marshal all of our abilities for the work at hand

“September 2001

“Committee for the Establishment of a Korean Soybean Museum Promoters: Kwon Tai-wan, Kim Seok-dong, Kim Seok-min, Kim Jun-young, Ryu Yong-hwan, Lee Cherl-ho, Lee Young-tack, Chang Hak-gil; Jeong Jang-seop, Jung Chai-won, Cho Se-young, Hong Eun-hi “With the support of research funds from the Daesan Agricultural Foundation in 1998, this work began with a study written by Kwon Tai-wan, Kwon Sin-han, Lee Cherl-ho, and Hong Eun-hi, “The feasibility study on the establishment of a World Soybean Center,” which began an all-inclusive research project into the history and scientific development of soybeans.

“In 2005 the committee, which included most of the major soybean specialists in the country, published the book Soybeans (15 chapters, 794 pages, published by Korea University Press)...”

1611. Lee, Cherl-Ho. 2001. Fermentation technology in Korea. Seoul, Korea: Korea University Press. iii + 330 p. Illust. Index. 26 cm. [Eng]

• **Summary** : Korea has a long history of eating fermented soyfoods. Early documents indicate that the cultivation of soybeans originated in Manchuria, which was part of Korea in ancient times.

Contents: 1. Evolution of Korean Dietary Culture. 2. Primitive Pottery Age (B.C. 8000 to about 3000)-the era of fermentation experiments. 3. History of Cereal Fermentation Technology. 4. Korea, the land of soybean fermentation: the origin of soybean as food, history of soybean fermentation, meju preparation-the fermentation starter, Korean soysauce [kanjang, made at home] vs. Japanese soysauce [shoyu, made industrially], chongkukjang: a fermented soybean paste as an instant military paste of the old days, kochujang: a wonderful harmony of hot, sweet, meaty and salty tastes. 5. Effect of soybean fermentation on the protein quality. 6. Kimchi, Korean fermented vegetable food. 7. Fish fermentation technology. 8. Lactic acid fermented foods and their benefit in Asia. 9. Present status and prospect of Korean fermentation industry. Appendix: Collection of research paper abstracts in Korea. I. Alcoholic fermentation. II. Soybean fermentation. III. Kimchi fermentation. IV. Fish Fermentation. V. Other fermentations. Authors index.

Page 79. The earliest known document that mentions kochujang (fermented red pepper paste) is the Chungbosanlimkyungje written by Chung-Im in 1765. It describes several varieties of fermented soybean products including jeupjang and chongkukjang besides kochujang and their processing methods practiced in Korea

at that time. date from the 2nd half of the 17th century.

Shell mounds along the coastline of the Korean Peninsula and the Japanese archipelago show that the dietary habits of the people changed from less hunting and more gathering at the beginning of the Holocene period (ca. 10,000 BCE) as the dwellings moved to the coastline.

Interestingly the increased consumption of marine products coincided with the invention of primitive pottery. Around the late Paleolithic, by 6000 BCE, the use of Jeulmun (Korean) or Jomon (Japanese) pottery has spread over the Korean Peninsula and the Japanese Archipelago. Archaeologists call this period the Jeulmun period in the Korean Peninsula and the Jomon period in the Japanese archipelago (from ca. 8000 BCE). Agriculture had not yet begun.

Page 6: Table 1-1 “Chronology of early Korean culture” includes the following:

ca. 2,333-108 B.C. Traditional date of the founding of the Kingdom of Chosun by Tangun.

ca. 1,200 B.C. Beginning of the Bronze Age, black pottery, Megalithic culture, dolmens, menhirs, agricultural tools.

ca. 1,122 B.C. The establishment of Kija Chosun.

ca. 800-700 B.C. The rise of the Chin state and the Han tribes in the south [of Korea].

ca. 500 B.C. The beginning of the Iron Age.

ca. 194 B.C. The rise of Wiman Chosun in the north and the three federations of the Han tribes in the south.

109-108 B.C. Invasion of Korea by the Han dynasty of China, the fall of Wiman Chosun.

57 B.C. to 699 A.D. The Three Kingdoms period.

57 B.C. The founding of the state of Saro (later Silla).

ca. 37 B.C. The emergence of Koguryo.

ca. 18 B.C. The emergence of Paekche.

372 A.D. Official adoption of Buddhism and the establishment of a school of Confucian studies in Koguryo

384 A.D. Official adoption of Buddhism in Paekche.

527 Official adoption of Buddhism in Silla.

663 The destruction of Paekche by Silla.

668 The destruction of Koguryo by Silla.

668-918 Unified Korea of Silla.

About the author (inside front dust jacket): Cherl-Ho Lee earned his PhD in Food Science at the Royal Veterinary and Agricultural University, Denmark. He was a postdoctorate research associate at the Massachusetts Institute of Technology in the USA. His previous works include:

1. Extrusion Technology I and I (1987, 1988, in Korean).

2. Fish Fermentation Technology (UNU Press, 1993).
3. Lactic Acid Fermentation of Non-dairy Food and Beverages (1994, in Korean).
4. Food Evaluation and Quality Control (1999, in Korean).
5. Introduction to Korean Food Science (Korea University Press, 2003). Address: Prof. of Food Engineering, Graduate School of Biotechnology, CAFST, Korea Univ., Seoul, 136-701, Korea.

1633. Lee, Cherl-Ho; Lee, Sang Sun. 2002. Cereal fermentation by fungi. In: George G. Khachatourians and Dilip K. Arora, eds. 2002. Applied Mycology and Biotechnology. Vol. 2. Agriculture and Food Production. Amsterdam, New York: Elsevier. 428 p. See p. 151-70. [50 ref]

• **Summary** : Contents: Summary. Introduction. Fermentation starters: History of solid state fermentation starters in northeast Asia, cereal alcoholic fermentation starters, soybean fermentation starters. Fungal fermented foods: Cereal alcoholic products (rice wine, rice beer, alcoholic rice paste, alcoholic rice seasoning), fermented soybean products (Korean kanjang and doenjang, Japanese shoyu and miso, tempe, Chinese sufu), other fermented products (Chinese red rice {Anka}, enzyme foods). Hygienic aspects of fungal fermented foods: Mycotoxins in fermentation raw materials, mycotoxin formed during fermentation. Conclusion.

Page 162: "... soybean sauce, kanjang, and soybean paste, doenjang, have been used in Korea for more than 2000 years and formed the characteristic flavor of Korean cuisine. The term "Shi" [fermented black soybeans], the Chinese letter [character] indicating meju, first appears in Jijiupian written in the Han period (206 B.C. to 208 A.D.) of China. Bowuzhi of Jin (265-420 A.D.) of China describes that Shi [fermented black soybeans] originated in a foreign country, and the letter is a dialect. Xintangshu of the Tang period (618-807 A.D.) in China names Shi as a special product of Balhai or Bohai (688-826 A.D.), a nation founded by the refugees from defeated Kokuryo (37 B.C. to 668 A.D.)

Note: The source for the very important information given above on page 162 is endnote 33: Lee, S.W. (1990). "A study on the origin and interchange of Dujang (also known as soybean sauce) in ancient Asia." Korean J. of Dietary Culture 5:313.

"It is generally recognized that Koreans were the first to experiment with soybean fermentation, sparking the beginning of the soy sauce culture of the Orient (Lee, C.H. 2001. Fermentation Technology in Korea. Seoul: Korea University Press). Their traditional fermentation technology was so advanced that they taught their techniques to neighboring countries."

Page 162-63: "Meju [soybean koji], the fermentation starter for Korean soysauce, kanjang, is made from soybean... The ripening of kanjang mash in the brine is ended in 1-2 months." Figures: (12) A combination diagram and flow sheet [flow sheet] showing the process of making Korean kanjang and doenjang. Address: 1. Graduate School of Biotechnology, CAFST, Korea Univ., Seoul, 136-701, Korea; 2.

Dep. of Biology, Korea National Univ. of Education, Chungbuk, 363-791.

1650. Kim, M.-R.; Kawamura, Y.; Lee, C.-H. 2003. Isolation and identification of bitter peptides of tryptic hydrolysate of soybean 11S glycinin by reverse-phase high-performance liquid chromatography. *J. of Food Science* 68(8):2416-22. Oct. [33 ref]

• **Summary** : “The 21 peptides purified from the bitter fraction of tryptic hydrolysates of soybean 11S glycinin by using gel-permeation high-performance liquid chromatography (HPLC) and a series of 3 C18 reverse phase (RP)-HPLC were in the molecular weight range of 200-1400 Da and showed mostly the hydrophobicity of less than 1400 cal/mol. Although the primary structures of the bitter peptides from 11S glycinin were not exactly the same as those of the proglycinin, many bitter peptides were basic mimics of the common structure, indicating the significance of the primary structure of a peptide playing a role in the bitter taste perception.” Address: 1, 3. Center for Advanced Food Science and Technology, Graduate School of Biotechnology, Korea Univ., Seoul, 136- 701, Korea.

1675. Lee, Cherl-Ho. 2004. The role of biotechnology in modern food production. *J. of Food Science* 69(3):CRH92-CRH95. April. 12th World Congress of Food Science and Technology. [18 ref]

• **Summary** : “Modern food production technology is given great challenges by the emerging fields of biotechnology and molecular biology. Knowledge of conventional fermentation technology is upgraded by the gene level explanations of enzyme actions and physiological functions of biomaterials derived therefrom. The use of genetically modified organisms (GMOs) and their products in food widens the availability of resources while also raising public interest about safety and labeling. As an example of the application of molecular biology in conventional fermentation technology the selection of proteases from a *Bacillus* species grown in Korean traditional soybean fermentation starter, Meju, and the production of peptides with blood cholesterol lowering effect, obtained from soybean protein hydrolysate, are presented. Recent developments in the Korean bioindustry are reviewed as an example of the role of biotechnology in the food industry. The present status of GMO enzymes in food production is reviewed and safety issues about GMO use in the food system are discussed.”

Note: Soy is mentioned 19 times in this document. Address: Graduate School of Biotechnology, Korea Univ., Seoul, 136-701 Korea.

1717. Lee, Cherl-Ho. comp. 2005. Kong [Soybean]. Seoul, Korea: Korea University Press. 794 p. Illust. No Index. 26cm. [600+ ref. Kor]

• **Summary** : Contents: Foreword, by Kwon Tai-wan.

1. "History of the uses of soybeans," by Lee Cherl-ho and Kwon Tai-wan.
2. "Prehistoric and ancient soybean remains," by Cho Hyeon-jong.
3. "Sauce culture and earthenware," by Shin Suk-jeong.
4. "The history of soybean cultivation," by Hong Eun-hi.
5. "Soybean cultivars and breeding," by Kim Seok-dong and Lee Young-ho.
6. "Characteristics of soybean processing," by Kim Woo-jeong.
7. "History and current state of soymilk and soybean curd," by Son Heon-su.
8. "Fermented soybean foods," by Shin Dong-hwa and Lee Hyo-ji.
9. "The health functionality of fermented soybean products," by Park Kun-young.
10. "Korean foods made with soybeans," by Lee Hyo-ji
11. "Soybean cuisine in other countries," by Cho Jung-soon.
12. "The nutritive value and functionality of soybean foods," by Seung Jeong-Ja;
13. "Industrial uses of soybeans," by Chee Kew-man,
14. "Soybean oil and its by-products," by Lee Gyeong-il.
15. "The current state and future outlook of soybean production and distribution," by Cho Se-yeong.

Each chapter lists 30-60 references and has 10-figures.

Note: This book was conceived of by the Committee for the establishment of a Korean Soybean Museum. The authors of the various chapters include most of the major soybean specialists in the Korea. It is intended to be a comprehensive work on all major aspects of soybeans and soyfoods.

1809. Lee, Cherl-Ho. 2008. Chongkukjang [Korean-style salted natto]. In: Kan Kiuchi, Toshirô Nagai, and Keitarô Kimura, eds. 2008. *Natto no Kagaku: Saishin Jôhō ni yoru Sôgôteki Kôsetsu [The Science of Natto: A Comprehensive Examination of the Latest Information]*. Tokyo: Kenpakusha. viii + 285 p. See p. 224-26. 22 cm. [Jap]

• Summary: Cherl-Ho Lee (PhD of Korea Univ., Seoul) kindly sent us his English-Language copy of this chapter. Cc = Chinese characters "1. The origin of Chongkukjang

"Chongkukjang (3 Cc) is a branch of Korean soybean fermented products (Cc). It is a bacterial fermented soybean food, similar to Natto of Japan, but different in the usage. Chongkukjang is made by rapid fermentation of cooked soybean to produce soybean paste (Doenjang) by mixing salt after the bacterial fermentation. Therefore, it is one of the fermented soybean condiments stemmed from the long history of soybean fermentation in Korea as classified in Figure 1.

Shi (Cc) is prepared by fermenting individual cooked soybean whole grain with bacteria, *Bacillus subtilis*, while Maljang is made by Meju, cooked and pounded soybean ball grown with mold, *Aspergillus oryzae*, outside and bacteria, mainly *Bacillus* species, inside. The term "Shi (Cc), the Chinese letter indicating fermented soybean, first appears in Jijiupian (3 Cc) written in Han period (Cc 206 B.C.-208

A.D.) of China. Bowuzhi (3 Cc) of Jin (Cc 265-420 A.D.) of China describes that Shi was originated from foreign country, and the letter is a dialect. Xintangshu (3 Cc) of Tang (618-807 A.D.) in China names Shi as a special product of Balhai or Bohai (2 Cc 688-826 A.D.), a nation founded by the refugees from defeated Kokuryo (3 Cc 37 B.C.-668 A.D.). Chi-Min-Yao-Shu (4 Cc) written by Jia-Si-Xie (3 Cc 550) of Late-Wei (2 Cc) in the 6th century, describes several methods of Shi preparation (Lee, C.H., 2001)

“It is generally recognized that Koreans were the first people to experiment with soybean fermentation, sparking the beginning of the soy sauce culture of the Orient. The history book of Wei (2 Cc) praises the fermentation skill of the Korean people (8 Cc). The techniques were transferred to Japan around 2-3 Century A.D. from Kokuryo. The Japanese term for soybean paste, Miso was originated in Korean language Maljang, an old term indicating fermented soybean products as shown in Figure 1.

“Masakurainbunsyo (5 Cc) written in Japan in 752, describes Miso as a dialect from Koryo (2 Cc), and called as Koryojang (3 Cc) (Lee, S.W., 1990). Although the term ‘jang (1 Cc)’ is used for the fermented condiments in general in the Orient, in this classification it is the soybean products fermented with other cereals using Koji, mostly developed in Japan.

“Chongkukjang is termed as Yumshi (2 Cc) in the earlier Korean literatures like Samkuksaki (4 Cc) written by Kim Bu-Shik (3 Cc, 1075 -1151). The 18th century literatures like Sanlimkyungje (4 Cc, 1715) describe it as Jeonkukjang (3 Cc), reflecting the need for rapid processing of soybean paste during the war time of Byungjahoran (4 Cc). Food historians believe that the phonetic change from ‘Jeonkuk (2 Cc)’ to ‘Chongkuk (2 Cc)’ took place at that time. Another story is that the Qing (Cc) army used to carry the instant fermented soybean as military ration, so people called it Chonkukjang (3 Cc). What all these names imply is that this product was made for extraordinary situation, for example war time or famine conditions, for the urgent supply of nutritious savory food ingredient.

“2. Methods of preparation

“The first written record on the preparation of Jeonkukjang appeared in Jeungbosan limkyungje (3 Cc) written by Yoo Jung-Im (3 Cc) in 1765. Newly harvested soybean is cooked and covered with straw mat, and placed on the warm ondol, typical Korean stone floor heated by fire underneath, for 3 days until the mucous string is formed with strong fermented smell. It is mixed with decoupled and roasted soybean powder, and pounded in a stone mortar with the addition of salt, and sun dried. The mixing ratio of fermented soybean and roasted soybean powder is 2 to 1, and the amount of salt addition is determined by taste. The product appears to be in dried form, easy for storage and transport, and suitable for the military use. This process is slightly different from the method practiced today. Today, the process is very simple as shown in Figure 2. Soybean is cooked

and covered with straw mat or cloth, and placed on the warm ondol for 3-4 days until mucous strings are formed. It is mixed with chopped ginger, chopped garlic and salt, and pounded slightly until the bean kernels are separated into halves, and stored in an earthen jar. Industrially, inoculation is made by adding pure culture of *Bacillus subtilis* or placing pieces of rice straw to cooked soybean. Rice straw is the source of *Bacillus subtilis*, which grow fast at 40°C and becomes naturally dominating flora in the system (Lee H.C., 1995) The strong smell of the bacterial fermented soybean is partially masked by ginger and garlic, and turned to the characteristic Chongkukjang flavor. The spicy seasoning is thus prepared in 3-4 days, while ordinary soybean paste, Doenjang, which uses Meju as fermentation starter, takes over 6 months to complete ripening.

“3. Usage and function

Bacillus subtilis produces strong proteolytic enzymes, and soybean proteins undergo rapidly partial hydrolysis into peptides and even to amino acids and ammonia in the short fermentation period of Chongkukjang. This process produces the typical Chongkukjang flavor, strong meaty and sharp smell. It is used for making Chigae, a stew of vegetables, meats, fish and shell-fish, same as Doenjang. Chongkukjang-chigae is one of the most favorite menu in Korea, especially for the aged group. The amount of Chongkukjang added to the stew is large enough to supplement protein to the diet significantly. The fermented bean halves floating and mixing in the vegetable stew gives healthy sign of the dish. The strong desire on Chongkukjang of old Koreans may be not only the sensory nostalgia, but the physiological demands for their better health.

“Recently scientists discover the health beneficial physiological functions of some components produced in Chongkukjang. The soybean peptides are inhibiting angiotensin converting enzyme (ACE), and thus expected to suppress the incidence of high blood pressure. The mucous substance in Chongkukjang is peptido-polysaccharides produced by *Bacillus subtilis*, and contains enzyme kinase which has fibrinolytic and immune-modulating activity. The isoflavonoides in soybean support estrogen hormone function and relieve the malfunction of human menopause (Lee C.H., 2004).

“It is not surprising to find that fermented soybean products have been used as medicine in many Oriental medicine subscription, such as those in Donggeuibogam (4 Cc), a Classic of Eastern Medicine written by Hur Jun (2 Cc) in 1611. Recently, the dried form of the bacterial fermented soybean, either in granules, pills or powder form, are sold as health food in Korea.

“References:

“Cherl-Ho Lee, *Fermentation Technology in Korea*, Korea University Press, 2001, 44-81.

“Cherl-Ho Lee, The role of biotechnology in modern food production, *Journal of Food Science*, 2004, 69(3), R92-95.

“Han-Chang Lee, The mystery of Chongkukjang, Shinkwang Publishing Co., 1995.

“Sung-Woo Lee, Study on the origin and interchange of Dujang (also known as soybean sauce) in ancient Asia, Korean J. Dietary Culture, 1990, 5(3), 313-318.”
Address: PhD Korea Univ., Seoul, 136-701, Korea.

1950. Lee, Cherl-Ho. comp. 2013. Food war 2030. Translated by Colin A. Mouat. Seoul, Korea: Sikanyeon Publishing. [xiv] + 241 p. Illust. 21 cm. [600+ ref. Kor]

• **Summary** : This novel makes bold predictions about world food security during the next few decades. Sikanyeon is the publishing house of Korea Food Security Research Foundation.

1959. Lee, Ggot-Im; Lee, Cherl-Ho. 2014. Safety aspects of alkaline-fermented foods. In: Prabir K. Sarkar & M.J. Robert Nout, eds. 2014. Handbook of Indigenous Foods Involving Alkaline Fermentation. Boca Raton, Florida: CRC Press, Taylor & Francis Group. xxviii + 601 p. See p. 399-423. [69 ref]

• **Summary** : Contents: 6.1 Alkaline-fermented foods (AFFs) are generally safe (Korean chongkukjang and doenjang, Japanese natto, Chinese douchi, Thai thua nao, and Nepalese and Indian kinema, which are all made from soybean, belong to this class of fermented foods. *Bacillus subtilis* and related bacilli are the essential and main microorganisms responsible for making AFFs).

6.1.1 Initial thermal treatment.

6.1.2. Growth of *Bacillus subtilis* (It's optimal growth temperature is around 40°C. Several researchers have reported that *Bacillus subtilis* and *Bacillus pumilus* can produce metabolites that inhibit the growth of pathogenic bacteria. The *Bacillus* species, especially *B. subtilis*, not only have an antibiotic effect, they also produce strong proteolytic enzymes that hydrolyze that protein in the beans and seeds into peptides and amino acids, and finally into ammonia. The combination of high pH and high concentration of free ammonia, along with rapid growth of *B. subtilis* at the high temperature of 40°C makes it very difficult to grow).

6.1.3 pH change (The pH of AFFs typically rise from 6.0 to 7.0 at the start to 7.9 to 9.0 at the end. Many of the pathogenic and spoilage microorganisms are inhibited by a pH over 8.0). 6.1.4 Cooking process.

6.2 Hazards in alkaline-fermented foods (microbiological and chemical). 6.2.1 Microbiological hazards (*Bacillus cereus* is the main culprit). 6.2.1.2 Other potential pathogens. 6.2.1.3 Mycotoxins (incl. aflatoxins). 6.2.2 Chemical hazards: Biogenic amines (Biogenic amines have been reported in AFFs such as natto, chongkukjang, and doenjang. Miso is reported to have had high levels of histamine, putrescine, cadaverine, and tyramine).

6.3 Control of hazards (by applying good agricultural practices {GAP} and hazard analysis and critical control points (HACCP)). 6.3.1 GAP. 6.3.2 HACCP (The critical control points are placed in the flowchart of operational steps). 6.4 Conclusion.

Soy-related tables: 6.3 Approximate pH tolerance of some microorganisms (shows maximum and minimum for each).

6.6 Main biogenic amines and their precursors. This table has 4 columns: Compound name, precursor structure (2), and molecular weight. It also has 9 rows: Agmatine, Tryptamine, 2-Phenylethyl amine, Putrescine, Cadaverine, Histamine, Tyramine, Spermidine, and Spermine.

6.7 Contents of biogenic amines in different fermented soybean products (mg/kg). This table has 10 columns: Tyramine, Tryptamine, Histamine, Putrescine, Cadaverine, Phenylethylamine, Spermine, Spermidine and Reference. It also has 9 rows: Miso, Doenjang (Korean traditional type), Doenjang (Korean modern type), Miso, Chongkukjang, Chongkukjang powder, natto (Japanese), natto (Taiwan), natto (Japanese). The foods with the highest Spermidine content are (1) natto (Japanese) 339.7. (2) chongkukjang powder 54.6 (3) chongkukjang 52.0.

Soy-related figures: 6.1 (graph) The pH change of several alkaline-fermented foods (Chongkukjang, Thuanao, and Ogiri), Address: Korea Food Security Research Foundation, Korea University, Seoul, South Korea.

1960. Lee, Jang-Eun; Lee, Ggot-Im; Lee, Cherl-Ho. 2014. **Chongkukjang**. In: Prabir K. Sarkar & M.J. Robert Nout, eds. 2014. Handbook of Indigenous Foods Involving Alkaline Fermentation. Boca Raton, Florida: CRC Press, Taylor & Francis Group. xxviii + 601 p. See p. 63-71. [11 ref]

• **Summary** : Chongkukjang is similar to Japan's natto.

Contents: Origin of chongkukjang (first written record is from 1765). Methods of preparation. Biochemical composition. usage and function. Safety aspects.

Figures: (2.26) Diagram. The position of chongkukjang in Korean fermented soybean products (Modified from Lee, C.H., Fermentation Technology in Korea, Korea University Press, Seoul, 2001). Shows that chongkukjang is related to Japan's natto.

(2.27) Photo. Chongkukjang with mucous strings-when lifted up with chopsticks.

(2.28) Diagram. Process for making chongkukjang (From Lee, C.H. Fermentation Technology in Korea, Korea University Press, Seoul, 2001).

(2.29) Photos. Chongkukjang packages. Traditional earthen jars (a) and modern package (b).

(2.30) Graph. Changes in pH during chongkukjang preparation using 3 different strains of Bacillus for 72 hrs, 40°C. (From Baek, L.M. et al., Korean Journal of Food Science and Technology, 40, 400-405, 2008).

Tables: (2.7) Chemical composition of soybean and chongkukjang. Source: Rural Development Administration 2011.

(2.8) List of biogenic amines in commercial chongkukjang in Korea. 10 samples, 11 amines.

(2.9) Possible hazardous components in chongkukjang. The 3 types are (a)

pathogenic microorganisms, (b) aflatoxin or pesticide residues, and (c) extraneous material (weed, seed, stem, etc). Address: 1. Korea Food Research Inst., Seongnam, South Korea; 2-3. Korea Food Security Research Foundation, Korea Univ., Seoul, South Korea.

1963. Sarkar, Prabir K.; Nout, M.J. Robert. eds. 2014. Handbook of indigenous foods involving alkaline fermentation. Boca Raton, Florida: CRC Press, Taylor & Francis Group. xxviii + 601 p. Illust. Index. 24 cm. [500+ ref]

• **Summary** : See next page. This is a unique and outstanding book. Contents (through Chapter 2): Series preface. Preface. Editors. Contributors. 1. Introduction. 2. Diversity of plant-based food products involving alkaline fermentation. Chapter 2 is divided into “2.1 Legume products” and “2.2 Non-legume products.” “2.1 Legume products” is divided into “2.1.1 Soybean products” and “2.1.2 Non-soybean products.” The soybean products are:

Natto, by Toshirou Nagai (p. 8-18).

Douchi, by Li-Te Li and Yan-Li Ma (p. 18-33).

Kinema and similar products, by Prabir K. Sarkar and M.J. Robert Nout (p. 33-53).

Doenjang, by Kun-Young Park Ji-Kang Jeong (p. 33-63).

Chongkukjang, by Jang-Eun Lee, Ggot-Im Lee, and Cherl-Ho Lee (p. 63-71).

Douchi, by Li-Te Li and Yan-Li Ma (p. 18-33).

Thua Nao, by Ekachai and Chukeatirote (p. 71-76).

Meitauza, by Li-Te Li and Yan-Li Ma (p. 76-87).

Yandou, by Hongjiang Yang (p. 87-92).

For other soy-related material: Soybean, p. 4-5.

Cultivation, p. 8. Protein, p. 8. Tempe bongkrek, p. 150. Yeasts, p. 282-89. Soy dawadawa, p. 285. Meju yeasts, p. 287-88. Nutritional value, p. 323-24. TI [trypsin inhibitor] reduction, p. 336 Antioxidative activity, p. 342-43. Okara: See also Meitauza. Okara, antioxidative activity, p. 343-44. Miso, biogenic amine levels in, p. 411, 413t. Spermidine, contents in different fermented soybean products, p. 413t, 414.

Note: Biogenic amines include (table 6.7, p. 413): tyramine, tryptamine, histamine, putrescine, cadaverine, phenylethylamine, spermine, and spermidine. Spermine, precursor of, p. 412t. Spermidine, precursor of, p. 412t Spermidine, contents in differentiated fermented soybean products, p. 413t, 414. Soybean meal, alkaline protease production, p. 480-81. Soy sauce, p. 490.

From the publisher (back cover): “Handbook of Indigenous Foods Involving Alkaline Fermentation details the basic approaches of alkaline fermentation, provides a brief history, and offers an overview of the subject. Devoted exclusively to alkaline-fermented foods (AFFs), this text includes contributions from experts from around the globe. It discusses the diversity of indigenous fermented foods

involving an alkaline reaction, as well as the taxonomy, ecology, physiology, and genetics of predominant microorganisms occurring in AFFs.

“Presented in 10 chapters, the book explains how microorganisms or enzymes transform raw ingredients into AFFs. It discusses the quality and safety aspects of AFFs, and considers the challenges associated with the technological aspects in modernizing AFFs. It stresses the significance of the microbiological and biochemical processes in the fermentations, as well as the factors that influence the development of the characteristic microbiota, and the biochemical and organoleptic changes induced by them. It also proposes solutions, discusses the value of AFFs and related dominant microorganisms, and assesses the future of AFFs.

“The authors highlight commonly known foods and beverages of plant and animal origin. They provide insight into the manufacture, chemical and microbiological composition, processing, and compositional and functional modifications taking place as a result of microbial and enzyme effects. The text examines safety, legislation, traditional and industrialized processes, as well as new product development, and opportunities for developing commodities from Africa, Asia, Europe, USA, and the Middle East. In addition, it also assesses the value of food processing by-products, biotechnology, and engineering of solid-state processes, modern chemical and biological analytical approaches to safety, and health and consumer perception.”

This book contains a wealth of new and detailed information about several fermented foods, including Meitauza (by Li-Tee Li and Yan-Li Ma) which is made from okara (p. 76-87) and Yandou (by Hongjiang Yang), which is a fermented salted soybean food, widely consumed in eastern China, especially in Jiangsu province and surrounding areas (p. 87-92).

Note: Cherl-Ho Lee (PhD of Korea Univ., Seoul), wrote 2.1.1.5 Chongkukjang (p. 63-71), Hongeohoe (p. 224-28), and 6. Safety aspects of alkaline fermented foods (p. 399-423). Address: 1. Dep. of Botany, Univ. of North Bengal, Siliguri, India; 2. Lab. of Food Microbiology, Wageningen Univ., Wageningen, the Netherlands.

1993. Lee, Cherl-Ho. comp. 2015. Kong Se Kye Gwa Hak Gwan [Soyworld Science Museum]. Seoul, Korea: Sikanyeon Publishing. 212 p. Illust. (many color photos). 26 x 20 cm. [Kor]

• **Summary** : This beautiful book is a catalogue of the soybean museum at Yeongju City, Kyungsangbukdo. Korea. On the cover is a color photo of one end of the museum against a green background. On pages 2-3 is a color aerial illustration of the entire expansive site with 9 places numbered and named in both Korean and English: 1. Parking area. 2. Soyworld Science Museum. 3. Soyworld Activity Hall. 4. Farming experience center (large outdoor farm). 5. Picnic square. 6. Eaoullim Madang. 7. Farm products market. 8. Public restroom. 9. Yeongju

apple exhibition hall.

2001. Lee, Cheryl Ho; Kim, Moonsil Lee. 2016. **History of fermented foods in northeast Asia**. In: Jyoti P. Tamang, ed. 2016. *Ethnic Fermented Foods and Alcoholic Beverages in Asia*. New Delhi, India: Springer Verlag. xiii + 409 p. See p. 1-16. [24 ref. Eng]

• **Summary** : Contents: 1.1 Introduction: where and who? 1.2 Pottery and dietary culture in northeast Asia. The *Hou Hanshu* [History of the Later Han dynasty (25 to 220 CE), written in the mid-5th century CE] mentions the “eastern archers” (dongyi). The word dongyi was originally written with two words meaning “big” + “bow.” The *Hou Hanshu* also states that the dongyi were good at riding horses and archery, and that they had “established several proto-states in Manchuria, the Korean Peninsula, and the Japanese Archipelago such as Puyo, Dongye, Okcho, Koguryo, Samhan and Wa.” This suggests that as early as the 3rd century BCE the Dongyi has already established a unique culture that differed from the Chinese civilization to the north. Moreover, an oracle bone inscription from the Shang dynasty, dating to about 1200-1046 BCE, states “... the king orders to campaign against the Yi.” This statement implies that, since around 1000 BCE the Dongyi had occupied part of northeast Asia and competed against the Chinese. And archaeological evidence indicates that they used fermented soybean products.

1.2 Pottery and dietary culture of Northeast Asia. Late Paleolithic (40,000 to 10,000 BP) sites have been found on the Korean Peninsula, South Manchuria, and the Japanese Archipelago. The meat-centered diet of the early hominin gradually changed to an omnivorous one. The Korean Peninsula served as a land bridge connecting the seasonal movements of Paleolithic hunters from the north of Manchuria to the south of the Japanese archipelago; the Korea strait is about 200 km (120 miles) wide, with Tsushima island in the middle. Evidence of this migration is the many pieces of primitive pottery found on both sides of the strait. A map (Fig. 1.2) shows where such pottery has been found. An earthen vessel excavated from Paldang in Korea has traces of soybeans on the surface; this supports the theory that these people used pottery for cooking soybeans in Central Korea beginning in the Bronze Age.

1.3 Origin and development of fermentation technology in Northeast Asia. 1.3.4 Origin of soybean fermentation. In the West, it is generally understood that soybeans were first domesticated, cultivated and consumed in China [Hymowitz 1970].

1.4 Fermented soybean products in Northeast Asia. 1.4.1 Korean Kanjang and Doenjang. The meju used as soybean koji for both these products is made from cooked soybeans. It is generally covered with *Aspergillus oryzae* mold and the inside is laden with bacteria, typically *Bacillus subtilis*. The result is liquid soy sauce (kanjang) and Korean-style soybean paste (doenjang). The flavor of soy

sauce improves with increasing storage time, just as the flavor of wine becomes smoother as it ages. 1.4.2 Japanese shoyu and miso. The flavor of these two seasonings is mild and sweet compared to their Korean counterparts.

1.4.3. Korean Chongkukjang (like Japanese natto but salted). Cook soybeans and cover with a straw mat or cloth. Place on a warm stone floor, ondol, for 3-4 days until mucous strings (peptido-saccharides) formed. Then mix in chopped ginger, chopped garlic, and salt. Pound slightly until the soybeans are separated into halves. Store in an earthen jar. Natto is not generally liked by Koreans. In the so-called urbanized, apartment culture of today, Korean elders miss the stimulating savory smell of chongkukjang wafting from their kitchen; Korean young people generally dislike this smell.

1.4.4 Korean Kochujang uses meju (soybean koji) as a main ingredient, but mixed with strong, pungent red peppers. The most distinctive difference between Korean food that of neighboring Japan and China is the fiery taste of red peppers in most Korean dishes.

1.5 Role of fermented food in Northeast Asia. Fermented soybean products plays a major part. Korean koji is called *nuruk*.

1.6 Conclusion.

An excellent map (p. 2) shows the area described by the term "Northeast Asia."

Note: M.L. Kim is the daughter of C.H. Lee. Address: 1. Korea Univ., Seoul, South Korea; 2. Rhode Island College, Providence, Rhode Island.

2015. Lee, Cherl-Ho. 2016. **Background and vision of Soyworld Science Museum** [in Yeongju, Korea]. <https://mail.google.com/mail/u/0/?pli=1#inbox/KtbxLzGSwSXXKLPLwTwPqvcmgchwCSXGxV?projector=1&messagePartId=0.113> p. [Eng]

• **Summary** : Contents: 1. Title page.

2. "Why Soyworld Museum in Korea?"

"The origin of soybean-South Manchuria and Korean Peninsula.

"First user of soybean as food-DongYi, the ancestor of Korean people."

3. "Why Soyworld Museum in Korea?"

"The Primitive Pottery Age (BC 6000) started at Korea Strait Region-Beginning of fermentation technology in Northeast Asia

"Beginning of soybean fermentation technology in this region."

4. "Origin of soybean and its propagation.

"Botanically most abundant wild species are found in South Manchuria and Korean Peninsula.

"Carbonated seeds of late Neolithic (BC 2000) and early Bronze (BC 1500) Ages are excavated in Korea."

5. "Origin of soybean and its propagation." A Chinese book Guanzi (2 Cc, BC 7th century) describes soybean was introduced into China from south Manchuria (2 Cc).

“Soybean appears to be introduced into Japan in AD 3rd century. from Korea, and into southeastern Asian countries in AD 4-7 centuries from China.

“Soybean was introduced to Europe and to North America in the 18th-19th centuries.

6. “History of Soyworld Museum establishment” Based on a paper titled “The feasibility study on the establishment of a world soybean center,” by Tai-Wan Kwon, Shin-Han Kwon, Cherl-Ho Lee, and Eun-Hi Hong, published in Korea Soybean Digest 18(1):1-25 (2001).

7-8. “History of Soyworld Museum establishment.”

“Jan. 2001-Formation of Soyworld Museum Promotion Committee (SMPC), initiated by Prof. Tai-Wan Kwon, Founding Chairman, searching for the museum site and fund raising.

“Oct. 2005-Publication of the book “Soybean” by SMPC at Korea University Press (15 ch., 794 p.)

“Dec. 2006-Dr. Seok-Dong Kim, the 2nd Chairman of SMPC

“April 2008-Cyber Soyworld Museum and Home-page open (www.soyworld.org).”

“Dec. 2008-MOU [memorandum of understanding] with Yeongju City for the construction of Soyworld Science Museum

“May 2009-Project for the Basic Plan for the construction of Soyworld Science Museum (Dr. Jong-Hwan Hwang)

“March 2011-Project for the Soy-world story telling (Ms. Mi-Kyung Yu)

“Jan. 2013-Prof. Cherl-Ho Lee, 3rd Chairman of SMPC

“Feb. 2013-Completion of Basic design of Soyworld Science Museum in Yeongju

“March 2013-Ground-breaking for the start of Museum construction

“March 2014-Donation of Soybean Growth Chamber by Dr. Chung’s Food

“Sep. 2014-Completion of Exhibition Hall, Activity Hall and Soybean Growth Chamber

“April 30, 2015-Opening of Soyworld Science Museum.”

9. “Why Soyworld Science Museum in Yeongju?

“Home of a native soybean variety Buseoktae

“Strong will of the city to host the museum

“Support of the Korean government to open a science museum in Yeongju

“Most elegant landscape around Buseoksa Temple and Sobaeksan National Park”

10. “Vision of Soyworld Science Museum

“Construction of Soybean Theme Town

“Soyworld Information Center with both domestic and world-wide information network

“Hosting an International Soybean Research Center in Yeongju”

11. “A proposal to United Nations to establish UN International Soybean Research Institute in Yeongju

“(A public promise of the Mayor Wook-Hyeon Jang)

“Implementing organization: Ministry of Agriculture, Food and Rural Affairs (MAFRA), Republic of Korea (ROK)

“Party of concerned: Yeongju City, Kyungsangbuk-Do

“Set up a Task Force for hosting UN ISRI to Korea under MAFRA

“Feasibility study, National and local government budgets, Institute site, etc.

“Contact to UN FAO”

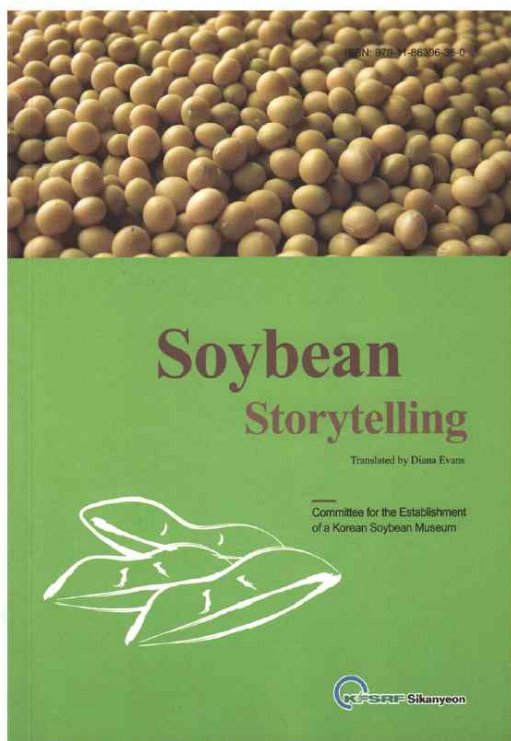
“12. Members of Soyworld Museum Promotion Committee” (table in Korean / Hangul)

13. “Thank you!” A photo shows one view of the completed museum across a reflecting pond. Address: Emeritus Prof., Korea Univ., Seoul, South Korea.



2018. Committee for the Establishment of a Korean Soybean Museum. 2017. **Soybean storytelling**. Translated from Korean by Diana Evans. Seoul, Korea: Lee Cheri-Ho (Korea Food Security Research Foundation); Publishing house: Sikanyeon. 187 + 156 p. April 5. Illust. No index. 23 cm. [50+ ref. Eng; Kor]

• **Summary** : This is the earliest known English-language book that describes Korean research into the origin of cultivated soybeans. This book is divided into two parts. One half is in English (187 p.). Turn the book over and the other half is in Korean (156 p).



The Foreword begins by asserting that the cultivation of soybeans began in Korea, not in China. In 2001 Dr. Kwon Tai-wan, the founding director of the Korea Food Research Institute, formed the Committee for the establishment of a Korean Soybean Museum, which would inform visitors of the true history and use of soybeans.

The letter of intent to establish the museum states that “Koreans were the first to plant soybeans and to use them for food. Soybeans were used as food in Northeast Asia more than 2,000 years ago.”

In 2014 the Soyworld Science Museum was established in the city of Yeongju, North Gyeongsang Province. “Soybean Storytelling” was vital to the exhibits and included in the museum catalogue.

Contents: 1. The Origin of Soybeans: When Did We Begin to Eat Soybeans? Where Did Soybeans Originate? The Image of Soybeans Over Time, The Story of Soybeans through Historical Figures.

2. The Culture of Soybeans and Sauce: The Origin of Soybean Food Products, Traditionally Processed Soybean Products, Korea’s Culture of Sauces, Varieties of Soybean Foods,

3. The Growth and Ecology of Soybeans: Korean Soybean Varieties and Varietal Explanations, The Life Cycle of Soybeans, Variety Classification by Use, Farming and Cultivation Methods.

4. Processing & Utilization of Soybeans: Utilizing Soybeans, The Soybean’s Great Transformation, Soybeans, Food for the Citizens of the World.

5. Nutrition and Functionality of Soybeans: Structure and Composition of

Soybeans, Soybean Nutrition and Bioactive Substances, Functionality of Soybean Products, Efficacy of Soy Foods on Various Diseases.

6. The Future of Soybeans: Legumes and Nitrogen Fixation, Soybean Products Saving the Environment, Hope Seen in Afghanistan, Wild Soybeans vs. Genetically Modified (GM) Soybeans, Production and Trade of Soybeans, The Future of Korean Soybeans.

Pages 16-17: "Charred remains of about 20 examples of rice grains and soybeans have been excavated from Neolithic lots in the village of Daecheon in Okcheon, North Chungcheong Province. Through radioactive carbon dating it has become clear that these date from the Late Neolithic, between about 3000-3500 BC, making them the oldest example of soybeans found on the Korean Peninsula." The Korean nation originated 5000 years ago.

Note: 2017 Sept. 24: Wm. Shurtleff asks Dr. Cheryl Ho Lee for the source of the information in the last paragraph above. Dr. Lee replies: "Concerning the Neolithic evidence of soybean cultivation in Korea, please see the book Kong (2005) page 46-48. There are two Neolithic remains mentioned, (1) Okchoen Daejeonri, and (2) Jinju Sangchonri. The evidence for the carbonized beans found in Okchoen was not clear, but those in Jinju was more clear as shown in the photographs on page 48. From page 49 to 58, numerous Bronze Age soybean remains are described. This chapter (Chapter 2) was written by Dr. Cho Hyeon-jong of National Museum of Korea, as I mentioned earlier, and he must have the original paper bags on the excavations."

Page 18: "The opinion that soybeans originated on the Korean Peninsula and in Manchuria is founded on Japan's Dr. Fukuda's [1933] assertion that the division of wild soybeans led to many areas of origin.) The scholar most representative of the China origin theory is the United States' Dr. Hymowitz, and his assertions are based on the 11th century BC text Yi Zhou Shu (The Lost Book of Zhou). In this Zhou dynasty history, mention is made of a bean called yungsuk ('warrior plant,' or wild beans). In the 11th century BC China's northeastern region supported not just one tribe, but several Eastern Yi tribes. In the past the whole of Manchuria, China's northeast region and stage of the Korean people's activities, was known worldwide as the soybean's place of origin. However, Koreans now make their base on the Korean Peninsula and find that wild soybeans grow naturally there, and the cultivated genetic variation is so high that Korea is also considered one of the places of origin of the soybean."

Note: Dr. Hymowitz's assertions are based on the Shijing [The Book of Odes / The Classic of Poetry], not on the Yi Zhou Shu [The Lost Book of Zhou]. This key paper is: Hymowitz, T. 1970. "On the Domestication of the Soybean." *Economic Botany* 24(4):408-21. Oct/Dec. (131 refs). Unfortunately it is not even cited in this Korean Soybean Storytelling book.

Letter of 2 Aug. 2017 from Dr. Cheryl H. Lee:

"I would like to add following record to your soybean chronology, as stated in Soybean Storytelling page 19:

"623 BCE-Duke Huan of Qi brought back the warrior beans (Yungsuk) from Sanyung when he defeated the Northeastern Yi tribes (The Lost Book of Zhou, 6th century BCE; Sima Qian's Shiji). Guanzi reads, "Duke Huan of the state of Qi pushed the warring nomads north and brought back winter onions and warrior beans (Yungsuk), which now cover the land."

"It implies that Yungsuk was a superior variety of cultivated soybean compared to the beans found in China at that time. We read Chinese letter Su as Suk in Korean.

"Several remains of soybean from the Late Neolithic Age (before 1500 BCE) and Early Bronze Age have been excavated in Korean peninsula (Soybean Storytelling, pages 24-26; Cho, H.-J. in Kong, 2005 (Korean))."

2027. Lee, Cheryl Ho. 2017. History and characteristics of Korean fermented foods (PowerPoint presentation). Korea. 36 slides. [Eng]

• **Summary** : Slides: (2) Map of Northeast Asia, with Korean Strait highlighted. (3) Prehistoric culture in Northeast Asia (Korea, China, Manchuria, Siberia). (4) Colored map showing "Bones excavated from the paleolithic remains in Korean peninsula." All are animal bones; no human bones are included. (5-7) Foodstuffs of the Paleolithic men in Korean peninsula and Northeast Asia. The foods are divided into Early Paleolithic, Middle Paleolithic and Late Paleolithic, and into animals and plants. Wild beans are first consumed in the Late Paleolithic. See also Lee 1998. (8) Prehistoric culture in Northeast. Homo sapiens sapiens, Primitive pottery. Appearance of tribal states. (9) Chronology of prehistoric era of Korean Peninsula and Northeast Asia. (10) Techno-historical consideration of primitive earthenware. (11) Average temperature and sea level of the globe during the alluvial epoch (Barnes 1993). (12) Geography of Northeast Asia in 16,000 B.P. (Barnes 1993). (13) The depth of sea around Korean peninsula. (14) Paleolithic remains found in Northeast Asia (Lee 2001). (15) Primitive pottery age remains excavated in Korea Strait Region. (16) 8,000 to 3,000 B.C. Primitive pottery age. Fermentation technology began during this period. (17-18) Table 1-1. The estimated ages of primitive pottery remains of the Paleolithic era in Korean Peninsula and Northeast Asia (Lee 1999). (19) Beautiful color photo of early Korea pottery, showing different shapes, sizes, colors, and wall thicknesses.

(20-21) Table 2-3. Chronology and manufacturing characteristics of potteries excavated from Sangnodaedo remains (Lee 1999). (22) Direction of technological progress of primitive pottery in Korea Strait Region. Harder, lower water absorbency, durable in fire, bigger. A color photo shows an early pottery bowl. (23) Classification according to usage: Cooking vessel. Fermentation crock (middle size jar, 4-17 liter). Storage jar (large size jar; 17-56 liter), high absorbency,

Origin of Fermented Soybean Foods

- ▶ **Primitive Pottery and Fermentation Technology in Korea Strait Region (6000 BC)**
- ▶ **Arrival of Northern Nomads and the Need for Protein Source**
- ▶ **Invention of Soybean Use for Food by Boiling Technology (ca. 2000 BC)**
- ▶ **Invention of Soybean Fermentation by Adopting Cereal Alcoholic Fermentation Technology**
- ▶ **Fermented Soybean Paste and Soybean Sauce Making (Before 200 BC.)**
- ▶ **Marinating Meat with Soysauce – Bulgogi (Roasted Beef of Korea)**

Social developments during Primitive Pottery Age

- ▶ **Improvement of food storage technology**
 - Fermentation
- ▶ **Improvement of nutrition and food hygiene**
 - Chigae culture
- ▶ **Population increase**
- ▶ **Formation of tribal states (BC. 3-4000)**
- ▶ **Megalithic culture, Eastern tribe (*Dong Yi*)**



round/fl at bottom. (24) Dietary culture of littoral (related to the shore of the sea or a lake) foragers. Cooking vessel & Chigae culture. Storage jar & fermentation technology. (25) Origin of fermentation technology. Nuruk (alcoholic fermentation starter). Kimchi fermentation. Jeotkal fermentation. (26) Beginning of Nuruk making and alcoholic fermentation of cereals. (27) Kimchi fermentation. (28) Jeotkal fermentation.

(29) Origin of soybean fermented foods: Primitive Pottery and Fermentation Technology in Korea Strait Region (6000 BC). Arrival of Northern Nomads and the Need for Protein Source. Invention of Soybean Use for Food by Boiling Technology (ca. 2000 BC). Invention of Soybean Fermentation by Adopting Cereal Alcoholic Fermentation Technology. Fermented Soybean Paste and Soybean Sauce Making (Before 200 BC). Marinating Meat with Soy Sauce Bulgogi (Roasted Beef of Korea).

(30) The origin and interchange of Dujang (fermented soybean products) in East Asia (Lee 1990, 2009). (31). Early records on fermented foods. Shijing (B.C. 1000). Zhouli (B.C. 200).

(32) Social developments during the Primitive Pottery Age: Improvement of food storage technology-Fermentation. Improvement of nutrition and food hygiene-Chigae culture. Population increase. Formation of tribal states (B.C. 3000-4000). Megalithic culture, Eastern tribe (Dong Yi).

(33) Sundubu-Chigae. Cheuotang-Chigae. Deulggae-Chigae. (34) References: Lee, C.H. 2001. Fermentation Technology in Korea. Seoul: Korea University Press. Lee,

C.H. and M.L. Kim. 2016 "History of fermented foods in Northeast Asia. In: Ethnic Fermented Foods and Alcoholic Beverages of Asia. (Ed. J.P. Tamang). New Delhi: Springer.

(35) Key Takeaways: 8,000 to 3,000 B.C. Primitive Pottery Age in Northeast Asia. Techno-historical consideration of Primitive earthenware. Food culture related with pottery use. Origin of fermentation technology. Origin of Fermented Soybean Foods. Social developments during Primitive Pottery Age.

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