Red Pepper and Kimchi in Korea

By Jae Bok Park

In Korea, one of the most popular vegetable seasonings—red pepper—is used fresh and as an ingredient in hot soup, kimchi and hot pepper paste. It accounts for 4.5% of the gross agricultural product and 30% of vegetable production. Annual red pepper production ranges from 170,000 to 200,000 and the planted area 85,000 to 90,000 ha (table 1). The annual consumption of powdered red pepper is about 2.5 kg per capita and the total red pepper production is estimated at about $800 million US. Red pepper, like rice, is an important economic crop for Korean farmers.

Table 1. Production and planted area of red pepper in Korea.

<table>
<thead>
<tr>
<th>Year</th>
<th>Planted area (ha)</th>
<th>Production (M/T)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>70,919</td>
<td>141,320</td>
</tr>
<tr>
<td>1992</td>
<td>77,178</td>
<td>171,790</td>
</tr>
<tr>
<td>1993</td>
<td>85,221</td>
<td>187,043</td>
</tr>
<tr>
<td>1994</td>
<td>88,871</td>
<td>176,269</td>
</tr>
<tr>
<td>1995</td>
<td>87,469</td>
<td>193,331</td>
</tr>
<tr>
<td>1996</td>
<td>90,762</td>
<td>218,462</td>
</tr>
</tbody>
</table>

*Based on dried red pepper.

Red pepper was introduced to Korea from Japan around 1600 and became a seasoning in most Korean dishes. Today, 20 varieties of red pepper are cultivated in the main producing area. Four companies supply red pepper seeds and seedlings to farmers. The cultivating period of red pepper is about seven months, from early February to late September. Harvest begins in mid-August and ends in late September.

Fresh red peppers are usually 12 to 14 cm long and weigh 10 to 14 g. The capsaicin component—which gives peppers a pungent taste—is 15 to 70 mg/g. Cheungyang, the hottest variety,

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has a capsaicin component of 120 to 180 mg/g, making it popular in hot soups.

There are three significant problems in the Korean red pepper industry: the complexity of red pepper distribution, the increase of farm labor cost and the improvement of the quality of powdered red pepper. Market price of dried red pepper is unstable because the current distribution process requires five to six complex and unreasonable steps from farmers to consumers. Most consumers shop in small stores, purchase some dried red pepper and make powder using a simple, small roll mill. Sixty percent of the total red pepper production is consumed as a seasoning at home in the urban areas. Only 10 percent of factory-processed, powdered red pepper products are sold to consumers in domestic markets.

Present red pepper cultivation is hindered by the lack of farm laborers for small planted areas and the required cultivating steps from breeding to harvest. This is especially apparent during red pepper harvest season. For this reason, farmers are decreasing their cultivation areas. The mechanization of red pepper production is seen as the only way to overcome the present lack of farm labor and is currently being studied.

About twenty large-scale red pepper milling factories produce powdered red pepper product. The demand for powdered red pepper is increasing gradually and many consumers want higher quality products. To improve red pepper milling technology, the Korean Food Research Institute (KFRI) has developed new processing devices. Since 1987, KFRI has introduced the steam cleaner, red pepper stem cutter and continuous roll mill. In addition, seven new red pepper milling factories owned by the National Agricultural Cooperative have been established in the main planted area where the advanced milling technologies are being used. About 70,000 tons of high-quality, powdered red pepper are being produced every year.

Currently, other KFRI research programs are being conducted to improve the milling performance, sterilize harmful microorganisms and analyze the products’ quality by NIR (Near Infrared Radiation) in the factory.

Kimchi

Kimchi is a traditional fermented vegetable food in Korea. It is usually served as a “must” with almost every meal, along with cooked rice and other dishes.

Kimchi is a natural food created by the lactic acid fermentation of Chinese cabbages and radishes. It is a major vegetable and is often

Roll milling system at new red pepper processing factory.
blended with aromatic vegetables, seafood and pickled fish. Since kimchi is rich in vitamins, minerals and proteins, Koreans rely on it as source of nutrients when fresh vegetables are scarce in winter.

It's thought that kimchi may have originated from Chinese pickles. The pickles were brought to Korea and were altered into several types of kimchi to suit the tastes of Koreans during the Shilla (A.D. 654-935) and Korea (A.D. 918-1392) dynasties. Since red peppers were imported to Korea in the early part of the 17th century, whole-cabbage kimchi and other kimchi prepared with hot, red pepper became popular.

Many types of kimchi are available depending on the raw materials, processing methods, harvest seasons and localities. A current survey indicates that there are at least 187 kinds of kimchi. Chinese cabbage and radish are the most common vegetables used in making kimchi. Whole-cabbage kimchi, diced-radish kimchi (Kaktugi) and ponytail kimchi are local favorites. Whole-cabbage kimchi is the most popular and traditional kimchi in Korea. It is a winter kimchi, prepared in large quantities in November for winter use. However, this trend is gradually disappearing due to year-round production of high quality Chinese cabbage. Whole-cabbage kimchi also can be prepared in small quantities throughout the year.

When making whole-cabbage kimchi, roots and discolored outer leaves are removed and the cabbage is cut lengthwise. The cabbage sections are soaked in 81.5 percent brine for 27 hours until softened, rinsed in water and then drained. Radish strips (10 percent of cabbage quantity) and spices including green onion strips (0.6 percent), crushed garlic (1.4 percent), crushed ginger (0.6 percent), hot red pepper powder (2.7 percent), fermented seafood and seasonings are blended together. The blended stuffing materials are packed between the layers of leaves, and the stuffed cabbages are stacked tightly in a jar. The kimchi is stored at 3°C to 4°C.

Fermentation of kimchi is carried out by various microorganisms, especially lactic acid bacteria that exist in the ingredients. The lactic acid bacteria grow by converting sugars in the raw materials during fermentation. Viable lactic acid bacteria are found to have good effects on human intestinal microflora. Nutritional composition of typical kimchi is shown in Table 2.

### Table 2. Nutritional composition of typical kimchi.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Per 100 g of edible portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>food energy (cal)</td>
<td>32</td>
</tr>
<tr>
<td>moisture (g)</td>
<td>88.4</td>
</tr>
<tr>
<td>crude protein (g)</td>
<td>2.0</td>
</tr>
<tr>
<td>crude lipid (g)</td>
<td>0.6</td>
</tr>
<tr>
<td>total sugar (g)</td>
<td>1.3</td>
</tr>
<tr>
<td>crude fiber (g)</td>
<td>1.2</td>
</tr>
<tr>
<td>crude ash (g)</td>
<td>0.5</td>
</tr>
<tr>
<td>calcium (mg)</td>
<td>45</td>
</tr>
<tr>
<td>phosphorus (mg)</td>
<td>28</td>
</tr>
<tr>
<td>vitamin B1 (mg)</td>
<td>0.03</td>
</tr>
<tr>
<td>vitamin B2 (mg)</td>
<td>0.06</td>
</tr>
<tr>
<td>niacin (mg)</td>
<td>2.1</td>
</tr>
<tr>
<td>vitamin C (mg)</td>
<td>21</td>
</tr>
</tbody>
</table>

According to a national survey, an adult Korean consumes 50,100 g of kimchi per day in summer and 150,200 g per day in winter—constituting 12.5 percent of total daily food intake. In 1997, the amount of kimchi consumed per year in Korea was estimated at 1,500,000 M/T, of which 400,000 M/T was estimated to be produced by commercial kimchi manufacturers. The portion of commercial kimchi production has increased by 1,520 percent yearly.

There are approximately 450 kimchi processing factories in operation. Most kimchi products

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sold in the domestic market are packaged in plastic bags, pouches and glass jars. Recently, the kimchi industry in Korea has shown rapid growth with the increasing domestic and overseas demand since the Seoul Olympic Games (1988). Globalization of kimchi will be accelerated by more frequent cultural exchange between Korea and other countries.

**Instant Cabbage Kimchi**

1. Quarter one medium Chinese cabbage head; soak the sections in salted water until softened. Wash and drain.
2. Cut 2 to 4 green onions in 1-inch lengths; cut 2 to 3 red chile (Sandia or Asian chiles) into diagonal pieces. Chop 2 garlic cloves, and 1 tsp. grated ginger. (More or less of the ingredients can be added based on personal preference)
3. Mix the cut-up vegetables with 1 Tbsp. red chile powder, 1/4 cup red bell pepper threads, and 1 tsp. sugar. Tear the salted cabbage leaves lengthwise into narrow strips. Mix them with the red pepper mixture; garnish with sesame oil.

**Chile Leaf Kimchi**

1. Soak 3 cups chile leaves with baby green chiles still attached in salted water for about 3 days or until brownish green.
2. Cut one small Japanese radish into thin 1/2 x 3/4 inch pieces; sprinkle with salt. Cut 3 to 4 green onions into 3/4 inch lengths; add 1 tsp. Crushed ginger root.
3. Chop 1/2 cup pickled baby shrimp.

4. Rinse the salted chile leaves and radish pieces; drain well. Mix them with the green onions, radish and ginger mix. Sprinkle 1 Tbsp. chile powder over mixture. Season with salt and add shrimp.

**Crunchy Green Chile Kimchi**

1. Soak green chile and chile leaves in salted water until brownish green; rinse.
2. Boil pickled anchovies with a little water; cool, strain and save the liquid.
3. Mix the pickled fish juice with red chile powder; add chopped garlic and ginger, green onions cut into 1-inch lengths, julienned pickled fish.
4. Mix the fermented chiles and leaves with fish juice mixture; garnish with toasted sesame seeds and red bell pepper threads.

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**CPI Board Member Retires as County Agent**

Javier Vargas, Chile Pepper Institute board member, has retired from his position as a county Extension agent. As an agent in Doña Ana County, New Mexico, he feels fortunate to have been a part of a great agricultural transition period and to have worked with several inspiring people. “Earlier farming generations did an outstanding job in the Mesilla Valley and Elephant Butte Irrigation District with what they had, and now the newer generations, mostly farmer descendants, are successfully making the transition to newer techniques,” he said.

Vargas was born in San Francisco del Oro, Chihuahua, Mexico, the son of Aurelio and Elovia Vargas of Jemenez, Chihuahua. He grew up in New Mexico near Rincon, where his father was the foreman on a cotton farm and cattle ranch owned by Jim Smith. He graduated from New Mexico State University in 1971 with a bachelor’s degree in agricultural business and
in 1977 with a master's degree in agriculture and extension education. Vargas has worked in a series of positions with NMSU's Cooperative Extension Service for rural communities in Socorro, Sierra, Otero and Doña Ana counties. "I was fortunate to work with other people in Extension who had a strong commitment to help New Mexico agriculture," he said. What made work more interesting, he added, was associating with people who knew what it is like to ride out depressed markets and bad weather and still meet bank loans and payrolls. A few of these people were farmers Karl Nakayama, Adrian Ogaz and Ray Enriquez; dairymen Ed DeRuyter; and Elton Bailey, former official in the Agricultural Services Department. He and Bailey organized the first chile conference in the mid-1980s. "The conference is one of my biggest accomplishments as a county agent," Vargas said. "It grew from a local growers meeting with 30 attending the first conference to about 400 individuals who participate in the chile industry from all over the world."

For several years, Vargas served as secretary of the Dairy Herd Improvement Association (DHIA), which monitored butterfat content and cow production. The DHIA was disbanded in 1995 because, with new technology, dairy producers are able to do their own monitoring. Vargas also served on the Western Pecan Growers' Association, the Mesilla Valley Pest Management Association, the initial organization to control the cotton boll weevil, and the New Mexico Library Commission. He was appointed to the commission by former Gov. Bruce King and served for 10 years, including terms as chairman. He also has traveled to Venezuela four times as an Extension consultant.

Vargas doesn't have any immediate plans following retirement except to assist Extension with special projects and keep working with the Chile Conference, for which he has a special feeling. Paul Bosland, CPI director, said that Vargas had been a great help to him. "I have valued his advice and commitment to the institute. His efforts and leadership have contributed to the success of the chile conference. We wish Javier well in his retirement and look forward to his continued association with us."

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**Capsicul y Cultura La Historia Del Chilli**

Janet Long-Solis, Mexico's foremost authority on chiles, covers the history of chile in her wonderfully written and beautifully illustrated book, *Capsicul y Cultura La Historia Del Chilli*. She begins the book with the archeological evidence of chile and writes about chile as a tribute (El Chile como Tributo); chile through the centuries (Los antecedents hisoricos del siglo XVI; Referencias de los siglos XVII al XIX); the worldwide distribution of capsicum (La difusion mundial del Capsicum); the taxonomy of chile (Taxonomia); the cultivation of chile (El cultivio del chile); the commercialization of chile (El comercio del chile); the industrialization of chile (La industrializacion del chile); the use of capsicum in traditional medicine (El uso del capsicum en la medicina tradicional); capsicum as a ritual (El Capsicum como elemento ritual); and capsicum: a cultural constant in Mexico (Capsicum: Una Constante Cultural en Mexico). She includes a dictionary of chiles; the word "chile" in a variety of indigent languages; an ode to chile; and references to the tribute of chile in "Suma de Vistas de Pueblos" in the appendices. The book includes photographs of chiles taken by Dave DeWitt and Paul Bosland. Price varies, and the book, written in Spanish, is available in Mexico.
Aspirin Cures Cucumbers

Amsterdam Dutch farmers whose slow-growing cucumbers have been causing them headaches may have found a solution—aspirin. For the cucumbers, that is. Scientists with the Dutch research institute TNO have discovered that feeding aspirin to young cucumber plants helps prevent thickening of the root walls. Plants with thick root walls absorb water and minerals less easily than those with thin root walls, leading to slower growth. The article reported that aspirin contains an acid also made naturally by plants to protect themselves. Researchers also are planning to extend their experiment to eggplants, tomatoes and peppers.

Source: World Report Innovation

CPI Tile Wall Honors Donors

Construction plans are now underway for the oak display case that will house chile-decorated ceramic tiles honoring Chile Pepper Institute donors. The “Tile Wall” will be part of CPI’s “Story of Chile” exhibit at the New Mexico Farm and Ranch Heritage Museum in Las Cruces. For information on how you can be part of this exciting project, contact Danise at the Institute, (505) 646-3028 or e-mail hotchile@nmsu.edu.

Chile Garden Open to Public

The annual New Mexico State University Chile Breeding Program and Chile Pepper Institute’s teaching and demonstration garden has been planted at the Fabian Garcia Research Center in Las Cruces, N.M. There are more than 100 different varieties of chiles planted. The garden is open to the public from 8 a.m. to 5 p.m. Monday through Friday. Tours can be arranged by contacting Danise at the Chile Pepper Institute, (505) 646-3028, or e-mail at hotchile@nmsu.edu.

Capsicum and Eggplant Newsletter Goes Online

Piero Belletti, editor of the Capsicum and Eggplant Newsletter, reports that the newsletter now has its own World Wide Web site at http://www.agraria.unito.it/~belletti/capsicum.html. He invites everyone to visit the site and to send comments on the newsletter or its web site to capsicum@agraria.unito.it.

Plastic Mulch Speeds Plant Development

Fred Teague, CPI member from Palo Alto, Calif., writes concerning his experience with plastic mulch:

I heeded the advice in The Pepper Garden and used plastic mulch on my peppers. The only color I could find was black, even though I wanted to try yellow to control pests. Turns out, black worked fine. Because the mulch prevented weed development among the pepper plants, and because I kept the spaces between the rows well hoed, there was no staging area for a pest invasion—hence, no pests at all.

The mulch speeded plant development and enhanced it. All my plants grew slightly larger than I had expected, and appeared healthier. Blossoms appeared earlier and I harvested fruit from some plants in late June. Overall, the production of the plants was 25 percent higher with the mulch. Even varieties I previously had trouble with grew well and produced bountifully. I laid 50-foot soak hoses in pairs 18 inches apart, attached to a manifold I made of PVC pipe which was connected by a hose to a hose bib. Then, I placed 36-inch mulch over the soak hoses, which allowed the mulch to overlap the pairs of rows 9 inches on each side. I had begun germinating seeds in January, so I was ready to transplant in late March. I
planted through the mulch into pre-fertilized holes and placed about a tablespoon of snail bait around the base of each plant. After that, maintenance consisted of hoeing and raking between the rows and turning on the hose bib a few times a week. I used the mulch elsewhere in the garden with the greatest success in the melon patch. It’s difficult to grow melons this far north of the Imperial Valley, but the mulch kept the ground warm, and I had a good harvest of large cantaloupes, honeydews and Crenshaws. The black plastic also improved tomato production. I was skeptical because my experience with organic mulch had been disappointing—generally a breeding ground for insects and fungus. Now, I’m a fan of plastic mulch and am looking forward to next year when I can try new ways to use it.

Question: I got some rocoto seeds from the USA. They all germinated, but only one survived and has done very well in a shady part of my garden. It’s covered in purple flowers, but sadly doesn’t have a mate with which to cross pollinate and, therefore, according to Paul Bosland’s book, will not bear fruit. What can I do?—Tony, Cape Town

Answer: In the pubescens species, some peppers may not fruit because of self-incompatibility. To get fruit, pollen must be transferred by bees or humans from a neighboring plant.

Question: Because of space, materials and financial limitations, I must change my pepper seed germination method this year.

I will be using a radiant heat lamp to warm the soil. I’m sure I will be able to adjust the distance between the lamp and the seed beds to maintain the proper soil temperature as indicated by a thermometer sensor placed below the soil surface. I am concerned, however, that the radiant heat lamp may damage the seedlings upon emergence. The air temperature of the room is 60–65°F daytime and 50–55°F at night. Warming the air in this room is not an option and I have no source for bottom heat.—David, Tennessee

Answer: Yes, a heat lamp could damage the seedlings. Use the light only to encourage germination, then raise the lamp after seedlings have emerged.
Over 350 growers and other individuals associated with the chile industry attended the New Mexico Chile Conference 1999 held in Las Cruces, N.M., in early February. Topics presented at the conference included:

- NMSU chile breeding—update
- survey of southern New Mexico chile production
- high technology chile production
- chile breeding programs of Arizona and Texas
- chile production issues in a global market
- soil and tissue testing for maximizing chile yields

An overriding theme of the conference was surviving an increasingly tough market. According to Rhonda Skaggs, NMSU associate professor of agricultural economics and agricultural business, labor has been a chronic problem, including higher costs, not finding good workers and government regulations. Other problems include decreasing profits, high production costs, high risk, decreasing yields, market problems, disputes with buyers, imports from countries with lower labor costs and the U.S. Environmental Protection Agency's ban on necessary chemicals.

Rich Phillips, project manager in NMSU's Department of Agronomy and Horticulture, said, "Chile growing will have to develop better technology to survive in the international markets."

Paul Bosland, co-chair of the chile conference, said the chile conference was a huge success, attracting local farmers as well as national and international participants. "People are really interested in the chile industry as indicated by the turnout for this conference," he said.