



Edamame in Virginia I: Products and Marketing

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Introduction

Vegetable (or immature) soybean [*Glycine max* (L.) Merrill] is harvested in the R6 (full seed) development stage, when pods are 85%-90% filled with seed. Unlike grain-type soybean, which is used primarily for vegetable oil and as a source of protein in animal feeds, edamame is consumed as a high-value and nutritious specialty vegetable (fig. 1). It represents a group of large-seeded soybean cultivars that have a bright green color at harvest stage, pods that contain two to three beans, a soft texture, and a sweet and less beanlike flavor (Saldivar et al. 2010).



Figure 1. Edamame plant in the field. Photo by Xiaoying Li.

These soybeans are better known as “mao dou” (hairy bean) in China. The earliest documentation of vegetable soybean comes from poems by Lu You (1125–1210 AD), a distinguished scholar in the Song dynasty, that describe the picking and eating of green soybean pods (Dong et al. 2014). In 1275 AD, the popular name “edamame (branched bean)” appeared in Japan when the Japanese Buddhist Saint Nichiren Shonin wrote a thank-you note to a parishioner in appreciation for his vegetable soybean gift (Shurtleff and Aoyagi 2009). The name “edamame” is later used worldwide.

Charles C. Georgeson and William J. Morse introduced edamame in the U.S. during World War I when they were searching for an inexpensive source of protein (Djanta et al. 2020; Shurtleff and Aoyagi 2009). Today, edamame is a popular soy food in the U.S. It has enjoyed an expanding market with vigorous growth in demand over the past two decades, increasing at an estimated 12%-15% annually (Neill and Morgan 2021). Edamame products are available in most grocery stores, wholesale clubs, and farmers markets, and they are increasingly available in restaurants (Jiang, Rutto, and Ren 2018).

To inform and guide those interested in consuming, growing, processing, and/or marketing edamame in Virginia, this edamame series includes three publications.

1. Edamame in Virginia I: Edamame Products and Marketing (SPES-454P).
2. Edamame in Virginia II: Producing a High-Quality Product <https://www.pubs.ext.vt.edu/SPES/spes-455/spes-455.html>.

3. Edamame in Virginia III: Handling and Processing
From Harvest to Package <https://www.pubs.ext.vt.edu/SPES/spes-456/spes-456.html>.

The publications describe this new specialty crop and its whole production and supply chain from field to fork in Virginia.

Edamame Products

Edamame is usually processed into three primary end products to meet the market needs of edamame products: (1) on-the-stalk plants, (2) fresh product whole pods and shelled beans, and (3) frozen product whole pods and beans. Growers must consider the target customer and the labor involved to decide which edamame products to sell (Miles, Lumpkin, and Zenz 2000).

Fresh Product: On-the-Stalk Plants

Fresh edamame can be marketed as on-the-stalk plants and sold in grocery stores or farmers markets (fig. 2). Many Asian customers are more interested in purchasing edamame on the stalk, which maintains pod freshness. This product requires the least amount of time and labor for processing and handling. After the edamame plants are harvested by hand, bunch four to six plants together; trim the branches to make the bouquets more aesthetic, marketable, and conveniently sized; remove the top and lower leaves from the plants to expose pods; and remove any blemished pods.



Figure 2. On-the-stalk edamame plants at a local farmer market. Photo by Bo Zhang.

Fresh Product: Whole Pods

Some consumers prefer edamame pods removed from the stems and packed fresh. Pods are removed from plants with a green bean picker in the field or an in-house manual pod stripper, and then sorted and packed. A good quality pod contains two or more beans and has no damage or blemishes. Low temperature and high humidity are very important to preserve freshness and extend

shelf life of edamame pods. Fresh edamame plants or pods stored at 32 F and 95% humidity can retain flavor and appearance for up to two weeks (Chiba 1991). According to a study by Saldivar et al. (2011), it is not recommended that edamame be stored at room temperature (77 F) or under open air because the pods started turning yellow on the second day of storage. Most pods and one-third of beans can turn yellow by the fourth day.

Fresh Product: Shelled Beans

Many U.S. customers buy shelled edamame beans, which require an additional processing step (i.e., shelling) after pod picking. Shelling edamame is easy with the right equipment, but hand-shelling is very labor intensive and time consuming. A mechanical sheller is therefore strongly recommended.

Frozen Products: Whole Pods and Beans

Due to the short shelf life of fresh edamame, many edamame industries or companies process edamame and sell it as a frozen product (frozen pods or frozen shelled beans). Frozen edamame alleviates the oversupply of fresh edamame due to the short harvest window and prolongs edamame shelf life, providing edamame availability throughout the year. To freeze edamame, raw edamame pods must first be blanched to inactivate enzymes that would otherwise quickly cause flavor deterioration. The detailed steps for processing edamame have been described previously (Carneiro et al. 2020; as well as in Virginia Cooperative Extension publication SPES-456, Edamame Handling and Processing from Harvest to Package).

Other Processed Edamame Product

Some companies process edamame into canned products, sweets, desserts, green noodles, and dry bean snacks. Edamame can be used to make soymilk that can be further processed into ice cream, tofu, yogurt, etc. Beans sold to restaurants can also be used as an ingredient for salads, sushi, soups, dumplings, edamame hummus, side dishes, and more.

Edamame Nutrition

The nutritional value of edamame is mainly determined by its chemical constituents, such as protein, minerals, vitamins, fibers, and sugars (table 1). Compared to green peas, edamame beans contain six times the caloric value (energy), 60% more calcium, twice the phosphorus and potassium, plus similar quantities of iron, thiamin (vitamin B-1), and riboflavin (B-2) (Masuda 1991). In con-

trast, edamame contains only one-third of the sodium and carotene of green peas. In addition, edamame contains all the essential amino acids needed by humans and is a good plant-based source of complete protein. Therefore, it can be considered as an alternative to meat and can add diversity to vegan, vegetarian, and other plant-based diets by providing viable proteins (Lord, Neill, and Zhang 2019).

Edamame is also considered a functional food, mainly because it contains isoflavones that are associated with the prevention of several human diseases. Clinical studies showed that isoflavones reduce the risk of cardiovascular diseases as well as other diseases, such as diabetes, menopausal symptoms, and osteoporosis diseases (Mebrahtu et al. 2004). Certain varieties containing black or brown seed coats when seeds are mature — reported to accumulate anthocyanins and procyanidins, two antioxidants that could aid in fighting cardiovascular disorders — prevent inflammation and scavenge harmful radicals (Nizamutdinova et al. 2009; Takahata et al. 2001).

Table 1. Name and amount of nutrition in a 100 gram frozen edamame product.

Composition	Quantity
Water	72.8g
Energy	507.0kJ
Protein	11.9g
Total lipid	5.2g
Carbohydrate	8.9g
Fiber	5.2g
Sugars	
Sucrose	1.1g
Fructose	0.1g
Maltose	1.0g
Starch	1.5g
Minerals	
Calcium, Ca	63.0mg
Iron, Fe	2.3mg
Magnesium, Mg	64.0mg
Phosphorus, P	169.0mg
Potassium, K	436.0mg
Sodium, Na	6.0mg
Zinc, Zn	1.4mg
Copper, Cu	0.3mg
Manganese, Mn	1.0mg
Selenium, Se	0.8µg
Amino Acids	
Methionine	0.1g

Cystine	0.1g
Phenylalanine	0.5g
Tyrosine	0.3g
Valine	0.3g
Arginine	0.7g
Tryptophan	0.1g
Threonine	0.3g
Isoleucine	0.3g
Leucine	0.7g
Lysine	0.7g
Histidine	0.3g
Alanine	0.4g
Aspartic acid	1.4g
Glutamic acid	2.0g
Glycine	0.4g
Proline	0.7g
Serine	0.7g

Vitamins	
Vitamin C	6.1mg
Vitamin B-6	0.1mg
Vitamin A	15.0µg
Vitamin E	0.7mg
Vitamin K	26.7µg
Tocopherol	9.5mg
Folate	311.0µg
Choline	56.3mg
Betaine	4.5mg
Carotene, beta	175.0µg
Cryptoxanthin, beta	8.0µg
Lutein + zeaxanthin	1,620.0µg
Thiamin	0.2mg
Riboflavin	0.2mg
Niacin	0.9mg
Pantothenic acid	0.5mg
Other	
Cholesterol	0.0mg
Caffeine	0.0mg

Source: United States Department of Agriculture, Agricultural Research Service (USDA 2019).

Cooking and Storage As a Snack

Edamame is usually consumed as a snack. Fresh edamame pods can be boiled in water or steamed. Steps for these cooking methods are provided below.

1. Wash the pods and boil them in salted water or steam them for 5-8 minutes. It should be noted that blanching did not significantly affect the composition of amino acids; however, the water-soluble nutrients — including soluble sugars, vitamin C, and isoflavones contents — can be reduced to an extent during boiling, so boiling for a long time should be avoided (Saldivar et al. 2010; Simonne et al. 2000; Song, Gil-Hwan, and Chul-Jai 2003; Tosun and Yücecan 2008).
2. Place the pods in ice cold water for a minute and then drain the water.
3. Squeeze the cooked pod between thumb and forefinger to “shoot” the beans into the mouth.

Edamame can also be cooked in a microwave.

1. Place the pods in a microwave-safe container.
2. Add a small amount of water and microwave in 1-minute increments until pods become tender.
3. Sprinkle with salt, pepper, Parmesan cheese, or spices as desired.

As a Vegetable

Edamame beans can be used as a substitute for green peas or lima beans in many recipes. Boil the pods for 5-8 minutes in unsalted water and squeeze the beans into a bowl. Beans can be added into vegetable soups or ground into a paste with miso, which is used to form a thick broth. Beans can also be tossed with a bit of olive oil and a sprinkle of salt and served as a vegetable side dish. In addition, beans can be mixed into salads, stir-fried, or roasted like peanuts. More recipes can be found at ndsu.edu/agriculture/sites/default/files/2022-03/fn1836.pdf (Garden-Robinson and Halsted 2022).

How to Cook Frozen Pods

Frozen edamame pods and beans should be cooked without thawing. They are prepared in the same manner as fresh edamame except that less cooking time is needed because frozen edamame has already been partially cooked when blanched.

Precautions

Compared with dry seeds, edamame has fewer trypsin-inhibitor and indigestible oligosaccharides (Kon-

ovsky, Lumpkin, and McClary 1994). However, eating too much at one time can still lead to indigestion. Edamame is a popular snack that can be consumed by the general public, except for those who are allergic to soy or who have uremia or diarrhea, since eating edamame could aggravate these conditions. It is important that consumers who have soy allergies or these conditions are aware of these potential issues.

Storage

Fresh edamame beans should be eaten within three days of purchase. Fresh pods packaged in a perforated plastic bag can be kept for about a week under refrigeration. For longer storage, pods can be washed and blanched for one minute to stop the adverse enzymatic reaction, immersed in cool water, drained, patted dry, sealed in zipper bags, and kept in the freezer. Properly frozen edamame will retain its flavor and quality for up to 12 months. Refrigerated food containing edamame should be consumed within four days.

Conclusions

In the past few decades, globalization has provided a platform for the international edamame trade and allowed more people to enjoy the bean’s unique taste as well as its multiple health and nutritional benefits. Edamame is becoming more popular around the world, particularly in the United States. This publication provides information on how to sell and consume edamame to local growers and consumers, which help diversify the vegetable choices on Virginian plates.

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