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EDAMAME

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Farming West of the Cascades

Edamame (pronounced "eh-dah-MAH-may") is a traditional Japanese vegetable that is growing in popularity in the United States (Konovsky et al. 1994). Also called "vegetable soybean" and "sweet bean," edamame is a nutritious and tasty vegetable or snack food with a sweet, nutty flavor. The purpose of this publication is to introduce edamame as a specialty crop and to describe how to grow and market it.

About Edamame

Called ***edamame*** in Japanese ("branched bean") and *mao dou* in Chinese ("hairy bean"), these specialty vegetable soybeans originated in China more than 2000 years ago (Jian 1984). Edamame is the same species as grain (or field) soybeans, *Glycine max* (L.) Merrill, but it has larger seed, sweeter flavor, smoother texture, and better digestibility (Rackis 1978).

This nutritious bean is great tasting *and* good for you. Edamame contains about 38% protein, and a one-half cup serving contributes 11 grams of protein towards the average adult requirement of 46-63 grams per day (USDA 1998; Alleman et al. 2000). Edamame is also rich in calcium, vitamin A, and phytoestrogens (plant-produced estrogens).

Edamame does not have edible pods; only the beans are eaten. It can substitute for green peas or lima beans in any recipe. In China, the shelled beans are stir-fried with other ingredients. In Japan, pods are boiled in salted water and the beans are squeezed from the pod directly into the mouth, and the pods are discarded.

Edamame pods

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Growing Edamame

Edamame is easy to grow in the Pacific Northwest. Choosing the right variety and paying particular attention to planting needs are the keys to success with this crop.

Variety Selection

One of the most critical steps in successfully growing edamame is selecting an appropriate variety. You must consider maturation date, pod characteristics, and cost of seed.

Maturation date. All edamame except the earliest-maturing varieties are photoperiod-sensitive—"short-day" plants (Shanmugasundaram 1981). Photoperiod-sensitive plants are affected by the relative length of day and night. These lengths influence the shift from vegetative (leaf and stem) growth to reproductive (flower) growth. Short-day plants flower only when the length of the day is less than a critical value. The long summer days of high latitude regions such as the Pacific Northwest combined with relatively cool summer temperatures make it necessary to choose a variety which matures early and is less sensitive to photoperiod.

Table 1. Days to maturity of edamame varieties tested in western (Chehalis) and eastern (Prosser) Washington (Miles 1997; Konovsky 1995).

Variety	Chehalis Days to Vegetable Maturity	Prosser* Days to Vegetable Maturity
Misono Green	110	105
Bukers Favorite	110	—
White Lion	110	—
Sayamusume	110	103
Butterbeans	112	103
Lucky Lion	112	—
Shironomai	113	107
Kegon	115	—
Gion	118	—

*Where days to maturity are not listed, varieties were not available for testing.

Like all soybeans, edamame is ranked in maturity groups of 0-8, where 0 represents the earliest maturation and 8, the latest. In the Pacific Northwest, choose a variety with a ranking of 0-3. Varieties in these early maturity groups will be listed as maturing in 70-90 days; however, this maturation period is not accurate for the Pacific Northwest, where the varieties take 100-120 days to mature. To calculate maturity for the Pacific Northwest, add 25-40 days to the "days to maturity" presented in most seed catalogs. Table 1 lists varieties which WSU research has shown to mature in Washington (Miles 1997; Konovsky 1995). This list does not include all available varieties.

Pod characteristics. Varieties also differ by seed color and size and by the color of pods and their pubescence (fine hairs which cover the pods). If you want to market edamame to Asian customers, choose a variety having large, light-colored beans; bright green pods with gray or light brown pubescence; and three beans per pod. For customers who are unfamiliar with edamame, pubescence color and the number of beans per pod should not be issues; they do not affect bean quality.

In Japan, dark-seeded edamame is used as a dry bean at New Year. If there are Asian food stores in your area, you might consider growing a dark-seeded variety for this niche market.

Cost. Also, consider the cost of edamame seed before selecting a variety. Seed cost range from $5-$20 per pound, depending on the variety. Seed sources are listed at the end of this publication.

Soil pH

Edamame can grow in most Pacific Northwest soils. The optimum soil pH for edamame is 6.0. In the early fall of the year *preceding* edamame planting, conduct a soil test to determine your soil's lime requirement. If necessary, apply agricultural lime at the rate suggested by the test results. Most soil-testing laboratories will recommend lime application rates based on a soil "SMP buffer test" (Shoemaker et al. 1961). If specific information is not available, Table 2 lists guidelines for lime applications based on general soil pH SMP buffer test results.

You must apply any necessary lime in the fall because, in order for agricultural lime to be effective, it must first dissolve and disperse in the soil, a process that

takes many months and lots of water. Another Farming West of the Cascades publication, *Soil Management for Small Farms*, describes soil testing and soil nutrition in more detail.

Fertilizer Application and Seed Inoculation

Phosphorus and potassium. In the spring, several weeks prior to planting, conduct another soil test to determine the phosphorus and potassium content of your soil. Apply phosphorus and potassium at recommended rates based on this soil test result (Table 3). Apply fertilizer at planting in a band next to the seed row. Band the fertilizer approximately 2 inches to the side of the seed and 2 inches below the seed.

Nitrogen. As legumes, edamame fix nitrogen from the atmosphere. Therefore, you do not have to apply large amounts of nitrogen fertilizer if you inoculate the seeds with *Bradyrhizobium japonicum*, a beneficial bacterium. If the field has never before been planted with edamame or any type of soybean, inoculating the seed will ensure formation of nitrogen-fixing nodules on the roots of plants. Inoculant for soybeans is not the same as bean or pea inoculant. Purchase soybean inoculant through seed catalogs which offer soybeans.

If the seed is inoculated, apply 50 pounds of nitrogen per acre (Shanmugasundaram 1979). If the seed is not inoculated, apply 100-120 pounds of nitrogen per acre (Hemphill and Miles 1999). In both cases, apply 25 pounds of nitrogen at planting with the phosphorus and potassium. Apply the remaining nitrogen in a band 4 inches to the side of the crop row during the growing season, approximately six weeks after planting.

If using manure, broadcast it prior to final field preparation and thoroughly incorporate it into the soil. Another Farming West of the Cascades publication, *Applying Manure on Your Farm*, describes manure application in detail.

Table 2. Lime application rates according to Oregon State University soil pH SMP buffer test results (Mansour and Hemphill 1999).

SMP Buffer Test Result	Lime Application (tons/acre)
below 5.2	3-4
5.2-5.6	2-3
5.6-5.9	1-2
over 5.9	0

Planting

Seedbed preparation. Although edamame seeds are large, they tend to be sensitive, and they do not emerge or grow well when field conditions are unsuitably cold or wet. Prior to planting, plow and harrow soil as needed to form a smooth, level seed bed; low spots will flood and seed will not emerge.

Timing. In the Pacific Northwest, you may plant between late April and mid-June. To ensure good emergence, plant on well-drained soils when soil temperatures are at least 55°F. Well-drained soils warm up faster, and they are less likely to have soilborne diseases.

Table 3. Phosphorus (P) and potassium (K) application rates based on soil test results (Mansour and Hemphill 1999).

Soil test P (ppm)	Phosphate Application (lb/A of P_2O_5)	Soil test K (ppm)	Potassium Application (lb/A of K_2O)
0-15	80-120	0-75	100-120
16-30	40-80	76-100	80-100
31-60	0-40	100-150	40-80
> 60	0	151-200	20-40
		> 200	0

Soil moisture. Plant seed into moist soil. If the soil is too dry, irrigate prior to planting. Irrigating after planting can cause a crust to form on the surface of the soil, and this crust can prevent emergence (Mansour 1998, personal communication).

Seeding rate and planting depth. Space rows 24 inches apart, and plant seeds 2-4 inches apart within the row. Plant population is equivalent to 60,000-70,000 plants per acre, and one pound of edamame seed contains 1200-1600 seeds. This seeding rate is equivalent to 40-55 pounds per acre.

Planting depth should be no deeper than 0.25-0.5 inch—any greater depth will reduce emergence. Plants should emerge 1-2 weeks after planting.

Irrigation

Irrigation is necessary for growing edamame in the Pacific Northwest, where the seasonal precipitation from late May to the end of September is 2-6 inches. West of the Cascades, apply 2 inches of irrigation five times from mid-June until late August, for a total application of 10 inches. If there is no precipitation in early September, irrigate an additional time.

Weed Control

Control early-season weeds to prevent competition between young edamame plants and weeds. At least two weedings are usually necessary. Mechanical cultivation between rows and hand cultivation between plants is an efficient weed control method. Also, there are herbicides for soybeans; contact your local Cooperative Extension office for current information. As the season progresses and the plant canopy closes in, the need for weed control will drop.

Pest Control

There are several insect pests which attack edamame, including wireworms, cucumber beetle, and two-spotted spider mite. Slugs and birds can do extensive damage to young plants, while elk and deer can be devastating to mature plants. Contact your local Cooperative Extension office for current pest control information.

Harvesting

Timing. Harvest edamame when the pods begin to plump and the beans almost touch within the pod. Pods should be bright green in color, similar to snow peas. By the time pods show any yellow, the optimum time for harvest has passed and beans have become starchy, losing their sweet, nutty flavor. The window for harvesting can be as short as 3-4 days, so monitor the plants frequently as the pods approach maturity.

Method. Most growers harvest edamame by hand, although some use a green bean harvester with some mechanical adjustments. Whether harvesting edamame by hand or by machine, determine when the majority of pods are mature, and harvest the entire plant. By hand, it is easiest to clip the plant at the soil surface and either remove individual pods from plants or sell the whole plant, minus most leaves, with pods still attached to the stem. Harvesting whole plants by hand, an individual can harvest approximately 50-60 row-feet per hour (Culbertson 1999, personal communication). To remove pods from the plant, give the pods a firm tug; they do not come off easily. A stationary pod stripper also can be used to remove the pods from the plant.

Yield. Expected yield is one pound of marketable pods per three feet of row. To maintain freshness and flavor, precool harvested edamame at temperatures from 32-37°F (Tsay et al. 1991). Air-cooling, vacuum-cooling, and using ice water are three precooling methods that are effective for edamame. Store edamame at 32°F and 95% relative humidity to maintain green pod color, flavor, and weight (Chiba 1991). In proper storage, edamame will retain its flavor and appearance for up to two weeks.

Marketing

When deciding how to sell your edamame, you must consider your customer and the labor involved.

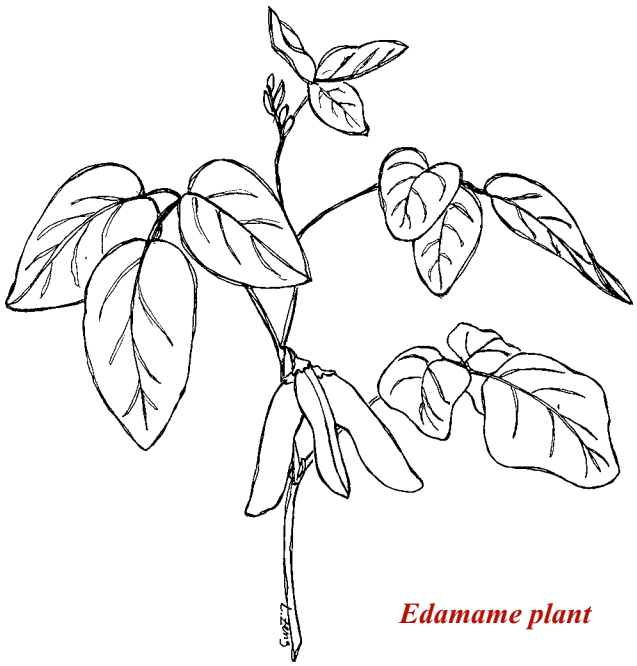
By the Bunch

Many Asian customers expect to purchase pods on the stem; keeping pods on the stem maintains freshness, flavor, and quality. When pods are left on the plant, beans retain sugars for several days, and quality remains high (Konovsky et al. 1994). Selling the whole plant requires the least amount of time and labor. Bunch 4-6 plants together and remove the leaves from the tops of the plants, exposing the pods.

Asian markets require that most pods contain 2 or more beans per pod, and damaged or blemished pods are generally not acceptable. For customers who are not familiar with edamame, all undamaged pods are marketable; quality and flavor of the beans are not influenced by the number of beans per pod.

By the Bean

Customers who are not familiar with edamame may not want to take time to pick pods from plants or dispose of crop residue. Some companies are now shelling edamame and marketing them as "sweet beans." Shelling edamame is easy with the right equipment; by hand, it is extremely tedious. Both small- and large-scale commercial equipment that easily separate beans from the pod is available from Japan.



Edamame plant

Seed Sources

Because edamame is a new crop in the United States, seed can be difficult to find. This list of seed sources is designed to help readers find edamame seed. We do not endorse any of these businesses nor do we detract from any business not listed.

American Takii, Inc.
301 Natividad Rd.
Salinas, CA 93906
(831) 443-4901

Johnny's Selected Seed
1 Foss Hill Road
RR1 Box 2580
Albion, MA 04910
(207) 437-4357

Lockhart Seed
PO Box 1361
Stockton, CA 95201
(209) 466-4401

Nichols Garden Nursery
1190 N. Pacific Hwy
Albany, OR 97321
(541) 928-9280

Osborn International Seed Co.
1679 Highway 99 South
Mount Vernon, WA 98273
(360) 424-7333

Pachamama Organic Farm
Ewell Culbertson
10771 N 49th St.
Longmont, CO 80503
(303) 776-1924
csafarm@ecentral.com

Sakata Seed America, Inc.
P.O. Box 880
18095 Serene Dr.
Morgan Hill, CA 95037
(408)778-7758

Territorial Seed Company
PO Box 157
Cottage Grove, OR 97424-0061
(541) 942-9547

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About the Authors

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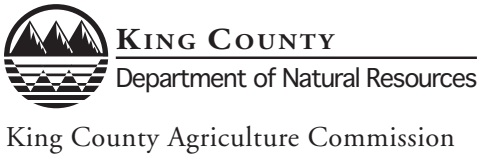
Leslie Zenz, Sustainable Agriculture Coordinator with the WSDA Organic Food Program, is committed to sustainable agriculture and building community through the enhancement of local food production. She farms an acre of fresh-cut flowers for market, and she will always have a plot of edamame in her garden.



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