

Edamame and “Gardensoy”

Soyfoods are gaining considerable interest in the marketplace because of their high nutritional value and health benefits. Most of this interest has focused on soybean products such as tofu, soymilk, soy protein, fortified flour, or meat analogs constructed from extracted soy protein.

Recently, more and more Americans are discovering soybeans as an excellent fresh vegetable, and interest is expanding as more consumers appreciate the value of whole foods. Known as “vegetable soybeans,” or by the Japanese term “edamame” now popularized in English and pronounced “ay-duh-MAH-may,” they have a rich, distinctive and delicious flavor. Soybeans suited for fresh use are generally larger-seeded, sweeter, smoother and more digestible than grain soybeans. In addition to taste, their recent increase in popularity might be because they are well suited to modern lifestyle — as a convenient and highly nutritious snack or meal accompaniment, appealing to adults and children alike.

Brief History of Edamame. The earliest reliable evidence of consumption of edamame dates from 1275 AD in Japan (Shurtleff and Aoyagi, 2009, <http://www.soyinfocenter.com/books/133>). Year by year, varieties that were larger-seeded, smoother, sweeter or that had more interesting flavor (not to mention desirable field traits) were selected for replanting. Henry Yonge was the first documented person to plant soybean in what is now the US on his farm in Thunderbolt, Georgia in 1765 (Hymowitz and Harlan, 1983), though his crop was most likely a grain type soybean. The first reported use of “green vegetable soybean” in the US was in 1856, and in 1915 William Morse of the USDA wrote that they “compare favorably with the butter or lima bean.” To address food scarcity issues in World War I, the USDA sent an envoy to China to investigate the soybean as a human food rich in protein and other nutrients. During USDA soybean collection missions from 1929 to 1931 (<http://www.ars.usda.gov/is/AR/archive/jun03/plant0603.pdf>), Morse and P.H. Dorsett were fascinated to discover many varieties of soybean “used as a green vegetable.” They brought back about 100 varieties and planted them on the USDA’s Arlington, Virginia farm. The best yielding varieties were sent to state agricultural experiment stations where they were further tested (<http://www.ideals.illinois.edu/handle/2142/3371>). Cooking and composition tests were also conducted and the new vegetable types were found to be “some of the most nutritious vegetables ever analyzed.”

University of Illinois: “Gardensoy” Variety Samples Available. Soybean breeders in the US have cross-bred some of the large-seeded Asian varieties with US grain varieties, and there are now a number of promising number of US-adapted vegetable-type soybean lines. Fourteen Gardensoy varieties have been released to date by the University of Illinois, ranging from early maturing (maturity group 0) to late (group V). The first digit following “Gardensoy” indicates the maturity group of that variety. Maturity groups are explained in more detail below. Gardensoy varieties form seeds 50–100% larger than the common grain types but yield only 60–80 % as well and, therefore, are not competitive as grain for processing. However, edamame can be harvested as mature dry beans for the “food grade” market and may receive a premium per bushel (<http://www.soybeanpremiums.org/>).

The University of Illinois has research plots of edamame each year. The National Soybean Research Laboratory has a limited quantity of 30- to 50-seed packets of several Gardensoy varieties available free-of-charge to gardeners wishing to try the crop. For information on research trials and/or to receive Gardensoy seed packets, contact Research Specialist [Theresa Herman](#).

Growing Edamame. Edamame are very easy to grow, similar to grain soybean or any bush bean. After the soil has warmed (65°F), sow seeds 1 inch deep and 2–3 inches apart, in rows 15–30 inches apart, in full sun. Don’t rush planting. If the soil is not warm enough, the seeds will not germinate. Keep the seedbed moist until plants are established, but do not overwater — and do not presoak seed — as both can lead to pre- and post-emergence rot. A mature edamame plant is about 2 to 3 feet tall. Plants will compensate for greater seed spacing with more branching.

Fertility Needs. If you are in a soybean growing area, a nodulating bacterium (*Rhizobium*) that will infect soybean roots and give the plants extra available nitrogen is probably present in your soil. If there is enough nitrogen in your garden for corn, edamame will do fine with or without treating the seed with *Rhizobium*. Edamame may be somewhat drought tolerant; however, make sure there is adequate moisture during pod-fill for best results. If you plant in containers, some fertilizer treatments may be necessary.

Soybean Maturity and Edamame. Soybeans are termed “short-day” plants because the main trigger for their flowering is a dark period of minimum required length. This requirement varies by variety. Therefore, performance of any one variety will differ at different latitudes, where day length (i.e. night length) on any calendar day is different. Varieties grown out of adapted zone (latitude) will either flower too early (when plants are very small and resulting in fewer pods), or flower too late (where fall frost may kill the plant before fresh pods or mature seeds are ready).

In order to guide commodity soybean growers on choosing the best adapted cultivars, commodity soybeans have been divided into 13 maturity groups (MG), ranging from 000, 00, 0 and I – X, according to the latitude at which they are best adapted for growth. At any one latitude, several MGs will grow well and mature in succession according to their MG.

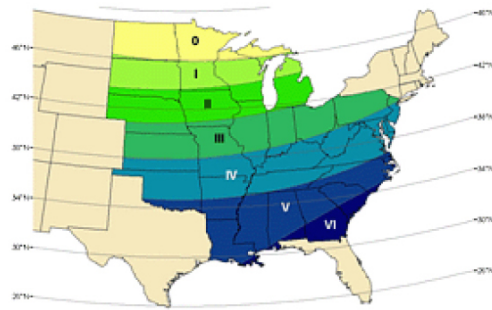


Fig. 1. Map showing the zones of adaptation for soybean maturity groups in the continental USA.

<http://www.plantmanagementnetwork.org/pub/cm/research/2007/zone/>

Edamame growers can use the varying flowering periods of different cultivars to extend green pod harvest of the crop. Unfortunately, edamame seed is typically marketed by “days to maturity,” similar to other vegetable crops, though this is not accurate information for edamame, or any other soybeans. Because flowering is so dependent on day length, the number of days to maturity will vary for any one variety planted at different latitudes. “Gardensoy” edamame are named according to soybean maturity group. Gardensoy 01 and 41, for example, belong to group 0 and IV, respectively (see map below for where these are best adapted). Until commercial edamame are classified by maturity group, experience planting multiple varieties in your area will be the only way of knowing what is best adapted to your area or what to plant to achieve the maximum harvest duration.

When to plant? In the Midwest, soybeans are normally planted in May for maximum growth and yield. Vegetable types are no different. On the University of Illinois research farm in Urbana, Illinois, we have planted edamame until mid-June. Depending on your area, an expanded planting schedule may succeed, though early planting runs the risk of soil temperatures too cool for seed germination or rot due to wet ground, and later plantings can be lost to frost. In northern latitudes, late planting of early-maturing varieties should be avoided as shortening days will trigger flowering while the plants are still very small. In the south, very early planting could “catch” short days of winter, causing similar problems in early varieties.

Extending Harvest. The best way to extend your harvest is to plant varieties from various MGs. However, multiple planting dates can also help to extend the duration of harvest somewhat. Planting all Gardensoy varieties each week or two weeks apart will give 4–5 weeks of harvest. Though you may obtain varieties in MGs that are, according to the map above, outside your area, know that the map was developed for commodity beans going to full maturity. Varieties outside your band will help extend the harvest period, since edamame are harvested in the green-pod stage. The further out of your zone, the more yield may be affected. Varieties better adapted to areas north of your location will flower earlier and set fewer pods, but will give you a longer harvest time since they will mature first. Varieties that are better adapted to areas south of your location will grow longer before getting the signal to flower and set pods. Some may be too late and not mature in time to harvest pods. Well-adapted plants have a good balance between vegetative growth (growing the stem and leaves) and reproductive growth (flowering

and setting pods and seed). In central Illinois, good yields can be expected from varieties in MGs I – IV. For the home or market gardener, the best way is to experiment with a small plot of each variety and find your favorite(s) among those that are best adapted.

Diseases and pests. Most fields of edamame will endure some diseases and pests without appreciable yield loss. Leaf diseases like bacterial pustule and blight, brown spot, Cercopsora leaf blight, downy mildew, and a few others can be common. Insect pests include bean leaf beetles, Japanese beetles, soybean aphids, and white flies. In most seasons, these do not affect yield and intervention is not necessary. In southern states, another concern may be soybean rust, visible as brown or tan spots on the leaves. This disease can devastate soybean. In some locations rabbit damage may be excessive, and fencing during early growth may be a necessity. Deer also find vegetable soybean plants delicious.

There are many other potential disease and pest problems, and what occurs on field soybean can also occur on edamame. Info on these diseases is available at The Soybean Disease Laboratory (<http://www.soydiseases.illinois.edu>).

Harvesting Edamame. Edamame are ready to pick when the seeds are about full size and when pods are bright green. Even a hint of yellowing means the beans are already losing sweetness and accumulating starches that diminish taste and digestibility. This stage is usually about 2 weeks before full plant and seed maturity.

Any one variety will have an optimum harvest period for green pods of about 5 days. The pods on a soybean plant tend to develop together, so the whole plant is harvested at once (though some later varieties may have extended picking). Most pods will be “marketable,” but each plant may have some under-developed pods that can be discarded before or after cooking.

Harvesting edamame at the right time is critical for optimum texture and flavor. The quality is best when the pod is plump and bright green. Harvesting can be done by hand picking each pod or by cutting the whole plant at the base (or pulling the whole plant out of the ground) and picking pods by hand. Cutting whole plants saves labor and whole plants hold their quality a bit better, but whole stems require more storage and transportation space.

It is possible to harvest edamame mechanically with a green bean picker. However, cultivars may vary in their adaptability to mechanical picking and little research has been conducted in the US to compare green pod yield of commercial varieties harvested mechanically.

Like all soybeans, Gardensoy varieties are self-pollinating and true-breeding. Therefore, you may let a few plants of your favorite varieties ripen without picking (i.e. “go to seed”), and save those seeds in a cool dry place for next year’s planting. To ensure good seed quality and robust plants in the next generation, designate a certain number of whole plants for seed harvest rather than picking the best pods for consumption and leaving leftover, small pods for seed harvest.

Post-Harvest Storage. If you are a commercial grower planning on producing edamame for fresh market or wholesale distribution, be aware that taste and digestibility are diminished with increased post harvest time or if harvested material stays in the sun or in a warm area. Keep harvested pods in a cooler, or the coolest place you can find (and out of the sun). Market or cook them as soon as possible.

Cooking and Storing Edamame. The most common and convenient way of using edamame is to boil them in the pod for 5–10 minutes, cool under running water, salt lightly, and pop directly from pod to mouth (edamame shells are too fibrous to eat). As such, they make a great snack, appetizer or side dish that is both convenient to prepare and nutritious. Cooked and shelled edamame (beans are difficult to remove from pods unless blanched or steamed) may be added to soups, stews, salads, rice dishes or casseroles, and are a great finger food for toddlers. Substitute shelled edamame wherever peas or lima beans are called for or, at your whim, wherever the color green is needed. *Edamame: 60 Tempting Recipes Featuring America’s Hottest New Vegetable* by Anne Egan (2003 Rodale Inc.) has a variety of ideas, a simple layout and some nice pictures to inspire you.

Edamame freeze well in the pod or shelled. Blanch for at least 1–3 minutes to stop the maturation process (or fully cook), immerse in cool water, pat dry, and place in zipper bags in the freezer. When you are ready to eat them, add to boiling water for about 5 minutes to complete the cooking process. Or, if you

froze fully cooked beans, you need only to thaw them.

Edamame may be grown to maturity and stored as a dry bean. Harvest seed as soon as possible as large-seeded varieties tend to shatter. Dried edamame may be used similarly to other dry beans in a variety of dishes, or for making your own tofu, soymilk, veggie burgers, etc. Commercial growers may find a market for these “food grade” or “premium beans” in their local market.

Advantages of eating edamame as a fresh bean as compared to a dry bean, include better taste and appearance and a much shorter cooking time. For many people, the fresh beans are also more digestible, as the complex carbohydrates that occur in mature seeds have not yet formed.

Commercial Edamame Varieties. Most of the edamame seed available from commercial suppliers in the US are varieties that have been developed overseas. Adapted US varieties all have “parents” from Asian varieties. If you are a commercial grower planting average size edamame (30g/100 seed), a pound of seed at 2-inch spacing (intra-row) will plant 250 feet. For the home gardener, a packet of 50 seed will plant 8 feet. If you have more space and/or would like bushier plants, you can increase the seed spacing and still achieve a similar yield per acre or per square foot.

GM Soybeans and Edamame. There are no genetically-engineered edamame. Some people ask whether edamame might become cross-pollinated from neighboring fields of genetically-engineered commodity soybeans. Soybeans are self-pollinating. If you grow edamame in an area where GM commodity soybeans are planted, there is very little chance of cross-pollination; even if co-planted, only 0.5% for plants in adjacent rows and 1% for those grown in close contact (Weber and Hanson, 1961), though this may vary by cultivar.

Edamame Nutrition. Edamame are among the few plant foods that provide a complete protein. This means that they have all the essential amino acids your body needs. Unlike other complete-protein foods, such as eggs or meat, edamame have no cholesterol and very little saturated fat. They are low in sodium. Recommended daily allowance (RDA) percentages may vary slightly by cultivar (and by frozen brand), however generally edamame are high in vitamin C, K, manganese and folate, and are a good source of dietary fiber, iron, calcium, thiamin, magnesium, phosphorus and copper (<http://www.nutritiondata.com>, <http://caloriecount.about.com>). A 1999 FDA ruling allows companies to create retail package labels stating that “Consuming 25 grams of soy protein a day as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease.”

The Future of Edamame in the US. Edamame have a very long history in Asia, and a longer history in the US than most people know. Though availability of fresh edamame in the US is rising every year, it has yet to catch up with consumption. More and more Americans are discovering this flavorful, versatile and highly nutritious food each year, and more and more growers are discovering the market for this cash crop. Most frozen edamame are currently imported. As US consumption and production continue to grow, larger-scale commercial production is a good possibility. Hopefully this will result in greater availability of US-grown frozen options in coming years, and the inclusion of this nutritious crop in US government food programs.

Further Reading

Go to <http://www.nsr.uiuc.edu/aboutsoy/edamame.html>, scroll down to “What’s in a soybean seed,” “Planting, Growing and Harvesting Soybeans,” or “Diseases of Soybean.” Also, check out the following:

Shurtleff W. and Aoyagi A. History of Edamame, Green Vegetable Soybeans, and Vegetable-type Soybeans (1275-2009) Extensively Annotated Bibliography and Sourcebook. Lafayette, CA: Soyinfo Center, 2009. Available at <http://www.soyinfocenter.com/books/133> (3.59MB pdf, 764 pp).

Lloyd J.W. and Burlison W.L. 1939. Eighteen varieties of edible soybeans. Bulletin 453. University of Illinois Agriculture Experiment Station. 74pp. Available at <http://www.ideals.illinois.edu/handle/2142/3371>

Bibliography

Hymowitz, T. and Harlan, J.R. Introduction of soybean to North America by Samuel Bowen in 1765. Economic Botany 37: 371-379.

Shanmugasundaram S. and Yan, M.R. Global Expansion of High Value Vegetable Soybean. VII World Soybean Research Conference. Foz do Iguassu, PR, Brazil; 2004. p. 915-920.

Weber, C.R. and Hanson, W.D. 1961. Crop Sci. 1: 389-392. Natural hybridization with and without ionizing radiation in soybeans.