



Center for Environmental Farming Systems

FIELD NOTES FOR FARMERS

No. 3

Organic Edamame Production

Edamame are large-seeded soybeans that are becoming more and more popular in U.S. cuisine because of their good taste, high nutritional content, and popularity as an Asian food. Edamame are also called *vegetable soybeans*, *green soybeans*, and *edible soybeans*. They originated around 200 B.C. in China, where they are still popular as a vegetable. These soybean plants look like grain soybeans and are produced similarly. They are the same genus and species as grain soybeans, *Glycine max* (L.). But edamame varieties are larger and sweeter than grain soybeans and are harvested and eaten when green, in an early maturity stage.

The beans have a sweet, nutty flavor, are high in protein and beneficial phytochemicals, and are known for their health benefits. As a snack food, edamame pods are generally boiled in salted water for 3 to 5 minutes. The beans are eaten straight from the pod. Edamame can also be shelled and used in stir-fries, or used like butterbeans in soups and other vegetable dishes. Generally, shelled edamame are prepared by food processing companies and sold frozen and packaged.

The demand for edamame, especially organically grown edamame, is increasing in health food and Asian markets. North Carolina vegetable and field crop farmers may want to take advantage of the opportunity to grow a specialty crop that has familiar production methods yet can fetch a premium price. Marketed fresh at farmers' markets, edamame bunches (whole plants with stems and pods) can fetch \$1.50 to \$2.50 per pound. Fresh edamame pods (picked off the stems) sold wholesale to grocery stores bring the same price.

Planting

Edamame should be planted after the last frost and when soils have warmed. Planting in cool, wet soils may cause seedling death and will exacerbate any germination problems. Seeds should be planted 2 to 4 inches apart in the row, depending on row width. The goal is to have 60,000 to 70,000 plants per acre. Overseeding is not a good idea since the seed is expensive (\$4 to \$20 per pound). Place seeds at ½- to 1-inch

deep in the soil. Because edamame plants are generally shorter than grain soybean plants, plant on 20-inch rows, or narrower, which allows the canopy to close early and prevents weeds from germinating. If using cultivation for weed control, create wider rows that allow equipment to pass easily. A compromise may be needed between the desire for wide rows for cultivation and the yield and weed-control payoffs of narrow rows.

Edamame can be planted throughout most of the summer. If an early maturing variety is used, it may be possible to plant and harvest two crops of edamame in one growing season. The earlier the beans are harvested, however, the better the chance that they will avoid major insect and disease pressures that occur late in the growing season.

Variety Selection

Edamame seed is relatively expensive, and few varieties are available (or economical) for large-scale production. Yields and maturity dates vary among varieties. Farmers and researchers have noticed problems with inconsistent germination in some years and with some varieties of edamame. We conducted a variety trial at the Center for Environmental Farming Systems (CEFS) in Goldsboro in 2003 to investigate the performance of 12 varieties of edamame available from five different seed companies (Table 1).

Emergence. Germination (or emergence) was good in some varieties in the trial and very poor with others (Table 2). Because uniform emergence affects a crop's yield potential and the ability to compete well with weeds, this is a very important consideration for variety choice, especially for organic growers who have limited weed control choices after a crop has emerged.

Plant height. Varieties in this trial also differed in plant height (Table 3), time to maturity, yield, and pod quality. The tallest varieties were the varieties with the longest time to maturity. These varieties were able to achieve a closed canopy, effectively shading the row middles. The plants' ability to shade row middles (overlap plants) is important for yield and weed control. However, the later an edamame plant is in the field, the more insect pests (especially stinkbugs) and

disease pressures it may encounter, leading to possible yield and pod quality losses.

Yield. GardenSoy 31 had the highest yield of marketable pods, significantly higher than all but Black Pearl (Table 4). Of the lowest yielding varieties, BeSweet 292 and Misono Green were probably low yielding because they had poor germination and, therefore, few plants per foot. Envy had fairly good germination and an average number of pods per plant, but produced very small beans with low weight. We also divided the marketable yield of each edamame variety by the cost of the seed to figure which variety gave the best value for its seed cost (Table 5). GardenSoy 31 had the highest yield and was also the best value.

Pest Management

Weeds are probably the biggest season-long pest problem in edamame. Like grain soybeans, edamame have only a few problematic insect pests.

Weeds. Organic edamame must be managed without prohibited substances for weed control. Therefore, mechanical weed control techniques, such as tillage, blind cultivation (cultivation before the crop emerges without regard to row spacing), and between-row cultivation are important. Hand weeding may also be needed. Choose varieties with these characteristics to help with weed management:

- Seed vigor contributes to a high germination rate and uniform emergence.
- Tall growth means the plants will shade row middles.

Proper soil fertility management and planting (correct depth, rate, and date) will also contribute to uniform emergence and vigorous growth so that plants will compete well with weeds.

Insects. Stinkbugs puncture pods with their mouthparts causing aesthetic damage and disease entry points. Corn earworms (or soybean pod worms) eat the pods, and bean leaf beetles eat the leaves. Eating leaves does not cause direct damage, so bean leaf beetles usually do not affect pod quality and are usually not present in large enough numbers to affect yield. Bean leaf beetles are often found in edamame as soon as the first leaves appear and remain until harvest. In most years, stinkbugs and corn earworms are not present in large numbers early in the summer, but their populations increase towards late summer and can become damaging. Avoid insect pests in organic edamame by planting early enough so that the plants are harvested before mid-August.

Research findings. We set up an experiment at CEFS in the summer of 2003 to investigate insect pest pressures (especially from stinkbugs) in soybeans har-

vested at different dates. We looked at the number of insects present in the field and the increase in stinkbug damage to edamame pods for beans planted on different dates. Seeds of the Butterbean edamame variety were planted on three different dates:

- May 1 (harvested July 9). We did not find stinkbugs at any time before harvest in the beans planted on May 1.
- May 15 (harvested July 28). In late July, we found a few stinkbugs in the later-planted beans.
- June 2 (harvested August 7) In early August, we found four times more stinkbugs in the beans than in late July—just a few weeks earlier.

The number of insect damaged pods from the beans planted on June 2 was much greater than in those planted on May 15 (Table 7). This indicates that significantly more insect pressure occurred on beans that were still in the field in August. Nevertheless, the yields from beans planted later (May 15 and June 2) were significantly higher than those planted on May 1 (see Table 6) because the later-planted beans were able to take advantage of higher moisture levels and temperatures—a cold spell began in early May and lasted through late May.

Harvesting and Marketing Edamame

Harvesting high-quality edamame is the first step in successfully marketing this crop. Edamame pods should be harvested when 85 to 90 percent of the pods are expanded and contain beans that are almost touching each other. You can see this by picking a bean and holding it up to the sunlight. This is the R6 stage of soybean maturity, when the sugars and amino acids required for good taste are at their peak. There is a short window of time for harvesting best-quality edamame. If the pods start to turn yellow, it is too late to harvest. Taste deteriorates quickly.

Harvesting methods. Edamame can be harvested by hand or by machine. Mechanical green bean pickers can be adjusted to harvest edamame fairly efficiently. For farmers growing edamame for Community Supported Agriculture groups (CSAs) or farmers markets, hand harvesting may be more practical. Edamame can be hand-harvested by picking pods from the plants in the field or by cutting the plants at their base and picking the pods off of them in another location. Another often-used method of harvesting edamame for market is to cut the plants at their base and sell the entire plant in bundles with the pods still attached. Cool edamame pods immediately after they have been harvested to preserve bean quality and taste.

Marketing options. Edamame in North Carolina is often marketed directly to consumers through CSA shares or at farmers markets or farm stands. Grocery and natural food stores sometimes sell fresh edamame

pods, and some Japanese restaurants use edamame in their menus. If interested in the grocery or restaurant market, talk to the produce manager or chef and be sure you can provide a consistently high-quality product. Some edamame processors located in the mid-Atlantic States and in the Midwest buy large quantities of edamame and shell, freeze, and package the beans, which are then sold in grocery stores.

Conclusion

Seed germination is a problem that needs more investigation. Results from the variety trial at CEFS confirm that some edamame varieties have poor emergence and perhaps do not germinate well when field conditions are cool and wet (Miles, 2001). Use fresh seed every year, and test germination before planting. Avoid any practice, such as crop rotation with other legumes or planting in cool soil, that exacerbates seedling emergence problems.

In addition to determining which varieties perform best in terms of yield, further variety trials that look at seed size, taste, and nutrition (seed components) need to be conducted. Closer investigations of insect pressure and damage in edamame would help determine thresholds for insect pests as well as the feasibility of a double-crop of edamame in one season.

Edamame is a specialty crop that has great potential for North Carolina farmers, organic and conventional, as a niche market crop with the potential for high returns. More information for edamame farmers, processors, and markets will help this crop be successful for North Carolina.

CEFS Variety Trial Results, 2003

Seeds planted for the variety trial were obtained from these suppliers:

- Johnny's Select Seeds, 955 Benton Ave, Winslow, ME 04901 www.johnnyseeds.com
- Fedco Seeds, PO Box 520, Waterville, ME 04903 www.fedcoseeds.com
- Wannamaker Seeds, St. Matthews, SC 29135 www.wannamakerseeds.com
- Territorial Seed Company, PO Box 158, Cottage Grove, OR 97424-0061 www.territorial-seed.com
- Rupp Seeds, Inc 17919 County Road B, Wauseon, OH 43567

Tables 1 through 7 present the trial results.

Table 1. Cultivars, seed suppliers, and days between planting and harvest

Variety	Seed Company	Days to Maturity
Envy	Johnny's Select Seeds	64
Shirofumi	Fedco Seeds	68
Midori Giant	Wannamaker Seeds	68
Misono Green	Territorial Seed Co.	70
Black Pearl	Territorial Seed Co.	70
BeSweet 292	Rupp Seeds, Inc.	75
BeSweet 2020s	Rupp Seeds, Inc.	75
Butterbean	Johnny's Select Seeds	75
Sayamusume	Territorial Seed Co.	75
GardenSoy 11	Rupp Seeds, Inc.	77
GardenSoy 31	Rupp Seeds, Inc.	88
Mojo Green	Wannamaker Seeds	118

Table 2. Percent of seedlings emerged in 20 row-feet 15 days after planting

Variety	Seedlings Emerged (%/20 row-feet)	
GardenSoy 11	72.4	a
GardenSoy 31	68.3	a
Black Pearl	63.9	ab
Mojo Green	52.5	bc
Butterbean	50.3	bc
Envy	49.1	c
BeSweet 2020s	33.4	d
Shirofumi	29.8	d
Sayamusume	28.2	de
Midori Giant	25.5	de
Misono Green	22.5	de
BeSweet 292	14.5	e

Percentages followed by the same letter are not significantly different from each other at the $p \leq 0.05$ level (Fisher's Protected LSD).

Table 3. Mean final height (in.) of cultivars

Variety	Final Height (in.)	
Mojo Green	29.6	a
GardenSoy 31	22.5	b
GardenSoy 11	22.2	b
BeSweet 292	19.4	bc
Black Pearl	18.4	bcd
BeSweet 2020s	16.9	bcde
Midori Giant	16.3	cde
Butterbean	14.5	cde
Shirofumi	14.3	cde
Envy	13.4	de
Sayamusume	12.9	e
Misono Green	12.4	e

Means with the same letter are not significantly different from each other at the $p \leq 0.05$ level (Fisher's Protected LSD).

Table 4. Mean yields of category-one pods from 60 row-feet

Variety	Yield (lb/60 row-feet)	
GardenSoy 31	13.77	a
Black Pearl	11.55	ab
GardenSoy 11	10.17	bc
Mojo Green	9.90	bc
Butterbean	8.92	bcd
BeSweet 2020s	8.66	bcd
Midori Giant	8.33	cd
Shirofumi	6.83	de
Sayamusume	6.76	de
Misono Green	5.02	e
Envy	4.92	e
BeSweet 292	4.08	e

Varieties with the same letter are not significantly different from each other at the $p \leq 0.05$ level (Fisher's Protected LSD).

Table 5. Mean relative yield per \$1 of seed cost

Variety	Seed Cost (\$/lb)	Yield (lb/60 row-feet)	Mean Relative Yield (lb/\$1 Seed Cost)
Misono Green	14.00	5.02	0.36
Shirofumi	16.00	6.83	0.43
BeSweet 292	8.40	4.08	0.49
Sayamusume	14.00	6.76	0.48
Envy	8.60	4.92	0.57
Black Pearl	14.00	11.24	0.80
Midori Giant	9.95	8.35	0.84
Mojo Green	9.95	9.90	1.00
BeSweet 2020s	8.40	8.66	1.03
Butterbean	8.60	8.92	1.04
GardenSoy 11	4.40	10.17	2.31
GardenSoy 31	4.40	13.77	3.13

Seed costs may vary depending on amounts purchased.

Table 6. Planting date trial: Average estimated total yield of harvested edamame

Date Planted (Date Harvested)	Total Yield (lb/acre)
May 1 (July 9)	2,403 a
May 15 (July 28)	3,808 b
June 2 (August 7)	3,834 b

Yields with different letters are significantly different from each other at the $p \leq 0.05$ level (Fisher's Protected LSD).

Table 7. Planting date trial: Percentage of 250-pod sub-sample damaged by insects, machines, and disease

Date Planted (Date Harvested)	Insect Damaged	Machine Damaged	Diseased
May 15 (July 28)	23.8 a	8.1 ns	2.5 ns
June 2 (August 7)	63.6 b	12.6 ns	1.9 ns

Results with different letters are significantly different at the $p \leq 0.05$ level (Fisher's Protected LSD)

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January 2007

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