

Maryland Edible Soybean Performance Evaluations
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What are edible soybeans?

Edible soybeans are used in the processing of the many different soyfood products on the market. Soyfoods are rapidly becoming a part of many Americans' healthy diets. Soybeans have been identified as a food source that has health benefits. In October of 1999, the Food and Drug Administration reported that 25 grams of soy protein daily as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease. The New England Journal of Medicine published a study in 1995 that concluded a diet with soy protein reduced serum cholesterol in people with moderately high to high cholesterol. In addition, this report indicated that the inclusion of soy protein in the diet lowered the LDL or "bad" cholesterol but not the HDL or "good" cholesterol. As people have begun looking for sources of soy protein, a number of soyfood products have appeared on grocery shelves. Just a few examples are tofu, soymilk, miso, tempeh, and meat alternatives. Green-pod soybeans, known as edamame when blanched, are either salted and eaten as a snack food or used in stir-fry recipes. You can find canned and frozen green-pod soybeans that are packaged and marketed similarly to other commonly eaten vegetables. The only distinguishing morphological characteristics that edible soybean varieties have from their grain-type counterparts are a larger seed and a clear or transparent hilum.

How are edible soybeans grown?

Production practices for edible soybeans that are to be harvested as dry beans are identical to the practices a farmer uses to produce the oil- or grain-type soybeans commonly grown in Maryland. They are planted at the same time and with the same equipment, managed in the same way and harvested with a combine. Of course, the management of edible soybeans for green pod production is slightly different and more labor intensive because the pods are picked by hand. People who produce green pod soybeans are generally doing so either in their gardens for personal consumption or they are producing them in a "pick your own" market situation.

Can edible soybeans be successfully produced in Maryland?

Dr. William Kenworthy, soybean breeder at the University of Maryland, began evaluating the performance of edible-type soybean varieties in 1997. Dr. Robert Kratochvil joined the Natural Resource Sciences Department faculty as Extension Specialist-Field Crops in 2000 and assumed responsibility for the edible variety evaluations. Dr. Kratochvil and Dr. Kenworthy have continued to work closely on the edible variety testing program. The 2000 and 2001 trials have been supported by grants from the Maryland Soybean Board (both years) and the A.T. and Mary H. Blades Foundation (2001). The agronomic performance for all entries evaluated during the 2000 and 2001 crop years are reported in Table 1. Ten elite breeding lines obtained from the Virginia State University program were added to the test in 2000. These lines are of late group five to early group six maturity and have been found to be too late for dry bean production under Maryland conditions. An early October, 2001 killing frost especially affected the dry-bean yield for these lines (Table 1). However, these lines have been developed primarily for their potential for green pod production and may have some use in that area.

Yield in 2001 was much less (20-30 bu/a per variety) than was obtained for the 2000 crop (Table 1). One exception was the variety Enrei that actually had better yield in 2001 compared to 2000. In general, the ranking of the entries for yield in 2001 was similar to their performance in 2000. A number of popularly grown, grain type varieties have been included in these evaluations as check varieties. Comparisons between the edible type and the grain type varieties indicate that there are edible varieties (i.e. FG-1, FG-2, Iowa 3001, and Vinton 81) that will yield well under Maryland's environmental conditions. The seed size for the edible entries has been consistently greater than for the grain entries (Table 1). In general, seed quality (measured only in 2000) for the edible entries have been poorer. This may have been the result of not harvesting each variety on the ideal date. This delay in harvesting may have led to some seed quality deterioration. A producer would certainly want to monitor the maturation of an edible variety and harvest it when it reached harvest maturity. One negative trait that appears to be inherent with the majority of the edible varieties is the tendency for their mature pods to shatter and split open. Again, close attention to the maturation of the soybean crop should allow a farmer to harvest the crop at the ideal time and avoid excessive losses caused by shattering.

Table 1. Summary of the performance for all edible- and grain-type soybean varieties evaluated in the edible soybean trials conducted at Upper Marlboro, MD during 2000 and 2001.

Variety	Type ¹	Yield in Bu/A 2001	Yield in Bu/A 2000	100 Seed Wt. in gm. ²	Seed Quality (1-5) ³	Shatter Rating (1-4) ⁴	Maturity ⁵
Butterbean	Food	30.5	NA	24	N/A	4 (1)	9-01
Enrei	Food	52.5	29.3	23	2.7	4 (3)	10-30
Envy	Food	18.2	NA	15	N/A	4 (1)	9-01
FG-1	Food	32.7	78.8	24	2.7	2 (3)	10-12
FG-2	Food	51.2	70.9	26	3.3	2.5 (3)	10-13
Iowa 3001	Food	51.8	70.9	21	3.7	1.5 (2)	9-29
Vinton 81	Food	46.5	67.6	24	3.7	2.5 (3)	9-24
Morgan	Grain	42.0	68.0	19	1.7	1.5 (3)	10-15
Stressland	Grain	50.8	81.3	17	1.7	1 (2)	10-16
Ware	Grain	33.2	61.8	19	2.7	1.5 (3)	10-21
York	Grain	42.0	67.6	18	1.7	1.5 (3)	11-01
MD 86-5788	Grain Hi-protein	43.6	59.3	14	1.0	1 (3)	10-31
BARC-7	Grain Hi-protein	50.6	57.2	16	2.0	1.5 (3)	10-22
Jack	Grain Res. SCN ⁶	42.1	60.8	15	4.7	1.5 (3)	10-12
PI 88306	Chinese	23.4	60.9	24	3.7	2.5 (2)	10-12
PI 88310	Chinese	25.9	58.3	22	3.3	2 (2)	10-21
Funkungaha	Japanese	37.3	48.6	31	3.3	4 (3)	10-15
Suzuyutaka	Japanese	48.0	56.8	24	2.3	3.5 (3)	10-23
VS 20-415	VSU line	24.1	54.5	27	2.7	1 (2)	>11-01
VS 20-416	VSU line	12.8	43.3	20	2.0	3.5 (2)	>11-01
VS 20-417	VSU line	6.5	40.9	21	2.7	3.5 (2)	>11-01
VS 20-418	VSU line	13.5	34.1	24	3.0	2 (2)	>11-01
VS 20-419	VSU line	10.9	51.6	22	2.3	3.5 (2)	>11-01
VS 95-50	VSU line	10.6	42.3	20	2.7	3 (2)	>11-01
VS 95-55	VSU line	10.1	43.1	22	1.7	3 (2)	>11-01
VS 95-70	VSU line	7.8	44.3	22	2.3	3 (2)	>11-01
VS 96-206	VSU line	18.2	42.2	22	2.7	2.5 (2)	>11-01
VS 96-239	VSU line	37.8	43.7	21	2.7	1 (2)	>11-01
Mean		31.2	55.3		2.7		
LSD .05		9.3	7.3		1.1		

¹ Describes the type of soybean (either food or grain) or other descriptive information about the varieties.

² Seed size reported is for 2000 crop. Seed size for Butterbean and Envy is for 2001.

³ Seed quality rating: 1=no stains, no seed coat cracking, no blemishes; 5=very poor quality seed (2000 data).

⁴ Shatter rating = 1=no shattering; 2= small number of seed shattered; 3= some shattering; and 4= substantial shattering.

Numbers in parenthesis in this column indicate the number of years of data collection for shatter rating.

⁵ Maturity is the date of 100% leaf drop for 2000 crop. Butterbean and Envy dates are for 2001 crop.

⁶ Variety has resistance to soybean cyst nematode races.

The yield performance for the edible varieties that have been evaluated in Maryland under conventional irrigated management since 1997 are found in Table 2. This table also provides the seed size, lodging scores and plant height information for those varieties.

Table 2. Yield performance, seed size, lodging scores and plant height of selected edible and grain-type soybean varieties evaluated at Upper Marlboro, MD during 1997-2001.

Variety	Type ¹	Yield Bu/A (2001)	5 Year Avg. Bu/A	100 Seed Wt. in gm. ²	Lodging Score ³	Plant Height (in.)
Enrei	Food	52.5	37.5	23.1	2.8	30
FG-1	Food	32.7	55.1	22.8	1.6	29
FG-2	Food	51.2	54.1 ⁴	24.0	1.8	30
Iowa 3001	Food	51.8	57.3 ⁴	21.0	2.6	38
Vinton 81	Food	46.5	52.3	22.4	3.1	33
Morgan	Grain	42.0	55.2	17.3	2.1	38
Ware	Grain	33.2	49.5	18.1	3.1	36
York	Grain	42.0	51.4	17.8	3.5	38
Suzuyutaka	Japanese	48.0	45.8	21.9	2.6	30
Fukungaha	Japanese	37.3	40.0	30.5	1.8	27
Mean		43.7	49.4	21.9		
LSD .05		9.3				

¹Describes the type of soybean (food or grain) or other descriptive information about the variety.

²Indicates the average seed size calculated over the number of years the variety has been in the test.

³Lodging scores are averaged over 2000 and 2001 and range from 0-5 with 0= no lodging and 5= flat.

⁴Yield reported is four-year average for FG-2 and three-year average for Iowa 3001.

What is the local market potential for edible soybeans?

One component of the work that was conducted with the grant from the Maryland Soybean Board was to survey area grocery stores to determine the types of soyfood products that are locally marketed. Though soyfood products are found in the large, mainstream grocery markets like Giant or Safeway, they are more prevalent in the niche market grocery stores therefore our survey focused primarily upon those types of stores. Two organic and one oriental market located in the Baltimore-Washington corridor were visited. Though only three stores were visited, the number of specialty grocery markets is increasing in the Baltimore-Washington corridor. More than 30 of these niche grocery markets were identified just in the Washington-Baltimore suburbs of Maryland via a phonebook survey.

As can be seen in Table 3, there are a large number of soyfood products that are marketed. These products range in the amount of processing they require from little or none (represented by the bulk soybean sales) to a considerable amount of processing (soymilk, soy flour and soy sauce products). Probably the most visible observation was that the vast majority of processed soyfoods that were found on the shelves came from the West Coast, primarily California. This fact plus the health benefits associated with soybeans are the basis behind Heartland Fields. Dr. John Schillinger (a Maryland native, former soybean breeder at the University of Maryland, and longtime leader of Asgrow Seeds) is CEO for this new company. In his promotion of this company, Dr. Schillinger has identified the Mid-Atlantic and the Mid-South as the two leading regions of the country where soyfood product demand is greatest, both right in our back yard. Heartland Fields goals are to 1) develop a variety of soyfood products; 2) develop a market for locally grown edible soybeans; and 3) build a processing plant preferably within Maryland. Most importantly, Heartland Fields wants farmers to be the owners of this company and thus, benefit from the profits that are envisioned for the company. A second local value-added initiative is Chesapeake Fields, a Kent County based organization that is being coordinated by John Hall, Kent County Extension Agent. Edible soybean production and promotion is one of the cornerstones of this newly formed organization.

Table 3. Soyfood products found on the shelves of niche market groceries in the Baltimore-Washington region.

Soyfood Product	Comments
Bulk soybeans	Sold either in 1-5 lb bags or in bulk for \$.69 to \$.79 per lb. Large seeded, very clean and generally labeled organically grown.
Meat alternatives	Tofu hotdogs, tofu burgers, tofu bologna, Chinese sausage, tofu turkey
Tofu	Soybean curd, it is a cheese-like food made by curdling fresh hot soymilk with a coagulant
Miso	A salty soybean paste used extensively in Japanese cooking
Soymilk and soy beverages	Soybeans that are soaked, ground fine and strained producing a liquid that is a good substitute for cow's milk or to be used in other flavored soy drinks
Soy flour	Roasted soybeans ground into a fine powder
Soybean yogurt	
Tempeh	A chunky, tender soybean cake
Natto	Fermented, cooked whole soybeans
Frozen soy dessert	Made from soymilk or soy yogurt
Soy cheese	A number of flavors are available including the recent development of a mozzarella that will offer a non-fat option in the pizza market
Soy sauce	Soy sauce is such a staple for the Asian population that it is sold in one and two gallon containers
Soynut butter	A peanut like product made from roasted, whole soybeans and blended with soyoil and other ingredients
Soy granules and powders	Used as high protein fillers in many different recipes
Soynuts	Roasted soybeans packaged as a snack food
Green-pod soybeans	Marketed as fresh pod soybeans, frozen pod soybeans, blanched pod soybeans (edamame) and as canned, shelled soybeans
Soybean cereals	Soy based breakfast cereals
Soybean oil	Probably the most commonly consumed soybean product in the U.S.
Soybean based margarine and mayonnaise	