

Edamame Variety Trials in Western Washington

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INTRODUCTION AND METHODS

We have been conducting edamame variety trials in western Washington since 1995. Our initial studies indicated that earliness was the primary key to suitability in our region where growing degree days are limited (1500-2000 GDD per growing season). On May 24, 2000, we planted our variety trial at WSU Vancouver Research and Extension Unit (WSU VREU) and included 15 commercial varieties from six seed companies, plus 4 breeding lines from the Asian Vegetable Research and Development Center (AVRDC), for a total of 19 entries. The experiment had a randomized complete block design with four replications. Plots were double-row beds, 20 feet in length (6 m), on 5-foot (1.5 m) centers. Seeds were spaced 3 inches (7.5 cm) apart in the row.

Plots were mechanically cultivated for weed control between rows and hand weeded to control in-row weeds once a month from June to August. Overhead irrigation was applied weekly (as needed) throughout the growing season. Plant stand was counted in early July. In July and August, flowering dates were observed. Harvest began on August 31, 2000, and continued through September 28. Plants were harvested from 10 feet (3 m) of row in the center of each plot to estimate yield. Pods were hand picked from the harvested plants and sorted into three quality categories: 1) marketable pods with two or more beans per pod; 2) pods with only one bean; and 3) unmarketable pods. Each category of pods was weighed. 100 pods were taken from the category with 2 or more beans per pod, and weighed. From those 100 pods, the beans were removed from 25 of the pods. These individual beans were then weighed and counted.

RESULTS

Plant Stands Plant stands continue to be below expected values of 120 plants per 10 feet of row (Table 1). In laboratory assays, seed germination is high, therefore we suspect a soil environment interaction that inhibits seedling emergence. The varieties Kitanosuzu, Gion and Sayamusume had the best establishment this year, and this contributed to the high pod yield of Kitanosuzu and Sayamusume. The variety White Lion and all 4 breeding lines had very poor establishment, and only one breeding line, AGS 91027-6-2-3, had enough plants for yield evaluation. The variety Shironomai had average plant establishment yet achieved a very high pod yield, indicating its compensation ability and yield potential.

Flowering The variety Envy flowered first, and attained 50% flowering on August 1 (Table 1). Most other varieties flowered within the following week, and 50% flowering was accomplished by August 7. The variety Kagon flowered on August 7 and pods did not mature for harvest before a killing frost at the end of September. The other late flowering variety, Lucky Lion, produced a moderate yield, indicating it has a quicker seed ripening period. The variety Sayanishiki was flowering when other varieties were being harvested (data not shown).

Plant and Pod Heights The overall average plant height for all commercial varieties

was 36.6 cm. The variety Shironomai had the highest plant height, and one AVRDC breeding line, 91027-6-2-3, was significantly taller (2 times taller) than all varieties (Table 1). The overall average height from the ground to the lowest pods for all varieties was 10.6 cm. The variety Shironomai had the greatest height from the ground to the lowest pod compared to other varieties. The distance from the ground to the lowest pod is significant when considering variety suitability for mechanical harvesting. Pods that are too low to the ground will not be harvested and thus will not contribute to yield. Based on these measurements, Shironomai may be a good candidate for machine harvesting and large-scale production. The varieties Kitanosuzu and Sayamusume had medium plant height and pod position, and thus may not be suitable for machine harvesting. The varieties Envy, White Lion, and SB 1200 may not be suited to machine harvesting due to their low plant height and pod position.

Yield In 2000 the variety trial at WSU VREU achieved the highest marketable yields as compared to our edamame trials of preceding years (Table 2). The improved inoculation procedure used in combination with weekly irrigations may have contributed to these results. The variety Shironomai was consistently high yielding over the four years it was included in our trials. The varieties Sayamusume, Butterbeans, Kitanosuzu, Lucky Lion, Gion, and White Lion were also high yielding (greater than 500g) over the 5-year period. The varieties Sayanishiki and Kagon did not mature and were eliminated from the comparison because they lacked yield data.

The varieties Kitanosuzu, Sayamusume and Shironomai produced high marketable yields (pods with 2 or more beans) (greater than 800g per 10 feet of row), and the yields of Kenko and Gion were also good (greater than 700g) (Table 3). The varieties Kitanosuzu and Sayamusume produced high marketable pod yields in both 1999 and 2000.

The varieties Sayamusume, Shironomai, and Kenko produced large pods where 100 pods weighed close to 300 grams. Sayamusume and Kenko also produced the largest pods in 1999 (data not shown). The weight of 25 beans should be equal to or greater than 20 grams for the fresh vegetable market. In 2000, all varieties were below this criterion, perhaps due to our irrigation practices. Bean weights of different varieties were not statistically different, perhaps due to small sample size. Next year we will measure bean weights from 50 pods.

CONCLUSIONS

Results indicate there are significant differences in variety performance. Plant stand continues to be an issue in these studies; plants do not emerge well although germination tests indicate good seed viability. The varieties Shironomai, Kitanosuzu, Sayamusume and Kenko performed best in our trials in 2000. They were the highest yielding with the largest pod weights. Shironomai also appeared to be most suitable for mechanical harvest based on the distance from the ground to the lowest pods.

Table 1. Plant establishment and some morphological characteristics of the varieties and breeding lines tested at WSU Vancouver in 2000.

Genotype	Plant height (cm)	Distance from ground to the first marketable pod (cm)	No. Plants per plot	Date of 50% flowering
Yukimusume	31.9bc†	8.6bc	99abc	8/5
White Lion	25.9c	8.8bc	51fg	8/4
Shironomai	45.3a	14.0a	88cde	8/4
SB 1002	25.7c	7.7c	64def	8/7
Sayamusume	31.9ab	11.5abc	109abc	8/4
Sapporo Midori	31.6bc	10.0abc	90bcde	8/4
Misono-Green	37.9bc	9.4bc	90bcde	8/5
Lucky Lion	36.9ab	9.3bc	90cde	8/6
Kitanosuzu	33.2bc	11.2abc	125a	8/4
Kenko (SE-4)	38.7ab	11.7abc	83cdef	8/4
Kegon	38.2ab	12.3ab	80cdef	8/7
Gion	37.8ab	10.6abc	124ab	8/3
Envy	37.9ab	8.7bc	93abcd	8/1
Butterbeans	36.9ab	10.1abc	55ef	8/4
AGS 93037-15-1	34.1bc	10.9abc	16g	8/4
AGS 91027-6-2-3	30.2bc	9.2bc	52f	8/3

†, Means with different characters are significant at P=0.05 level by Tukey's HSD test.

Table 2. Marketable yields (g) in 10 feet row of edamame varieties grown at Chehalis, 1995-99, and WSU Vancouver REU, 2000; and average yields over 2-5 years.

Genotype	1995	1996	1997	1999	2000	Mean
Yukimusume				154	529	342
White Lion	810	731	585	212	324	532
Shironomai	743	728	931		835	809
Shirofumi	220		586			403
SB 1002				90	341	216
Sayamusume	699			202	852	584
Sapporo Midori		408	397	138	431	344
Mikawahima 202			321			321
Lucky Lion	614	736	593	183	625	550
Kitanosuzu				226	923	575
Kenko (SE-4)				95	778	437
Gion	687	321	735	198	753	539
Fiskeby V	631	61				346
Envy	332		379		478	396
Early Hakucho	495	120	468			361
Butterbeans	663	770	617	327	501	576
AGS 91027-6-2-3				263	210	237

Table 3. Edamame marketable (pods with 2-3 beans) and unmarketable yields (g) and yield components in 10-foot row of varieties grown at WSU Vancouver REU in 2000.

Genotype	Wt. of pods with 2-3 beans	Wt. of pods with 1 bean	Wt. Of unmarketable pods	Wt of 100 pods	Wt of beans from 25 pods	# of beans from 25 pods	Wt. Of 25 beans
Yukimusume	529.4ab†	230.3abc	77.6a	278.5ab	40.1a	62.5ab	15.9a
White Lion	323.6ab	57.4c	25.0a	249.0ab	34.5a	59.5ab	14.5a
Shironomai	835.3ab	336.3a	110.0a	315.0a	39.3a	58.3b	16.7a
SB 1002	340.9ab	69.0bc	42.8a	222.8ab	32.6a	58.0b	13.9a
Sayamusume	852.4ab	139.2bc	58.0a	314.5a	42.5a	61.5ab	17.2a
Sapporo Midori	430.8ab	97.2bc	61.5a	268.0ab	38.8a	62.8ab	15.5a
Misono-Green	484.3ab	191.5abc	80.0a	268.8ab	38.0a	61.3ab	15.9a
Lucky Lion	624.6ab	191.5abc	96.3a	262.3ab	36.3a	57.5b	15.9a
Kitanosuzu	923.3a	187.0abc	104.8a	271.8ab	40.0a	71.0a	14.1a
Kenko (SE-4)	778.3ab	320.0a	102.0a	299.3a	37.5a	55.3b	16.9a
Gion	753.1ab	247.0ab	92.5a	274.0ab	39.3a	59.8ab	16.7a
Envy	478.2ab	209.5abc	90.3a	200.5b	25.6a	54.0b	11.9a
Butterbeans	501.1ab	161.7abc	68.7a	256.8ab	30.9a	58.8b	13.1a
AGS 91027-6-2-3	209.5b	93.3bc	102.8a	249.0ab	36.5a	56.0b	16.0a

†, Means with different characters are significant at P=0.05 level by Tukey's HSD test.