COOPERATIVE EXTENSION
UNIVERSITY OF HAWAI'I AT MĀNOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

Soybean Variety Trial: Fall 2017

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Background

Soybean is a common and popular vegetable in local diets from home cooked meals to party *pūpū* (appetizers). This legume is rich in protein; fiber; vitamins A, B-6 and C; and minerals like calcium, iron, and magnesium (USDA, 2016). Soybeans are the base ingredient in many value added products such as soymilk, soy flour, tofu, soy protein, and soy sauce. The commercial success of this crop is partly dependent on the selection of high yielding, good quality, and easily harvestable varieties. A soybean variety trial was conducted at the Waimānalo Research Station in October 2017 to evaluate yield, pod quality and size, plant growth, and harvest ease.

Methods

Eleven varieties were selected for this trial. Nine of these varieties are commercially available from five different sources. Two varieties are currently being evaluated by the University of Hawaii at Manoa, Agricultural Diagnostic Service Center's Seed Laboratory for commercial and homegarden potential (Table 1). All varieties were direct seeded on August 1, 2017 to 1.5" depth and sowed in double rows 5' long. Screen and Agribon row covers (Johnny's Select Seed, Wislow, Maine) were placed over direct seeded plants but birds damaged a few rows in the trial. The rows affected by bird damage are specified in Figure 2. Rows were spaced 18" apart, with 3" between plants in rows. Plants were later thinned to about 6" spacing between plants in a row. Each variety was replicated three times.

Table 1. Varieties evaluated in 2017- Waimanalo Research Station

VARIETY NAME	SEED SOURCE
1. Kahala (*root knot nematode resistant*) 2. Goo (*evaluated in 2017*) 3. Big Island (*evaluated in 2017*)	UH Seed Laboratory
4. Midori Giant 5. Kuroshinju 6. Sayamusume	Territorial Seed Company
7. Envy 8. Tohya	Johnny's Selected Seeds
9. Butter Bean 10. Be Sweet	Jung Seeds
11. Beer Friend	Kitazawa Seeds

The Waimanalo Research Station sits on the Waialua soil series (Pachic Haplustoll). This is a fertile soil rich in base cations and a soil pH of about 6.5, which is within the desired pH range of soybean (Takeda, K.Y. and R.T. Sakuoka 1997). In addition to natural soil fertility, a pre-plant fertilizer was used to provide adequate nitrogen for soybean plants at the start of the trial and supplemented with a general use fertilizer at flowering. Sevin was sprayed at three weeks after planting to control the green stink bug. Although not encountered in this trial, other common pests of soybean include French bean fly, Chinese rose beetle, aphids, mites and white fly.

Plants were grown for approximately 70 days, with harvest and data collection starting from September 27 through October 19, 2017, based on maturity. As followed commercially, whole plants were deemed mature and harvested when majority of pods were filled. All pods from each 5' replicate were compiled and weighed for yield data, and 20 representative pods were weighed collectively for an average pod weight. Yield data were statistically analyzed using Analysis of Variance (ANOVA) with Tukey's Method for Multiple Comparisons to indicate differences among means.

Results:

Yield:

Midori Giant, Sayamusume, and Be Sweet varieties produced the statistically heaviest soybean pods at 60-70g per 20 pods (Fig. 1). For overall yield, these three varieties exhibited moderately high yields of 3 to 4 lbs. of pod per 5' of row (Fig. 2). Visually these pods were larger than other varieties like Kahala and Butter Bean (Fig. 3), and produced about 2 to 4 beans per pod. University varieties of Big Island and Goo also produced high yields per 5' row, both over 4 lbs. average, as well as moderately heavy pods.

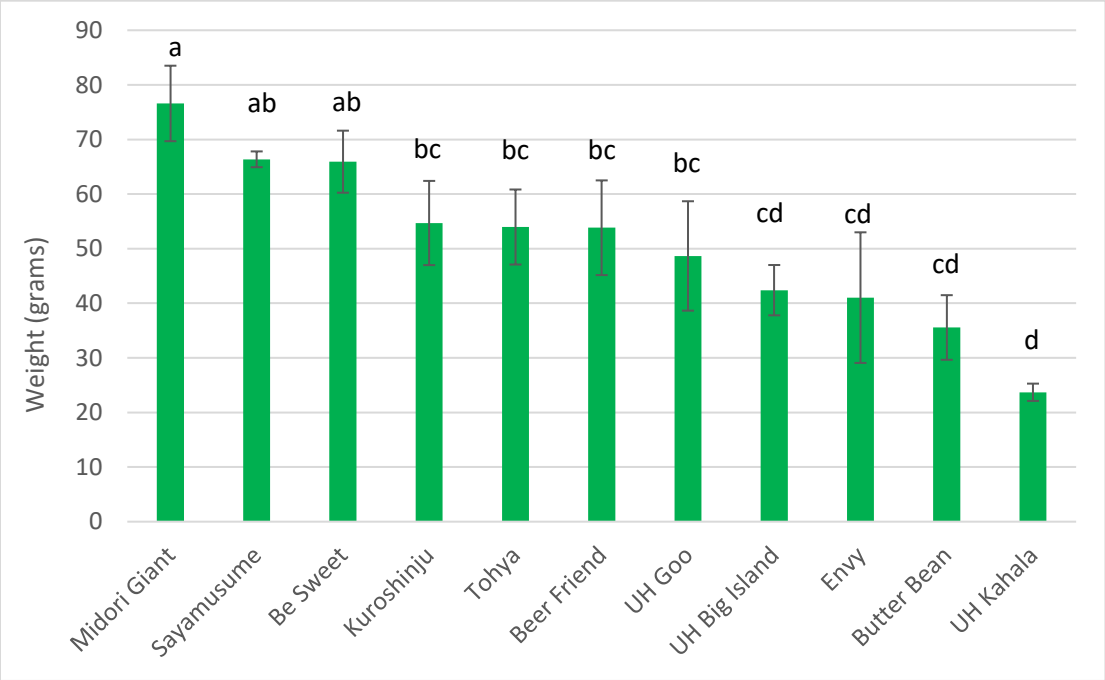

Figure 1. Average Weight for 20 Pods (grams)
Varieties not sharing a letter are statistically different (One-Way ANOVA)

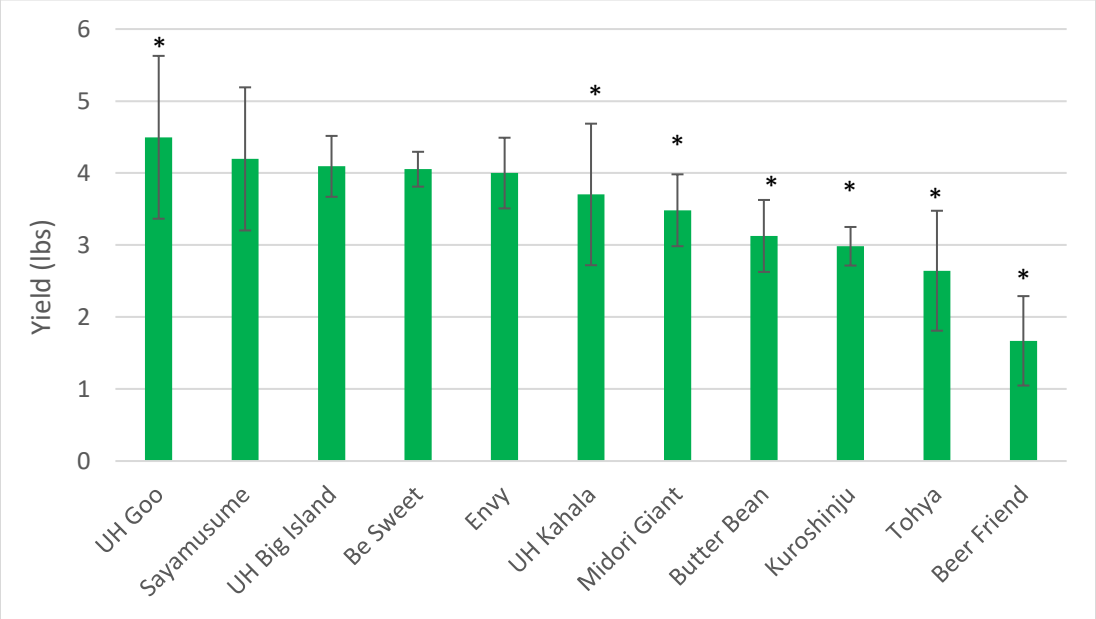

Figure 2. Average Yield from 5 Foot Double Rows
*: Indicates variety missing data for one replicated half of double row
All varieties were not statistically different (One-Way ANOVA)

Figure 3. Plant structure, height, and pod size of eleven soybean varieties.
Tape measure units are in inches.

Ease of Harvest, Labor:

Project investigators found Kuroshinju, Tohya, and UH Big Island to be the easiest to harvest. The pods of these varieties were uniform in size, clustered together on the stem, and easily detachable compared to other varieties. The uniform position and size of pods hold potential for mechanized harvesting. Kuroshinju and Tohya also produced large pods, but had lower yields (Fig. 1, 3). Varieties with thick and scattered distributions of pods throughout the stem structure, such as Butter Bean and Kahala, were more difficult to harvest by hand. Harvest and sorting of the soy bean pods were labor intensive, taking several man hours to manually harvest. Imported soybeans can be found in retail stores washed, packaged and ready to eat for about $1.00 to $1.50 a pound. For soybeans to be commercially viable as an import replacement crop, mechanized harvesting needs to be explored and utilized.

Maturity:

Sayamusume, Be Sweet, Envy, Tohya, and Kuroshinju had the shortest days to harvest (Table 2). These varieties were also the highest yielding, indicating their commercial potential in Hawaii. UH varieties such as Big Island, Goo, and Kahala were late maturing. Despite this, Big Island and Goo have commercial production potential given their moderate yields and uniform harvest qualities. Kahala is better suited for home gardening due to its small pods and non-uniform ripening. On a yield per acre basis, Kahala with its heavy fruiting potential, may also be suitable for other markets such as animal feed.

Table 2. Number of Days to Harvest and Flowering from August 1, 2017

		Number of Days to		
Varieties	**Harvest Date**	**Harvest**	**Initial Flowering**	**Last Flowering**
Tohya	September 27	57	21	29
Sayamusume		57	25	36
Envy		57	28	37
Be Sweet		57	28	37
Kuroshinju	September 28	58	26	36
Midori Giant	October 3	63	28	37
Beer Friend		63	29	36
Butter Bean		63	29	38
UH Big Island	October 12	72	29	37
UH Kahala		72	34	42
UH Goo	October 19	79	31	38

Flavor:

An informal tasting of the eleven soybean varieties with CTAHR faculty and staff found that Beer Friend had the best soybean flavor. However, it had the lowest average crop yields. Other varieties with noted flavor and moderate yields included Sayamusume and UH Goo.

Implications:

This soybean variety trial provided science-based evidence that soybeans can be grown in the islands for the local fresh market. Commercially available varieties like Sayamusume, Kuroshinju, and Be Sweet exhibited high-quality characteristics in regards to pod size, average yields, days to maturity, and ease of harvest. Other varieties such as Big Island and Goo exhibited moderate performance in these metrics. They displayed moderate yields and good harvest qualities. However, the limitations to these locally sourced varieties is the longer days-to-harvest which adds to production cost such as land, water, labor, fertilizers, etc. UH Seed lab will need to assess whether there is enough interest and sales potential to offer Big Island and Goo varieties for retail sales.

Ultimately, harvesting is the limiting factor in the advancement of this crop in Hawaii. Competition with imports may not be economically possible without some means of mechanization to reduce harvest expenses. Kuroshinju, Tohya, and UH Big Island varieties were well suited for mechanized harvest. Growers should ensure they obtain an optimal price to recover production and harvest expenses in order to generate a profit from fresh pod sales. Producers should add value to this crop or partner with restaurants or chefs who will pay a premier price for a locally produced product.

Photos of Field Trial Can Be Found Here:

https://www.flickr.com/photos/150583970@N07/albums/72157684327160862

References

Takeda, K.Y. and R. T. Sakuoka. 1997. Vegetable Soybean. College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, Pub. HGV-14. Honolulu, HI.

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