Yield and phytonutrient content of aquaponically grown pak choi (*Brassica rapa*, Chinensis group)

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Aquaponic growbed at the Waimānalo Research Station.

Pak choi varieties approximately 1 week before harvest.

Introduction

Aquaponic systems have been widely adopted in Hawai'i by commercial businesses, home owners and schools as a science-based method of food production that reduces the amount of water required compared to ground culture (see: Aquaponics in the classroom). As adoption of the technology continues to expand, CTAHR researchers and their industry partners are working to address gaps in our understanding of how to maximize the productivity of aquaponic systems (Fox et al., 2012; Mari's Garden, 2011; Tamaru et al., 2011). One of the first steps farmers can take to ensure good produce quality is variety selection (Sugano et al., 2011; Radovich, 2009; Uyeda et al., 2012). Until recently, no information was available to Hawai'i aquaponic producers regarding vegetable variety performance in aquaponic systems. To address this need, on-going vegetable variety trials were initiated at the Waimānalo Research Station aquaponic facility. This article reports data from a pak choi variety trial conducted in the summer of 2012. The objective of this trial was to evaluate the yield and phytonutrient content of seven commercial pak choi varieties.

What we did

Seven pak choi (*Brassica rapa* Chinensis group) varieties were seeded at the Waimānalo Agricultural Research Station on 7/2/12 in seedling trays with a peat-based mix containing 10% vermicompost by volume. Varieties 'Red Choi', 'Mei Qing', 'Joi Choi', 'Black Summer', 'Shiro' and 'Win-Win' were obtained from Johnny's Selected Seeds. 'Bonsai' was obtained from Harris Seed. Seedlings were transplanted on 7/25/12 into a 4 x 48 foot cinder bed fed by a 650 gallon tank with approximately 325 tilapia fish being fed Silver Cup Feed (Skretting USA) daily.

The experiment was arranged in a randomized complete block design with four replications. Three representative heads were harvested from each replication (12 heads per variety) on 8/22/12. On the day of harvest, white and green-stem pak choi heads (unknown variety) were purchased from a nearby local store to serve as a commercial control. Heads were trimmed and weighed, and the 4th leaf from the center of each head was prepared and analyzed for total glucosinolates, phenolic and carotenoid compounds as previously reported (Pant et al. 2012). Data were subjected to analysis of variance and mean separation using statistical software.

The seven pak choi varieties at harvest on 8/22/12, 28 days after transplanting.

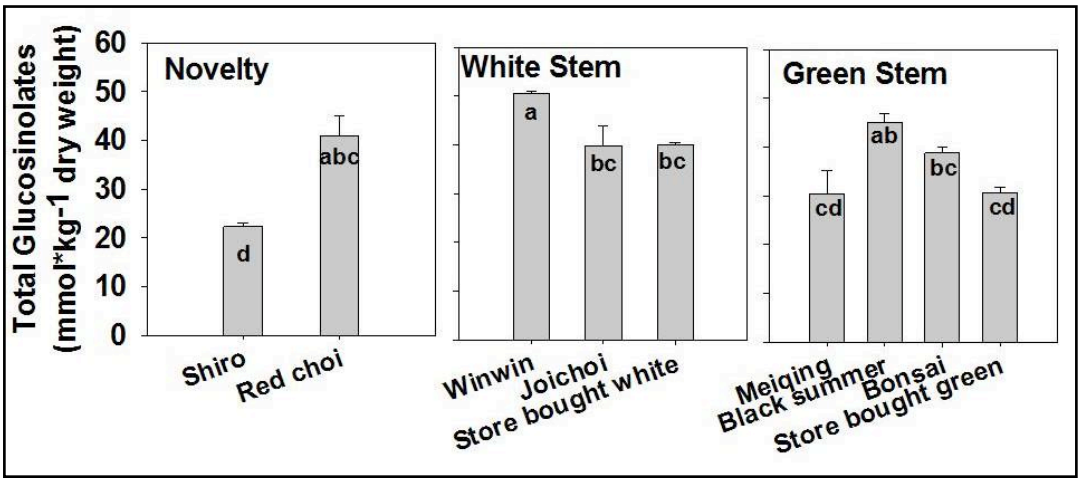
What we found

Yield. Average head weights ranged from 0.16 - 0.55 pounds. The white-stem varieties 'Win-Win' and 'Joi choi' produced the largest heads (~0.5 lbs per head). 'Mei Qing' was the heaviest (0.34 pounds per head) yielding green stem variety. Head sizes of both types were comparable to store bought samples purchased on the day of harvest. The white stem pak choi variety 'Shiro' was shorter, but comparable in yield to the green stem varieties (0.25 pounds per head). 'Shiro' and the green stem varieties 'Mei Qing', 'Black Summer' and 'Bonsai' are appropriate for the baby pak choi market. Smaller head size might be offset by closer spacing and higher prices. 'Red Choi's' primary value is likely in baby greens (leaf) mix.

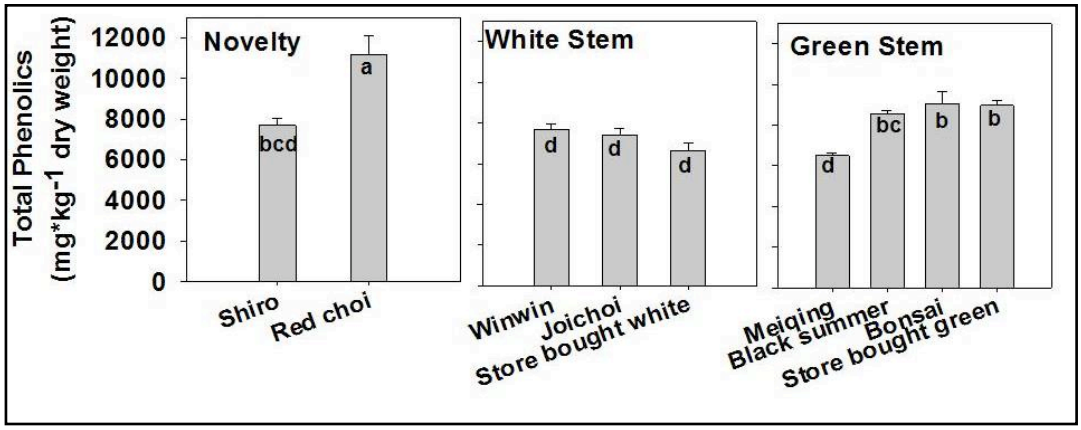
Variety	Mean (lbs)	Stdev
Win-Win	0.55a	0.06
Joi Choi	0.49ab	0.11
Mei Qing	0.34b	0.09
Black Summer	0.26bc	0.08
Shiro	0.23bc	0.04
Bonsai	0.23bc	0.03
Red Choi	0.16c	0.06

Average weight (lbs) of pak choi heads harvested 8/22/12, 28 days after transplanting at the Waimānalo aquaponics facility. Each value is a mean of 3 subsamples from 4 replications (N=12). Values with same letter are not significantly different from each other.

Phytonutrient content. There were significant differences in total glucosinolates and phenolic compounds among the varieties. These phytonutrients are important antioxidant, anticarcinogenic and flavor compounds. In this trial, 'Win-Win' and 'Black Summer' were the most phytonutrient



Total gluccosinolate concentration of pak choi leaves harvested 8/22/12, 28 days after transplanting at the Waimānalo aquaponics facility . Each value is a mean of 3 subsamples from 4 replications (N=12). Values with same letter are not significantly different from each other. Error bars are standard error of the means.



Total phenolic concentration of pak choi leaves harvested 8/22/12, 28 days after transplanting at the Waimānalo aquaponics facility . Each value is a mean of 3 subsamples from 4 replications (N=12). Values with same letter are not significantly different from each other. Error bars are standard error of the means.

dense of the white- and green-stem varieties respectively. There was no significant difference among the varieties in total carotenoids.

Conclusions. Variety selection is an important, underutilized tool to maximize quality and yield in aquaponic vegetable production and should be continued. In this trial, aquaponic pak choi yield and phytonutrient content were comparable or superior to store bought samples. Trials should be conducted throughout the year, because of the influence air temperature and other factors have on plant growth and quality. Additional data on fish yield (pending) will be required for an analysis of economic returns. While the jury is still out regarding the long term commercial viability of large scale aquaponic systems, aquaponic is an effective tool for home food production and STEM skill development.

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Green stem varieties. Head pictured above others is store bought head of unknown variety.

White stem varieties. Center head is store bought head of unknown variety.

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