



A Vegetable Trial of Neglect:

Cultivars producing, while untended, during COVID-19 lockdown

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Introduction

At the start of 2020 a vegetable variety trial was planted at the CTAHR Kauaʻi Agricultural Research & Extension Station (KARES) transitional-organic demonstration field. The objective was to identify and make recommendations of cultivars which performed well under local, organic conditions, beyond those directly developed by the University. This is a common request from our commercial grower and Master Gardener stakeholders, and the intention was to have preliminary data available at community outreach events organized by CTAHR and the Master Gardeners in the spring.

We procured a range of cultivars from many different seed companies, looking for ones with documented adaptation to tropical climates or unusual market characteristics which current adapted cultivars lack (different colors, processing/preparation methods, shape, flavor, etc.). Seedlings were started on benches and approximately 3-5 seedlings of each cultivar were transplanted into the field in blocks. Unfortunately, with the subsequent COVID-19 lockdown and resignation of the supervising technician, the trial became fully overgrown with weeds and also faced intense pressure from unchecked pests and diseases. This eliminated many of the cultivars planted, or stunted them to the point of not reaching maturity. However, almost a year after planting, while cleaning up the field we were pleasantly surprised to find that a small handful of cultivars for each crop had survived and reached reproductive maturity (i.e. producing seed). Due to the state of the plants, quantifiable data was difficult to obtain so we limited our results to noting which cultivars survived to reach the harvestable stage of that crop, and set seed. All of the successful cultivars are detailed below by crop, with some observations when relevant. A table of all of the cultivars trialed for each crop, with their observed survival, is provided as a reference at the end of this document.



We hope this publication will be useful for growers and breeders looking for more cultivars adapted to conditions in Hawai'i, and encourage folks to include them in future trials and plantings (and share the results with us!). The silver lining of the prolonged neglect this planting faced is high selective pressure, suggesting that these cultivars might be useful to try in low-input/low-maintenance conditions in farms and gardens.

Tomatoes

The trial in the demonstration field identified 5, out of 30, tomato cultivars which continued regularly bearing fruit under our high weed, pest, and disease pressures: 'Indigo Blue Berries', 'Golden Tressette', 'Sun Gold' F₁, 'Yellow Bell', and 'Green Zebra'. Interestingly, none of these are red tomatoes. In addition, plants of the rootstock cultivars 'Estamino' and 'Superstrong' thrived and bore copious fruit but, since the fruit is considered inedible, we are excluding them from consideration. While many of the edible cultivars are smaller tomatoes, which are known for generally having better pest and disease resistance purportedly from higher percentages of wild species ancestry, 'Yellow Bell' and 'Green Zebra' are larger types (*Figure 1*). 'Yellow Bell' is a sauce-type family heirloom from Tennessee, introduced to the market in 1986 by Southern Exposure Seed Exchange. 'Green Zebra' is a modern cultivar, bred by Tom Wagner of Tater-Mater Seeds and released through them in 1983. 'Golden Tressette' was bred and offered by Alan Kapuler of Peace Seeds, which has since closed, and is no longer commercially available from their spin-off company, Peace Seedlings, or anywhere else on the market to the best of our knowledge (*Figure 2*). However, we saved seeds from the plant in our trial and from cuttings of this plant grown in the greenhouse; small amounts of seed may be available upon request. 'Sun Gold' is a very popular hybrid, but does not come true from seed; several attempts at 'dehybridizing' it or breeding with it have been made though, with varying degrees of popularity and grower acceptance.



Figure 1. Immature tomatoes discovered during the field cleaning after lockdown. Left to Right: ‘Yellow Bell’, ‘Green Zebra’, and ‘Indigo Blueberries’.

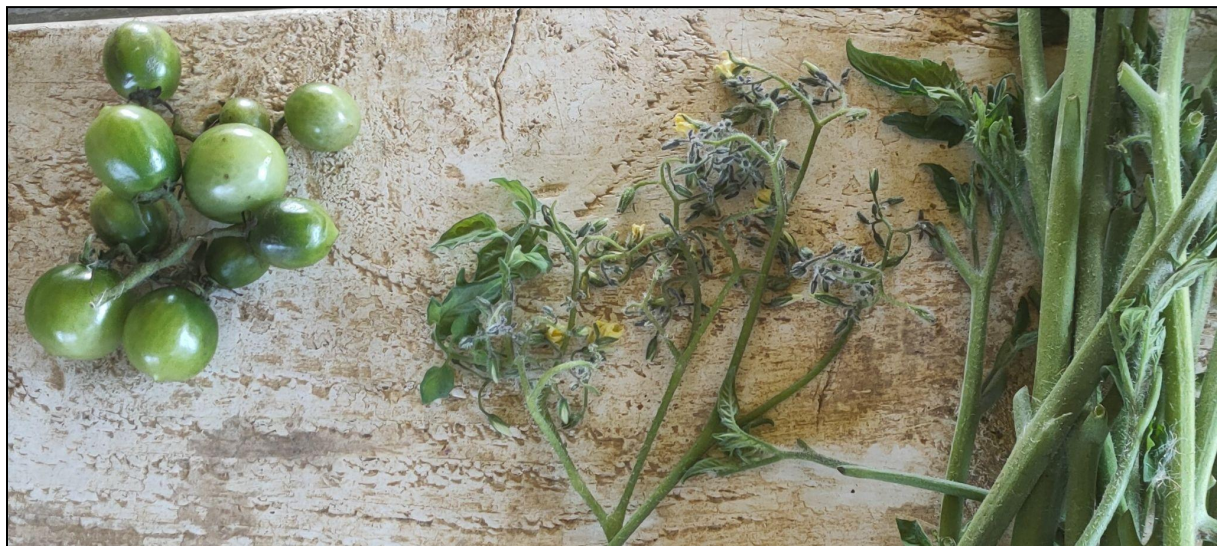


Figure 2. Immature tomatoes, inflorescence, and stem cuttings (L-R) of ‘Golden Tressette’ collected during field cleaning. The ‘tressette’ in the name alludes to the hypertresses shown in the center, where more flowers (and then fruit) are produced due to the presence of the compound inflorescence gene: *s*. This cultivar is currently not available commercially but small amounts of seed may be available from the authors, upon request.

Peppers

Out of the 17 planted in the KMG Demonstration garden, 10 pepper cultivars performed well. These included included ‘Ají Amarillo’, ‘Ancient Sweets’, ‘Calico’, ‘Carolina Wonder’, ‘Combahee’, ‘Hawaiian Chili’, ‘Peace Bell’, ‘Poblano’, ‘Truhart’, and ‘Waialua’. Most of these are *Capsicum annuum*, except for ‘Ají Amarillo’ (*C. baccatum*), ‘Combahee’ (*C. chinense*), and ‘Hawaiian Chili’ (*C. frutescens*). The cultivar releases for ‘Truhart’ (Fery & Thies, 2011), ‘Carolina Wonder’ (Fery et al., 1998), and ‘Combahee’



(syn. PA-559; Fery & Thies, 2010) each specifically mention being bred to integrate nematode-resistance, which likely plays a role in their local adaptation. 'Ají Amarillo' produced prolifically in the field, and continued to do so even when dug up and put into a pot (*Figure 3*). 'Calico' is a miniature, ornamental type. 'Ancient Sweets', 'Carolina Wonder', 'Peace Bell', and 'Truhart' are non-pungent (i.e. sweet) peppers. Interestingly, while the pungent UH cultivars 'Waiialua' and 'Hawaiian Chili' survived and bore fruit, the non-pungent UH cultivar 'Kala'a' did not survive our field conditions. Of all of the peppers, 'Ají Amarillo', 'Combahee', and 'Hawaiian Chili' were the most productive, bearing multiple fruits through the end of trial.



Figure 3. A pepper on a plant of 'Ají Amarillo' shortly after that plant was dug up from the field and put into a pot. It fruited continuously while in the pot, and also when later transplanted into a new field.

Basil

We identified 3 basil cultivars, out of 6 planted, which did well in our trials and showed limited, if any, downy mildew infection: 'Mrs. Burns' Lemon', 'Purple Petra', and 'Mrihani'. Close observation of these plants in the trial yielded several spontaneous hybrids between 'Purple Petra' and 'Mrihani', which were preserved and propagated for use in a subsequent trial. These hybrids also have great ornamental potential, with round frilly leaves which are also glossy and dark purple (*Figure 4*). They are



reminiscent of cultivars bred and offered by Frank Morton at Wild Garden Seed in Oregon, several of which are also derived from hybrids between ‘Mrihani’ and ‘Opal’ (another purple cultivar).



Figure 4. Surviving basil plants in the field rediscovered during cleanup.
Top Left: ‘Mrihani’, Top Right: ‘Purple Petra’, Bottom: one of the spontaneous hybrids found growing between these two cultivars.



Squash

Our trial of squash differed from the other crops, as the 10 cultivars were planted in areas with existing woven black plastic weedmat. This proved to be a bad idea, as smaller seedlings crisped from the absorbed heat and the plants which survived to maturity were not able to root at the nodes, a trait that can let them access more water and nutrients leading to increased yields. Most plants perished quickly without setting fruit. However, 2 of the cultivars trialed grew well: 'Honeynut' and 'Bon Bon' F₁. 'Bon Bon' F₁ is a hybrid *Cucurbita maxima* type, and had vigorous vines that spread across the top of the weedmat. Unfortunately, it did not set any fruit. 'Honeynut' is marketed as *C. moschata* but has *C. maxima* in its ancestry as well. Serendipitously, one author was involved with its release from the breeding program at Cornell, and so was privy to some of its pedigree background and characteristics. It yielded several 'personal size' butternut-type squash, the only squash in the trial to set any fruit, but these were approximately half the size of normal fruit for this cultivar.

Tomatillo

Our tomatillo trials were smaller than for other crops, only including 3 cultivars. Of these 3, only 'Malinalco' (syn. 'Queen of Malinalco') set fruit. We performed a small, unreplicated second trial of 4 cultivars, including the original 3 plus 'Everona', in a conventionally-managed field. Of these, only 'Malinalco' yielded well, with 20+ fruits, compared to 1 or 2 for each of the other cultivars. However, 'Malinalco' has a very different shape and flavor profile than standard tomatillos, being pear-shaped, sweet, and mild. This might have implications for market acceptance. At the time of writing, we are starting a larger tomatillo trial with over 50 cultivars and accessions, as well as breeding populations developed from the second trial. We hope to have more data to share in a future article.

Eggplant

Of all the crops trialed, the eggplants were the standout stars, tolerating neglect and producing prolifically while untended. We planted 4 cultivars, and 3 of these consistently produced fruit until the trial was terminated. The 3 cultivars were developed and sold by UH: 'UH Long Green', 'Waimanalo Long', and 'Nitta Waimanalo' F₁; all of these were planted in rows of approximately 10 plants. The fourth cultivar, 'Apple Green', was a single small-but-productive plant, which bore approximately 5-7 standard fruits and then perished, and so comparing it with rows of the other cultivars



is not appropriate. Harvests from the rows of UH cultivars yielded over 750 lbs of eggplant, later donated to the local foodbank, as well as more than enough for all of the county's CTAHR Extension employees and Station collaborators.

Discussion

While several of the cultivars which did well in this trial were developed by UH, or had documented resistance to local stressors like nematodes, there were several with previously undocumented tolerance to local conditions and new characteristics to expand local offerings. As all of UH's tomato cultivars are red, the range of colors in cultivars identified in this trial may provide marketable/usable diversity for local growers and future breeding work. In addition, the majority of UH's releases had been bred to remove the 'green shoulder' trait, as was the market preference at the times of their releases. However, research in the decades after their release has shown that retaining this trait can actually improve the nutritional quality of the fruit (Powell et al., 2012), and all of the successful tomato cultivars in this trial retain the 'green shoulder' trait. Similarly, the range of market classes encompassed in the successful pepper cultivars from the trial could broaden grower options. Especially, sweet peppers from this trial may provide a good genetic base for breeding larger non-pungent peppers in combination with UH's cultivars; the original UH cultivar release (Takeda et al., 1996) identified this as a shortfall of their sweet pepper cultivar, 'Ka'ala', and there are a range of traits available in newer cultivars which were not available when UH released this cultivar almost 30 years ago. The good performance of other pepper species, beyond the more common *Capsicum annuum*, may also provide ideas for future trialing and breeding research. Similar opportunities exist for the basil, squash, tomatillo, and eggplant cultivars identified in this trial.

One shortfall of this trial, due to its unplanned structure, is the lack of consistent pressure from biotic stresses. Diseases such as Tomato Yellow Leaf Curl Virus or bacterial wilt (*Ralstonia solanacearum*) are regularly mentioned as major obstacles to commercial tomato growers and home gardeners, and future trialing work would need to intentionally document and include these, and other modern diseases, as well as improve replication of the cultivars evaluated.



References

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Takeda, K. Y., Tanaka, J. S., Sekioka, T. T., & Hamilton, R. A. [“Ka‘ala and Waialua Peppers.”](#) HortScience 31.6 (1996): 1054-1054.

Table of Cultivars in Trial

Cultivars in each crop are sorted by survival, then alphabetically.

Cultivar	Crop	Survived to maturity?	Source	Notes
Aristotle	Basil	No	Horticultural Products & Services	
Cardinal	Basil	No	Botanical Interests	
Genovese	Basil	No	High Mowing Organic Seeds	
Mrihani	Basil	Yes	Southern Exposure Seed Exchange	
Mrs. Burns Lemon	Basil	Yes	Native Seeds/SEARCH	



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Cultivar	Crop	Survived to maturity?	Source	Notes
Purple Petra	Basil	Yes	Botanical Interests	
Apple Green	Eggplant	~	Pinetree Garden Seeds	
Nitta Waimanalo	Eggplant	Yes	UH Seed Lab	hybrid
UH Long Green	Eggplant	Yes	UH Seed Lab	
Waimanalo Long	Eggplant	Yes	UH Seed Lab	
Candy Cane	Pepper	No	Horticultural Products & Services	hybrid
Fluorescent Purple	Pepper	No	Garden Hoard	
Ka'ala	Pepper	No	UH Seed Lab	
Maui Purple	Pepper	No	Garden Hoard	
Numex Twilight	Pepper	No	Garden Hoard	
Sonoran Tepin	Pepper	No	Native Seeds/SEARCH	
Thunder Mountain Longhorn	Pepper	No	Garden Hoard	
Ají Amarillo	Pepper	Yes	Peace Seeds	<i>Capsicum baccatum</i>
Ancient Sweets	Pepper	Yes	Garden Hoard	
Calico	Pepper	Yes	Garden Hoard	



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Cultivar	Crop	Survived to maturity?	Source	Notes
Carolina Wonder	Pepper	Yes	Southern Exposure Seed Exchange	
Combahee	Pepper	Yes	Southern Exposure Seed Exchange	<i>Capsicum chinense</i> syn. PA-559
Hawaiian Chili	Pepper	Yes	UH Seed Lab	<i>Capsicum frutescens</i>
Peace Bell	Pepper	Yes	Peace Seeds	
Poblano	Pepper	Yes	Native Seeds/SEARCH	
Truhart	Pepper	Yes	Southern Exposure Seed Exchange	
Waiialua	Pepper	Yes	UH Seed Lab	
Bonbon	Squash	~	Bonnie Plants	<i>Cucurbita maxima</i> hybrid
Bugle	Squash	No	Holmes Seed Company	<i>Cucurbita moschata</i> hybrid
Costata Romanesco	Squash	No	Uprising Seeds	<i>Cucurbita pepo</i>
Dark Star	Squash	No	Seeds of Change	<i>Cucurbita pepo</i>
Kakai	Squash	No	Holmes Seed Company	<i>Cucurbita pepo</i>
Orangeti	Squash	No	High Mowing Organic Seeds	<i>Cucurbita pepo</i> hybrid
Shin Asia Mat Dol	Squash	No	Asia Seed Korea	<i>Cucurbita moschata</i> hybrid
Tetsukabuto	Squash	No	Kitazawa Seed	<i>Cucurbita</i> hybrid



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Cultivar	Crop	Survived to maturity?	Source	Notes
Tuffy	Squash	No	Johnny's Seeds	<i>Cucurbita pepo</i>
Honeynut	Squash	Yes	High Mowing Organic Seeds	<i>Cucurbita moschata</i>
Everona	Tomatillo	No	Southern Exposure Seed Exchange	only in 2nd trial
Plaza Latina Giant	Tomatillo	No	Adaptive Seeds	
Really Purple	Tomatillo	No	Holmes Seed Company	hybrid
Malinalco	Tomatillo	Yes	The Roughwood Shop	synonymous with 'Queen of Malinalco'
Black Cherry	Tomato	No	Southern Exposure Seed Exchange	
Black Krim	Tomato	No	Quail Seeds	
Cherokee Purple	Tomato	No	Quail Seeds	
Dr. Carolyn	Tomato	No	Southern Exposure Seed Exchange	
Geranium Kiss	Tomato	No	Peace Seeds	
Heatwave II	Tomato	No	Burpee	hybrid
Heialani	Tomato	No	UH Seed Lab	
Iron Lady	Tomato	No	High Mowing Organic Seeds	hybrid



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Cultivar	Crop	Survived to maturity?	Source	Notes
Komohana	Tomato	No	UH Seed Lab	
Legend	Tomato	No	Experimental Farm Network Cooperative	
Momotaro	Tomato	No	Territorial Seed	hybrid
Mortgage Lifter VFN	Tomato	No	Southern Exposure Seed Exchange	
New Big Dwarf	Tomato	No	Garden Hoard	
Orange Centiflor	Tomato	No	Peace Seedlings	
Peace Vine	Tomato	No	Peace Seeds	
Principe Borghese	Tomato	No	Botanical Interests	
Reisotomate	Tomato	No	Garden Hoard	
Renegade Spider	Tomato	No	Garden Hoard	
Roughwood Golden Plum	Tomato	No	The Roughwood Shop	
Silver Fir Tree	Tomato	No	Garden Hoard	
Sungella	Tomato	No	Renaissance Farms	
Sweet Tangerine	Tomato	No	Burpee	hybrid



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Cultivar	Crop	Survived to maturity?	Source	Notes
Variegated	Tomato	No	Garden Hoard	
Estamino	Tomato	Yes	Tomato Growers Supply Company	rootstock
Golden Tressette	Tomato	Yes	Peace Seeds	
Green Zebra	Tomato	Yes	High Mowing Organic Seeds	
Indigo Blueberries	Tomato	Yes	Territorial Seed	
Sungold	Tomato	Yes	Botanical Interests	hybrid
Superstrong	Tomato	Yes	Tomato Growers Supply Company	rootstock
Yellow Bell	Tomato	Yes	Southern Exposure Seed Exchange	