

Final Report to the 2018 Saratoga Horticultural Research Endowment

Project Title: The Ruth Bancroft Garden 2018-2019 Aloe Hybrid Breeding Project

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Introduction:

This project tested 5 aloe hybrids created by Curator Brian Kemble of The Ruth Bancroft Garden (the Garden) to find out how well they would grow in differing climate exposure. The aloes were planted in three differently exposed locations of the Garden: one location in shade (Bed N), one location in sun (Bed B), and one location with morning shade and afternoon sun (East Fence).

Materials and Methods:

Soil tests were conducted on the three plots chosen for the experiment, to help determine if there were any abnormalities in the soil. A hi-low thermometer was placed in each of the three plots for the curators to note the temperature variability weekly. Pictures of the aloes were taken monthly to document their progress over 12 months. Curators made weekly notes on temperature exposures and any other noticeable factors appearing on the plants.

Years One was to be the planting and weather trial, and the education of the public on the experiment through signage, brochure, and website. This year also included reporting on the hybrids' success in their stressful microclimates, as well as building a relationship with the tissue culture laboratory which will be chosen for the mass development of the best performing hybrids. At the end of this year patents for the best performers were to be applied for, if funds allow.

Because the temperature ranges did not reach below zero Fahrenheit for any extended period of time during this year, we are going to extend the climate testing for another year in hopes of seeing how well these plants will do in more severe cold spells. We also would like to experiment with these plants as potted subjects, in order to assess their suitability for horticulture in this regard.

Year Two was going to be placing the plants into in vitro tissue culture, and reporting out to the horticultural community on the results of the trial. This and future efforts will be done outside of this grant process.

Year Three will then become the time for marketing the hybrids' special characteristics and telling the story of their responses to climate and stressful conditions. Marketing the new plants will be done through articles, website, social media, public speaking, and collaborative work with industry professionals. This will also be a year of developing relationships with the nurseries which will be used to grow the plants in mass production.

Year Four will be placing the tissue cultured specimens into nursery culture to produce product ready to be sold. Marketing the expected new hybrids will continue at TRBG. By end of Year Four enough plants will be produced to start selling to the public.

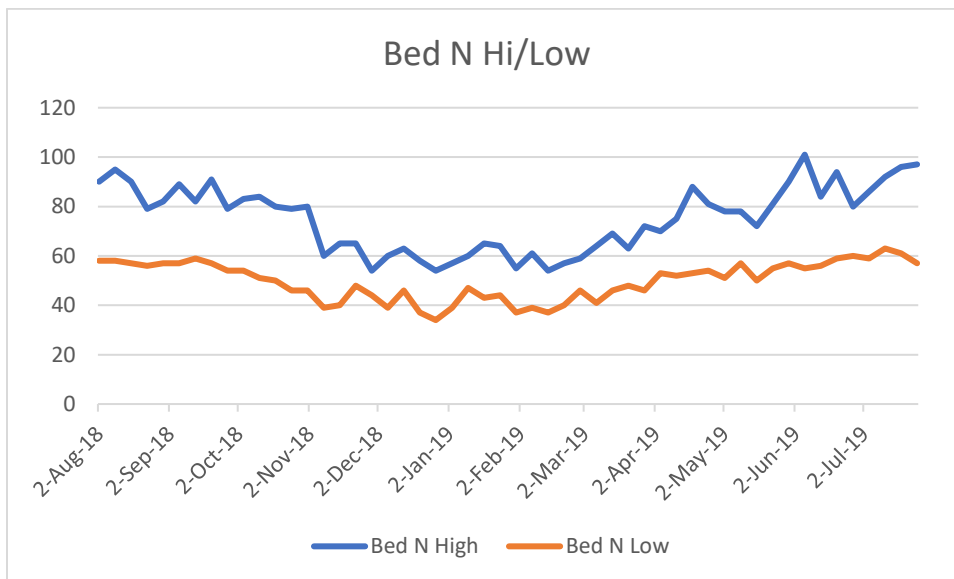
Project Timeline final report through August, 2019.

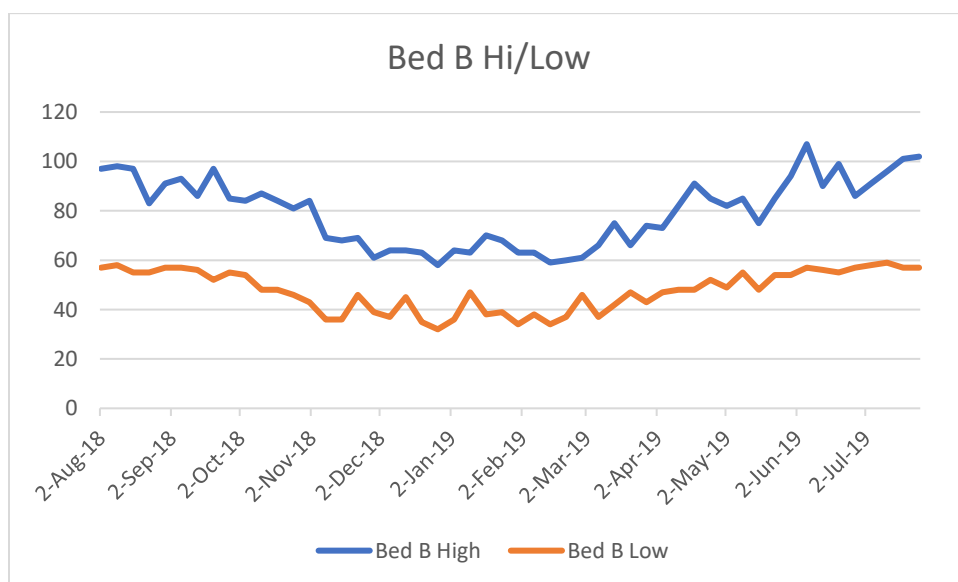
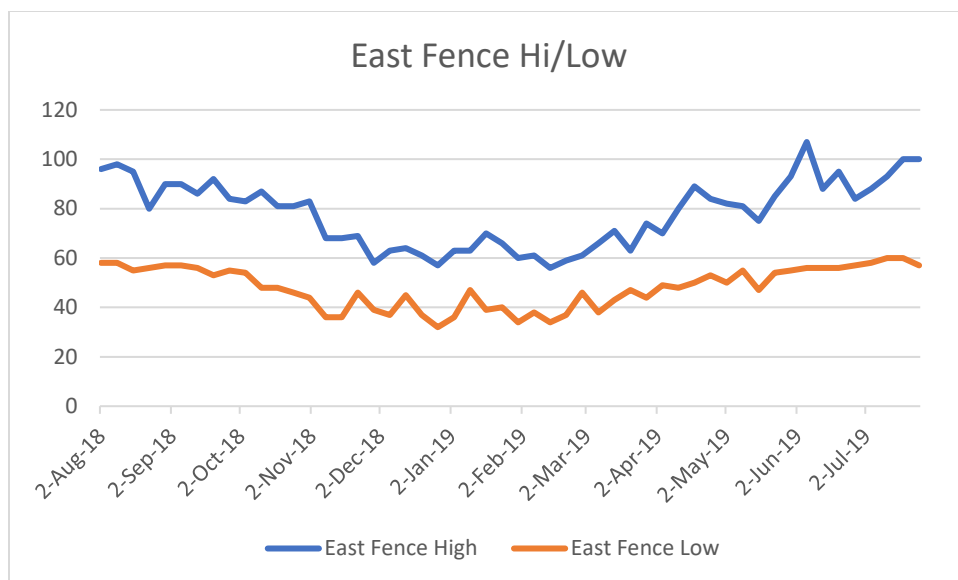
Month	Activity
August, 2018	<p>Selected Garden test sites:</p> <ol style="list-style-type: none"> 1. Overhead canopy with relative constant bright exposure, little wind. 2. Site under a tall plant and tree, giving partial shade and full afternoon sun, some wind exposure 3. No overhead shade, windy exposure <p>Two sites had soil tested previously. One site soil to be sent for testing.</p> <p>Prepared sites, created soil consistency; purchased and installed high-low thermometers; planted hybrids; hand irrigated test sites; used shade cloth on newly planted plants.</p> <p>Designed signage; drafted informational brochure.</p> <p>Began bi-monthly monitoring of temperatures; hand irrigated test sites; produced signage; Got brochure designed and printed. Posted information on TRBG website.</p>
Sept. 2018- November, 2018	<p>Monitored hybrids in bi- monthly; hand irrigated sites. Noted water use and reactions to temperature and wind; installed signage; began photographing plants monthly. Discussed Hybrid Project brochures with interested visitors and on docent led tours.</p>
December- 2018- January, 2019	<p>Continued monitoring hybrids for reactions to rain, wind and temperature during late November rains and December and early January cold. Plants doing well in all locations with temps down to 29 degrees Fahrenheit. Soil analysis received back for portions of beds where new soil was added. The soil contained low levels of nitrogen, and did not show elevated levels of selenium or other potential problems often seen in our area. Principal Kemble explored tissue culture sources with Randy Baldwin and San Marcos Growers.</p>
March	<p>Continued monitoring and photographing hybrids. Added granular humic acids to boost the absorption of micronutrients. Added feather meal to boost the level of nitrogen.</p>

April.	Added help for soil enzymes and micronutrients. Added compost tea to assist soil microbial activity. Continued monitoring hybrids in bi- monthly; hand irrigated sites, noted water use and reactions to temperature and wind; continued photographing plants monthly. Continued to receive and respond to inquiries by visitors about plant hybridization, and the process of choosing hybrids for public release.
May-July	Additional application of compost tea. Began vegetative propagation in the nursery of two of the hybrids, #4-zubb x squarrosa, and #5 – ‘Rubin’, in anticipation of their eventual marketing to the public. Continued monitoring, photographing, talking to interested visitors about hybrid experiment.
August	Meeting with patent attorney to explore patenting options or other steps short of patenting to market the hybrids. Made decision to continue monitoring of hybrids for another 12 months.

Results:

Below are three graphs: one showing the temperatures for each of the test beds from August 2019-July 2019. The plants did well in the extreme heat experienced this year. The Garden did not experience especially cold temperatures in this year, and the curators had hoped to see how well the plants did in temperatures below freezing. So they will be keeping the experiment going for the next 12 months in hopes to see how the hybrids weather more extreme cold.





All five of the hybrids tested have done well in the ground over the course of the year. During the winter, we were interested to see how they would cope with cold and with winter rain. As noted above, we did not get many days below freezing in the winter of 2018-2019, but there was no damage to any of them on the days when frost came along, even those in the most exposed bed. This is encouraging, because their mixed parentage includes species with varying levels of cold-tolerance, so we did not know how they would perform. We intend to keep the experiment going through another winter, thinking that more extended or severe cold spells might help us to better evaluate their cold resistance. With regard to rain during the winter season, our deluge in February gave us an excellent opportunity to see how the plants fared with excessive winter wet. Happily, they all came through with flying colors.

During the summer months, we wanted to see how well the five hybrids coped with heat waves. Since Walnut Creek is located in an interior valley, it gets much more extreme summer heat than coastal areas, and we wanted to see if this was a problem for the hybrids being tested. Here again, we were pleased to find that even heat waves in excess of 100 F did not harm the plants.

In addition to looking at how well the hybrids perform in the Garden, we are also interested in how well they perform as potted plants. Many gardeners in urban areas have only a patio or a deck to work with, and we would like to know how well the plants do in containers. To this end, we have taken offsets of the three hybrids with are the most prolific, and we are testing these in containers with other succulents. Seeing them doing well in planter boxes is very encouraging, since it broadens the scope of their horticultural usefulness.

We also intend to approach labs that do tissue culture, including Magnolia Garden, Rancho Tissue Technologies, and Walters Gardens, so that we can proceed with mass-producing the hybrids in order to get them distributed widely.

The Names of the aloes are listed below, followed by pictures of the plants. There are three pictures per month of the five aloes in each of the three locations, and 15 single pictures of each of the hybrids in each of the beds as of August 17, 2019, with the number of each aloe corresponding to its name in the original list.

1. x Gasteraloe 'luman': produces rosettes to 1 ' in diameter; is a stemless clumper, with spotted leaves that take on a pink, orange and reddish tinge in summer; orange tubular flowers on a branch stock.
2. Aloe buhrii x reynoldsii, pictured below: produces rosettes to 18 " in diameter; is a stemless clumper with wide choral edged leaves; much branched flower stalk to 18" high with yellow-orange flowers.
3. Aloe pearsonii x mitriformis pictured below: either upright or horizontal growth clumper with stems of stacked triangular shaped leaves, becoming purple-flushed in sun; red flowers in a round cluster in summer.
4. Aloe zubb x squarrosa, pictured below: clumper with curled-back, light green heavily spotted leaves; flower stalk is branched with yellow-orange flowers.
5. Aloe 'Rubin', picture below: a relatively compact hybrid with four species in its parentage: Aloe humilis and Aloe brevifolia from South Africa, Aloe zubb from Sudan, and Aloe squarrosa from Socatra. It forms mounded clusters of six inch and heads with short spotted triangular leaves. In shade plats are green, but in sunnier positions they become purple-tinged. Flowers not known.

February 1, 2019 Bed B (Sun)



February 1, 2019 Bed N (Shade)



February 1, 2019 E. Fence (Shade/Sun)



February 28, 2019 Bed B (Sun)



February 28, 2019 Bed N (Shade)



February 28, 2019 E. Fence (Shade/Sun)



April 4, 2019 Bed B (Sun)



April 4, 2109 Bed N (Shade)



April 4, 2019 E. Fence Bed (Shade/Sun)



May 2, 2019 Bed B (Sun)



May 2, 2019 Bed N (Shade)



May 2, 2019 E. Fence Bed (Shade/Sun)



June 1, 2019 Bed B (Sun)



June 1, 2019 Bed N (Shade)



June 1, 2019 E. Fence Bed (Shade/Sun)



July 5, 2019 Bed B (Sun)



July 5, 2019 Bed N (Shade)



July 5, 2019 E. Fence Bed (Shade/Sun)



August 1, 2019 Bed B (Sun)



August 1, 2019 Bed N (Shade)



August 1, 2019 E. Fence Bed (Shade/Sun)



August 17, 2019 All hybrids in each bed:

Aloe # 1, Bed B (Sun)



Aloe # 1, Bed N (Shade)



Aloe # 1.E. Fence Bed (Shade/Sun)



Aloe # 2, Bed B (Sun)



Aloe # 2, Bed N (Shade)



Aloe # 2 E. Fence Bed (Shade/Sun)



Aloe # 3 Bed B (Sun)



Aloe # 3 Bed N (Shade)



Aloe # 3, E. Fence Bed (Shade/Sun)



Aloe # 4, Bed B



Aloe # 4 Bed N (Shade)



Aloe # 4, E. Fence Bed



Aloe # 5, Bed B



Aloe # 5, Bed N (Shade)



Aloe # 5, E. Fence (Shade/Sun)

