Ranking, testing and selecting parent trees for an *Acacia koa* improvement program in Hawai'i

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INTRODUCTION

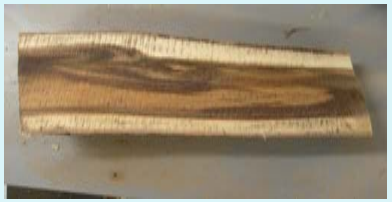
Hawai'i is one of the most unique places in the world and one of the only tropical ecosystems in the United States. Because it is an island, Hawaii is particularly susceptible to invasive exotic species and the native ecosystems are being rapidly diminished (Loope 1989, Vitousek 1988) . Of the native Hawaiian trees, *Acacia koa* A. Gray is probably the most important economically since it produces one of the most valuable woods in the world. It is also ecologically important because it is part of the native forest ecosystem, providing food and shelter to a variety of animals and plants and koa is an integral part of watersheds (Whitesel 1990, Wilkinson and Elevitch 2003).

Unfortunately, it tends to produce multiple trunks instead of one single trunk, decreasing the possibility to produce a log that is suitable for commercial milling and therefore decreasing its value (Scowcroft et al 2010). For this reason, we are starting an A. koa improvement program, with the goal to produce improved stock of koa but also with the hope to add to the conservation of the species by making it more attractive for landowners that are cattle ranching presently.

FROST RESISTANCE

Some of our research sites are located at high elevations and the trees are subjected to below freezing temperatures. For this reason, we are performing an electrolyte leakage test, that will allow us to identify the families that have better frost resistance. For this experiment, we will subject phyllode samples from different families to several below freezing temperatures and then measure the solution conductivity. We will compare it to the conductivity after autoclaving the samples to achieve total cell damage. This difference in conductivity will reflect the cell damage produced at the predetermined temperatures.

WOOD QUALITY



For wood quality measurements, we will use a SilviScan-3 that will give us information about microfibril arrangement and wood density. In addition, we will use a colorimeter to standardize wood color comparisons, and sapwood:heartwood ratios to identify families that have smaller ratios and therefore have more potential to produce a larger amount of heartwood. With this information, we will make informed and accurate selections that will provide the basis for producing improved stock which will benefit landowners, entrepreneurs and natural ecosystems.

RANK AND SELECTIONS

We developed seed orchards in order to assure seed availability from known sources. To do this, we used two established plus tree plantations and evaluated them for the characteristics listed below. We calculated the mean of each trait per family, developed a ranking, and selected the trees or families that presented the best combination of desired characteristics.

Morphological characteristics:
-Total height
-Height to the first fork
-Number of stems (up to 9)
-Straightness
-Crown class
-Composite DBH
-Potential as a crop tree (P. C. T)

P.C.T:
No forks below 3 meters
Straight trunk
Healthy full crown
DBH at least 3 cm.
(Scowcroft and Dudley 2010)

Fam	Height	Ht 1st fork X2	# stems	1 stem X2	Straightness X2	Crown class	P.C.T X2	Survival	Composed DBH X2	Total	Rank
18	1	4	4	2	2	1	12	4	2	32	22
17	2	2	7	10	12	3	16	2	12	66	21
12	3	12	5	16	8	5	22	5	6	82	20
20	10	6	1	4	14	14	14	15	14	92	19
6	9	10	3	8	18	6	8	16	24	102	18
16	7	14	2	12	28	10	32	9	10	124	17
5	13	8	6	6	22	7	6	12	42	122	16
7	12	18	9	28	10	4	10	20	40	151	15
19	6	36	21	42	44	9	4	1	4	167	14
2	16	16	13	18	6	17	20	8	38	152	13
13	14	28	19	30	4	21	2	10	20	148	12
10	4	30	20	34	34	20	18	3	16	179	11
9	21	20	11	20	32	2	28	17	30	181	10
15	5	26	10	26	20	15	30	19	34	185	9
11	15	24	8	22	42	8	42	14	22	197	8
14	8	32	15	24	24	16	38	21	8	186	7
22	20	22	14	14	30	19	36	6	36	197	6
21	19	42	17	40	26	12	26	11	28	221	5
8	11	44	22	44	40	11	24	13	18	227	4
1	18	40	12	32	36	22	44	7	26	237	3
3	22	34	16	38	16	18	34	18	44	240	2
4	17	38	18	36	38	13	40	22	32	254	1

Based on their rank, we selected the best families or individuals and rogued the sites, taking into account the spacing among the remaining trees.

BEFORE ROGUING

AFTER ROGUING

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