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FY 2013 HAWAII STATE PLAN

Final Report

Project Coordinator

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The Kohala Center
http://kohalacenter.org/

Project Summary

The purpose of the project was to develop a greater understanding of the barriers faced by Hawaii's tea growers and to address these challenges through educational opportunities. Barriers to tea production and processing were assessed via a statewide grower survey, which was followed by participatory and observational research by the project Team to assess means of addressing identified barriers. Information gained was incorporated into five statewide workshops and two publications aimed at increasing familiarity with tea production, tea processing techniques, and tea quality evaluation.

The project Team developed a survey to assess barriers that was distributed electronically to individuals associated with the Hawaii Tea Society, participants in a previous SCBGP FY12 tea project, the University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR) tea program, and The Kohala Center (TKC). A total of 39 respondents completed the survey. Almost three-quarters (72%) of the respondents were growing tea on Hawaii Island, distributed relatively evenly throughout Hawaii County. In addition, six respondents were from Maui County, three from Oahu, and two from Kauai.

The majority of survey respondents (74%) had grown tea for five years or less, with the oldest operations (three farms) engaged in tea production for 10-15 years. Nearly all growers, according to the survey, had no more than two acres of tea, with 36% having a quarter acre or less. The survey results imply that the total acreage in tea, as reported by survey respondents, is no more than 40 acres, and likely around 23 acres. The majority of growers (46%) obtain their plants from 'other' sources including several plant-distribution programs; this was closely followed by CTAHR/USDA (44%), and other growers/friends (36%). The majority of respondents were not yet harvesting tea on a regular basis, with 29% harvesting six or fewer times per year and two growers harvesting more than 35 times per year. Nearly all respondents processed by hand, with only three using some machinery.

The survey results indicated that the major challenges to tea production as experienced by respondents include labor, processing, and accessing planting material. The Team traveled to Japan in 2014 to conduct field work and observe labor and processing trends in tea growing regions in Japan that are similar to those occurring in Hawaii (i.e., small farms, similar elevation and rainfall, etc.). The trip provided insight into the importance of mechanization, even for small farms, to developing a high quality tea through efficient labor means. Farm groups or

cooperatives also proved to be another means of aggregating product and sharing the expense of mechanization.

Other challenges mentioned including pest and weed problems, particularly with rose beetles; pests were primarily addressed through non-chemical methods (hand weeding). Only 9% of respondents (three growers) had soil which measured an appropriate pH for growing tea (4.5-5.0) and one fourth of the respondents did not know their soil pH. Soil pH will be an important issue to address with tea growers in the future as pH determines optimal tea growth and production.

A total of 54 existing or potential tea growers statewide benefitted from the educational workshops. Publications will be disseminated via CTAHR and The Kohala Center's networks which reach over 400 individuals statewide.

Project Approach

The project followed the proposed Work Plan with some delays (1-2 months past the proposed Work Plan date) due to the personal schedules of some project team members.

A statewide tea growers' survey was designed by the Team and conducted with growers between May 1-31, 2014. The survey was hosted and administered by UH-CTAHR. Survey results were analyzed in June 2014 and used to determine key points for further inquiry with Hawaii tea farms, and with farms and tea professionals located in Japan. Due to the types of barriers and bottlenecks identified by Hawaii growers (labor, processing, planting material availability), the Team did not need to conduct traditional field testing to identify recommendations for Hawaii growers. Observational field work conducted in Japan, in addition to research into mechanization opportunities for Hawaii growers was performed and information disseminated to project participants. Labor challenges and processing were addressed simultaneously by demonstrating mechanization opportunities and by providing workshops on tea quality evaluation.

Project results were disseminated through two publications (survey results and tea quality evaluation) and five workshops (tea production, propagation, processing, and quality evaluation). Draft publications are attached. The Team provided Tea 101 workshops on Hawaii Island, Oahu, and Maui to encourage the development of the tea industry by working with existing, new, and potential tea farmers. The Tea 101 workshops incorporated information on on-farm labor and mechanization in harvesting and processing, in an effort to address the bottlenecks mentioned by survey respondents. The lack of planting material could not be addressed by CTAHR staff at the Tea 101 workshops due to financial constraints in preparing and shipping tea material inter-island. This remains an important challenge to be addressed by CTAHR through upcoming field work and educational workshops on plant propagation.

A theme repeated by survey respondents and tea farmers statewide is 'quality' – the need to recognize good and bad quality tea, to understand how processing affects quality, the impact of

plant variety, the tea type of the final product, etc. Consequently, the Team developed and pilot tested a tea quality workshop including the development-testing/training of the UH research station personnel. Kimberly and Takahiro Ino provided considerable education to the UH team given their experience in tea processing and quality development.

Goals and Outcomes Achieved

Outcome 1: Identify barriers to production of Hawaii-grown tea as experienced by tea growers statewide

To identify barriers to tea production in Hawaii the Team designed a survey for tea growers and disseminated it to over 40 statewide. A total of 39 completed surveys were returned, of which 28 were obtained from Hawaii Island and five from Maui. The project team anticipated a total of 10 completed surveys; consequently, the response rate exceeded their expectations and provided them with a broader understanding of the industry's challenges and extent of production. The survey cover letter and a draft publication containing the survey questions and a summary of the survey findings are attached to this report.

Survey results were summarized in a CTAHR publication (February 2016, draft) entitled *Hawaii Tea Growers Survey 2014* (attached). Survey questions requested information on the following topics: farm location, annual rainfall, farm elevation, irrigation practices, soil depth, quantity of tea planted, time period in production at current location, percentage of seedlings/cuttings, tea varieties, plant sources, soil and leaf tissue health, growing medium, fertilizer and pesticide practices, pest problems, weed problems, and tea buyers. The most commonly cited barriers to production included the lack of labor, processing challenges, and the lack of planting material. The majority of growers indicated that the pests listed in the survey were either not a problem or at worst a mild problem. Weeds were listed as a minor problem by a number of respondents with non-chemical methods being the dominant form of control. Survey respondents indicated their willingness to attend workshops on tea. The most popular topics included harvesting and processing, pruning, tea cultivation, soil and tissue sampling, and marketing.

Outcome 2: Identify key recommendations to increase the statewide production of Hawaii-grown tea

The survey work guided the Team's identification of recommendations to growers to increase the production of Hawaii-grown tea. In addition to outreach with growers, including Mauna Kea Tea owners Kimberly and Takahiro Ino, the Team traveled to Japan to in August-September 2014 to interview tea farmers in the tea regions of Yame-Kumamoto, Kagoshima, and Okinawa.

Field work was performed through conducting participatory and observational research with tea growers in Japan and observing their methods for addressing labor and mechanization issues. The Team focused on small to medium sized operations that would be more similar to Hawaii's tea farms. In general, tea operations (even small farms) in Japan incorporated considerable mechanization as opposed to Hawaii's farms, in both harvesting and processing.

Consequently, labor was less of a problem on tea farms in Japan; only one farm relied on hand harvesting and was able to work with older individuals accustomed to manual agricultural work, in addition to local volunteer school groups. Many farmers in Japan faced similar challenges to Hawaii's growers in terms of weeds and insect pests, on both conventional and organic operations. The most important bottleneck for some Japanese growers is wind damage from storms, which is addressed through the planting of temporary windbreaks to protect young tea plants from wind and salt injury caused by typhoon winds. The marketing and promotion of tea in Japan is more intensive than in Hawaii, with distribution systems ranging from large cooperatives and auction houses to individual users that handle processing and marketing in house. Japanese value-added tea processors offer a wide variety of products including packaged and powered tea, bottled tea, noodles, matcha salt, candies, cookies, ice cream and other confections, and cosmetic and bath products.

A report from the Japan trip and a photo journal are attached to this report.

Outcome 3: Disseminate recommendations to tea growers statewide on means to increase the production of Hawaii-grown tea.
To address survey respondent's needs for training and education on production, mechanization, and business development, the Team designed workshops that provided an overview of production and processing, and tea quality evaluation. In addition, the Team developed two publications that will be disseminated through the University of Hawaii's College of Tropical Agriculture and Human Resources; currently the publications are in press.

For Hawaii growers, the lack of labor beyond a certain level will require mechanization in production and processing, a direction that is currently being pursued by Japanese tea growers, primarily with the assistance of equipment providers. Workshops were designed so that participants gained hands-on experience with processing and saw the machines involved in mechanization, in addition to obtaining an overview on tea production and propagation. Additionally, two workshops were given on tea quality evaluation to further develop the skills of tea farmers in product development and marketing.

A total of five statewide workshops were held between November 5, 2015, and January 14, 2016, on tea quality evaluation (two workshops) and tea production and processing (three workshops). No workshops were held on Kauai due to the low number of individuals growing tea on Kauai (two). Development of a new workshop on Tea Quality Evaluation was field tested on November 5 and December 1, 2015 on Hawaii Island where the majority of the growers are located. The attendance goal for the workshops was 20 per workshop; low participation numbers outside of Hawaii Island are attributed to lack of growers on the islands of Oahu and Maui. A total of 54 attendees were present at the five workshops.

- Nov. 5, 2015 Green Tea Quality Evaluation Training: Mealani Research Station, Waimea, Hawaii (10)
- Nov. 18, 2015 An Introduction to Tea Production and Processing, Maui CES Office, Kahului, Maui (6)

- Nov. 19, 2015. An Introduction to Tea Production and Processing, Pearl City Urban Garden Center, Honolulu (3)
- Dec. 1, 2015. Green Tea Quality Evaluation. Waimea Civic Center, Waimea, Hawaii (15)
- Jan. 14, 2016. Tea 101: Introduction to Tea Production and Processing, Mealani Research Station, Waimea, Hawaii (20)

Tea Workshop Evaluation Results

Tea 101 Workshops (aggregated)

1. Overall, how would you rate today's workshop on usefulness of information.
   (1=poor, 4=excellent) Mean score = 3.9
2. After today's presentations, how would you rate the increase in your knowledge and understanding of today's topic area?
   (0=no change, 4=a lot) Mean score = 3.9
3. Teaching methods were appropriate
   (1=strongly disagree, 3=not sure, 5=strongly agree) Mean score = 4.7
4. How many items/subjects that you learned will you apply to your operation?
   Mean score = 9.25 items/subjects

Tea Quality Workshop (aggregated)

1. Overall, how would you rate today's workshop on usefulness of information.
   (1=poor, 4=excellent) Mean score = 3.8
2. After today's presentations, how would you rate the increase in your knowledge & understanding of today's topic area?
   (0=no change, 4=a lot) Mean score = 3.7
3. Teaching methods were appropriate
   (1=strongly disagree, 3=not sure, 5=strongly agree) Mean score = 4.56
4. How many items/subjects that you learned will you apply to your operation?
   Mean score = 8.1 items/subjects
5. What did you like best about today's event (open ended question)
   The wide variety of hands on. Your teaching method was very good, thank you. Progressive experience built up taste evaluation. Experiencing what can go wrong in tea production and why. And then experiencing what is right about tea. Good instructor. Actual tasting of tea and explanation that went with it. I enjoyed the structure of the tastings. The actual visual presentation – and the fact that it was a "real" tea maker giving the instruction. Tasting and focus on objective quality. Hands-on creation of tea
6. How could we improve the event? (open ended question)
   You did well. All good. Maybe another example of a good tea and what made it that way. More events. More context on how taste is correlated to pricing and marketability of teas. Include processing.

Beneficiaries

Beneficiaries of the project include existing, new, and potential tea growers statewide. A total of 54 individuals benefited from the information disseminated at the workshops. Survey results, in the form of the publication, in addition to the Tea Quality Evaluation publication will be emailed to all project participants via CTAHR and TKC's networks. CTAHR has future plans to engage tea growers through workshops on marketing and planting, by focusing on increasing CTAHR's stock of planting material for dissemination at local workshops.

As future work is done with Hawaii's tea industry, it is hoped that the discrepancy between the annual yield at the CTAHR Mealani Research Station and the 10 known tea producing farms in the State will diminish (Nakamoto et. al., 2011). According to the UH study, Hawaii's known tea plantings could be producing 26,968 pounds per year of finished tea; however, the authors estimate that the actual annual production level of tea statewide is much lower, at 5000 pounds of tea per year. If the State's producing tea farms could generate yields resembling the test plot's average yield, and the extra tea was sold at reported market sales prices ($132.16 - $573.92/lb.), the Hawaii's tea industry could earn an additional $2.9-$12.6 million per year from the increase in production; this figure does not include crops currently in the development stage.

Lessons Learned

Two lessons were learned from this project:

1) In hindsight it was difficult to design an open-ended research project where the barriers to tea production and processing were not identified beforehand, leading to a detailed plan for research and education. This was the first assessment conducted with tea growers on barriers to production/processing and therefore it was worthwhile as an informative educational tool for researchers to help them better design educational initiatives and research priorities. However, it resulted in the lack of recommendations to growers other than a focus on education in mechanization opportunities and tea quality development.

2) The project was designed to have statewide impact which can be challenging in an island state, particularly when the industry is dispersed differently throughout the island counties. The majority of growers are located on Hawaii Island, however the emphasis of the original proposal required tea education opportunities to be provided statewide; a project revision was done which allowed workshops to focus on the islands of Hawaii, Oahu, and Maui, while excluding Kauai, where only two of 39 survey respondents were located. Consequently, the workshops on Maui and Oahu focused primarily on general tea education in production and processing, where workshops on Hawaii Island went more in-depth to focus on tea processing and quality.

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Additional information

The following are included in ATTACHMENT 1:

1. *Hawaii Tea Growers Survey 2014* (CTAHR, February 2016, draft) (includes survey questions)
2. *Green Tea Quality Evaluation: Identifying Common Defects* (CTAHR, January 2016, draft)
3. Survey Cover Letter
4. Advertisement for TKC Ag Bulletin (Tea Quality Workshops)
5. Workshop Flyers (4)
6. Workshop Evaluation Form
7. Japan Trip Report
8. Japan Trip – Photo Journal

Breadfruit versus Potato: A Public Education Campaign to Enhance the Competiveness of a Hawaiian Staple

Final Report

Hawaii Homegrown Food Network
http://www.hawaiihomegrown.net
http://www.breadfruit.info

Project Summary

This project was a public education campaign that enhanced the competitiveness of breadfruit by promoting:

- Consumption of a superior locally grown staple food
- Food self-sufficiency by substituting for an imported staple, and;
- Child and adult nutrition knowledge.

A key to increasing food self-sufficiency in Hawaii is to substitute locally grown staples for imported foods. A comparison of Breadfruit vs. Potato showed that Hawaii's ancient staple, breadfruit, is superior to imported white potato in many respects. Educating adults and children about the nutritional, economic, environmental, cultural and culinary advantages of breadfruit will directly increase its competitiveness in the local market.
Using bold graphics and featuring local celebrities, the public education campaign disseminated good-humored, easy-to-understand messages that promoted the consumption of breadfruit. The campaign used editorial and paid media—print, radio, public access television, social media, on-line and electronic media; posters and handouts, and; events.
Long-term project impacts include a stronger local agricultural economy, increased food security and self-sufficiency, and healthier adults and children. This project was a part of Hoʻoulu ka ʻUlu—an initiative of the Hawaii Homegrown Food Network and the Breadfruit Institute of the National Tropical Botanical Garden to revitalize breadfruit in Hawaii.

Project Approach

The project established partnerships with retail outlets and suppliers on Hawaii, Maui, Kauai, and Oahu, developed outreach materials, held a youth poster and video contest, and presented retail campaigns in Kona, Hawaii Island, Waianae and Kahala, Oahu, Lihue, Kauai and Kahului, Maui. Due to lack of training of producers, handlers, and consumers, the supply of consistently high quality breadfruit is the biggest challenge of this nascent industry.

Key messages:

A series of "edugraphics" using these key messages and additional supporting statements have been developed for use in social media and conventional media (see examples below). These graphics have been released on social media and in print in outreach activities.
Key messages authored and used for this campaign:
Breadfruit vs. Potato—You decide
ʻUlu vs. Spud—The Choice is Ours

Breadfruit, It's Not Small Potatoes™
Hawaiian Breadfruit—100% Local, 100% Ono
Anything potato can do breadfruit can do: ☐as well, ☐better, ✓best

Chef demos

Celebrity Chef Sam Choy was the voice and face of Breadfruit vs. Potato. This included authoring recipes and conducting cooking demonstrations at partner retailer locations. Chef Sam Choy is known throughout Hawaii, the Pacific, nationally, and internationally, as an advocate for healthy island foods with regional cuisine. Sam grew up eating breadfruit and was the perfect ambassador for the Breadfruit vs. Potato message.

Much of the campaign outreach centered around chef demos. The Breadfruit vs. Potato messages were included in all outreach and promotion for the demos. A summary of the demos follows.

Demo dates	Presenters and Location	Est. # reached	Notes
February 28, 2015	Project coordinators and local breadfruit entrepreneur	200	The Grow Hawaiian Festival venue was the kick off location where handling, nutrition, and recipe information was distributed.
March 6, 2015	Chef Sam Choy, KTA Super Store, Kailua-Kona	125	Both KTA stores in Kona participated in a month-long pilot to sell fresh breadfruit. Over 300 pounds of fruit was delivered to the stores and was sold quickly after each delivery.
August 15– September 12, 2015	Waianae Eat Local Challenge	1,276	Distribution of Recipe cards, Brief Breadfruit basics, Youth Posters, Nutrition Cards and Eat More ʻUlu stickers in packets to all participants. Vendors had ʻulu available for sale during project period at farmers markets.
September 8, 2015	Chef Sam Choy, five Oahu radio stations	thousands	Chef Sam Choy was interviewed by three morning radio stations for "Tasty Tuesday," Island (FM 98.5), Jamz (FM 93.9), and Star (FM 101.9). The announcers tasted four breadfruit dishes prepared by Chef Choy.
September 12, 2015	Chef Sam Choy, Waianae, Oahu	300	Chef Sam Choy held a Breadfruit vs. Potato cooking demo on the final day of the Waianae Coast Comprehensive Health Center Eat Local Challenge month. Students from the local college culinary class assisted Sam by plating hundreds of samples.
September 13, 2015	Chef Sam Choy, Kahala, Oahu	125	Chef Sam Choy demonstrated how to cut, handle and prepare simple breadfruit dishes at Whole Foods in Kahala.
September 19, 2015	Chef Sam Choy, Lihue, Kauai	200	Chef Sam Choy demonstrated how to cut, handle and prepare simple breadfruit dishes at Times

			Supermarket in Lihue. Seven volunteers from the Breadfruit Institute assisted in cooking and plating samples.
September 16 and 20, 2015	Chef John Cadman	60	Chef John Cadman, owner of Maui Breadfruit Company, demonstrated how to cut, handle and prepare simple breadfruit dishes at Whole Foods in Kahului.

Dish samples were served at each of the demos to give people an experience of how tasty breadfruit can be when harvested and prepared correctly. Presenters also demonstrated how easy it is to cut up a fresh breadfruit and cook a simple dish.

Posters and Handouts were completed and ready for dissemination in Spring 2015. Project staff distributed the shelf-talkers and other content developed at the demos in addition to Breadfruit Variety Cards, Breadfruit Nutritional Value, Brief Breadfruit Basics, and Recipe Cards. The *Breadfruit Production Guide*, Harvest & Postharvest Video, *Hoʻoulu ka ʻUlu Cookbook*, and Sam Choy videos were also promoted.
The demos gave both consumers and retailers better familiarity with selecting fruit, preparing dishes, and handling breadfruit.

Develop educational content

In collaboration with celebrity chef Sam Choy, project staff developed five original recipes related to common dishes that use white potato: breadfruit salad, breadfruit chowder, breadfruit-fish cakes, breadfruit poke, and breadfruit kale salad. On the reverse side of the recipe sheet, basic facts about breadfruit were highlighted. This letter-size sheet was supplied to supermarkets as "shelf talkers" that stores and markets could utilize to educate consumers at the point of sales, at cooking demos, and other project educational events. All Breadfruit vs. Potato information, including Sam Choy's recipe sheet can be found posted at: http://hawaiihomegrown.net/breadfruit-vs-potato and much of this information is mirrored at http://ntbg.org/breadfruit/resources

Printed information	Number distributed
Sam Choy Recipe Cards	2,000
Brief Breadfruit Basics	2,000
Breadfruit Nutritional Value	2,000
Breadfruit Variety Cards	1,000
Youth Posters	1,000

The School Poster and Video Contest outreach material were distributed and posted to http://hawaiihomegrown.net/breadfruit-vs-potato/12-passive/resources/525-breadfruit-vs-potato-youth-poster-and-video-contest. The winning entries are posted at www.breadfruit.info.

PROMOTIONAL OUTREACH AND MEDIA

Paid advertising

Project staff printed event advertisements with Breadfruit vs. Potato messages in the following:

Ka Wai Ola (Office of Hawaiian Affairs): one advertisement 64,000 copies plus Internet version
MidWeek: one advertisement, circulation of 270,000 on Oahu
TGIF: one advertisement, 297,724 statewide reach
Maui Time Magazine: two advertisements, circulation of 18,000

Media coverage

Hawaii News Now (KHNL) news story:
http://www.hawaiinewsnow.com/Global/story.asp?S=30017716
Garden Island on Sam Choy: http://thegardenisland.com/news/local/sam-choy-breadfruit-over-potato/article_6eb64c96-17d6-507f-a6d5-10b8bf31c989.html?TNNoMobile
For Kauai on Diane Ragone: http://www.forkauaionline.com/hooulu-ka-ulu-o-hawaii-nei/
Tasting Kauai: https://www.tastingkauai.com/sam-choy-in-kauai-for-cooking-demo/
Radio interviews: Island (FM 98.5), Jamz (FM 93.9), and Star (FM 101.9)
Maui Time calendar announcement: http://mauitime.com/food-drink/maui-food-news/breadfruit-vs-potato-with-chef-john-cadman/
Maui News Local Briefs: http://mauinews.com/page/category.detail/nav/15/Community-News.html

Video

Sam Choy Video (produced as a SCBGP FY12 deliverable, but promoted this project period)	25,193 views
Harvest & Postharvest Video	20,178 views
John Cadman	251 views
Choose ‘Ulu!	134 views
Aunty Berta Breadfruit vs. Potato	104 views

Educational partnership produced the *Roots of ‘Ulu* documentary film. Screenings were: Hawaii International Film Festival (Oahu, Kauai, Molokai, Hawaii Island) reached approximately 1,000 audience members; Waimea Ocean Film Festival reached approximately 500 audience members. This film is planned for showing nationally via the Public Broadcasting System.

Partner promotion

The Waianae Coast Comprehensive Health Center (WCCHC) mentioned their partnership with the Breadfruit vs. Potato campaign and Sam Choy’s Sept. 12 cooking demo on Perry & Price’s #1 rated Saturday morning show. WCCHC also ran a print media campaign (Star Advertiser, Midweek, Midweek West Oahu Voice + Go Kapolei), which mentioned the Sept. 12 cooking demo. Additionally, WCCHC ran an extensive social media campaign with cross-promotions of the Waianae demo.
Whole Foods Market promoted in-store demos on their Facebook page as well as email list (10,000+ subscribers).
Whole Foods Market, KTA, and Times Supermarket promoted the events in their stores in the run-up to in-store demos.

Statewide Proclamations

Coinciding with the Breadfruit vs. Potato campaign, Governor David Ige and the Mayors of Maui, Hawaii, and Kauai Counties all declared September, 2015 the month to revitalize breadfruit by issuing proclamations.

Internet

Facebook: Breadfruit Institute reached approximately 199,000 people (detailed below); Hawaii Homegrown Food Network reached over 3,000 people.

DATE	POST	LIKES	SHARES	REACH
2/26/15	The Waianae Coast Comprehensive Health Center (WCCHC) takes their 'ulu (breadfruit) seriously!	37	13	555
7/26/15	Remember, a firm, starchy, mature breadfruit can be boiled, steamed, or baked and replace potatoes in many recipes. A RIPE fruit is soft, creamy, and sweet and can be eaten raw or made into delicious treats like these.	550	1,000	12,100
8/8/15	Chef Sam Choy, Hawai‘i’s “‘Ulu Ambassador,” will hold a free Breadfruit Cooking Demonstration at KTA Kailua-Kona. The event is a part of the Breadfruit vs. Potato initiative of the Ho‘oulu ka ‘Ulu project.	35	134	814
9/1/15	Hawaii Governor David Ige and the mayors of all Hawaii counties proclaim September as the month to “Ho‘oulu ka ‘Ulu O Hawai‘i Nei”	61	47	3913
9/5/15	#BreadfruitvsPotato #betterwithbreadfruit	259	365	49710
9/5/15	The Breadfruit vs. Potato campaign is making a September to remember in Hawaii!	45	19	1331
9/6/15	Move over nectarines, and make room for breadfruit! Times Supermarket in Lihue, Hawaii carries breadfruit in the produce department for the first time. #BreadfruitvsPotato #ohnoweresurrounded #itsastart	143	16	3578
9/7/15	The best Au Gratin isn't made with potatoes! We're hosting Breadfruit vs. Potato events throughout Hawaii to raise awareness about the incredible importance of learning to eat and grow local foods for a healthier lifestyle and abundant future.	93	89	6116

DATE	POST	LIKES	SHARES	REACH
9/9/15	We're working on it! #BreadfruitvsPotato #betterwithbreadfruit breadfruit.org breadfruit.info Hawaii has proclaimed September the month to "Hoʻoulu ka ʻUlu o Hawaiʻi Nei"–lift up and celebrate breadfruit in the Aloha State.	125	144	30866
9/10/15	The #BreadfruitvsPotato campaign takes over Oahu this weekend with some awesome events planned.	40	14	743
9/11/15	Is breadfruit nutritious?	75	60	4655
9/11/15	#BreadfruitvsPotato starts tomorrow on Oahu, and it's going to be AWESOME.	44	14	1476
9/12/15	Food prep for tomorrow's breadfruit cooking demo with the awesome folks from Mākeke Wai'anae	53		829
9/13/15	163 breadfruit trees distributed in 1 hour at the finale of the Waianae Eat Local Challenge. Now the 'ulu food fun begins with Chef Sam Choy.	126	17	2921
9/14/15	AND it tastes great! #BreadfruitvsPotato	142	78	8015
9/15/15	Maui friends, #BreadfruitvsPotato is headed your way this week with two exciting and tasty events starting this Wednesday!	54	52	3221
9/15/15	This 8.5 lb. Yap breadfruit weighs more than the average newborn baby! It's almost unfair to put it next to the little potato (but we did it anyway). Learn more about the delicious Yap variety at http://ntbg.org/breadfruit/database/search/selected/. #BreadfruitvsPotato #itskindofnotfair #feedafamilyononefruit	72	25	1993
9/16/15	Hundreds of lucky people got to try Chef Sam Choy's delicious local-style 'Ulu Salad last weekend on Oahu, and it was a hit!	58	37	3206
9/17/15	Maui and Kauai, there are still more awesome #BreadfruitvsPotato events scheduled! Don't miss Chef John Cadman at Whole Foods, Kahului TODAY at 11am!	28	2	550
9/17/15	There are so many great breadfruit events planned this weekend, one might think the Hawaii governor and mayors declared September as the month to celebrate breadfruit. Oh wait, they did!	40	3	1010

DATE	POST	LIKES	SHARES	REACH
9/18/15	We can't have celebrity Chef Sam Choy cook dinner for everyone, but we can put his ultimate 'ulu (breadfruit) recipes in your kitchen!	25	18	1200
9/18/15	#BreadfruitvsPotato	237	228	22083
9/19/15	Tomorrow and Sunday!!! #BreadfruitvsPotato	28	1	512
9/20/15	'Ulu extravaganza!! Thank you to the nearly 200 people who came out for Chef Sam Choy's Breadfruit cooking demonstration at Times Supermarket, Kauai today!	76	12	3126
9/23/15	#BreadfruitvsPotato	104	72	6759
9/23/15	Our thanks to Chef Sam Choy for making his secret recipes available to all of us!	42	13	2484
9/24/15	"The Choice is Yours" by Teah Laupapa, Kapolei Middle School, Oahu Hawaii.	175	192	13986
9/25/15	Lovely and interesting coverage of our #BreadfruitvsPotato campaign in the Honolulu Star Advertiser.	45	12	1091
9/25/15	From Chef Sam Choy's kitchen to your table, Pan-Fried 'Ulu (Breadfruit) Cakes with Salted Cod.	36	20	1497
9/27/15	"Let the Battle Begin" by Melia LaFleur, Kapoei Middle School, Oahu.	75	27	2605
9/28/15	Get ready to smile while you watch "Choose 'Ulu!" by the awesome students and staff of Kua O Ka La Public Charter School.	20	17	1309
9/29/15	Chef John Cadman is a really important part of our breadfruit community, and he's got some great information to share with you.	55	29	2619
10/1/15	September was a great month for 'ulu (breadfruit) in Hawaii.	57	1	1775
Total				198648

Retail sales of fresh fruit (Consumption)

The following data are estimates based on retailer interviews. Most retailers had small or no breadfruit sales during 2013. Some retailers are now attempting to stock breadfruit on a regular basis, although supply is inconsistent (marked with *). Some retail locations stocked breadfruit during the August–September Breadfruit vs. Potato campaign, but have no current plans to stock fresh breadfruit.

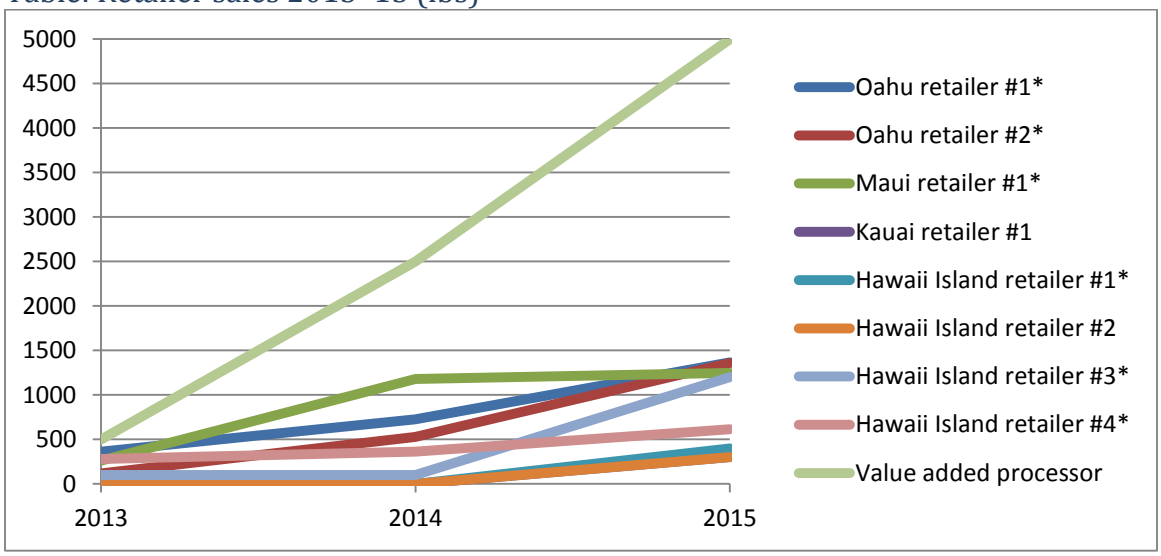
Location	2013 (pounds)	2014 (pounds)	2015 (pounds)	% Increase
Oahu retailer #1*	364	726	1366	275%
Oahu retailer #2*	120	530	1358	1032%

Location	2013 (pounds)	2014 (pounds)	2015 (pounds)	% Increase
Maui retailer #1*	263	1179	1246	374%
Kauai retailer #1	0	0	300	Inf.
Hawaii Island retailer #1*	0	0	400	Inf.
Hawaii Island retailer #2	0	0	300	Inf.
Hawaii Island retailer #3*	100	100	1200	1200%
Hawaii Island retailer #4*	279	362	614	120%
Waianae Farmers Market*	No data	No data	Sales increased approximately 50% during Breadfruit vs. Potato campaign	50%
Keauhou Farmers Market*	No data	No data	# of vendors selling breadfruit up 100%	Unk.
Value added processor	500	2500	5000	1000%

Farmer sales

Grower	2013 (pounds)	2014 (pounds)	2015 (pounds)	% Increase
Oahu farm #1	No data	No data	Est. 20%	20%
Kona farm #1	Negligible	600	1200	Inf.
Kona farm #2	600	600	1200	100%

Table: Retailer sales 2013–15 (lbs)



Goals and Outcomes Achieved

Outcome #1

- Goal: Increase consumption of breadfruit.
- Performance Measure: Increase in sales from first harvest season to last harvest season during project period (harvest season varies depending on weather).
- Benchmark: Survey of partner venues
- Target: 20 percent increase in sales from first harvest season to last harvest season by surveyed venues.

Actual Outcome

Based on interviews with retail outlets, the demand is strong (especially in areas with high Hawaiian and Pacific Islander populations), however, there is currently not enough consistent supply to meet that demand. During the project period (chosen because it was breadfruit season and project staff ensured supply through partners) an increase of more than 20% was evident.

Outcome #2

- Goal: Increase sales of breadfruit by growers.
- Performance Measure: Increase in sales from first harvest season to last harvest season during project period (time of harvest season varies depends upon weather).
- Benchmark: Survey of grower partners
- Target: 20 percent increase in sales from first harvest season to last harvest season by surveyed venues.

Actual outcome and analysis: Overall increase in sales well in excess of 20% See above table for detail.

There are currently few commercial growers/suppliers of breadfruit. However, project staff expect this will change dramatically over the next four years, as numerous trees have been planted on Maui, Hawaii Island, and Oahu, with additional projects in the planning stages. Growers who supplied breadfruit during the project period experienced increased sales.

Outcome #3

- Goal: Increase public awareness about the value of a locally grown vs. imported staple.
- Performance Measure: Educational materials created; distribution and reach of public education campaign; and outreach at events.
- Benchmark: Survey of existing resources.
- Target: Ten key messages with corresponding ads, info-graphics, articles, handouts and posters.
- Statewide reach; gross media impressions of paid and editorial media including: print, radio, TV, social, online, signage or at least 100,000 people.
- One educational event per island—outreach to 2,000 people.

Actual outcome: The media outreach activities (paid and editorial) reached about one million people in Hawaii. Cooking demonstration events reached 1,000 people and the Waianae Eat

Local Challenge reached 1,276 through direct distribution of educational materials in participant packets. See above for detail.

Beneficiaries

Waianae Eat Local Challenge participants 1,276
Participants at cooking demonstration events at Times Supermarket, Kauai, KTA, Kona Whole Foods Kahala, Whole Foods Kahului, Waianae ‘Ulu festival (1,000)

Outcomes → **Actions ↓**	Increased health, reduction of obesity	Increased nutritional knowledge	Affordable local staple / Food security	Cultural connection
Cooking Demonstrations	Yes	Yes	Yes	Yes
2,000 Nutrition and Recipe cards, Breadfruit basics and youth posters distributed	Likely	Yes	Yes	Yes
Consumption Increased at all venues	Likely	Yes	Yes	Yes
100 trees–Tree Give Away in Waianae	Future outcome	N/A	Future outcome	Yes

Growers experienced increased demand for breadfruit at farmers markets, supermarkets and restaurants
Retailers and farmers markets generally experienced large increases in sales, although sporadic supply was an issue. Project staff expect that these sales directly replaced imports of starches such as potato.

Lessons Learned

Due to the timing of the arrival of the first payment, the campaign and materials were not ready in time to launch during the fall (Sept–Nov 2014) breadfruit harvest season. It is important to raise awareness and drive consumers to purchase breadfruit during times when it is available in the markets and stores. Ads, info-graphics, handouts and posters will be developed and deployed to coincide with the next breadfruit harvest season.
A reliable supply of high quality fruit is the biggest issue in increasing breadfruit as a commercial crop. Much of the fruit in markets is immature and inferior in eating quality. This is due to the short shelf life of mature fruit, when not handled and stored correctly. Harvest seasons are short (6 weeks) and of variable timing. Some regions (such as Kona) have two harvest seasons per year, while many regions only have one harvest season. This presents a challenge for consistent supply, which the commercial industry will also face. In order to

guarantee high quality fruit at project venues, the project team worked in the field harvesting together with farmers. Project staff also spent time training retailers in storage and handling of high quality fruit.

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Additional information

The following are included in ATTACHMENT 2:

- Proclamations
- Sam Choy recipe cards
- Guidelines and Outreach materials for Youth Media Contest
- Youth Posters
- Edugraphics
- Event photos
- Social media graphics

The following materials were developed under a separate grant, but printed and distributed during this project:

- Breadfruit Nutritional Value
- Breadfruit Variety Cards
- Brief Breadfruit Basics
- Breadfruit Production Guide

Controlling Seasonal Fruit Quality in Pineapple: Translucency and Acidity

Final Report

University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources (CTAHR)
Tropical Plant and Soil Sciences
http://www.ctahr.hawaii.edu/site/

Project Summary

The foliar* application of potassium and calcium at flowering when cell division is still taking place had no discernible impact of normal fruit growth. Potassium application at this time did lead to a significantly higher acidity in the fruit when overall fruit acidity was low. Calcium responses on translucency were more muted with overall fruit calcium levels only increased slightly. The tests run under this grant have provide crucial data for the current trials that will be harvested over the next five months. The new trials will test different rates and times of application of potassium and calcium.
*Foliar feeding is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Plants are able to absorb essential elements through their leaves. The absorption takes place through their stomata and also through their epidermis.

Project Approach

This project was carried out with Dole Fresh Fruit, Hawaii as a partner. Dole granted the project staff free access to install field tests in already established commercial pineapple fields and covered the cost of field preparation, planting, fertilization and, disease and insect control.

Four large field trials were installed and harvested, an earlier fifth trial was lost. Another test is to be harvested in May 2015 with another field installed at that time and a third in June 2015 (after the project time period covered under this grant). All field trials were randomized complete blocks with three replications. The treatments involved foliar applications of calcium and potassium salts at mid- to late flowering. Application rates were based on earlier published research and the project manager's earlier studies. The treatments were:

1. Check Plantation practice
2. 2% $CaCl_2$ from mid-flowering two occasions one month apart
3. 2% KCl from mid-flowering two occasions one month apart
4. 2% $CaCl_2$ from mid-flowering four occasions a fortnight apart
5. 2% KCl from mid-flowering four occasions a fortnight apart
6. 2% $CaCl_2$ and 2% KCl from mid-flowering two occasions one month apart
7. 2% $CaCl_2$ and 2% KCl from mid-flowering four occasions a fortnight apart
8. GA_3 200 ai ppm 16 and 18 weeks from forcing

The data was collected from 15 feet of the center beds. Approximately 25 fruit were harvested from each plot. Fruit were harvested at shell color 2 (yellowing visible at the base of the fruit) and data on fruit and crown size, and fruit characteristics including translucency were collected. A sub-sampled of six fruit per plot was taken for fruit characteristics: Total soluble solids (TSS), titratable acidity (TA) and tissue calcium and potassium. Translucency will be measured after

the fruit is cut, based on the percentage of flesh that is translucent (0%: opaque flesh, not translucent; to 100%: fully translucent) (Paull and Reyes, 1996). This was converted to an index in which 1 = opaque flesh and 6 =fully translucent flesh. Fruit calcium and potassium was measured by homogenizing 50 g of fruit flesh in 100 ml deionized water, then taking a 20 ml aliquot of the mixture and adding 20 ml of 12 M HCl. The solution was heated at 60°C for 30 minutes and filtered through Whatman #42 filter paper into a 50 ml volumetric flask. The solution was made to volume with deionized water and the calcium concentration determined with an inductively coupled plasma analyzer (Qiu, et al., 1995).

The results were analyzed by analysis of variance using SAS/STAT (SAS Institute Inc., Cary, NC, 1988) and means were compared with the Duncan's Multiple Range test.

Goals and Outcomes Achieved

Short Term:

In all four trials the treatments had no significant impact on fruit weight or length, and crown weight and length. No phytotoxicity was seen also in the trials from the foliage application or in fruit development, all maturing at a similar rate. In the trials both 73-114 and 73-050 showed no increase in fruit size as was expected from GA_3 application. It is possible that the expected size increase from GA_3 application that occurs in pineapple in more tropical areas may not occur in the cooler tropics and might require a different application regime or rate.

Translucency rate varied between trials from less than 7% of the fruit flesh showing translucency to 50% in other trials. Translucency has been shown to be very seasonal in published results. In each trial, except for the trial that had an overall low rate of translucency, considerable variation occurred in translucency severity between fruit in each treatment. This variation could mask any significant difference due to treatments. In two of the trials translucency tended to be less but not significantly when four application of calcium were applied. In the trial on 73-050 harvested in 2015 April no such trend was seen (Table 1). These findings disagree with published results and the new trials recently installed a higher rate of calcium is being applied (5%). The rate used (2%) had in earlier trials significantly increased fruit flesh calcium however in this trial the increase was only about 7% (Table 2).

The application of potassium during early fruit development did increase potassium levels in the fruit at harvest by about 12% and the acidity levels about 25% to 0.55 to 0.6 % citric acid equivalents. This increase in acidity was most pronounced when the acid levels were low in the control treatment. When the fruit acidity was greater than 0.5 % acidity tended to be higher if potassium was applied though not significantly.

The low acid hybrids, such as 73-114 and 73-050 used in these tests, show a rapid decline in acidity as the fruit approaches maturity and starts to ripen. This decline is more dramatic than in the older canning varieties and suggests another way to achieve final desired sugars/acids ratio at harvest by modifying the harvest date. However the window for harvest would be more narrow and require having a very uniformly ripening field. Currently installed trials will help to answer questions relating to utility of this potassium foliar sprays for fruit acid management and the flexibility in the timing of application.

Table 1. Application of foliar sprays from mid- to late flowering on translucency, total soluble solids and titratable acidity. (2015 April; cv 73-050)

Treatment	Translucency (%)	Total Soluble Solids (%)	Titratable Acidity (%)
Control	46 4 a	13.7 a	0.42 c
2% $CaCl_2$ twice - one month apart	43.0 a	13.9 a	0.42 c
3. 2% KCl twice - one month apart	35.9 a	14.0 a	0.44 c
4. 2% $CaCl_2$ four times a fortnight apart	45.0 a	13.4 a	0.44 c
5. 2% KCl four times a fortnight apart	42.9 a	13.7 a	0.54 b
6. 2% $CaCl_2$ and 2% KCl twice one month apart	43.8 a	14.2 a	0.58 a
7. 2% $CaCl_2$ and 2% KCl four times a fortnight apart	50.3 a	13.5 a	0.55 ab
8. GA3 200 ai ppm 16 and 18 weeks from forcing	43.8 a	13.5 a	0.55 ab

Table 2. Fruit flesh levels of potassium and calcium following application during flowering (2015 April; cv 73-050)

	Potassium (ug/mL)	Calcium (ug/mL)
Control	19.4	0.91
2% $CaCl_2$ twice - one month apart	21.1	0.81
2% $CaCl_2$ four times - fortnight apart	16.4	0.95
2% $CaCl_2$ and 2% KCl four times - fortnight apart	23.5	1.01

Long-Term

The tests did highlight the difficulty of controlling fruit translucency and acid with calcium and potassium. Calcium is normally taken up into the fruit during early fruit development when rapid cell division is occurring and is poorly transport into the flesh during the expanding phases of fruit growth after flowering has finished. Potassium is very mobile in the fruit and therefore could be applied at any stage of fruit development. The economics of a spray application suggests that if a foliar application of potassium could occur during a current routine spray

practice then it would lower overall costs. Tests are underway to determine whether potassium can be applied near harvest with the current ethephon spray and still impact fruit acidity levels at harvest.

The project staff have already released in 2014 a free on-line extension bulletin on the handling of pineapple postharvest, see additional material below. This is an updated version of an older USDA Handbook #66 publication chapter. Upon completion of the next series of experiments, planned till 2016 June, The project staff will develop another extension bulletin on the impact of pineapple pre-harvest production practices on postharvest quality that will incorporate the results from this project.

Beneficiaries

The principle benefit of this research is to increase the profitability of the forty-two Hawaii pineapple farmers (2012 Census). The primary beneficiary will be:

1) Pineapple growers in Hawaii (42, 2012 Census).
2) State of Hawaii exporting consistent high quality product with reduced losses.

Losses of fruit reported to be upwards of 30% or more at certain times of the year due to translucency represent a significant cost to producers. Reduction of this loss will increase their profitability and their chances of long-term survival.

Maintaining taste quality is crucial to maintaining consumer satisfaction. The new low acid cultivar tend to have lower acid level during the warm season. Developing ways to increase the acid levels in an economic manner is essential.

With increased competition from foreign countries, improving quality and translucency enhances the competitiveness of pineapple grown in Hawaii as demonstrated by a letter from the General Manager of Dole Fruit Company. (ATTACHMENT 3)

Lessons Learned

Two major outcomes were anticipated from the proposed research. The first outcome would be knowledge as to whether calcium and potassium application can significantly reduce the occurrence of fruit translucency and acidity. The project staff were able to show that potassium applied at flowering does increase fruit potassium and acidity at fruit harvest. Translucency in project tests was highly variable though there is a suggestion that calcium possibly had an effect. Higher rates are being tested in the newly installed tests.

The second hoped for outcome would be recommendations as to time of application and application rate to minimize translucency. The one-year time-frame of this grant did not allow the project to reach that point. Work is continuing on this aspect. The important consideration is that a recommendation must be practical and attempt to compliment current management practices.

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Development of Genetically Engineered Blue Anthuriums

Final Report

Hawaii Agriculture Research Center (HARC)
http://www.harc-hspa.com

Project Summary

Hawaii's cut flower anthuriums have had worldwide appeal as exotic tropical specialties. As other national and international growers entered production, the Hawaii-grown anthuriums required increased marketing, more creative presentation, and reduced production costs to remain competitive. New products help support price stability and can overcome the increased competition that can lead to reduced revenues. Genetically engineered, commercially important Hawaii anthuriums transformed with genes to change flowers to new blue and purple colors could be a boon to Hawaii's anthurium growers. Genes from the anthocyanin biochemical pathway responsible for blue delphiniums and purple grapes were transformed into anthuriums. Small plants in tissue culture were shown to possess single genes from the pathway and are being cultivated to bloom in other studies. More recently two and three color genes were combined and transformed into anthuriums to increase the likelihood of expression of these colors, possibly in stronger hues than single-gene transformants. Two transcription factors, Rosea1 and Delila, and the "blue gene" (F3'5'H) that adds the delphinidin blue branch to the anthocyanin pathway in anthuriums, were combined into three DNA constructs, Rosea1+Delila (RD), Delila+F3'5'H (DF), and F3'5'H+Delila+Rosea1 (FDR). Important pest tolerant Hawaii cut flower anthuriums were transformed with DF and RD and embryogenic calli selected in the presence of G418, an aminoglycoside antibiotic that allows only transgenic cells to grow. Cultivars with flower spathes (the colored part) having fairly high pH are considered the most likely to express the deepest blue and purple colors. High and fairly high pH cultivars have light coral or pink, white, green, or purple spathes (P. Toves & T. Amore, unpublished results). The cultivars UH1545, a new coral-colored introduction from the University of Hawaii breeding program, Flamingo, with a light pink flower, and New Pahoa White, a nearly white tissue culture variant of New Pahoa Red, have fairly robust selectively growing, putative transgenic calli. The other two anthurium cultivars, New Pahoa Red (NPR) and Kalapana (KAL), are bacterial blight (*Xanthomonas axonopodis* pv. *dieffenbachiae*) and burrowing nematode (*Radopholus similis*) tolerant. The former is the industry's most important cultivar. Both were slower to develop selectively growing calli that were smaller than the former three cultivars. The three-gene construct was recently completed and callus growth on suboptimal selection concentrations is apparent.

Project Approach

Embryogenic were used for transferring double- and triple-color gene constructs into five important or potentially important Hawaii cut flower anthurium cultivars with fairly high or low spathe pH but high commercial value, Flamingo (FLA, Fig. 1A, fairly high pH), UH1545 (Fig. 1B,

fairly high pH), New Pahoa Red (NPR, Fig. 2A, low pH), New Pahoa White (NPW, Fig. 2B, high pH), and Kalapana (KAL, low pH). The three constructs were prepared by 1) joining two transcription factors that affect color gene expression in the anthocyanin pathway, 2) joining one of the transcription factors and a gene in the delphinidin blue branch of the pathway that is lacking in anthurium, and 3) joining the three genes in one construct. The plasmid constructs were introduced into anthurium by co-cultivation with *Agrobacterium tumefaciens* and stepwise selection on an aminoglycoside antibiotic that killed non-transgenic cells resulted in growth of calli that contained the color genes.

Molecular Biology

HARC staff made the plasmid constructs pL1463-1865 or Rosea1+Delila (containing color gene transcription factors Rosea1 and Delila) and pL1983-1865 or F3'5'H+Delila (containing delphinidin color gene F3'5'H and the transcription factor Delila). The single enzyme *Bam*HI was used to cut Delila from the plasmid pJAM1865 as an "insert" and to cut the plasmid pJAM1463 for making pL1463-1865 or pJAM1983 for making pL1983-1865 as "vectors." The inserts and vectors were connected by T4 ligase and transformed to competent DH5alpha cells to obtain the pL1463-1865 and pL1983-1865 constructs. The plasmid pL1463-1865 was verified to contain the two transcription factors Rosea1 and Delila, a pairing that resulted in some deep purple snapdragons and tomatoes (Schwinn et al., 2006; Butelli et al., 2008) and the plasmid pL1983-1865 was verified to contain the color gene F3'5'H and Delila by enzyme digestion and polymerase chain reaction (PCR) methods.

In the January to May 2015 timeline, the two new transformation constructs pL1463-1865 and pL1983-1865 were transferred to *Agrobacterium tumefaciens* strains AGL0 and EHA105 using the freeze-thaw method. Single color gene plasmids pJAM1889, pJAM1463 and pJAM1983 had been transformed to AGL0 and EHA105 using standard methods (Fitch et al., 2011).

Tissue Culture and Transformation

In January to December 2015, embryogenic calli of Hawaii commercial cultivars and new lines were prepared, subcultured, and maintained. About a month prior to co-cultivation, the calli were subcultured to fresh medium (Fitch et al., 2011).

Transformation of anthuriums with the two-color gene construct was conducted during the January to May and June to September 2015 timelines. The January to May experiments resulted in about 15 putative transgenic lines of UH1545 (~5 lines, Fig. 1 B) and NPW (~10 lines, Fig. 2B) with F3'5'H-Delila that are on near optimal selection medium (50 mg/L G418). In the first two of four co-cultivation experiments, the anthurium NPW was transformed with *Agrobacterium* AGL0 containing the F3'5'H-Delila pL1983-1865 construct. Co-cultivation time was 4 d and the selection medium contained 50 mg/L G418. However, after one month of selection most calli died (bleached or turned black) and surviving calli did not grow well. PCR testing for presence of the F3'5'H color gene were negative. In the meantime, NPR, KAL, FLA,

UH1545, and a light pink hybrid were also co-cultivated with pL1983-1865 and later the same cultivars were co-cultivated with pL1463-1865.

One month of recovery prior to the first G418 selection, the suboptimal 20 mg/L concentration, was followed by one month of near optimal (50 mg/L) selection. The vigorously growing calli on near optimal selection medium were finely minced and transferred to the same stringency (50 mg/L) and highly stringent selection (75 mg/L G418). Many putatively transgenic lines were again lost, thus the increase in selection stringency combined with fine mincing may have been too harsh a treatment. The soft selectively growing calli from the first subculture to near optimal stringency were probably more sensitive after the second round of selection on the same level when finely minced and also when subcultured to highly stringent medium. Larger amounts of vigorously growing but firmer calli were cultured before being minced and placed on increased selection levels to conserve and ensure that the putative transgenic lines were not lost.

The three-color-gene plasmid was constructed using the same method. *Bam*HI was used for cutting out the two transcription factors Delila and Rosea1 from the plasmids pJAM1865 and pJAM1450, respectively, as two "inserts" and cutting pJAM1983 (containing F3'5'H) as the "vector." Enzyme digestion and PCR were conducted to verify that the new construct contained the three color genes. The construct was transferred to *Agrobacterium* and co-cultivation conducted.

Goals and Outcomes Achieved

The goal achieved was the creation of double- and triple-color gene DNA constructs to develop blue and purple, large-flowered, pest tolerant anthuriums for Hawaii. The constructs were transformed into calli of five important or potentially important anthurium using *Agrobacterium tumefaciens*. Selection of transgenic calli is ongoing. There are putative transgenic lines of UH1545, FLA, NPW, KAL, and NPR containing DH and RD double constructs in selection on near optimal (50 mg/L) G418. A few UH1545 callus lines with DH are also on the third round of high stringency selection, 75 mg/L G418 that signifies stable and total transformation. Triple-gene transformants are still on suboptimal selection media as they were made out later than the first two double construct lines.

In scope of services, item #2, HARC stated that it would propagate at least 100 plants from independent selections of each of seven different cultivars that show novel colors after the new gene constructs are transferred. This work will be accomplished after plants are created from the transgenic calli obtained in this final report, but no plants were expected at the end of two years and blooming transgenic lines to observe new flower colors was not the expected intent after the two-year timeframe. The purpose of including this statement in the scope of services was to describe the expected final outcome of the completed project that takes a minimum of five or six years to bloom transgenic plants starting from construct development, if all experiments succeed and without unforeseen hurdles. Item #2 should not have been included

in the scope of services for the 2013-2015 grant proposal. The intent was item #1 in the scope of services, creating the double and triple-color gene constructs and transforming them into seven cultivars.

Item #3 in the scope of services was that early project results along with earlier data on single-gene transformants had been mentioned at Hawaii Island floriculture conference for growers and distributors presented at UH Hilo on 24 July 2013 at the 2013 Risk Management Floriculture Road Show organized by Mr. Kelvin Sewake, CTAHR. Since it was very early in the multiple-color gene project, Dr. M. Fitch talked about the single gene transformants and plans to create the multiple-color gene constructs ("Anthurium Transformation for Novel Colors"). There were no floriculture meetings in 2014 and in 2015, unfortunately Mr. Sewake was in transition in his UH position and did not contact HARC personnel about the meetings, thus the opportunity to present project results was lost. In emails about the omission, the problem was clarified. Mr. Eric Tanouye (President, Hawaii Floriculture and Nursery Association; President Green Point Nurseries), Mr. Grayson Inouye (President, Pacific Floral Exchange), and Mr. Vernon Inouye (President, Floral Resources Hawaii, Inc.), three important businessmen who ship anthuriums have been constant supporters of the multiple-color gene and other anthurium research projects as evidenced by their letters of support for various anthurium grant proposals. They are kept informed about progress of the projects in telephone and email contacts, project summaries are sent to them and they are free to share the summaries with whomever they choose. The most recent contact was for support for proposals for extension of the multiple-color gene and nematode resistance transformant projects.

Item #4 is partially covered by the conclusion of the two-year project, the data collected thus far will be pertinent to deregulation, licensing of transgenes, patenting, and commercialization of industry-approved transgenic anthuriums, however, the intent was not to state that this step would be reached by the end of the two-year project timeframe, rather these are the steps required as part of the culmination of the overall project, to produce transgenic, novel blue and purple large-flowered pest tolerant anthuriums for Hawaii.

The outcome that is expected is that the transgenic lines from these experiments will have large, blue and/or purple flowers that can be commercialized to boost the value of Hawaii anthuriums on the market. None of the single-gene transformants from an earlier project have yet bloomed, but it is anticipated that the plants from the double- and triple-gene constructs will produce more intense colors. Submission of a small business Phase I proposal is planned for the single-gene as well as multiple-gene transformants based on the outcomes of the current experiments.

Beneficiaries

The beneficiaries are the 300 members of the Hawaii Floriculture and Nursery Association (HFNA), each business of which has an average of four employees apiece expected to attend annual gatherings, special sessions, and workshops to hear research, business, and pest control progress reports and another 900 to 1000 non-member growers statewide who grow

anthuriums with revenues less than $10,000/year who would be invited to the workshops. The HFNA is the most active floriculture group in the state with large commercial operations. The Hawaii Anthurium Industry Association (HAIA) is not active.

Lessons Learned

In the research period January 2014 to the present, project staff did not encounter problems with the two-color gene molecular biology protocols. The selection of transformed lines on near stringent and highly stringent is ongoing and screening for presence of transgenes using PCR will be accomplished as soon as sufficient quantities of vigorous calli are obtained from highly stringent medium. The three-color-gene construct, however, was difficult to construct and to confirm by PCR. One of the insert sizes was close to extraneous DNA fragments in the digestion mixture and could not be easily separated during excision from the separating gel. Several attempts were made to ligate the third color gene into the two-color gene construct after repeated PCR assays showed the presence of extra DNA fragments. In the most recent experiment two isolates out of a total of 15 candidates were found to contain the three color genes. PCR assays showed that the two isolates did not contain extraneous DNA fragments. The two were transferred into *Agrobacterium* and used to co-cultivate embryogenic calli of the five anthurium cultivars.

Selection is ongoing for all constructs, on suboptimal to near optimal and highly stringent levels. If some cultivars produce few putative transformants, *Agrobacterium*-mediated transformation will be repeated until at least five PCR positive independent lines per construct are identified. Stepwise selection, first on a suboptimal selection level (20 mg/L G418) followed by a near optimal level (50 mg/L G418) until vigorous, firm calli grow, and culminating on the highly stringent selection level (75 mg/L G418) on which vigorous, firm calli grow and random samples are all PCR positive for the color transgenes, represents the latest improvement to anthurium transformation.

PCR screening for transgenic lines will be conducted after about three cycles of stringent selection on G418. PCR and Southern blot analyses will be conducted to reconfirm the transgenic lines. After these confirmation experiments, the transgenic lines will be bloomed at HARC and flower samples given to Drs. T. Amore and J.P. Bingham at the University of Hawaii to analyze color pigment content.

The SCBGP Proposed and Actual expenditures were different because the supplies used were obtained from different suppliers at reduced costs, some materials could be autoclaved and recycled to save on purchase of new consumables, and materials were also purchased in bulk with other laboratory research groups to reduce costs. In addition, PCR and Southern hybridization gene confirmation experiments on the transgenic plant lines were not accomplished because the transgenic lines were not yet in large enough quantity for the destructive assays. The large quantities of supplies required were therefore not yet purchased. Increasing the personnel budget category enabled the researchers to allot additional time to improve the three-color gene product that twice contained contaminating DNA that interfered

with the gene confirmation tests and made the first two attempts at constructing the three-color gene product questionable. The final three-color gene product that was put into anthurium cells was free of the contaminating DNA because a large number of samples were prepared from which to select the clean three-color gene product.

Contact Person

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Additional information

The following are photographs of the different Hawaii large-flowered anthuriums that were co-cultivated with *Agrobacterium tumefaciens* carrying the three multiple-color gene constructs. The photographs were included to show the colors of the fairly high and low pH cultivars into which the double and triple color gene DNAs were inserted because blue and purple colors are expected to show the strongest expression in high spathe pH plants. There are photographs of selectively growing and dead calli on near and highly stringent G418 from the Delila+F3’5’F co-cultivation experiments.

Figure 1A. **Figure 1B.**

Figure 1A is 'Flamingo,' a light pink commercial Hawaii anthurium cultivar with fairly high spathe pH, around 5.7. Figure 1B is UH1545, a coral colored anthurium line from the University of Hawaii breeding program that also has fairly high spathe pH, around 5.9. High spathe pH, around 6, is considered optimum for the strongest expression of blue and purple pigments.

Figure 2A. **Figure 2B.**

Figure 2A is New Pahoa Red (NPR), the medium red, pest tolerant, most important Hawaii cut flower cultivar, but its spathe pH is fairly low, around 5.4. Figure 2B is New Pahoa White (NPW), a tissue culture-derived variant of New Pahoa Red with relatively high spathe pH, around 6.2, higher than the red from which it originated. Therefore, NPW may express the strongest blue and purple colors combined with pest tolerant qualities.

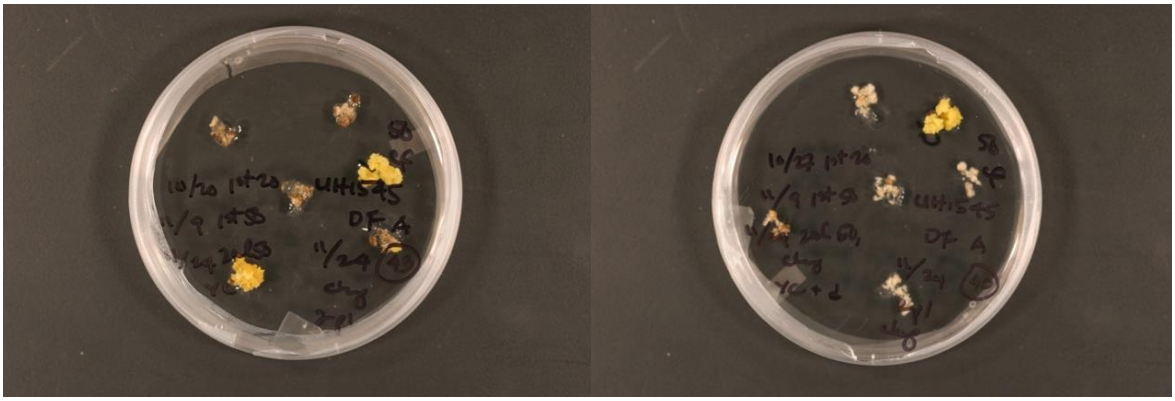

Figure 3A. **Figure 3B.**

Figures 3A and 3B are plates of two different Delila+Rosea1 putative transformants growing on near optimal selection medium, 50 mg/L G418, after the second subculture. The yellow calli on both plates are the growing calli. They grey/brown calli were yellow on suboptimal selection level but died on the higher level.

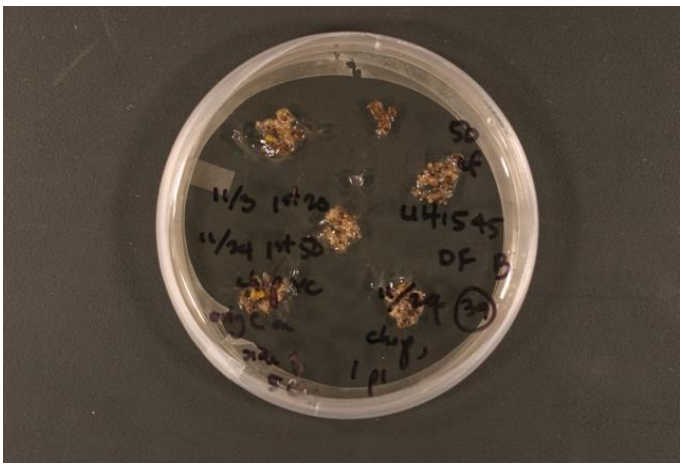

Figure 4.

Figure 4 shows a plate of brown calli that did not survive selection on the first near optimal level of G418, indicating that growth on suboptimal G418 was by non-transgenic calli.

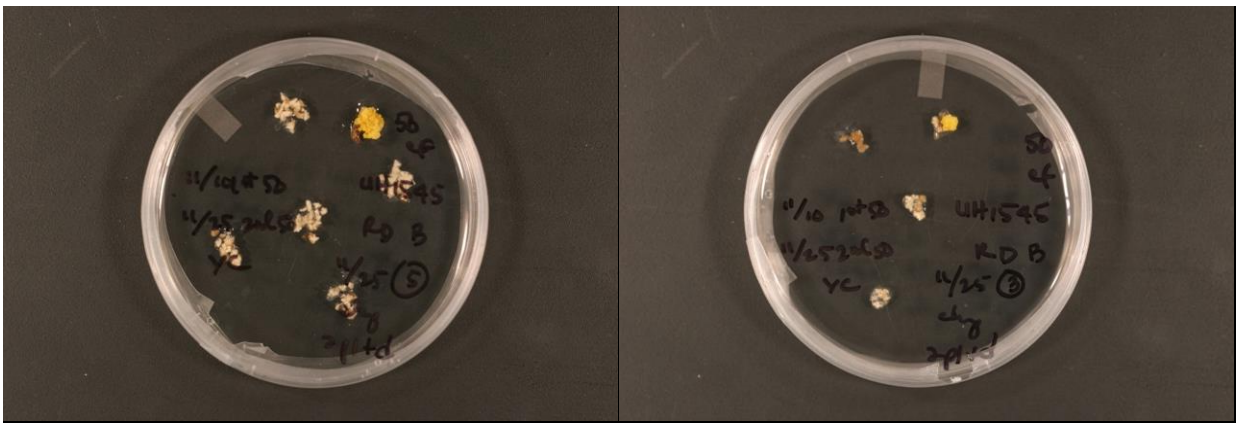

Figure 5A. **Figure 5B.**

Figure 5A and 5B show two different Rosea1+Delila putative transformants on the second subculture to near optimal selection concentration. Most of the calli bleached or turn brown and died as with the Delila+F3'5'H calli, but two yellow calli grew.

Development of Non-GMO, Virus Resistant Papaya

Final Report

Hawaii Agriculture Research Center (HARC)
http://www.harc-hspa.com

Project Summary

The purpose of this project was to develop papaya with introgressed virus resistance from its wild relatives by breeding. Genetically engineered papayas helped save Hawaii's papaya industry when *Papaya Ringspot Virus* (PRSV) nearly devastated the crop in 1995. The transgenic papayas, however, present problems with consumers not willing to buy the fruit, therefore export sales of Hawaii papayas to mainland markets have decreased greatly from previous levels. Although papayas, *Carica papaya*, have no inherent resistance to PRSV, some distantly related species from South America, *Vasconcellea pubescens*, *V. cauliflora, V. stipulata*, and *V. quercifolia*, are either highly tolerant or immune to the disease. Breeders have tried to cross the resistance into papaya for the past 30 years with little success. Some of the most resistant hybrids were with *V. pubescens*, but the seedlings were all female and sterile. Dr. Rod Drew, of Griffith University, Australia, used a technique called "bridge crossing" to first move the PRSV resistance gene, identified by his group as a serine-threonine kinase (STK), from *V. pubescens* to *V. parviflora*, a wild species that when crossed to papaya produces some fertile seedlings, and backcrossed the F_1 hybrid four times to *V. parviflora.* The backcross$_4$ hybrid was PRSV resistant, had partial fertility, and was shipped to Hawaii for crossing with local papayas. HARC produced ~70 F_1 seedlings with X77 or 'Waimanalo,' 35 of which contained the STK resistance gene. Three lines were inoculated with PRSV twice and showed no PRSV symptoms. The three lines are 30 to 45 cm tall, resemble both *Vasconcellea* and papaya parents, but have not yet bloomed to test for pollen fertility or to cross with X77 again for the BC_1 hybrid that should be ~75% papaya. The goal of the project is to backcross the resistance gene into papaya until a PRSV resistant, commercially suitable fruit is developed, perhaps BC_2, ~88% papaya or BC_3, ~94% papaya.

Project Approach

Tissue cultures of the PRSV resistant *Vasconcellea* hybrid were micropropagated, acclimatized to the greenhouse, flowered, and used to pollinate Hawaii X77 ('Waimanalo') papayas. Immature fruit were harvested, seeds removed aseptically, and embryo rescue performed by halving seeds and culturing them on nutrient medium. Zygotic or somatic embryos that developed from them were tested for presence of the PRSV resistance gene and positive lines acclimatized to greenhouse culture and inoculated with PRSV. The three resistance gene positive lines tested did not develop PRSV symptoms and now await flower formation for making the first backcross with papaya.

Tissue Culture

Cultures received from Australian collaborator Dr. Rod Drew (Drew et al., 1998; O'Brien & Drew, 2009) on May 31, 2013, enabled HARC to clone many copies of this *Papaya Ringspot Virus* (PRSV) resistant *Vasconcellea pubescens* (Fig. 1A) x *V. parviflora* (Fig. 1B) backcross$_4$ (parviflora BC$_4$), line #113 (Fig. 2), to grow plants in the greenhouse to bloom and to cross with papaya.

Field Work

Flowers from the #113 plants, a male line with partial pollen fertility, were used to pollinate female X77 ('Waimanalo') papayas at the Murakami Farm in Kahaluu starting from March 2014 up to late November 2014. Only 3 small fruits 8- to 9.5-cm in diameter yielded 3-month-old white seeds that bore zygotic embryos, many of which developed many somatic embryos, after about 150 pollinations of six or seven trees in Kahaluu using two to 12 #113 flowers and buds per flower. Several smaller fruit, 6.5-cm in diameter and smaller, were formed but most contained no immature white seeds except for one 5.3-cm fruit that contained two seeds but no embryos developed.

Murakami planted a new set of X77 as well as a few 'Kapoho' and 'Kamiya' seedlings to increase the variability of seedlings to be developed in backcross #1. HARC staff planned to cross pF$_1$ PRSV resistance gene positive plants with the Murakami plants when the plants flower and pollen fertility is confirmed for the first backcrosses.

Embryo Rescue

On August 6, 2014, the first two 3-month-old fruits were harvested, surface-sterilized with commercial bleach (Fitch et al., 2005), and cut. The 4-cm (diameter) fruit was empty; the 8-cm fruit contained 29 white seeds that were cut to expose immature embryos, some of which were visible, and the half seeds believed to contain embryos were plated on MBN medium and grown in subdued light. The seed cavities were about half the diameter of typical papaya seeds of the same age and contained no visible endosperm. About 20 of the 29 seeds germinated. It was not possible to determine the exact number of seeds that produced viable embryos because the half seeds believed to not contain embryos were all placed on a single plate but developed about 14 more embryo lines. These could have been new or duplicate lines. Assuming that the additional lines were duplicates, it was estimated that 20 of the total 29 seeds developed embryos.

Three more fruits, about 9.5-cm, 8-cm, and 5.3-cm in diameter, harvested in late November 2014 (fruit #2) and in mid-February 2015 (fruits #3 and #4) yielded 46, 89, and 2 white 3-month-old seeds. The seeds were processed as described for the first fruit except that both seed halves were placed on each plate to ensure that embryos from either or both half-seeds would be cultured as the same pollination event. The 2 seeds from the 5.3-cm diameter fruit did not form embryos.

Molecular Characterization

The Polymerase Chain Reaction (PCR) primers for the Psilk CAPS marker used for detecting the presence of *Vasconcellea* DNA (Dillon et al., 2006) were tested on *V. pubescens*, *V. parviflora*, papaya, #113, and 2 papaya F$_1$ (pF$_1$) seedlings (Figs. 3 & 4) from the X77 papaya X #113 cross. The primers were specific for all *Vasconcellea* species but papaya was not expected to show any bands. All samples showed single amplified fragments per lane and papaya showed no band. The fragments were either 348- or 372-bp but they were so similar in size that they could not

be distinguished visually. These results show that the primers were working properly. Moreover, the pF_1 seedling data show that #113 had successfully been crossed into female X77 papayas and no cross contamination with papaya X papaya pollen occurred.
The amplified 348- to 372-bp-fragment bands from each sample were digested with the restriction enzyme *Psi*I that is diagnostic for the *V. pubescens* PRSV resistance gene. Digestion of the 348- to 372-bp-fragment bands from *V. pubescens* and #113 yielded two smaller bands, 240 and 108 bp, showing that the resistance gene was present. The amplified bands from *V. parviflora* samples were not digested and were 372 bp. Digests of hybrids that did not contain the resistance gene also had only the 372-bp fragment, but those that did had 240- and 108-bp bands.
From fruit #1, 7 of the 20 independent lines contained the PRSV resistance gene. Only 11 seeds from the fruit #2 from late November 2014 developed embryos, but 8 were positive for the PRSV resistance gene. The most recent tests for presence of the PRSV resistance gene on embryos from fruits #2 and #3 yielded 27 of 42 positive lines. This result, ~64% positive, is higher than the 30 to 45% yield from fruit#1. More lines remain to be tested because embryos grew slowly and sufficient amounts were not available for the molecular assay.
PRSV inoculations
Positive control plants, *V. pubescens* and #113, inoculated with Hawaii PRSV using standard methods never showed PRSV symptoms after inoculations on 4/9/2015 and 6/6/2015. Negative controls, papaya, *V. parviflora*, and resistance gene PCR negative pF_1 plants all showed PRSV symptoms. None of the three resistance gene PCR positive lines showed PRSV (Figs. 3 & 4, 2 of the lines). Symptoms took longer than the typical ~3 weeks to develop. Some resistance gene negative plants showed symptoms 4 months after inoculation. The other PRSV resistance gene positive plant lines are being multiplied to ensure that the lines are conserved in tissue culture prior to potting plants for PRSV inoculations and for crossing with X77 plants to make papaya backcross$_1$ (pBC_1).

Goals and Outcomes Achieved

Measurable outcomes are the number of #113 plants that were propagated, acclimatized to greenhouse conditions, bloomed, and used to make viable hybrids (9), the number of papaya F_1 lines that were resistant to Hawaii PRSV (3/3 tested so far; 32 more contain the resistance gene but have yet to be inoculated).
The size, quality, and flavor of fruit from different crosses made with Hawaii papayas are the ultimate goals of this project but this stage is still to be achieved since flowers have not yet formed on the first three PRSV resistant pF_1 lines, Rod1-8R (Fig. 4), Rod1-21R (Fig. 3), and Rod1-28M. The next twelve pF_1 lines are rooted in tissue culture vessels and are being acclimatized for greenhouse culture and PRSV inoculations. The remaining 20 lines are small; some are rooted but require more time in culture before they can be acclimatized.
If PRSV resistance in good quality fruit is produced from these hybrids backcrossed two to four times to papaya, the measurable outcome is that non-transgenic and organic papaya growers will be able to purchase seeds, grow plants without the threat of losses to PRSV, and market their non-transgenic papayas. Seed sales data from the HPIA will be a concise measurement of utilization of the product. Designated growers will produce and guarantee seed quality as it is

currently done for 'Rainbow' and other transgenic papaya seed. The *Vasconcellea* virus resistance will be seed transmissible but the assumption is that if growers save their own seed, problems like mixing with transgenic plants, loss of the *Vasconcellea* resistance gene by inadvertent outcrossing, and various other seed production problems will arise. Thus, as with transgenic seed, saving seeds will be discouraged.

Beneficiaries

The 120 Hawaii Papaya Industry Association (HPIA) members meet annually around September or October for progress updates in the industry, e.g., reports on research, marketing, pest problems and controls, and new products. Workshops are convened by HPIA, the University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR) Extension Service, and/or Hawaii State Department of Agriculture occasionally for special topics, often new pest problems and solutions available. There are 30 to 40 non-HPIA papaya growers that are invited to these gatherings to help disseminate important information as quickly and broadly as possible to help overall industry survival. The introgression project is a potential report topic for the HPIA 2016 meeting. The potential impact of PRSV resistant introgressed papaya is great since U.S. mainland anti-transgenic food activists have managed to reduce significantly import volumes of Hawaii transgenic papaya. The introgressed fruit will represent an alternative to those markets as well as to the international and organic food markets that reject transgenic papaya. The high quality that Hawaii papayas represented in the past can be re-established to recapture markets. All growers and customers of papaya will be beneficiaries because a stronger papaya industry should grow from having two alternatives to PRSV destruction. A stronger industry with larger export options should increase the economic returns for a larger group of growers. Many papaya growers today grow for both transgenic and non-transgenic markets but need to carefully conduct surveillance to avoid destruction by PRSV of their non-transgenic trees and must monitor harvests to avoid intermingling transgenic and non-transgenic papaya. European governments routinely screen random shipments of Hawaii papaya and reject those containing transgenic fruit. Growers will be spared the additional cost and labor for surveillance for PRSV and waste in shipping fruit mixed with transgenic ones.

Lessons Learned

At the onset of the project it was known that two years was not long enough for developing a commercially suitable, PRSV resistant introgressed papaya. It was not known how rare the pollination success would be (4 fruit/150 pollinations: 35 resistance gene positive plants/60 plants from 166 3-month-old seeds). Potential project improvements are that with widely different parents like the ones used, many more pollinations must be accomplished as quickly as possible to ensure a large enough population of 3-month-old seeds to rescue. Since the papaya F_1 (pF_1) hybrids are still very different from papaya, the population of pF_1 plants must be as large as possible, especially when there is no knowledge of pollen and female fertility until each line flowers. The situation has been anticipated by growing as many replicate plants of the resistant pF_1 lines as possible and will be advantageous when the pF_1 papaya hybrids

finally bloom. The remaining 32 lines still in culture are similarly being grown in large numbers to ensure that the hybrids exhibited the pest susceptibility of the *Vasconcellea* and papaya parents (red spider mite, broad mite, hibiscus mealy bug, white peach scale) and the longer maturation for flowering of the papaya parent. Finally, *Vasconcelleas* defoliate and go into dormancy when too warm or too cold; the pF_1 seedlings did the same and have only leafed out since early March 2016. Seedlings are therefore being kept cooler, more shaded, and treated with systemic insecticides/miticides.

The younger pF_1 lines are being grown in a cooler growth chamber-like laboratory room rather than in the outdoor greenhouse or the shade house. Such a growth room at HARC became available in late 2015 where temperatures are under air conditioned control. After sturdy pF_1 plants develop indoors, they will be moved to greenhouses at cooler or warmer locations depending on the ambient temperature. HARC's Maunawili Substation is at a higher and cooler elevation than Kunia and will be utilized during the hottest summer months. Kunia's greenhouse and shade house are suitable for cool winter months. When the plants become dormant, despite greenhouse manipulations in the Hawaii winter and summer, the plants will be kept under drier conditions to prevent root rot. Improved drainage of potting soil is being used to prevent root rot and plant loss as well. The anticipated next generation papaya $backcross_1$ (pBC_1) seedlings will likely exhibit some of the detrimental *Vasconcellea* traits but to a lesser extent since they will be ~88% papaya. The experience in this project brought awareness of the mite and defoliation problems. Growth of plants in cooler/warmer temperatures depending on the season and more timely pesticide treatments should hasten flowering time. Larger numbers of pF_1 and papaya parents for crossing are keys to continued progress in the introgression project.

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Additional information

Photos of *V. pubescens, V. parviflora*, *V.* #113 BC_4 hybrid, and papaya X #113 F_1 plants.

Figure 1A.

Figure 1B.

Figure 1A is *Vasconcellea pubescens*, a PRSV resistant plant that produces F_1 plants with papaya but all plants are female and sterile. Figure 1B is *V. parviflora*, a PRSV susceptible plant that produces some fertile F_1 seedlings after crossing with papaya.

Figure 2.

Figure 2 shows 2 plants of *Vasconcellea* BC_4, #113, a male line, that arrived as tissue cultures from Australia and were crossed with female Hawaii X77 or 'Waimanalo' papayas.

Figure 3.
Figure 3 shows two plants of papaya F_1 line Rod1-21R from X77 X #113 that contain the PRSV resistance gene. The plant at the top is the largest, ~ 2 feet tall, but was infested with broadmites. The lateral branches of the plant on the bottom had mite damage but have recovered. Its top is similarly mite infested.

Figure 4.
Figure 4 depicts two views of one plant X77 X #113 hybrid line pF_1 Rod1-8R that struggles with mite damage and is not as vigorous as Rod1-21R. It is about 1.5 feet tall with several lateral branches.

Introduction and Propagation of New, High-Yielding Cacao Cultivars to Support the Specialty Cacao Industry in Hawaii

Final Report

Hawaii Agriculture Research Center (HARC)
http://www.harc-hspa.com

Project Summary

The demand for premium quality chocolate made from high quality cacao (*Theobroma cacao* L.) beans is increasing. Hawaiian specialty chocolate is a fledgling industry currently produced for local, national and international markets. Cacao is a great candidate for high value, low acreage agriculture in Hawaii. Cacao production has potential to be an ecologically sustainable farming practice, as pods are harvested from long-lived trees and therefore require minimal soil disturbance after establishment. Cacao is a suitable understory crop and can be grown in conjunction with native hardwood trees species such as koa (*Acacia koa*) in sustainable agroforestry systems.

Commercial cacao production in Hawaii is increasing and this trend is expected to continue. The increased acreage is being planted with seedlings from uncharacterized cacao populations from at least three initial introductions of cacao into the islands. Dole Fresh Fruit Co. planted 17 acres of cacao on former Waialua Sugar Plantation in 1998 and the beans are being used to produce 100 percent Hawaiian specialty chocolate products. Small acreage farmers are also growing cacao on all of the principal Hawaiian Islands (Bittenbender 2013). In 2012, the Hawaii Cacao and Chocolate Association (HCCA) was formed to "promote the emerging chocolate industry in Hawaii" (www.hawaiichocolate.org). HCCA has 28 industry members with three advisory members including HARC. During the 2013 Annual HCCA Conference, a variety of current issues were presented to industry professionals, including a desire to import disease free, high yielding germplasm to Hawaii.

Issues addressed by project
One of the greatest impediments to the fledgling cacao industry is the limited access to improved cacao germplasm. The current practice of growing trees from unimproved seed prevent Hawaiian growers from achieving yields seen in other cacao producing areas due to the inherent variability. It is estimated that 70 percent of production comes from only 30 percent of the trees in seedling plantations, meaning that 70 percent of the trees are not very productive. The variability also negatively impacts harvest costs, fermentation and flavor. Hawaii's current cacao germplasm is not resistant to the major cacao diseases worldwide, and the accidental introduction of these diseases would devastate the local industry.

Project Objectives
The goal of this project was to address this significant impediment through the following objectives:

- Importation of 8-10 selected, improved cacao clones released from the USDA-ARS-SHRS cacao breeding program and the USDA-ARS-TAR germplasm collection.
- Development of standardized methods for propagating the cultivars in Hawaii using bud-grafting (also known as patch grafting).
- Establishment of a clonal garden at the HARC Maunawili Station to serve as a source of the improved germplasm for future propagation and distribution in Hawaii.

Improved cultivars will make Hawaiian grown cacao more competitive, as other cacao growing areas are using this technology to improve productivity and quality. The utilization of high yielding, disease resistant, high quality cacao cultivars will increase the production, availability and distribution of Hawaiian chocolate by making it more economically viable through reduced production costs and improved flavor. Disease resistant cultivars will also serve to protect the long-term viability of the cacao industry in the event of accidental introduction of new cacao diseases. This improved germplasm, developed by USDA-ARS-SHRS and international collaborators, represents the most advanced germplasm publically available. The clones are the result of significant financial investment, and this project will leverage this investment to benefit Hawaiian cacao growers and chocolatiers.

Project Approach

The project approach was to meet the following five objectives:

A) Propagation Methods Improvement
B) Propagate existing Hawaiian cacao varieties
C) Obtain budwood from USDA-PBARC
D) Establish clonal garden of improved cultivars
E) Disseminate information to interested stakeholders

Activities performed:

Second Quarter FY2014: (Jan. 2014 – March 2014)
USDA ARS SHRS cacao geneticist, Dr. Osman Gutierrez visited Hawaii in February to further outline the project details and schedule. Dr. Gutierrez (USDA), Tyler Jones (HARC), Nick Dudley (HARC), and Dr. Nagai (HARC) met with Dr. Tracie Matsumoto (USDA PBARC) and staff in Hilo to examine the high yielding cacao clones and review the project further. Dr. Matsumoto replaced Dr. Zee (retired) at PBARC as a collaborator on this project. Hilo based cacao farmer, Tom Menezes, also attended the meeting. Dr. Gutierrez and HARC hosted a field day at the Maunawili Experiment Station in February for the Hawaii Chocolate and Cacao Association to highlight the project, and to inform growers about the new USDA clones.

All eight of the high yielding USDA cacao clones were shipped from USDA Miami to USDA PBARC and grafted onto rootstock. USDA PBARC staff is caring for the clones until they can be propagated further. Five hundred rootstock seedlings were germinated in February and grown

in greenhouses at the HARC Maunawili Experiment Station. All of the rootstock seed was collected from a single cacao clone (K25) to increase rootstock uniformity. Existing cacao rootstock seedlings were transplanted and fertilized at Maunawili greenhouses to expedite efforts for grafting refinement. The Hawaiian cacao orchard at Maunawili was fertilized and pruned to promote the development of budwood for grafting.

Third Quarter FY2014 (April 2014 – June 2014)
HARC technicians concentrated on developing and refining bud grafting methods at the Maunawili Station. Approximately 80 bud grafts were attempted per week beginning in May. Accessions from the HARC cacao orchard were the source of budwood. Initial success rate was approximately 60%, but the success dropped in June. After consultation with USDA ARS SHRS, it was determined that nighttime temperature was too cool at Maunawili. HARC grafting technicians and Chifumi Nagai visited the Dole Waialua cacao orchard to capture budwood from highly yielding trees previously identified.

Fourth Quarter FY2014 (July 2014 – September 2014)
A fully enclosed grafting house was constructed inside an existing greenhouse at HARC Maunawili to enable temperature control using a propane heater. Grafting success immediately improved with the increased temperature, and HARC technicians now regularly exceed 90% successful take. HARC is confident that the grafting methods have been refined sufficiently to meet (exceed) the project needs.
USDA ARS SHRS research technician, Michael Winterstein brought additional budwood from 7 of the 8 high yielding USDA clones to HARC and grafted them onto rootstock in August. Therefore, the clones are now growing at HARC Maunawili and USDA PBARC. Michael has over 10 years of experience with cacao grafting and he reviewed HARC's grafting procedures and stock plant management. HARC also obtained more budwood from high yielding clones selected from Dole Waialua, and from a clone commonly used in yield trials internationally (ICS 95) from Dr. Bittenbender at UH Manoa.

Site preparation for HARC's clonal garden was begun at Maunawili in August.

First Quarter FY2015 (October 2014 – December 2014)
HARC maintained the new USDA clones at the Maunawili station. The plants were managed as stock plants, to produce scion wood. Cacao growth is very slow during the winter months due to cool temperatures. Site preparation continued at Maunawili for the budwood garden. Tyler Jones and John Dobbs visited USDA PBARC in October. Two HARC clonal selections were taken to PBARC and HARC brought two Puerto Rican clonal selections back to Maunawili from the PBARC collection. Tyler Jones attended The Americas Cacao Breeders Working Group Meeting at CATIE in Turriabla, Costa Rica. Project collaborator and USDA cacao project leader, Dr. Osman Gutierrez organized the conference.

Second Quarter FY2015 (January 2015 – March 2015)
Tyler Jones and Dr. Chifumi Nagai visited with Tom Menezes, Dole Waialua and PBARC to finalize planting designs. Five hundred additional rootstock seedlings were germinated and

grown at the Maunawili station. All of the high yielding clonal stock plants continue to grow at Maunawili. The stock plants should begin growing more rapidly and therefore produce more budwood as the temperatures increase in the spring.

Third Quarter FY2015 (April 2015 – June 2015)
The USDA ARS sent additional budwood from 7 of the 8 new high yielding clones from to HARC and they were grafted in May 2015. The grafting success varied significantly by cultivar. The variation in grafting success may be due to genotype effects, but the varying size and vigor of the budwood is likely the biggest determinant of success. Three Hawaii selections, two USDA selections from Puerto Rico (TARS 1 and 9), and an international standard (ICS95) were also grafted at the HARC Maunawili Station. The budwood for the clones was collected in Hawaii and the grafting success rate was approximately 90%. All of the cultivars are primarily being grown at HARC Maunawili as mother plants to serve as a source of future budwood for further propagation.
HARC hosted an agroforestry field day in conjunction with Craig Elevitch from Agroforestry Net in June 2015. Over 50 participants visited the Maunawili station, and cacao production was featured during the field day. The grafting procedures were demonstrated during the field day and a discussion was held to highlight the benefit of using grafted

Fourth Quarter FY2015 (July 2015 - September 2015)
The mother plants continue to grow well at the Maunawili Station. The mother plants require regular fertilization and insect pest control. Field preparation continued for the budwood garden it will be established once the plants reach the appropriate size. Dr. Brian Irish, the cacao collection curator at the USDA-ARS Tropical Agriculture Research Station in Mayaguez Puerto Rico visited the HARC Maunawili Station and the grafting protocols were discussed. Dr. Irish has extensive experience in cacao propagation and he offered some suggestions to improve the method's efficiency.

Dr. Chifumi Nagai presented at the Big Island Cacao Conference on August 28th, 2015 in Hilo HI. Dr. Nagai discussed the SCBGP project and the cacao germplasm that HARC currently has available and the new, high yielding cultivars that will be available in the future.

HARC assisted a cacao farmer in Hilo, Hawaii establish a planting of the 8 new varieties, the Puerto Rican varieties, the Hawaii selections. The farmer anticipates growing the varieties along with his commercial production and will provide valuable information regarding the performance of these clones in Hawaii conditions.

First Quarter FY2016 (October 2015 – December 2015)
The last of the eight new USDA clones was successfully grafted at Maunawili. This completed the collection of mother plants:

1: 8 experimental USDA cacao clones
2: 2 USDA cacao cloned from Puerto Rico
3: 3 high yielding Hawaii clones
4: ICS-95 (international, publically available clone)

HARC continued to propagate new plant material off the mother plants in October and mid-November, and over 500 grafted plants from these clones are growing in the HARC propagation house. HARC installed a drip irrigation system to lower costs for producing grafted cacao.

The field preparation for the budwood garden continued, and the field was mowed to promote grass establishment and minimize future weed control costs.

Second Quarter FY2016 (January 2016 – February 2016)
The budwood garden was planted in January 2016. All of the 14 clones described above were planted at the HARC Maunawili Experiment Station. The plants for the budwood garden were grown in large containers, and only large, healthy plants were used. The plots and trees were labeled with permanent identification tags and a map was created to track the individual varieties. The field was amended with 0-45-0 and gypsum to promote plant health. Mechanical weed control (mowing) was performed to minimize weed competition.
The budwood garden will serve as the long-term supply of scion for producing these elite cacao varieties and for distribution to Hawaii's farmers. HARC anticipates maintaining the garden and continuing to produce grafted cacao plants at the Maunawili facility. Therefore, the project will have a lasting effect, increasing the productivity and competitiveness of the Hawaii cacao and chocolate industry.

HARC hosted a small group of landowners from the Maunawili Estates neighborhood in February at the Maunawili Station. While the attendees were not farmers, they showed a strong interest in the cacao project, thus helping to build general public awareness about cacao production in Hawaii. Several of the attendees also expressed interest in growing a few trees in their home gardens.

HARC also hosted representatives from the Department of Human Services, Youth Correctional Facility to discuss the potential for incorporating cacao farming at their Kailua facility. They are currently conducting a feasibility study and HARC provided costs and background information to assist in the process. Cacao production is likely a good fit for their facility, and project staff are hopeful that the project will go through.

In February 2016, HARC hosted representatives from the USDA-Forest Service, State of Hawaii DLNR-DOFAW and local landowners/managers at the Maunawili Station. While the primary focus of the meeting was *Acacia koa* forestry, HARC feels there is an opportunity for the development of a koa and cacao agroforestry production model and the cacao varieties from this project would play an integral role in the system. HARC recently planted a small koa/cacao demonstration field and this was reviewed during the meeting.

Goals and Outcomes Achieved

All of the goals of the project were achieved during the planned timeframe. The project had four primary goals:

Outcome #1: 10 improved cultivars were obtained from USDA-ARS and established at HARC Maunawili.

Outcome #2: HARC developed standardized grafting methods for bud grafting cacao. The methods now allow HARC to confidently and efficiently graft cacao, with 80-95% success (variation is based on varietal differences).

Outcome #3: HARC planted the cacao budwood garden at the Maunawili experiment station in early 2016. The budwood garden will serves as a source of scion/budwood for distributing the improved cacao varieties to Hawaiian farmers. HARC anticipates maintaining the site for well beyond the project. The garden contains all 10 USDA varieties, 3 Hawaii selections and an international standard variety.

Outcome #4: HARC disseminated information about the project through numerous outreach events. Some highlights include: field day with Hawaii Chocolate and Cacao Association members; public field day with over 50 attendees from Oahu as part of an Agroforestry training course; oral presentations at the Big Island Cacao Conference (2015) and Hawaii Chocolate and Cacao Association Conference (Kauai, 2015).

Beneficiaries

Based on the 2016 HI Cacao Survey by HC Bittenbender (University of Hawaii, CTAHR), the state is expected to increase the acreage planted in cacao over the next five years by over 200 acres. Additionally, the state average for dry bean production is only 710 pounds per acre. The ability to utilize improved varieties when expanding cacao plantings will significantly benefit the Hawaii cacao farmers. HARC is already working with three Hawaii cacao growers to utilize these varieties in their expansion plans. HARC anticipates providing approximately 3,000 plants in the next 12-18 months to Hawaii cacao farmers as a direct result of this project. As the HARC budwood garden matures over the next 2-3 years, HARC's ability to provide larger quantities of grafted plants will increase.

Lessons Learned

There were no significant problems or delays to report. The early grafting problems were expected and the need to develop improved methods was an impetus for the project.

The key lessons learned during the improvement of grafting methods were:

- the quality/health of the mother plant from which the budwood was taken. The budwood taken from vigorous/healthy trees performed much better.
- Hawaii's nighttime temperatures are too low for efficient budwood grafting of cacao. Temperatures should not drop below 78,^{o} and therefore, supplemental heat is needed.
- Sub irrigation is an effective method for efficiently watering recently grafted cacao without compromising the graft.

- Cacao grafts grow very little from November – March.
- There was variation in grafting ease between the different varieties.

The biggest issue project staff encountered was the ability to rapidly scale the project. During the project, several groups interested in larger scale cacao production contacted us wanting quotes for clonally propagated cacao plants. To plant 250 acres would require over 50,000 plants and it would be very difficult to achieve this quickly. Hawaii could eventually get to this scale with budgrafting, but other options are probably more efficient. Tissue culture has been used effectively in cacao and is likely a more economical option for producing large quantities quickly. Having both options available would benefit Hawaii cacao production.

In general, the project proceeded as intended and HARC anticipates the benefits extending well into the future.

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Additional information

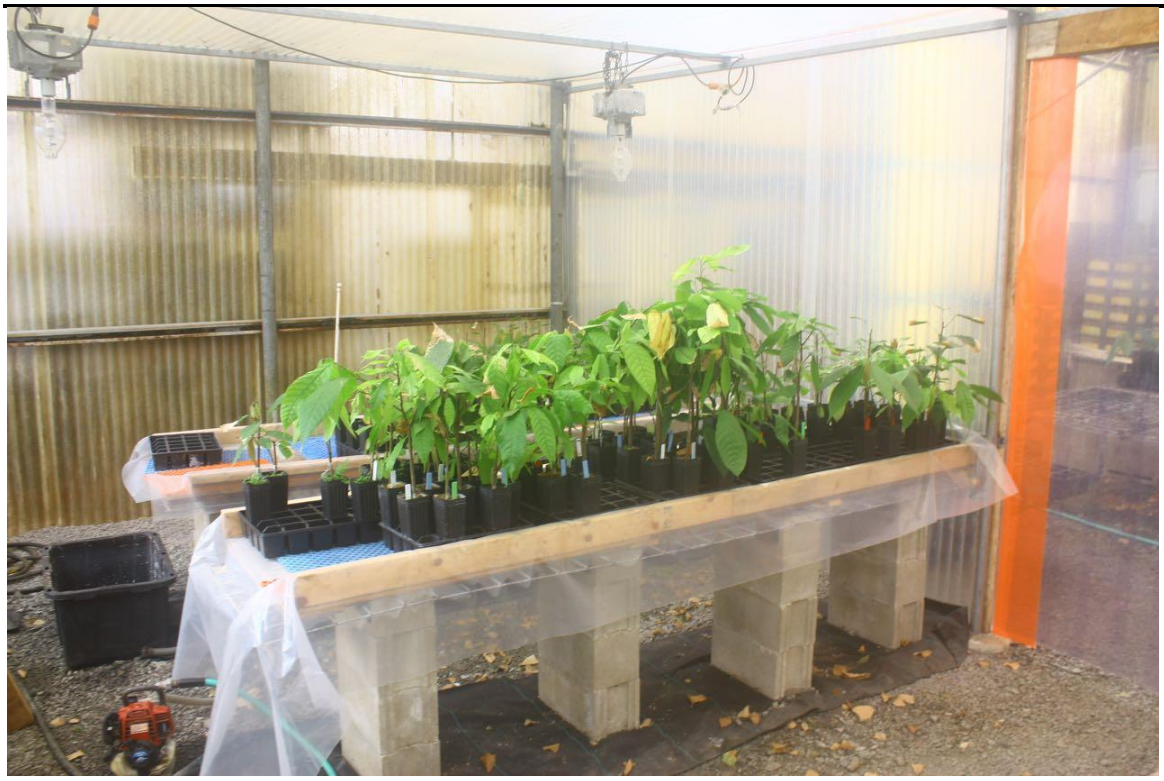

Figure1. Heated cacao grafting room at HARC Maunawili

Figure 2. High yielding USDA cacao variety. Bud grafted plant at HARC Maunawili.

Figure 3. High yielding USDA cacao grafts produced at HARC Maunawili

Figure 4. High yielding USDA cacao mother plant holding area at HARC Maunawili

Figure 5. Planting high yielding USDA cacao budwood garden at HARC Maunawili

Figure 6. High yielding cacao budwood garden at HARC Maunawili (wind shelters around each tree)

Facilitating the Export of Hawaii Specialty Crops through Postharvest Treatment
Final Report

Pa`ina Hawaii

Project Summary

The project was undertaken by Pa'ina Hawaii through the funding support of the State of Hawaii, Department of Agriculture Agricultural Development Division. Hawaii growers and shippers export a variety of fresh agricultural products to U.S. mainland markets employing irradiation quarantine treatment. Thirty-four new product configurations were developed and inputted into the USDA, APHIS, PPQ, Irradiation reporting and Accountability Database (IRAD) system to allow treatment of new export-ready commodities and existing exportable commodities in new cartons and stacking configurations tested at the Pa'ina Hawaii irradiator on Oahu, Hawaii, and visits were made to farms on Oahu and the Island of Hawaii, to explain the export and quarantine requirements and address treatment and regulatory issues pertaining to new commodities that have not yet approved for export from Hawaii.
The project is important and timely because Hawaii has been shifting from monocrop plantation farming to smaller diversified agriculture farm operations that welcome additional revenue streams from exporting their products. The timeliness of this project is evident by the recent closure of the Del Monte pineapple plantation on Oahu and the Maui Land and Pineapple Plantation on Maui, making available large tracks of prime agricultural lands for expansion of diversified agricultural on the respective islands. More recently, Hawaii Commercial and Sugar Company (HC&S) announced the decision to close its sugar plantation on the Island of Maui at the end of the 2016 harvest season, freeing up 36,000 acres of agricultural land on Maui for alternative agricultural crop production.

Project Approach

Pa'ina Hawaii is a commercial (for profit) entity, located at 92-1780 V Kunia Road, Kunia, Hawaii 96759. The company owns and operates a Gray*Star Genesis II Underwater Cobalt-60 irradiator for the quarantine treatment of fresh fruits and vegetables for export to U.S. mainland markets. The service is offered under a Compliance Agreement with the United States Department of Agriculture, Plant Protection and Quarantine (USDA, APHIS, PPQ). The irradiation facility has been fully commercial since January 2013, treating a variety of products, including, tropical fruit (papaya, longan, lychee, rambutan, mangosteen) curry leaves, sweet potato, taro leaves, Moringa pods and leaves and basil) on a fee-for-service basis for growers and shippers primarily located on the Islands of Oahu and Hawaii.

Scope of Work:

- **Conduct** one outreach meeting each on Oahu and Hawaii Island at the start of the project to explain the goals and objectives of the project and solicit feedback from at least 20 specialty crop stakeholders.
- **Collaborate** with at least 30 export ready farmers on Oahu and Hawaii Island and select 14 fruit and vegetable specialty crops that are on the approved list for movement outside the State and determine post-harvest treatment protocols for export.
- **Develop** irradiation as post-harvest treatment for the selected specialty crops by determining proper packing materials, suitable irradiation dosimetry and dose-mapping standards of exposure time for each of the selected crops.
- **Provide** results of the project to the stakeholders and conduct outreach to share the results with participants and make the results readily available to interested stakeholders statewide.

A. Clarification Regarding Applicable Federal Plant Protection Regulations:

For the purpose of clarification regarding activities and task performed, the following discussion is provided regarding the applicable Federal Plant Protection Regulations that apply to Hawaii export ready commodities.

1. **Federal Quarantine §318.13**

Federal Quarantine 13 prohibits the movement of all Hawaii grown fresh fruit, herbs and vegetables to the U.S. mainland unless specifically approved by the USDA, APHIS, PPQ. The "quarantine" is in place because of the presence of pests in Hawaii that pose a threat to U.S. mainland agriculture. Pests of major concern are four Tephritid fruit fly species established throughout the Hawaii Islands (Mediterranean, Melon, Oriental, and Solanaceous), and various feeding and hitch-hiking pests, including sweet potato weevil, Asian citrus psyllid, green coffee scale, brown apple moth, and ants. Fresh agricultural products allowed movement from Hawaii to the U.S. mainland are listed in Table 3-1 of the USDA Hawaii Manual ("List of Approved Fresh Fruits, Herbs, and Vegetables from Hawaii – Authority 7 CFR 318.13) (See ATTACHMENT A). Products not listed cannot be moved from Hawaii to the U.S. mainland. Over a hundred products are currently listed in Table 3-1. Some may be moved from Hawaii to the U.S. mainland solely on the basis of Federal PPQ Inspection and finding of no apparent pest infestation. Others may require specific post-harvest quarantine treatment as a known host of pests of quarantine concern, e.g., fruit fly pests. Post-harvest irradiation quarantine treatments are specifically prescribed for fruit fly hosts (i.e., virtually all tropical fruit, other than durian), for sweet potato for the sweet potato weevils and a vine borer, and for curry leaves for the Asian citrus Psyllid. All listed commodities, however, can be treated with irradiation to mitigate risks of hitch-hiking insect pests. A generic treatment dose has been approved by USDA, APHIS, PPQ for insect pests, other than for pupae and adult life stages of Lepidoptera species for which additional efficacy data is required

for the generic dose of 400 Gray to be inclusive of all life stages of this group. The minimum absorbed dose (Dmin) for Tephritid fruit flies and for sweet potato weevils in Hawaii is 150 Gray.

New products can be added to Table 3-1. The regulatory review process for each new product is generally multi-year beginning with the Hawaii Department of Agriculture (HDOA) as the applicant; the USDA, APHIS, PPQ Hawaii office as the initial reviewing authority for USDA; and USDA, APHIS, PPQ Riverdale, Maryland (i.e., Regulations, Permits & Manual), the responsible reviewing authority. The initial step is the compilation of production, marketing and pest risk information by the HDOA. When the information has been sufficiently compiled and questions addressed, the information is forwarded to USDA, APHIS, PPQ Riverdale for a pathway pest risk assessment. The findings are summarized and published in a Federal Registry Notice for a 60-day public comment period. Based on this review and the public comments received, USDA will propose measures as may be necessary to mitigate identified pest risks by inspection, treatment, and /or handling requirements, as field pest surveys and treatment, pre-and/or post-harvest, pest free production areas, limited market distribution, geographical and/or time (seasonal restrictions) or a restriction solely to commercial shipments. The final rule for authorization for movement is then published in the Federal Registry. Should the USDA determine that one or more of the designated phytosanitary measures are not sufficient to mitigate the risk posed by the interstate movement of the commodity, APHIS will prohibit or further restrict the movement pending resolution of the review.

While many fresh vegetable products, such as basil and taro leaves, can be shipped without quarantine treatment, many growers and shippers elect to have consignments quarantine treated with irradiation because of product rejection by PPQ inspection (i.e., at Honolulu International Airport or other ports of departure from Hawaii) or in California at the first port of entry, as a result of hitch-hiking pests.

Treated commodities are accompanied by a USDA, APHIS, PPQ Certification of Treatment with Irradiation affirming the consignment has been quarantine treated by an approved facility under USDA, APHIS, PPQ oversight. The Certification of Treatment is the assurance that a pest detected in a consignment is no longer a pest of quarantine concern {i.e., non-viable and reproductive (sterile)}.

2. 318.13-3 General requirements for all regulated articles

This section reads in part:

“All regulated articles (i.e., fruits and vegetables in the raw or unprocessed state; cut flowers; seeds; and plants or plant products for non-propagative or propagative use) under Federal Quarantine 318.13 must be moved in accordance to requirements of the regulation, with Certification for movement issued by USDA, APHIS, PPQ under the following conditions:

1) Certification on basis of inspection or nature of lot involved. Regulated articles may be certified when they have been inspected by an inspector and found apparently free from infestation and infections, or without such inspection when the inspector determines that the lot for consignment is of such a nature that presents no danger of infestation or infection is involved.
2) Certification basis of treatment. (i) regulated articles for which treatments are approved under part 305 ("Phytosanitary Treatments") of the chapter may be certified if such treatments have been applied in accordance with part 305 of the chapter and if the articles were handled after such treatment in accordance with a compliance agreement executed by the applicant for certification or under the supervision of an inspector.

3. Dose Mapping:

Since a live (albeit sterile) pest may be present in an irradiated quarantine treated product, regulatory requirements have been established to assure the appropriate quarantine treatment of product through inspection, dosimetry, and documentation of product moving from certified treatment facilities to export markets. USDA, APHIS, PPQ and the PPQ Center for Plant Health Science and Technology (CPHST) in Raleigh, North Carolina, are the regulatory enforcement entities, which establish specific guidelines for irradiation quarantine treatment. Treatment approvals are granted on a per product and product-configuration basis through treatment facilities under Compliance Agreement with USDA, APHIS, PPQ. New product configuration development and approval by PPQ and CPHST can be a lengthy and time consuming process for small independent growers (as well as for treatment facilities) wishing to explore export opportunities to U.S. mainland markets from Hawaii due to the requirement for the dose mapping of new stacking configurations in an irradiator and the use of shipping carton that meets CPHST approval.
Dose mapping for new product approval can be by one of two methods. The first method developed by USDA, APHIS, PPQ – Center for Plant Health Science and Technology (CPHST) is described in detail in ATTACHMENT B.1. Commercial irradiation facilities, including Pa'ina Hawaii, are required to submit dose mapping data to USDA, APHIS, PPQ – CPHST for review and approval. The protocol and guidelines specify three preliminary runs of product in the proposed product stacking configuration in the irradiator with dosimeters placed throughout the stacking to characterize the absorbed dose of irradiation received by the product and to identify the minimum (Dmin) and maximum (Dmax) absorbed dose locations in the stacking configuration. The dose mapping results are submitted to USDA, APHIS, PPQ Hawaii for initial review. If the resulting data is deemed sufficient and proper, the results are submitted by PPQ Hawaii to CPHST in Raleigh, North Carolina for final determination and approval for the treatment facility to conduct three verification treatments in the presence of a PPQ inspector. The USDA dose mapping protocol is time

consuming and destructive to the product and may take several weeks to several months to complete to a final approved treatment. The second dose mapping procedure is a procedure developed by Gray*Star and Pa'ina Hawaii specifically for use with the Gray*Star Genesis II underwater irradiator (ATTACHMENT B.2). The procedure has been reviewed and approved by USDA, APHIS, PPQ – CPHST and is now being employed by Pa'ina Hawaii for the dose mapping of new process configurations. The system is based on the use of a Dose-Setup-Calculator to identify the appropriate placement of dosimeters in a stacking configuration in the irradiator to identify the Dmin and Dmax positions in the proposed treatment configuration. The calculator incorporates information on the flux distribution in the irradiator through measurements and modeling. The Gray*Star dose mapping procedure is not destructive to the product; absorbed dose is determined through an initial partial treatment (i.e., dwell time) to identify the Dmin and Dmax positions. The calculator then provides the required "residual" time to complete the treatment to assure that all product in the stacking has received the required Dmin exposure and no more than the maximum exposure (Dmax) currently allowed for fresh fruits and vegetables established by the U.S. Food and Drug Administration (FDA). The product used for the dose mapping is available for export, thereafter, with a Certificate of Treatment issued by USDA, APHIS, PPQ Hawaii (ATTACHMENT C).

As noted above, post-harvest quarantine treatments are reviewed and approved by USDA, APHIS, PPQ (i.e., CPHST); in addition, for Pa'ina Hawaii, approved treatments must be listed in the USDA, APHIS, PPQ Irradiation Reporting and Accountability Databased (IRAD). Pa'ina Hawaii irradiator operators input treatment data into the IRAD system at the completion of consignment "run" i.e., treatment. The IRAD record is verified by PPQ Hawaii to confirm actual dosimeter values for the treatment provided by e-mail to PPQ by the operator, along with information on the product, assigned trace back codes, shipper, consignee and carrier.

With the Gray*Star system, multiple process configurations can be readily developed for a given product, to accommodate growers and shippers using different cartons for product shipments to U.S. mainland markets and differences in volume of product that a grower or shipper can provide to specific markets. Multiple stacking configurations tailor treatments to the needs of specific growers and shipper at this time giving the supplier of product to Pa'ina Hawaii and Pa'ina Hawaii the flexibility to treat the volumes of product available and requested by export markets. The Gray*Star method offers the further advantage of allowing partial cart loads (i.e., one less layer of product on a product handling cart) of product to be treated, while the method employed by USDA allows no deviation from the stacking configuration as dose mapped and approved by CPHST.

Goals and Outcomes Achieved

A total of 34 new product configurations were developed and inputted into the USDA, APHIS, PPQ Irradiation Reporting and Accountability Database (IRAD) system. Of this number, 25 new product configurations in IRAD were dose mapped:

Basil (3)	Jackfruit	Moringa leaves (2) pods (2)
Breadfruit	Longan (2)	Rambutan (2)
Culantro	Lychee	Saluyute jute (3)
Curry Leaves	Mango	Taro leaves (2)
Honeydew melon	Mangosteen (2)	

Eleven were approved for dose mapping with no additional prior approvals required for future commercial treatments. The proposed deliverable for new product approved configurations for this project was met.

A. Meetings with Growers and Shippers:

Most small farms in Hawaii are family owned and operated businesses. Many of these farms are owned or operated by recent immigrant families from Asia, including, China, Taiwan, Thailand, Laos, Cambodia, and Philippines. The farms may produce a variety of ethnic products for local markets. A few farms have ventured independently into export markets and have expanded substantially over the years, especially in tropical fruit production (e.g., papaya, lychee, rambutan, longan and others). For products, such as basil and curry leaves, brokers and shippers work with individual growers to consolidate production to meet export demand.

Two meetings were held with growers on Oahu; the first at You Farm on October 30, 2014, in Kahuku; the second at the Hawaii Agricultural Research Center (HARC) facility in Kunia on December 18, 2014.

E-mails were sent to growers on the USDA, FAS list by FAS Honolulu (Jason Shitanishi, USDA Farm Service Agency) announcing the meeting (see ATTACHMENT D) and calls were made to key growers and shippers encouraging attendance.

Meeting in Kahuku at You Farm:

- Two growers
- One freight forwarder

Meeting at HARC in Kunia

- Two growers
- HARC representative

With the poor turn out at both meetings the decision was made to postpone holding one or more meetings with growers and shippers on the Island of Hawaii where travel distance would be significantly greater for potential attendees. Instead a decision was made to focus on meetings with interested growers and shippers at Pa'ina Hawaii in Kunia with follow-up discussion at the facility, on the farms, or by phone and e-mail as

needed. In these meetings, it was generally acknowledged that it would be difficult to assure a turnout of growers and shippers at a public meeting on export ready commodities and the interest to produce and export products to specific markets. Growers work long hours on the farm making it difficult to commit to attending a meeting during the week day, or weekend or after hours. As a result, the decision was made to continue to outreach to growers on a one-on-one basis to identify crops of export interest with irradiation quarantine treatment.

A power point presentation with handouts was prepared to share with growers (see ATTACHMENT E). The presentation narrative was translated into Chinese by Dr. Po Yung Lai who worked with Pa'ina Hawaii from the outset of the project.

In meetings with growers and shippers, the point was emphasized the growers and shippers can employ the services of two irradiators in Hawaii, one on the Island of Hawaii, the other Oahu. With the high costs of inter-island transport this was important. Quarantine treatment is not proprietary; facilities can provide service as needed with dosimetry and/or other testing that may be required by USDA, APHIS, PPQ. In the case of irradiation quarantine treatment, the treatments are specific to the facility as a result of possible differences in approved cartons, and differences in the handling and geometry of the source systems that are employed. Delivery of the required quarantine treatment dose is determined by dosimetry and dose mapping with USDA, APHIS, PPQ approval thereafter. Therein, growers and shippers in Hawaii would need to work with both facilities to minimize inconvenience to product and shipping opportunities over time.

B. Crops of Export Interest:

Of the products currently listed in Table 3-1 of the USDA Hawaii Manual, few are realistically export ready at this time. It is likely that the majority are not available in commercial production in Hawaii at the present. Of the products listed, the following were identified of interest to growers and shippers through one or both of the commercial irradiators in Hawaii:

Taro leaves	Basil
Allium spp.	Atemoya
Cherimoya	Sour sap
Carambola	Avocado
Betel nut	Korean melon
Little bitter melon	Bitter melon leaves
Curry leaves	Moringa pods and leaves
On-choy	Sweet Potato leaves and tubers
Culantro	Pineapple*
Saluyute Jute	Skinny eggplants
Wing beans	Bread fruit
Jack fruit	Guava
Passion fruit	Papaya

Dragon fruit	Longan
Mango	Lychee
Rambutan	Mangosteen
Galanga	Pohole fern
Tumeric	Abiu

*Varieties less than 50% smooth Cayenne

The list is compiled from various meetings with growers, primarily at the facility as well as in the field on Oahu and on the Island of Hawaii. Many of these products can be moved based solely on PPQ inspection requiring no post-harvest quarantine treatment (e.g., galanga, turmeric, pohole fern, saluyute jute, culantro, basil, taro leaves); the tropical fruit require a minimum absorbed dose of 150 Gray for fruit fly dis-infestation; sweet potato requires a minimum absorbed dose of 150 Gray for weevils and a vine borer; some products of export interests are not listed in Table 3-1 of the Hawaii Manual, therein, not currently allowed movement from Hawaii to the U.S. mainland (passion fruit, wing beans, On-choy, and sweet potato leaves). And for specific products, export from Hawaii may be currently allowed through the irradiator in Keaau (e.g., carambola, atemoya, and abiu), but not yet through the Pa'ina Hawaii irradiator on Oahu as the products have not been dose mapped as yet by Pa'ina Hawaii, therein, approved for treatment through by Pa'ina Hawaii irradiator by USDA, APHIS, PPQ.
For majority of commodities listed in Table 3-1, commercial production may be on a small scale or may not be currently available on a commercial scale in Hawaii despite the potential for significant production for export markets (e.g., saluyute jute and culantro).
The project specified work to be done on products currently approved for movement from Hawaii to U.S. mainland markets. Two of the products listed (sweet potato leaves and on-choy), were of particular interest to growers and shippers in Hawaii, however, neither are currently listed in Table 3-1. Pa'ina Hawaii has devoted considerable amount of time and effort on both products given the potential for these crops for export from Hawaii to U.S. mainland markets.

C. Status of Sweet Potato Leaves:

While sweet potato is listed in Table 3-1 of the USDA Hawaii Manual and is allowed movement from Hawaii to U.S. mainland markets with irradiation quarantine treatment (for sweet potato weevil, West Indian sweet potato weevil and the sweet potato vine borer at 150 Gray), the listing applies to the tuber but not foliage and leaf plant parts, despite an enabling pest risk assessment (PRA) in 2002 by the HDOA that addressed pests of all plant parts in the review. Pa'ina Hawaii was advised by USDA, APHIS, PPQ that a market access request would have to be submitted for sweet potato leaves and this has been initiated by Pa'ina Hawaii through the HDOA.
A document has been prepared to request a supplemental pest risk assessment to the Hawaii Department of Agriculture 2002 PRA in support of the movement of sweet potato in Hawaii (all plant parts) to U.S. mainland markets with irradiation quarantine

treatment (see ATTACHMENT F). The 2002 PRA covered pests of all plant parts of *Ipomoea batatas* in Hawaii; the regulatory review process, however, concluded with the listing of "Sweet Potato" in Table 3-1 which USDA has determined to apply solely to the tuber and not to foliage (leaves and stems). Pa'ina Hawaii reviewed the pest database in the HDOA, Plant Pest Control Branch, and found only one new pest of sweet potato, the rough sweet potato weevil (*Blosyrus asellus* (Oliver)), in Hawaii since 2002. Therein, the HDOA 2002, "Qualitative Pathway-initiated Pest Risk Assessment" (for the) Movement of Sweet Potato, *Ipomoea batatas,* from Hawaii to the Continental United States" is current, other than for the new pest, the rough sweet potato weevil.
The HDOA, Plant Industry Division, reviewed Pa'ina Hawaii updated pest risk assessment and industry details information required by USDA guidelines and forwarded the document to USDA, APHIS, PPQ Hawaii office for review for completeness of documentation and the appropriate wording of the quarantine request. After exchange of e-mail and discussion with PPQ Hawaii, Pa'ina Hawaii came to agreement with PPQ Hawaii that the request should be worded:
"This request is to allow movement of sweet potato leaves, foliage, stems, petioles to the U.S. mainland from Hawaii with Post-harvest irradiation treatment at 400 Gray,"
The request was subsequently forwarded to USDA, APHIS, PPQ, Regulations, Permits & Manual (RPM), Regulatory Coordination and Compliance (RCC) for review (July 21, 2015) which replied to PPQ Hawaii on July 22, 2015, as follows:
"Since we already know that the leaves et al would be irradiated at 400 Gy and the analyst would have the 2002 PRA to work from, we will likely request that PERAL start with a pest list only rather than a full PRA. It could cut down on the timeline for completion. The hardest part can be getting them to prioritize."
Pa'ina Hawaii has since been informed that Hawaii's document has been forwarded to a research specialist in CPHST formerly with the HDOA who authored the Hawaii's initial Sweet Potato PRC in 2002. As of this writing the rule allowing movement of sweet potato leaves from Hawaii to U.S. mainland markets is still pending, but is anticipated to be approved, hopefully by the end of the current calendar year.
A production treatment configuration and IRAD listing for sweet potato leaves has not yet been scheduled for dose mapping. This will be a priority once the Table 3-1 of the USDA Hawaii Manual has been revised to reflect that sweet potato leaves are a commodity approved for movement from Hawaii to the U.S. mainland.

D. Status of On-Choy Request:

On-choy (*Ipomoea aquatica*) is a listed Federal Noxious Weed and as such, is not eligible for listing in Table 3-1 of the USDA Hawaii Manual; on-choy, however, can be exported (i.e., moved) from Hawaii to U.S. mainland states that concur with Noxious Weed Permits 256 issued by USDA, APHIS, PPQ, for the movement of on-choy from Hawaii to the U.S. mainland. The permits are state-specific.
PPQ Form 526 permits are generally issued to individual growers and/or shippers. While the application process is not technically difficult, the process can be very confusing through the USDA, APHIS PPQ website and, for an individual grower or

shipper, the civil and criminal penalties that apply to permit violations can be discouraging in the application process.

To facilitate market access, Pa'ina Hawaii applied to USDA, APHIS, PPQ for a Form 526 Permit that growers and shippers could use for product treated by the Pa'ina Hawaii irradiator. The Pa'ina Hawaii Form 526 permit would be used solely for the movement of on-choy treated by Pa'ina Hawaii. Treatment, however, as a specific permit condition was denied by USDA, APHIS, PPQ, as on-choy as a Federal Listed Noxious Weed can be moved between U.S. mainland states by permit solely on the basis of visual inspection by PPQ to be pest free.

To date, between September 2014 and April 2015, seventeen states have concurred to entry of on-choy from Hawaii under the Pa'ina Hawaii Form 526 Permit; a list of the concurring states is attached (see ATTACHMENT G) along with a copy of the enabling permit. Pa'ina Hawaii remains as the responsible permit holder for all shipments of on-choy made to these states through the Pa'ina Hawaii permit allowing movement of product to these states.

To resolve the issue of irradiation quarantine treatment of on-choy for pests of quarantine concern identified by inspection, Pa'ina Hawaii prepared a discussion paper (see ATTACHMENT H) for review by CHPST and the USDA, APHIS, PPQ Treatment Advisory Panel. TAP agreed with the Hawaii analysis that on-choy could be subject to treatment with irradiation to mitigate a pest risk, and therein, for CPHST, the listing of the treatment in IRAD.

On-choy's listing as a Federal Noxious Weed is based on the plant's rapid growth that can pose a risk to lakes, ponds, rivers and open waterways. To address this concern, Pa'ina Hawaii treated on-choy at 400 Gy and submitted the samples to the Dr. Janice Uchida, University of Hawaii College of Tropical Agriculture and Human Resources (UH-CTAHR) for independent determination whether a treated on-choy will germinate and grow. The study (see ATTACHMENT I) found that on-choy irradiated at 400 Gy will not germinate and grow. Nevertheless, the release of on-choy to the environment would be a violation of the Form 526 Permit issued to Pa'ina Hawaii, subject to civil penalty and liability to the permit holder.

E. New Product Configurations:

As noted above, new product configurations development by Pa'ina Hawaii must be submitted to CPHST for input into the IRAD system. ATTACHMENT J is a printout from the current IRAD database listing all approved treatments and product configurations development and approved for use by Pa'ina Hawaii to date. Configurations from ID 170 to 289 for Pa'ina Hawaii were development during the Contract funding period for growers and shippers to access export markets. New product treatments were worked on largely in the order that growers and shippers presented their particular needs and interests to move product to specific export markets.

1. Basil – 400 Gray

USDA, APHIS, PPQ, CPHST approved three configurations for the treatment of basil (Thai and Sweet) prior to approval of the grant award to Pa'ina Hawaii in June 6, 2014, and consignments of basil shipments were being treated by Pa'ina Hawaii for growers on the Island Oahu since early 2013. The bulk of commercial basil production in Hawaii is on the Island of Oahu. With the availability of quarantine treatment for basil on Oahu, new growers have expressed interest in the production for export. Growers are generally aware of the risk of hitch-hiking insect pest and the possibility of product rejection for hitch-hiking pests in Hawaii prior to export or in California at the first port of entry. Some growers and shippers avoid export to California where the port-of-inspection programs are seen by some growers to be unfairly harsh. Others choose a quarantine treatment as irradiation to minimize risk of quarantine concern. To assist small growers to access new markets, Pa'ina Hawaii dose mapped a single carton configuration (ID 184) for basil to allow shipment of test samples to potential new markets and dose mapped two 16 - carton basil configurations (sweet (ID 201) and Thai (ID 202)) to allow growers and shippers to move product to export markets using cartons from inventory available at the time.

2. Moringa Pods – 400 Gray

Pa'ina develop two new treatment configurations for Moringa pods in two new cartons proposed by shippers, in two stacking configurations for 6 (ID 191) and 16 carton (ID 199) treatments at 400 Gray. This is a new export ready commodity with limited available export production at this time but significant backyard and commercial expansion initiatives underway in Hawaii as a result of the high protein content of both the pod and the leaves of this crop.

3. Moringa Leaves – 400 Gray

Pa'ina Hawaii developed a 15-carton (ID 220) treatment configuration for Moringa leaves for a new shipper. The grower/shipper preference was to export product with frozen gel pack to maintain to preserve product quality and to minimize risk of leaf drop in transit. Dose mapping was conducted with the gel packs in the cartons. After a number of weekly shipments of product to U.S. mainland markets, PPQ Hawaii raised concern that the inclusion of gel pack in cartons required specific approval of CPHST. This was brought to the attention of CPHST which offered no objection so long as the gel pack container was approved for food contact when treated with irradiation. A check of the product packaging indicated the packaging was approved food contact after treatment with irradiation.

4. Culantro (Eryngo leaf) – 400 Gray

Culantro is a leafy vegetable popular in Vietnamese cooking. Culantro is listed in Table 3-1 of the USDA Hawaii Manual as Eryngo leaf, with no requirement for quarantine treatment for movement from Hawaii to U.S. mainland markets. A 20-carton configuration (ID 194) was dose mapped and included in IRAD at the request a grower and his California customer to minimize risk of product loss in inspection as a result of possible hitch-hiking insect pests.

5. Taro Leaves – 400 Gray

Pa'ina Hawaii developed a 24-carton configuration (ID 189) for taro leaves at 400 Gray. The configuration was developed to allow a grower/shipper to use a sturdier carton for the product and to treat a larger volume of product on a cart to maximize efficiency of treatment and to reduce treatment costs.

6. Honeydew Melon, Taro Leaves, Moringa Leaves, Litchi, Curry Leaves – Single Carton Configuration – 400 Gray

The single carton configurations were developed and approved for listing in IRAD for each of the above products to allow movement of test samples of product (single cartons) to a photo shoot and promotion at the University of California, Davis, on irradiation and to allow growers/shippers to move test samples of product to U.S. mainland markets. (IDs 181, 182, 183, 184, 185, 186).

7. Jackfruit – 400 Gray

Pa'ina Hawaii developed a 16-carton configuration (ID 260) for Jackfruit for treatment at 400 Gray. Jackfruit is a very large tropical fruit with individual fruit weighing up to 20 pounds or more, making the shipment of product in an approved seal carton a challenge with one and no more than two fruit likely in a suitable cardboard shipping carton. Fruit can be selected of a uniform size to minimize carton density variance, but fruit harvested for market will likely represent a range of sizes. Stacking configurations should be uniform in product density throughout the stacking configuration, this will be difficult with jack fruit. Two dose mapping results were shared with CPHST with cartons switched in position after the first treatment. CPHST approved the treatment for listing in IRAD with the understanding that Pa'ina Hawaii will closely monitor commercial treatments for any serious variance in Dmin values for residual treatment as appropriate
See discussion below on Jack and breadfruit regarding the additional quarantine requirement that product must be treated infield or post-harvest with a pesticide for the control of *Phytophthora* disease control.

8. Saluyute Jute – 8, 16, and 20 carton configurations – 400 Gray

A treatment configuration for Saluyute Jute was requested by a grower on Oahu to fill orders for the product to a California food chain with 13 supermarkets in California and one outlet in Hawaii. Three configurations (ID 219) were dose mapped, the first for the movement of an 8 carton test shipment of product, and for larger consignments of 16 and 20 cartons, as commercial orders for the product were received by the local grower.

9. Mango – 16 carton configuration

Pa'ina Hawaii received 20 cartons of mango for dose mapping from a local importer of fresh agriculture products. While at the tail end of the mango season at the time of receipt of the product, the concern was that a heavy mango season as projected for 2016 would result in an excess of mango for local markets, therein, the interest to move product to export markets on the mainland. The configuration was treated to a 400 Gray dose for hitch-hiking insects, as well as fruit fly and mango seed weevil disinfestation and submitted to CPHST for input into IRAD.

10. Breadfruit – 12 carton configuration, 400 Gray

A 12 carton breadfruit treatment configuration was tested and submitted to CPHST for inclusion in IRAD. While accept into IRAD, the breadfruit as well as Jackfruit configuration, previously reported, may not be useable to growers and shippers in Hawaii as a result of an additional requirement for the treatment of fruit in the field or after harvest for Phytophthora control. The Quarantine 13 additional requirement reads:
"Fruit must be free from stems and leaves and must originate from an orchard previously treated with a fungicide appropriate *for the fungus Phytophthora tropicalis or after irradiation, a post-harvest fungal dip may be used."*
No fungicide product is currently registered nor licensed for sale and distribution in Hawaii for use on bread and jackfruit for Phytophthora control, in field or post-harvest. Pa'ina Hawaii has consulted with the Hawaii Department of Agriculture, Pesticides Branch, and the University of Hawaii, CTAHR, and both have been unsuccessful in finding a suitable product label for the two crops. In a review of the Federal Registry, Malaysia growers can export jackfruit to U.S. mainland markets with irradiation quarantine treatment. The approval also includes the additional declaration that the fruit must be treated in-field or post-harvest with a fungicide appropriate for *Phytophthora* control. The proposed and subsequent final rule notes that APHIS has an approved list of fungicides that Malaysian growers can use, copper-based fungicides as well as metalaxyl and mancozeb that are effective. Pa'ina Hawaii contacted USDA, APHIS, PPQ for a copy of this list and has been advised that the agency has not located such a list in files, but that the fungicides

listed would probably be acceptable (see ATTACHMENT K). Further research into this is required in light of the fact that a pesticide cannot be applied to a food crop in the absence of a tolerance or exemption from tolerance and approved pesticide label (Federal or State).

11. Eggplant – 20 carton, 150 and 400 Gray:

The proposed configuration was accepted by CPHST (ID 268 and 274) for inclusion in IRAD for a test shipment. The approval was based on information provided regarding anticipated product density and the stacking configuration to be used. The test was subsequently postponed and has been on hold pending the growers assessment of the feasibility of moving eggplant from Hawaii to U.S. mainland markets.

12. On-choy - 400 Gray:

Pa'ina Hawaii dose mapped a 20 carton configuration of on-choy in preparation of the first consignment of on-choy to be commercially treated for export to the U.S. mainland under Pa'ina Hawaii PPQ Form 526 Permit. The consignment was received at Pa'ina Hawaii for inspection by PPQ and when inspected, several cartons of on-choy were found to be infested with snails. Snails are not approved for quarantine treatment with irradiation; consequently, the entire consignment of on-choy (20 cartons) was returned to the shipper. A visit to the grower in Waianae (Oahu) was made several weeks later by Pa'ina Hawaii to survey the production area. On-choy is generally an aquatic plant; while the growing area was not in standing water, overhead sprinklers provide the irrigation requires for production of the crop and snails are prevalent in the growing area. Harvested on-choy bundles are rinsed with tap water prior to distribution to local markets; salt water is also used by the grower to rinse product free of snails. While a salt water rinse appears to be effective, close examination of several on-choy bundles did turn up several snails still attached to stems and foliage in several bundles of on-choy ready for local markets. The grower considered the use mollusicides in the field but had not yet made an application as a result of cost. Some insect damage was noted in the field; however, insect pressure did not appear to be significantly affecting on-choy production on the farm.
Pa'ina Hawaii reviewed the findings with the UH Extension Service and requested that assistance be given to the farmer to evaluate the efficacy of snail control with various commercial mollusicidal products as iron phosphate e and metaldehyde.

13. Longan and Rambutan 48 carton configurations, 150 and 400 Gray:

Two 48-carton configurations were dose mapped one for longan (ID 270/271), the other for rambutan (ID 272/273), to maximize the number of cartons on a product handling cart to increase the efficiency of treatment through the irradiator. Pa'ina Hawaii works under a time constraint; treatments must be completed and results

submitted to IRAD and to USDA, APHIS, PPQ before 1:30 p.m. for a Certificate of Treatment to be issued by 2:30 p.m. Treatment report received after 2:30 p.m. are issued Certificate of Treatment with an overtime charge or are issued the following day on regular time (no-charge).

14. Commodities in IRAD for Future Dose mapping:

Pa'ina Hawaii has over three years of experience with the Gray*Star Dose Setup Calculator and dose mapping procedures to identify the Dmin and Dmax positions in stacking configurations. The DSC method for dosimetry has proven useful in dose mapping a larger number of product configurations for growers and shipper for export of products into U.S. mainland markets. Growers and shippers have requested quarantine treatment configurations through the Pa'ina Hawaii irradiator for a variety of additional crops, not all requiring quarantine treatment for movement from Hawaii to U.S. mainland markets, including, abiu, guava, dragon fruit, kabocha , galanga and turmeric. CPHST has approved abiu (ID284/285), guava (ID286/287), and kabocha (as *Cucurbita* spp.)(ID 282/283) for dose mapping and commercial treatment without prior additional approvals required. The configurations were approved based on anticipated cartons, product densities, and stacking configurations to be used.

Beneficiaries

Pa'ina Hawaii has worked most closely with stakeholders currently in production and moving product to U.S. mainland markets with quarantine treatment. Much of the discussion has focused on the movement of specific consignments to Oahu from the Island of Hawaii for treatment, the approval to do so with mixed container loads of product and whether specific items required inspection at the first port- of - departure (Hilo) prior delivery to Pa'ina Hawaii, or whether inspection by PPQ on Oahu could be arranged at Pa'ina Hawaii. The discussions have been about logistics and agreements and policy with respect to PPQ inspection programs. New product development for export has also been an important part of the discussion especially with growers and shippers on the Island of Oahu. To this end, Individual growers have also come to Pa'ina Hawaii with market representatives to discuss the production and treatment of new products including Saluyute Jute, bitter melon fruit and leaves, and others. Pa'ina Hawaii has devoted a considerable amount of time and effort to address the specific needs and interests of these stakeholders, more so than outreaching to potential new stakeholders statewide to expand the number of growers and shipper currently into export markets. Pa'ina Hawaii will publicize the service of its irradiator and experience and expertise in working with regulatory agencies and the requirements that apply to outreach to new clients. However, the priority of this project has been to serve the immediate needs of the existing export community, to learn from this experience the allocation of limited time and resources to obtain new treatment approvals in a timely fashion, and to establish the required protocols and the confidence of USDA, APHIS, PPQ and CPHST in the process.

As noted previously, USDA's preference is for standardized treatments for a given product to minimize the number of treatment configurations for PPQ oversight and inspection. Hawaii agriculture at this point in time consists of numerous small independent growers with limited production and resources to re-tool at the very outset. This will happen over time with commodities with the best opportunity for expanded production in Hawaii and position in export markets. A wider outreach effort will develop with stakeholders statewide as more and more products are cleared for treatment and become available for export to U.S. mainland markets. Outreach to stakeholders with be at the irradiator in industry briefings and visits and through newsletters and seminars sponsored by the Hawaii Department of Agriculture, the University of Hawaii College of Tropical Agriculture and Human Resources, the Hawaii Farm Bureau Federation industry organizations (See ATTACHMENT L).

Other beneficiaries of the program include:
USDA, APHIS, PPQ – Hawaii officers in the field and supervisors inspect consignment prior to treatment and address a range of issues, some procedural, on how their work is to be done in the facility. Through this effort, PPQ officers in Hawaii are uniquely familiar with many of the details of irradiation quarantine treatment and better understand the usefulness and value of post-harvest quarantine treatment with irradiation for the growth and diversification of agriculture in Hawaii.

USDA, APHIS, PPQ – Center for Plant Health Science and Technology (CPHST) is the lead authority for the approval of new product configurations and dose mapping procedures. The USDA dose mapping protocol, which all treatment facilities, domestic and foreign are required to employ, is not well suited for Hawaii agriculture at this time due to the fact that Hawaii diversified agriculture currently consists of small independent growing units with limited production and financial resources, as such, it is best suited for small niche markets. To facilitate new product development (approved product configurations for treatment), Gray*Star Corporation and Pa'ina Hawaii developed an alternative dose mapping procedure that is not destructive to products, thus, allowing the product to be moved to export markets after dose mapping. The system has made new product development much more readily available for a wide variety of new products of interest to growers in Hawaii. This has been a learning experience for both CPHST and Pa'ina Hawaii.

Representatives of Hawaii Farm Bureau Federal and University of Hawaii College of Tropical Agriculture and Human Resources (UH-CTAHR) have made numerous visits to irradiator over the course of the project for background information on the application of irradiation as quarantine treatment for Hawaii fresh agricultural products. The goals and objectives of the HDOA project have been shared by these organizations with their stakeholders in the on-going discussions to facilitate the transition of Hawaii agriculture from plantation production to small, diversified agricultural production, and the need to enhance the quality of Hawaii production to meet domestic as well as export market requirements.

Pa'ina Hawaii as a service provider for post-harvest quarantine treatment operates under a Compliance Agreement with USDA, APHIS, PPQ – Hawaii. The Compliance Agreement imposes specific regulatory and procedures requirements for Pa'ina Hawaii to operate under as an approved treatment facility. In turn, Pa'ina Hawaii is a private, for profit entity, working with a diverse group of stakeholders with various interests and resources. This has been a learning experience for the company in both arenas enhanced by the need to meet the deliverables of this project.

Lessons Learned

A. Problems and Delays

This project was granted to Pa'ina Hawaii on June 6, 2014 with termination date set in November 2015. Due to an anticipated longer time needed to perform the planned project activities, a no-cost extension was requested and approved on April 15, 2015, which effectively extended the project termination date to March 2016. As noted previously, the vast majority of growers in Hawaii are small farming entities. Production levels on any given farm may be very small by U.S. mainland standards. Growers are hard-working in producing their products to meet the local market needs. Expanding production to test export opportunities can be a daunting challenge for most. Understanding regulatory requirements is one problem, making a coordinated effort to test shipments is another. Pa'ina Hawaii has met with numerous growers on the opportunities for export using irradiation as a post-harvest quarantine treatment. A few of these discussions have resulted in new product developments for dose mapping and inputted into the IRAD system to enable commercial shipments of such crops as Moringa pods and leaves, saluyute jute, and culantro and to allow movement of product in cartons available to growers and in the volumes of interest to markets at the time. While this progress has progressed slowly at times, the regulatory review process has vastly improved with quicker decisions now being made. This enhances the establishment of better operating procedures for processing each treatment request and improves the lines of communication between Pa'ina Hawaii and USDA.

B. Opportunities for Export

As noted previously, over a 100 different commodities are listed in the USDA Hawaii Manual, Table 3-1, for export from Hawaii to the U.S. mainland. The majority are not in significant production or available commercially in Hawaii. The list was compiled by USDA, APHIS, PPQ administratively over some period of time. Since 2009, the listing must be done through a rule making process, which may require multiple years to complete from initiation to a final rule. Hawaii does not receive special treatment from USDA in the rule making process to allow market access for Hawaii's new products into U.S. mainland markets. Consequently, sweet potato leaves will likely take some additional time to move forward in the regulatory queue. However, it is expected that USDA will approve this request without any specific additional handling requirements

other than for quarantine treatment of the foliage at 400 Gray for hitch hiking insect pests if and when they are detected in consignments.
Jack fruit, bread fruit and on-choy may have additional hurdles to overcome as discussed previously.
Market access is an ultimate goal for a treatment facility. However, there are a number of issues that need to be addressed before the goal can be reached, i.e., is it allowed movement, is there a treatment requirement and has the product been approved for treatment (i.e., dose mapped) for inclusion into the IRAD system. Addressing these issues can be achieved through discussion, review, and/or submission of proposals to USDA for product treatment and listing. The endeavor may lead to a modest product configuration for the movement of a limited available product to a small, restrictive market. Test shipments of these limited available products can be made. However, any larger shipment of these products will depend on its availability, costs, quality, and other factors thereafter. Treatment facilities in support of growers and shippers must provide the necessary services, support, and treatment to help customers succeed in market access for the products that they produce. This is clearly a part of the business of a treatment facility, which is at its infancy phase in Hawaii.

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Additional information

The following are included:

- ATTACHMENT A Fresh agricultural products allowed movement from Hawaii to the U.S. mainland are listed in Table 3-1 of the USDA Hawaii Manual ("List of Approved Fresh Fruits, Herbs, and Vegetables from Hawaii – Authority 7 CFR 318.13).
- ATTACHMENT B.1 Dose mapping for new product approval can be by one of two methods. The first method developed by USDA, APHIS, PPQ – Center for Plant Health Science and Technology (CPHST) is described in detail.
- ATTACHMENT B.2 The second dose mapping procedure is a procedure developed by Gray*Star and Pa'ina Hawaii specifically for use with the Gray*Star Genesis II underwater irradiator.
- ATTACHMENT C The product used for the dose mapping is available for export, thereafter, with a Certificate of Treatment issued by USDA, APHIS, PPQ Hawaii.

- ATTACHMENT D E-mails were sent to growers on the USDA, FAS list by FAS Honolulu (Jason Shitanishi, USDA Farm Service Agency) announcing the meeting and calls were made to key growers and shippers encouraging attendance.
- ATTACHMENT E A power point presentation with handouts was prepared to share with growers.
- ATTACHMENT F A document has been prepared to request a supplemental pest risk assessment to the Hawaii Department of Agriculture 2002 PRA in support of the movement of sweet potato in Hawaii (all plant parts) to U.S. mainland markets with irradiation quarantine treatment.
- ATTACHMENT G To date, between September 2014 and April 2015, seventeen states have concurred to entry of on-choy from Hawaii under the Pa'ina Hawaii Form 526 Permit; a list of the concurring states is attached.
- ATTACHMENT H To resolve the issue of irradiation quarantine treatment of on-choy for pests of quarantine concern identified by inspection, Pa'ina Hawaii prepared a discussion paper for review by CHPST and the USDA, APHIS, PPQ Treatment Advisory Panel.
- ATTACHMENT I The study found that on-choy irradiated at 400 Gy will not germinate and grow.
- ATTACHMENT J ATTACHMENT J is a printout from the current IRAD database listing all approved treatments and product configurations development and approved for use by Pa'ina Hawaii to date.
- ATTACHMENT K Pa'ina Hawaii contacted USDA, APHIS, PPQ for a copy of this list and has been advised that the agency has not located such a list in files, but that the fungicides listed would probably be acceptable.
- ATTACHMENT L Outreach to stakeholders with be at the irradiator in industry briefings and visits and through newsletters and seminars sponsored by the Hawaii Department of Agriculture, the University of Hawaii College of Tropical Agriculture and Human Resources, the Hawaii Farm Bureau Federation industry organizations.

College of Tropical Agriculture
and Human Resources
University of Hawai'i at Mānoa

New Plants for Hawai'i
February 2016
NPH-14

Hawai'i Tea Growers' Survey 2014

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In June 2014, the University of Hawai'i's College of Tropical Agriculture and Human Resources (CTAHR) partnered with Mauna Kea Tea and The Kohala Center to conduct a survey targeting existing Hawai'i tea growers and those who had taken steps toward becoming tea growers. The survey therefore provided a snapshot of the fledgling Hawai'i tea industry. The purpose of the survey was also to identity problems that CTAHR might address in future research and Extension programs. Funding support was provided by Hawai'i Department of Agriculture and United States Department of Agriculture.

A link to an online survey was distributed to mailing lists maintained by the partners, the Hawaii Tea Society, and various government agencies and organizations. Respondents were self-selected. There were 39 valid respondents.

Summary of findings

Farm characteristics: Nearly three-quarters, 72%, of the respondents were from the Big Island, and they were distributed relatively evenly over the island. Six respondents were from Maui County, three from O'ahu, and two were from Kaua'i (Q1). A fifth of the operations were at sea level to 1000 ft elevation, over half at 1000 to 2500 ft, and a quarter above 2500 ft. (Q2). Survey results indicated that 43% receive less than 80 inches of rainfall a year and therefore, based on tea's water requirements, may need to irrigate at least during some part of the production season (Q3). Eighteen respondents reported that they did irrigate their crop (Q4).

In terms of soil depth, 40% had more than 20 inches of soil, while 23% had from 10 to 20 inches and 28% had 10 inches or less of soil (Q5). Soil pH ranged from less than 4.5 to over 6.5 (Q13). Given our experiences, these results indicated that improper soil pH will be a significant limitation to optimal tea growth and production. Only 9% (3 growers) had soil that was in the 4.5–5.0 optimum range, with another 9% (3 growers) with a pH of 5.0–5.5. One third, 32% (11 growers) had soil with pH that was too high (6.0 or higher). Of note is that one fourth of the respondents (9 growers) did not know their soil pH.

Tea plantings: Most operations (74%) had grown tea for 5 years or less, while the oldest operations (3 farms) had had tea plants for 10 to 15 years (Q6). Nearly all growers had no more than 2 acres in tea, with 36% having ¼ acre or less (Q7). These results imply that the total acreage in tea (as reported in this survey) is no more than about 40 acres, and more likely around 23 acres. A quarter, or 26%, grew their plants in full sun, 34% had the entire planting in partial shade, and the remainder had a mix, with some plants growing in full sun and some plants under shade (Q12). Growing the tea plants under trees was the likely source of the shade.

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The majority of growers, 63%, had 1000 plants or less, while the largest (5 growers) had between 5000 and 10,000 plants (Q8). Twelve growers, or 44% of those responding to the question, reported growing only seedlings, while 14 growers (50% of respondents) grew only cuttings (Q9). Thirteen growers reported having *assamica* varieties; 16–18 growers had at least one of the varieties *Benikaori, Bohea, Yabukita,* or *Yutaka Midori*; 9 reported *Chin shin oolong*; and 6 respondents had other varieties (Q10). The source of plants for most growers (46%) was "other," including several plant-distribution programs. This was closely followed by CTAHR/USDA, with 44%, then other growers or friends, with 36% (Q11).

Harvesting and processing: The majority of respondents were not yet harvesting on a regular basis (responded with "not sure/don't know"). More than a quarter, 29%, harvest 6 or fewer times per year, while 2 growers (6%) report harvesting more than 35 times per year (Q21). In an open-ended question, eight growers reported harvesting more than 10 pounds of tea in 2013 (Q22). Nearly all processed by hand (Q24). Three used some machinery, while two reported using machines and no hand-harvesting. Green was the most commonly produced type of tea, by 67% of respondents (Q25). Many also produced black (40%) and white (37%) teas, while 9% processed oolongs. (Note: A long-term goal should be to develop and use Hawaii Tea terminology.) Most sold directly to final consumers (Q26). When asked about *banji* (shoot dormancy), over half (53%) didn't know or were unfamiliar with the condition (Q23). Of the remainder, those without a problem outnumbered those with excessive banji by a 2:1 ratio (32% vs 16%).

Bottlenecks/Problems: Respondents were also asked to describe their top barriers to production in an open-ended question (Q30). Lack of labor; processing issues, including the lack of equipment/facilities and knowledge; and the lack of planting material were limitations most often mentioned.

The majority of growers indicated that the pests listed in the survey were either not a problem or at worst a mild problem (Q18). On a scale of 1 = no problem to 10 = unmanageable problem, half to two-thirds rated each pest as 0 = not a problem. Some individuals were having significant problems, most often with Chinese rose beetles. The great majority, 87%, of the growers reported not using any pesticides (Q17).

Several grasses, vines, and shrubs were listed as problems (Q20). Non-chemical methods were the predominant form of control, with the most popular being hand-weeding (used by 90% of respondents), mowing/weed whacking (67%), and mulching (54%). Chemical methods were less popular, but 21% reported using herbicides (Q19).

More than half, 55%, conducted soil analyses (Q14), while only 8% conducted plant tissue analyses (Q15). Growers reported using a variety of synthetic and organic/"natural" fertilizers and amendments (Q16).

Respondents were asked to rate the likelihood of their attending workshops on various tea topics if they were offered by CTAHR (Q27). The scale used ranged from 1 = not likely to 5 = very likely. In general, responses to most topics fell into two groups, with a larger portion in the 4 and 5 range and a smaller group with 1 and 2 responses. Business-management and recordkeeping topics had fairly large groups with 3 = neutral/so-so response. All topics had more growers likely to attend than not. The most popular topics were harvesting and processing, pruning, and tea cultivation. These were followed by soil and tissue sampling and marketing topics. The two business subjects and propagation rounded out the topics. The four topics in greatest demand were verified when respondents were asked to select the top three topics of interest to them (Q28). In this question, propagation replaced marketing as the fifth-most demanded topic.

A conference-type venue could be a good method to educate tea growers and provide periodic updates, and could also help to foster an industry organization. A majority of respondents, 63%, stated they would definitely attend, and another 29% said they might attend an annual industry conference (Q29). Three individuals stated they were not sure or probably would not attend such an event.

The remainder of this document provides more detailed results for each survey question and commentary on these results.

Survey Introduction and Instructions

Thank you for participating in this Hawaii tea growers' survey. The purpose of this survey is to assist The Kohala Center and University of Hawaii College of Tropical Agriculture to determine growers' most significant barriers to production. Reading and thoughtfully answering the questions may give you insight into typical problems and solutions in tea farming. Results of this statewide survey and invitation to subsequent tea growing workshops will be distributed to survey participants who provide their contact information.

Should you manage more than one area of tea production, please fill out this survey once per unique area farmed. Thank you again for your participation.

Q1. Where is your operation located?

- Most (72%) are from the Big Island, then Maui, O'ahu, Kaua'i, and Moloka'i.
- Combined non-Big Island count is 11 growers compared to 28 on Big Island.

Location	n	%
Ka'u-Volcano-Puna	15	38.5%
Kona-Waimea-Hilo	13	33.3%
Maui	5	12.8%
Moloka'i	1	2.6%
O'ahu	3	7.7%
Kaua'i	2	5.1%
Total	39	100%

Q2. At approximately what elevation is this farm?

- The Mealani Research Station is at 2800'. Three quarters, 74%, of respondents are at a lower elevation and 18% are higher.
- One difference relating to elevation is that growers at the lower elevations seem to have had more problems with the Chinese rose beetle compared to growers with farms at the higher elevations.

Elevation	n	%
0–500 ft	6	15.4%
500–1000 ft	2	5.1%
1000–1500 ft	8	20.5%
1500–2000 ft	5	12.8%
2000–2500 ft	8	20.5%
2500–3000 ft	3	7.7%
3500–4000 ft	4	10.3%
4000+ ft	3	7.7%
Total:	39	100.0%

Q3. What is your approximate annual rainfall?

Inches/year	n	%	cum. %
0–40	3	7.7%	7.7%
40–80	13	33.3%	41.0%
80–120	9	23.1%	64.1%
120–180	6	15.4%	79.5%
180–240	4	10.3%	89.7%
240+	2	5.1%	94.9%
Not sure / Don't know	2	5.1%	100%
Total	39	100%	

Q4. Do you irrigate? ( ) Yes ( ) No

- 41% of farms may need irrigation at least during some part of the year.
- 46% (18 farms) reported that they had irrigation.

Q5. What is your approximate soil depth?

- 62% had plantings in fields with at least a foot of soil.
- The greatest impact of having a shallow soil depth might be that the plants could be more prone to water stress during drought and the cost of establishing the field might be higher.

Depth	n	%
0–5 in	4	10.3%
5–10 in	7	17.9%
10–20 in	9	23.1%
20+ in	15	38.5%
Not sure / Don't know	4	10.3%
Total Respondents:	39	100.0%

Q6. How long has tea been growing at this location?
0–3 yrs, 5–10 yrs, 10–15 yrs, 15+ yrs

- No respondent had been in operation for more than 15 years.
- Half of the respondents had been growing tea at their current location for three years or less, and three fourths for five years or less.

Years	n	%
0–3 yrs	19	50.0%
3–5 yrs	9	23.7%
5–10 yrs	7	18.4%
10–15 yrs	3	7.9%
15+ yrs	0	0.0%
Total	38	100%

Q7. At this location, how many acres are planted in tea?
¼ acre or less, ¼–1 acre 1–2 acres, 2–3 acres, 3–5 acres, 5–10 acres, 10–20 acres, 20–50 acres, 50+ acres

- Based on this survey, the total acreage reported to be planted in tea in Hawai'i is somewhere between just under 16 acres and 42 acres.
- The largest tea planting is 5–10 acres in size.
- Most (83%) are an acre or less.
- This is information from 36 respondents. In addition we were aware or have heard of a handful of potential growers, each with intentions to plant anywhere from 50 to 100+ acres.

Acreage	n	%
¼ acre or less	13	36.1%
¼–1 acre	17	47.2%
1–2 acres	5	13.9%
2–3 acres	0	0.0%
3–5 acres	0	0.0%
5–10 acres	1	2.8%
10+ acres	0	0.0%
Total	36	100%

Q8. How many tea plants are at this location?
500 or less, 500–1000, 1–2 thousand, 2–5 thousand, 5–10 thousand, 10,000 or more, Don't know

# Plants	n	%
500 or less	11	28.2%
500–1000	14	35.9%
1–2,000	6	15.4%
2–5.000	3	7.7%
5–10,000	5	12.8%
10,000+	0	0.0%
Total	39	100.0%

Q9. About what percentage are:
_____% Seedlings _____% Cuttings
_____% Don't know

- Nearly 2/3 reported having no more than 1,000 plants; 28% have 500 or fewer plants.
- These results are questionable. That is, if 44.4% said they had plantings consisting of 100% seedlings, it must mean that they have zero cuttings. However, only 14.3% stated that. As a check, the actual numbers are 12 of 27 respondents with 100% seedlings and 4 of 28 with zero cuttings.
- Similarly, 14 of 28 (50%) stated that their plantings consisted of 100% cuttings, but only 6 of 27 (22.2%) had zero seedlings.

Q10. What varieties and numbers of plants are planted?

Variety	#
( ) Assamica vars	_____
( ) Yabukita	_____
( ) Yutaka Midori	_____
( ) Benikaori	_____
( ) Bohea	_____
( ) Chin Shin Oolong	_____
( ) Other clones	_____
( ) Seedlings	_____

- Very few growers have more than 1,000 plants of any one variety.
- The varieties Yabukita, Yutaka Midori, Bohea, and Benikaori were fairly evenly distributed.
- Many responded that they had Assamica varieties, but it was unclear whether the respondent meant clonal or seedling.

Q11. What was the source of these plants?*
(_____)
***optional**

- The original CTAHR-USDA distribution program apparently accounted for a large proportion of the plants.
- Under "other," the Byron Goo/Tea Chest program was most frequently mentioned. Other sources include Cam Muir/Eliah Halpenny and Eva Lee/Chiu Leong/Tea Hawaii.

Q12. Are your tea plants growing in:
( ) Full sun ( ) Partial shade ( ) Mixed (some in full sun/some in shade)

	n	%
Full sun	10	26.3%
Partial shade	13	34.2%
Mixed (sun & shade)	15	39.5%
Total	38	100%

Q13. What is your current soil pH?

- Given our experiences, these results indicate that improper soil pH will be a significant problem. Only 9 percent (3 growers) are in the 4.5–5.0 optimum range, with another 9% (3 growers) with pH of 5.0–5.5. Eleven growers, 32%, have soil with a pH value that is definitely too high to support healthy tea growth.

pH	n	%
<4.5	1	2.9%
4.5–<5.0	3	8.8%
5.0–<5.5	3	8.8%
5.5–<6.0	7	20.6%
6.0–6.5	9	26.5%
6.5+	2	5.9%
DK / Not sure	9	26.5%
Total	34	100.0%

- One grower mentioned that lime is being applied, although at a very low rate.
- Of note is that one fourth of the respondents (26.5%, 9 growers) did not know their soil pH.

Q14. Do you conduct soil nutrient analysis?
( ) Yes ( ) No

- Twenty-one did, 17 did not.
- Since 9 stated they did not know their soil pH, the difference from the 17 who did not do an analysis could be a problem.

Q15. Do you conduct foliar/tissue analysis?
( ) Yes ( ) No

- Only 3 respondents conducted plant tissue analyses. This indicates that plant tissue analyses are underutilized and education in this area may be warranted.

Q16. What kind of fertilizer do you use? What is the application rate (e.g., lbs. per month)?

Type	Rate
( ) Organic:	_____
( ) Conventional:	_____
( ) Other:	_____
( ) None	

- Many of the materials listed were organic or "natural" rather than from synthetic sources.

Q17. Do you use pesticides? ( ) Yes ( ) No

- Five growers reported using pesticides, likely those reporting significant pest problems.

Q18. What are your main pest or disease problems, and how serious is the problem?
Please provide your rating for each of the following. (Scale of 1 to 10, with 1 being no problem, 10 being unmanageable).

- The vast majority indicate that the pests listed are either not a problem or at worst a mild problem. Half to 2/3 say they are not a problem.
- Some individuals are having significant problems, most often with rose beetles.
- Scales may not be considered an issue because they are not apparent?
- Others:
  - Three list mites.
  - Four list vog/acid rain—would there be pest symptoms that mimic these conditions? This has not been a problem at Volcano station.
  - One respondent mentioned that light brown apple moth caterpillars loved to feed on tea shoots. This could be confusion with caterpillars of the Mexican leafroller.
- This may indicate a need for education on pest/symptom identification.

Pest	1 - No problem	2	3	4	5	6	7	8	9	10 - Unmanageable	Total	Avg. rating
Scales	13	5	2	0	0	0	0	0	0	0	20	1.52
Aphids	10	5	4	0	0	1	0	0	0	1	21	2.45
Anthracnose, Fungal	11	5	1	2	0	0	0	0	1	0	20	2.19
Rose Beetles	13	1	0	2	0	0	2	1	1	0	20	2.90
Caterpillars	13	2	2	1	0	1	0	1	0	0	20	2.24

Q19. How do you control weeds?
( ) Herbicide ( ) Weedmat ( ) Mowing/ Weedwhacking ( ) By hand ( ) Animals ( ) Mulch

- Non-chemical methods of weed control were predominant.

Q20. What are your main weed problems? (Fill in the blank)

- Several grasses, vines, and shrubs were listed.

Q21. How often do you harvest each plant in a year?
( ) 1–3 ( ) 4–6 ( ) 7–12 ( ) 13–24 ( ) 25–35 ( ) More than 35

- Overall, less than half of the respondents have crops in the harvest stage.
- Of those reporting harvest, most are not yet harvesting on a regular basis.
- See next question on amount harvested.

Frequency	n	%
1–3	4	13%
4–6	5	16%
7–12	1	3%
13–24	3	9%
25–35	0	0%
More than 35	2	6%
Not sure / NA	17	53%
Total	32	100%

Q22. How many total pounds of wet leaf did you harvest in 2013? (Fill in the blank)

- Eighteen out of 32 (56%) had not harvested yet.
- Another 8 (25%) harvested test/very small quantities.
- Six (19%) harvested significant quantities (over 25–30 lbs) for the year.

Q23. Do you have problems with banji? ( ) Yes ( ) No

- More than half did not know what banji is, or whether they have it.
- Of those who know, a third (16% of all) report having excessive banji.
- Problems with excessive banji are likely to manifest later when the crop is being harvested regularly and when proper cultural practices are not followed.

	n	%
Yes	6	15.8%
No	12	31.6%
Don't know	20	52.6%
Total	38	100%

Q24. How do you process your tea?
( ) By hand ( ) Continuous machine ( ) Machine assist

- Nearly all respondents process by hand.
- Two reported using only machines; another 3 reported some machine use.

Method	n	%
By hand	27	96%
Only machine	2	7%
Machine assist	3	11%
Total	28	

Q25. What type of tea is your end product? (More than 1 choice may be selected.) ( ) White ( ) Green ( ) Yellow ( ) Oolong ( ) Black ( ) Other

- Green is most popular, with the other types somewhat evenly distributed.
- Perhaps Hawaii Tea terminology should have been used, but many might not be familiar with it.

- "Other" includes pekoe, silver needle, aged (pu-erh like), and several herbal "teas."

Type	n	%
White	11	37%
Green	20	67%
Yellow	3	10%
Oolong	9	30%
Black	12	40%
Other	8	27%
Respondents	30	

Q26. How do you characterize your buyers?

( ) Tea Shops _____%
( ) Food Service _____%
( ) Direct _____%

- Most sell direct to final consumers and other.
- Eleven responded.

Q27. On a scale of 1 to 5, with 5 being very likely and 1 being not likely, please rate your likeliness to attend the following workshops: Soil and Tissue Sampling, Cultivation, Pruning Harvesting & Processing, Propagation, Recordkeeping, Business Management, Marketing Topics

Q28. What are the top three topics where you would be interested in assistance from CTAHR?

1. _____

2. _____

3. _____

Topic	n	%
Tea cultivation	16	45.7%
Pruning/banji	16	45.7%
Harvesting and processing	16	45.7%
Soil and tissue sampling	15	42.9%
Propagation	11	31.4%
Other	11	31.4%
Business management	10	28.6%
Marketing topics	6	17.1%
Recordkeeping	4	11.4%
Total	35	100%

Q29. How likely are you to participate in an annual industry conference-type event?
( ) Would definitely attend ( ) Might attend
( ) Would not attend

	n / 35	%
No, I would definitely not attend	0	0.0%
I would probably not attend	1	2.9%
Not sure, undecided	2	5.7%
I might attend	10	28.6%
Yes, I would definitely attend	22	62.9%

Topic	1 - Not likely	2 - Somewhat unlikely	3 - Neutral, so-so	4 - Somewhat likely	5 - Very likely	Total	Rating average
Soil and tissue sampling	4	2	3	11	15	35	3.89
Tea cultivation	2	2	4	10	17	35	4.09
Pruning	4	0	5	5	21	35	4.11
Harvesting and processing	3	1	3	7	20	34	4.18
Propagation	8	4	2	4	13	31	3.32
Business management	4	2	8	8	10	32	3.56
Recordkeeping	3	3	11	6	10	33	3.52
Marketing topics	2	3	6	11	10	32	3.75

Q30. Please describe your top barriers to production.

- Production cost, human labor, available services
- So far none. Plants doing very well. Concerned about market, but that's down the road (we have about 6,000 cuttings, few mature plants.)
- Labor
- Labor. It is so labor-intensive to plant, partly due to all the hand labor to make the soil amendments. And, pruning and harvesting and processing are all so laborious. We probably won't be able to exceed ¾ acre due to these constraints.
- I am still trying tea growing; I have a very few # plants. Not enough for production.
- Not enough plants. At present there is not a Processing facility. One is badly needed or the industry will remain a backyard undeveloped industry. The potential for Tea to become a main industry for the Hawaiian Islands is overwhelming strong, however, without the infrastructure for processing the product, it will stagnate into a small household type of a business.
- Young plants, green algae seems to wipe out some plants if not removed by hand.
- Manpower
- Drought
- None
- Top barrier is huge Lava Rocks up to 70lbs.
- Need labor but can't afford labor until producing more but can't produce more without labor...
- 1. Need for seedlings 2. Need for money to pay labor to keep weeds at bay 3. Interested buyer of tea. We would just like to grow rather than value-add.
- Right now we still have everything in the growing pots under a shed, our plants are 6–7 months old as of this time.
- Slow growth; initially failure to prune early on... therefore, bushes aren't as thick and dense as should like.
- Concerns about processing harvested tea. No facility on Maui and equipment expensive plus not much expertise here either. Also LBAM (little brown apple moth) love the new tips. Really a problem here.
- Seedlings result in mixed genetics. Plants are not uniform resulting harvesting issues and mixed quality.
- Poor clay soils and high labor costs.
- Obtaining quality plant material.
- Cost and availability of processing equipment, time availability & labor cost, affordable access to farmland with long-term lease (at least 40 yrs.)
- Knowledge
- Brand new...don't know much about anything yet.
- Not enough time to prune, weed and manage fields all by myself.
- Lack of processing education and equipment
- None assessed, but availability of processing equipment.
- Irrigation and time!
- Labor
- We don't have a full time farmer. We have approximately 2000 tea plants in the ground. We acquired the plants from a local grower on the Big Island. They are all an Indian variety "Darjeeling". My partner attended the CTAR Tea Class in May 2014. We would like to acquire some Japanese variety to plant on our farm but are unsure on how to pursue.
- Lack of water as we're off the grid, expense to obtain more plants.
- Rain

Q31. Please contact me for

( ) Upcoming workshops ( ) Assistance in determining pH and soil & tissue nutrient analysis ( ) Survey results

	n	%
Upcoming Workshops	32	91.4%
Assistance in determining pH and soil & tissue nutrient analysis	18	51.4%
Survey results	23	65.7%
If you wish to be contacted please provide your information here: - Name - Email - Phone	29	82.9%
Total	35	100.0%

Publication Subject Area
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XX-XX

Green Tea Quality Evaluation: Identifying Common Defects

Randall T. Hamasaki[1], Takahiro Ino[2], and Stuart T. Nakamoto[3]
[1]Plant and Environmental Protection Sciences, [2]Mauna Kea Tea,
[3]Human Nutrition, Food and Animal Sciences

There is considerable interest in both drinking and producing tea. The selection of a tea for personal consumption is subjective and based on the drinker's tastes and preferences. Consumers can purchase tea based on their preference and at the price they are willing to pay. An understanding of its characteristics can add to the enjoyment of drinking tea. As a grower-processor, the conventional markets for tea have certain expectations, and prices received are heavily determined by the quality of the product. For producers, it is necessary to have a knowledge of tea quality and especially how production methods affect quality.

The objective of this publication is to help the consumer, grower, and processor understand how to evaluate green tea. The following three steps will be described to achieve this objective: 1) A general description of the procedure for cupping tea and the general characteristics that are evaluated; 2) Description of how the cupping procedure is used for evaluating green tea; and 3) Identification of common defects in green tea and their associated causes. This publication is based on a workshop on green tea quality evaluation conducted by Mr. Takahiro Ino of Mauna Kea Tea.

I. Tea cupping procedure:
The method described here is intended to help you to identify common defects in green tea rather than casually tasting tea for pleasure. Therefore, the ratio of tea to water, water temperature and the steeping time will be greater than what you would usually use for brewing green tea for casual drinking. The resulting brew is intended to be quite strong and intense to bring out the tea's characteristics. With training, the taster will be able to identify defects. Quality evaluation also involves noting the aroma and appearance of the dry leaves, wet leaves, and liquor.

Uniformity is important: Use the same type of vessel (e.g. standard 3-piece ceramic cupping set consisting of brewing cup with cover and bowl) and brew using the same conditions (amount of tea, type of water, temperature and steeping time) for all the samples.

Materials and supplies

- standard 3-piece ceramic cupping set consisting of brewing cup with cover and bowl (Fig. 1)
- timer
- spoon
- container for discarded tea
- tea to be cupped; 3 grams
- water: 150 ml (5 ounces) per sample. While tap water might be used in Hawaii, water should be of high quality as dissolved minerals and chlorine will affect the tea's flavor. If necessary, use distilled or bottled water.

Fig. 1. Standard tea cupping set

II. Brewing protocol:

Step 1. Measure out 3 grams of tea. Examine the dry leaf (Fig. 2) for:

- Appearance: color, shape, size, rolling, uniformity, powder, stems
- Density (tightly rolled tea will be heavy, loosely rolled tea will be light)
- Feel: brittleness, flexibility, smoothness
- Aroma

Fig. 2. Examine the dry leaf

Step 2. Put tea in brewing cup and add 150 ml (5 ounces) of boiling water. Cover and start timer. At the end of 5 minutes, strain by holding cover and tipping into bowl. It should sit comfortably as shown in Fig. 1. Let the liquor drain out.

Fig. 3. The tea liquor before draining

Step 3. Examine wet leaf (Fig. 4) and record your impressions.

- Aroma: –most intense when hot with cover slightly opened. Generally more revealing in the brewed leaf than in the aroma of the liquor. Aroma can indicate leaf maturity, stiffness, wither, fire used in roasting, and mishandling
- Appearance: color, uniformity, oxidation, degree of openness, broken pieces
- Feel: bounce

Fig. 4. Examine the wet leaf

Step 4. Examine liquor, then use spoon to slurp, swirl in mouth, and spit out. Taste twice. Record your impressions. Slurping involves sucking in the liquor quickly and forcefully so the tea is sprayed in and fully covers the mouth and tongue. This frees the volatile compounds while also cooling the tea.

- Aroma: Should be strong due to length of brew.
- Appearance: color, brightness, clarity/cloudiness, particles
- Taste: Flavor, intensity/depth, astringency, lingering and aftertaste. Also body, mouth feel, richness

Fig. 5. Pour the liquor into the bowl and examine it

III. Common defects in green tea production and how to detect them

Improperly harvested tea: Lack of uniformity in leaf ages is a common problem. Young leaves contain more moisture than older leaves. After processing, over-matured leaves will appear yellow, flat, hard and flakey.

Improperly withered tea: Over-withered green tea will show signs of oxidation—look for a reddish tinge along the leaf margins (Fig. 6).

Fig. 6. Improperly withered tea. Note the red leaf margins.

Insufficient heat during the fixation (kill-green) procedure (Fig. 7): This results in continued oxidation which causes the tea to lose its green color and fresh smell. The leaves may also have a reddish tinge.

Fig. 7. Insufficient heat used during fixation (kill-green) procedure

Excessive heat during the fixation (kill-green) procedure (Fig. 8): Leaf turns yellow similar to how over-cooked broccoli is yellowed and limp rather than green and crisp. Leaf vein may show reddening.

Fig. 8. Excessive heat used during fixation (kill-green) procedure

Inadequate rolling of tea: Liquor is light and has a flat taste. May also show red in liquor and brewed leaf.

Excessive rolling of tea (Fig. 9A & B): Leaf edges appear tattered and falling apart. Look for powder and flakes in the dry leaves and in the liquor. The liquor is cloudy and may be bitter and the wet leaves could be sticky and/or soft.

Fig. 9 A & B. Excessively rolled tea.

Insufficient drying: Tea becomes moldy in storage.

Excessive drying: The tea is very fragile and easily crumbled.

Disclaimer

Mention of a trademark or proprietary name does not constitute an endorsement, guarantee, or warranty and does not imply recommendation to the exclusion of other suitable products.

Hawaii Tea Growers' Survey 2014

You are receiving this message as a possible tea grower in Hawaii. We are asking tea growers for their assistance in participating in the Hawaii Tea Growers' Survey 2014.

The purposes of this survey are to (a) assess the current situation of the industry and (b) assist the University of Hawaii at Manoa, College of Tropical Agriculture (UH-CTAHR) Tea Project to determine growers' most significant barriers to production. Survey results will help guide research and future extension activities conducted by the Tea Project. We are partnering with The Kohala Center and cooperating growers in this effort. Funding for this project is made possible from HDOA's Specialty Crop Block Grant Program.

Reading and thoughtfully answering the questions may give you insight into typical problems and solutions in tea farming. Results of this state-wide survey and an invitation to subsequent tea growing workshops will be distributed to survey participants who provide their contact information. You can provide your info either in the survey, or if you prefer, by sending an email to Stuart or Randy (contact info below).

Click on the following link, or copy and paste it into your browser to start the survey. This link will be available until May 30, 2014.

https://www.quicksurveys.com/s/Do29Jk

Should you manage more than one location for tea production, please fill out this survey once per unique area farmed. The software being used allows each email address to respond only once, so you will need to use another account/create a temporary address. We apologize for the humbug.

Thank you for your participation. Please forward this message to other tea growers. For more information, please contact Stuart Nakamoto (snakamo@hawaii.edu) or Randy Hamasaki (rth@hawaii.edu)

P.O. Box 437462 | Kamuela, Hawai'i 96743 | +1 808 887-6411 | Fax +1 808 885-6707 | kohalacenter.org

THE KOHALA CENTER®

Tea Workshop: Quality Evaluation of Tea

Sponsored by The Kohala Center, CTAHR, and the Hawaii Department of Agriculture Specialty Crop Block Grant Program

Tuesday, December 1, 2015 from 4-6pm

Waimea Civic Center

67-5189 Kamamalu Street Kamuela, HI 96743

Tea maker and instructor Taka Ino, through common quality evaluation techniques will discuss deficiencies in green tea due to improper production methods. Participants will use hands-on cupping of samples to minimize personal preferences and develop an objective understanding of tea quality. The workshop is free but due to limited seating advanced registration is required. To register, please email proque@hawaii.edu or call 887-8183.

HAWAI'I-GROWN tea

UHM-CTAHR, The Kohala Center, and the Hawaii Department of Agriculture Specialty Crop Block Grant Program present

An Introduction to Tea Production and Processing

Wednesday, November 18, 2015

5:30 – 7:30 pm

Kahului CTAHR-CES Office
310 Kaahumanu Ave., Bldg. 214
Kahului, Maui

This lecture-only presentation will be an overview of basic tea production and processing. Attendees will also learn about the tea research being conducted at the University of Hawaii at Manoa - College of Tropical Agriculture and Human Resources (UH-CTAHR) Mealani Research Station in Waimea.

Topics include:

- Introduction and market feasibility of Hawaii grown tea
- The basic types of tea
- Tea propagation and field establishment
- Crop fertility management
- Pest management
- Pruning and harvesting tea
- Hand processing of tea

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Questions? Please email rth@hawaii.edu and/or snakamo@hawaii.edu.

This event is accessible for persons with disabilities. For information or to request an auxiliary aid or service (e.g. sign language interpreter, designated parking, or materials in alternate format), contact Randy (rth@hawaii.edu) or call (808) 887-6183 at least seven days before the activity/event.

University of Hawaii at Manoa
College of Tropical Agriculture and Human Resources

HAWAI'I-GROWN tea

UHM-CTAHR, The Kohala Center, and the Hawaii Department of Agriculture Specialty Crop Block Grant Program present

An Introduction to Tea Production and Processing

Thursday, November 19, 2015

10:30 – noon

Pearl City Urban Garden Center Classroom
955 Kamehameha Highway
Pearl City, Oahu

This lecture-only presentation will be an overview of basic tea production and processing. Attendees will also learn about the tea research being conducted at the University of Hawaii at Manoa - College of Tropical Agriculture and Human Resources (UH-CTAHR) Mealani Research Station in Waimea.

Topics include:

- Introduction and market feasibility of Hawaii grown tea
- The basic types of tea
- Tea propagation and field establishment
- Crop fertility management
- Pest management
- Pruning and harvesting tea
- Hand processing of tea

. .

Questions? Please email rth@hawaii.edu and/or snakamo@hawaii.edu.

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University of Hawaii at Manoa
College of Tropical Agriculture and Human Resources

HAWAI'I-GROWN tea

The Kohala Center, CTAHR, and the Hawaii Department of Agriculture Specialty Crop Block Grant Program present

Tea Workshop: Quality Evaluation of Tea

Registration fee is $30.

RSVP to Perci at proque@hawaii.edu or 887-6183 by 11/25/15

Tuesday, December 1, 2015

4:00 – 7:00 pm

Waimea Civic Center
67-5189 Kamamalu Street Kamuela, HI 96743

Preregister: Space is limited

Tea maker and instructor Taka Ino, through common quality evaluation techniques will discuss deficiencies in green tea due to improper production methods. Participants will use hands-on cupping of samples to minimize personal preferences and develop an objective understanding of tea quality.

Please call 887-6183 or email proque@hawaii.edu to reserve your spot and for last minute updates. Questions? Email rth@hawaii.edu and/or snakamo@hawaii.edu.

This event is accessible for persons with disabilities. For information or to request an auxiliary aid or service (e.g. sign language interpreter, designated parking, or materials in alternate format), contact Randy (rth@hawaii.edu) or call (808) 887-6183 at least seven days before the activity/event.

University of Hawaii at Manoa
College of Tropical Agriculture and Human Resources

HAWAI'I-GROWN tea

The CTAHR Tea Project presents:

Tea 101: Tea Production & Processing Basics

Cost: $25 cash or check at the door.

Thursday, January 14, 2016
8:30 am - 3:30 pm
UH-CTAHR Mealani Research Station
64-289 Mamalahoa Hwy, Waimea

Hosts: Randy Hamasaki, Stuart Nakamoto & Andrea Kawabata

Crop diversification is one strategy for managing risk. Tea has potential as a new crop for Hawaii. Tea 101 is a monthly event where participants undergo basic training in tea production and processing. They will also learn about the tea research being conducted at the University of Hawaii at Manoa - College of Tropical Agriculture and Human Resources (UH-CTAHR) Mealani Research Station in Waimea.

Some of the topics include:

- Introduction and market feasibility of Hawaii grown tea
- The basic types of tea (includes tasting)
- Tea varieties at the station and propagation
- Crop fertility management
- Pest management
- Pruning and harvesting tea
- Hand processing of tea
- Tea processing equipment
- Evaluation of processed tea

*For your protection: **REQUIRED – long pants and shoes** (no sandals/slippers). Come prepared for both full sun (sunscreen and other protection) as well as showers and chilly weather. **No pets allowed**. Please call 887-6183 or email proque@hawaii.edu to reserve your spot and to receive last minute updates.*

The Mealani Research Station is located at 64-289 Mamalahoa Highway (H19), just Hilo-side of the 53-mile marker. There is a blue "Mealani Research Station" sign at the entrance of the driveway. The phone number is 887-6185.

From the Hilo direction: Going toward Waimea, Mealani Station is about 0.8 mile beyond the 52 mile marker. Turn **left** into the driveway immediately **before** the blue sign.
From the Kona direction: Drive past **Waimea town** toward Hilo. Drive past **the Hawaiian Homes Hall** and **Mana Road**. Prepare to turn **right** shortly after passing the **53 mile marker**. Go up the driveway.

In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. To file a complaint of discrimination, contact USDA, Office of the Assistant Secretary of Civil Rights, Whitten Building, 1400 Independence Ave., SW., Washington, D.C., 02050-9410 or call 1-866-632-9992 Toll Free; or 1-800-877-8339 Federal Relay Service; or 1-800-845-6136 (In Spanish); or 1-800 795-3272 between the hours of 8:30 am and 5:00 pm Eastern Standard Time; or (TDD) 720-2600. USDA is an equal opportunity provider and employer.

For information or to request an auxiliary aid or service (e.g. sign language interpreter, designated parking, or materials in alternate format), contact Randy (rth@hawaii.edu) or call (808) 887-6183 at least seven days before the activity/event.

Partners for this event include: University of Hawaii, College of Tropical Agriculture and Human Resources, Mauna Kea Tea, The Kohala Center, and the Hawaii Department of Agriculture.

Randy Hamasaki
Kamuela Extension Office
67-5189 Kamamalu Road,
Kamuela, HI 96743

CTAHR Workshop Evaluation

Event: _____ Date: _____

1. Overall, how would you rate today's workshop on usefulness of information?

☐ Poor ☐ Fair ☐ Good ☐ Excellent

2. After today's presentation, how would you rate the following*: Please circle or X*

Increase in your knowledge & understanding of today's topic area	*No Change*	*Not sure if helped*	*A little bit*	*Yes, somewhat*	*Yes, a lot*
Teaching methods were appropriate	*Strongly Disagree*	*Disagree*	*Not Sure*	*Agree*	*Strongly Agree*
Today's workshop helped me learn about ways to better manage my ag risk	*Strongly Disagree*	*Disagree*	*Not Sure*	*Agree*	*Strongly Agree*
How many things that you learned, will you apply to your operation?	*zero*	*1-2*	*3-4*	*5-9*	*10 or more*

3. What did you like best about today's event? *(use back if necessary)*

4. How could we improve the event? *(use back if necessary)*

5. Would you attend the following workshops? *Please circle or X*

Pest & disease control	*Yes*	*Maybe*	*No*	Recordkeeping	*Yes*	*Maybe*	*No*
Crop insurance	*Yes*	*Maybe*	*No*	Fertilization	*Yes*	*Maybe*	*No*
New varieties, crops, products	*Yes*	*Maybe*	*No*	Marketing & adding value	*Yes*	*Maybe*	*No*

What other topics/events are you interested in? *(use back if necessary)*

Thank you for participating in UH CTAHR's Extension Education Programs.

Hawaii-Grown Tea: Industry Development through Farmer Education and Enhanced Production
Japan Tea Trip Report

August 24 to September 5, 2014

Takahiro Ino, Stuart T. Nakamoto, and Randall T. Hamasaki

Itinerary:

August 24 (Sun) travel day
Aug 25-28 (Mon-Thur) Yame-Kumamoto-Ureshino
Aug 28 – Sept 1 (Thur-Mon) Kagoshima
Sept 1 (Mon) travel to Okinawa
Sept 1-5 (Mon-Fri) Okinawa
Sept 5 (Fri) travel day

Locations visited:

Yame-Kumamoto (Ureshino area)

- Ooyama Seichaen
- JA Kamairi Factory
- Oldest Tea Plant in Japan – Ureshino National Treasure
- Michi No Eki, Miyama
- Saga Prefecture Tea Research Station
- Gamadaishimon Farmers' Market

Kagoshima

- Yame Traditional Craftswork Center (historical tea equipment)
- Michi No Eki (Yame, Ebino, Ibusuki)
- Ochiai Tea Equipment Manufacturer
- Farm Equipment Shop (inc Yamaha, Kubota)
- Kagoshima Prefectural Economic Federation of Agricultural Cooperatives (tea auction)
- Chiran Research Station
- Ibusuki Eel Display & Retail Market
- Kagoshima Tea Farm & Processing Facility
- LaSaLa Tea Shop (retail tea outlet/eatery)
- Airport area tea shop

Okinawa

- Yaka Farm (fruit & flower collection)
- Yamashiro Tea Farm & Café Cha-en, Uruma, Ishikawa, Iha
- Michi No Eki, Umi No Eki
- Nature Display, Kunigami (farm implements)
- Ogimi area farm lots
- Okinawa Research Station, Nago
- Oku Tea Farms (Northern Okinawa)
- Goya (Bittermelon) Park – good agritourism & value adding example

Highlights:

The project investigators visited some tea research stations, tea farms, processors and shops in the Ureshino, Kagoshima and Okinawa area of Japan in order to glean ideas that could be used to develop potential solutions for Hawaii tea producers. The growing conditions in these areas were similar to some of the growing conditions in Hawaii.

Formal Tea Research and Education: The investigators found that unlike in Hawaii, extensive investment and effort into the research and education was dedicated toward this important crop. Some stations were devoted primarily to tea research and education and had as many as 20 personnel. Work was being conducted to develop improved methods of tea crop cultivation, soil management, tea variety improvement, tea pest management, tea processing methods, quality evaluation, and to help establish regional brands and improve the marketing of tea.

Tea Farms: The investigators focused on the small to medium sized operations that would be more similar to the farms in Hawaii. Visits were made to both conventional and certified organic operations. Even small operations had considerable mechanization as compared to the Hawaii counterpart. For example, most operations used mechanical harvesting and obtained support from the equipment dealer. Similarly with tea processing, the operations were generally mechanized and obtained support from the equipment dealer when needed. Once set up, it appeared that tea processing equipment were quite dependable. Only one operation that was visited harvested tea by hand. This operation was able to find willing harvesters in the older age groups—people that were used to manual agricultural work. The same operation also worked with the local school where students would volunteer to work on the farm. In Okinawa, the most important bottleneck to tea farming and agriculture in general was the frequent occurrence of typhoons (hurricanes). Tea growers use temporary windbreaks consisting of hybrid sorghum to help protect young tea plants from salt injury that result from typhoons. The main tea cultivar Yabukita that is grown in most of the tea regions of Japan is not well suited to Okinawa and alternatives such as Shizu-India hybrids are being developed. Weeds were an important problem in organic operations. Weedy vines, grasses and fast growing broad leaved plants could quickly envelop a tea crop when conditions are favorable, such as after heavy rains during the warm season. Insect pests such as scales, leaf rolling caterpillars and beetles and some diseases such as anthracnose (brown blight) were also important pest problems at both conventional and organic operations.

Tea marketing/promotion: The distribution system of tea in Japan ranges from large cooperatives and auction houses where tons of tea pass from producers to buyers to small operations where a producer grows, processes and markets the tea to the end-user. The large auction houses are very well organized and modernized. Buyers can quickly evaluate many tea samples and submit their bids into a highly computerized system. Whether the tea comes from a large or small producer, one quickly senses that regional branding is very important. The investigators observed tea being sold to end-users at many venues throughout Japan including traditional Japanese style inns that featured the virtues of tea (eat, drink and bathe in tea), through markets at the many rest stations along the roads and highways in Japan (i.e., the *Michi No Eki*) that feature the local produce and products of the district, at specialized tea shops both traditional and modern (appeals to the younger generation), through agritourism based farm/tea shop operations, through the many vending machines that have cold ready to drink tea products, through restaurants and other eateries (many offer hot green tea at “no charge” while there is a charge for coffee or other beverages), through supermarkets and convenience stores and just about everywhere food is also sold. Tea products in Japan come in many forms including packaged tea for brewing, powdered tea, bottled tea, noodles, matcha salt for seasoning food, candies, cookies, ice cream and many other confections, soaps, bath salts, and other cosmetic products. Cold brewed tea was a fairly new product that is good for hot days when hot tea might not be appropriate.

Tea Trip 2014: Some Highlights and Photos

Randall T. Hamasaki, Takahiro Ino, and Stuart T. Nakamoto

Ooyama Seichaen http://ooyamaseichaen.tumblr.com


Mr. Yoshitaka Ooyama, Nagasaki, Japan
Family operation: husband/wife and parents, 9 hectares

JA Factory, Mr. Aoki


Kamairi (kama=pan, iri=fry)
Woks: 500 years ago in Ureshino
Sojuki: tossing and drying (after steaming, prior to rolling)

Ureshino National Natural Treasure Tea Plant

Largest old tea tree, 400 years old, Ureshino, Saga Prefecture



Beautiful tea related displays (items for sale) at the hotel lobby

Michi No Eki (roadside station), Miyama


Left: Signage, Middle: Blueberries, Right: Dango wrapped in ? leaves

A Roadside Station (道の駅 *Michi no eki*[?]) is a government-designated rest area found along roads and highways in Japan.

In addition to providing places for travelers to rest, they are also intended to promote local tourism and trade. Shops may sell local produce, snacks, souvenirs, and other goods.

As of April 4, 2014 there are 1030 Roadside Stations across Japan,[1] including 114 in Hokkaido.[2]

Services offered

All Roadside Stations provide 24-hour access to the following services:

- Parking
- Restrooms
- Facilities for sharing information

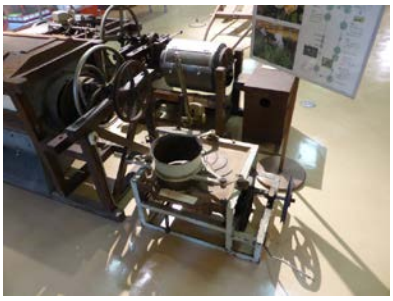
Source: http://en.wikipedia.org/wiki/Roadside_station

Saga Prefecture Tea Research at Ureshino




16 total acres, 8 acres of tea, 20 people: Promote and develop tea plant management
Soil Management, Variety development, Tea processing, Sychotron light (quality judging), Establish the Saga Prefecture Brand

Yame Traditional Craftwork Center



http://kyoiku.welcomekyushu.jp/en/spots/detail/9999900000336

Michi No Eki



Tea and tea-containing products

Ochiai, Kagoshima


Manufacturer of tea equipment, including harvesters

Kagoshima Prefectual Economic Federation of Agricultural Cooperatives (tea auction)


Chiran Research Station


Tea Farm: 180 Kg/hour Tea Processing Facility


Michi no eki, Ibusuki


La Sa La Tea Shop
http://www.shimo.co.jp/eng-store.html

A modern style tea shop where people (especially the working younger crowd) can drink tea, eat a snack and purchase tea and related merchandise.

Okinawa, Japan
Café Cha-En, Uruma, Ishikawa, Iha
http://www.okinawanokocha.com/index.html

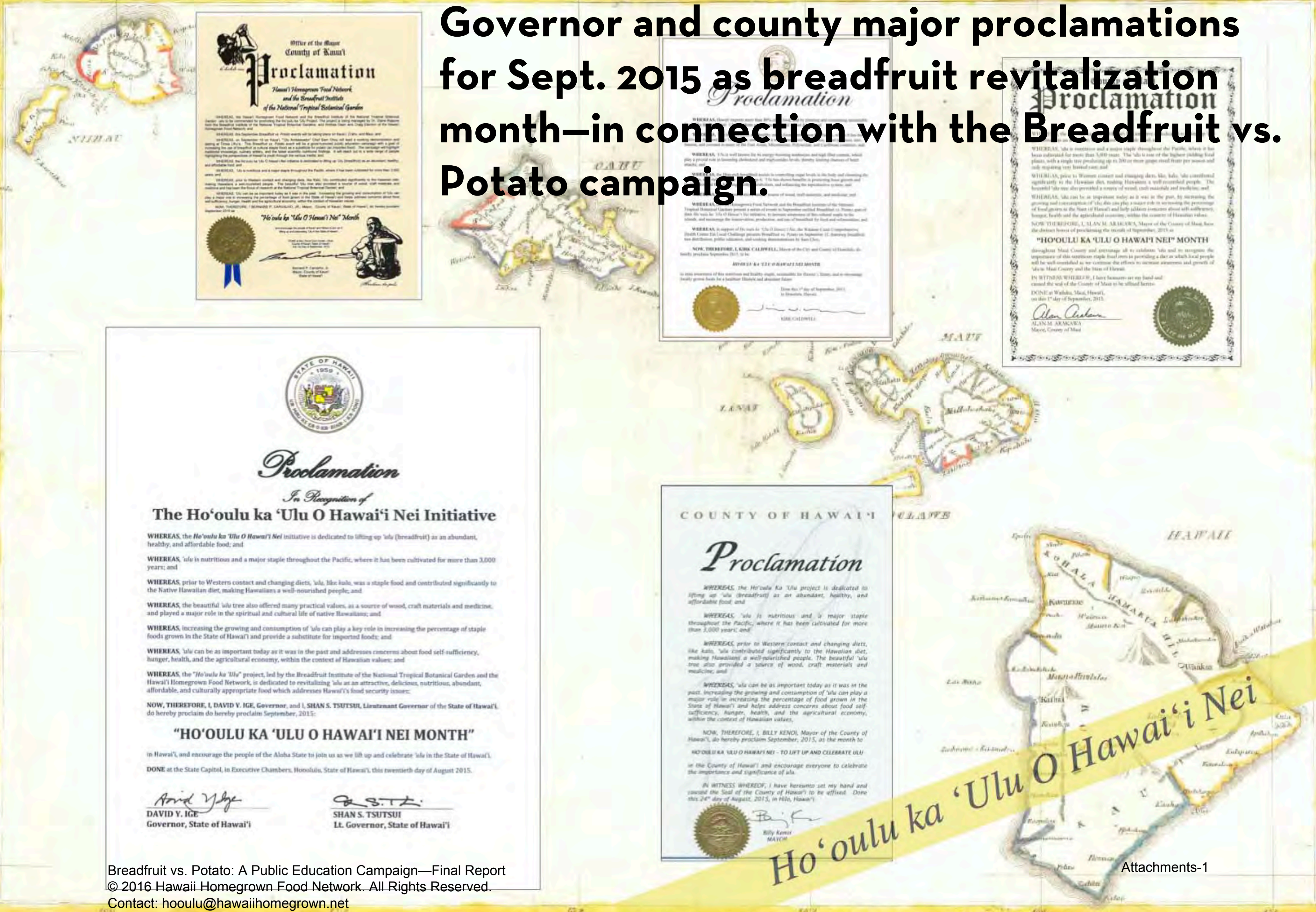

Certified Organic Tea Farm, 3 hectares

Okinawa Research Station




Tea farms in Oku area


Governor and county major proclamations for Sept. 2015 as breadfruit revitalization month—in connection with the Breadfruit vs. Potato campaign.



Office of the Mayor
County of Kaua'i

Proclamation

Hawai'i Homegrown Food Network and the Breadfruit Institute of the National Tropical Botanical Garden

"Ho'oulu ka 'Ulu O Hawai'i Nei" Month

Bernard P. Carvalho, Jr.
Mayor, County of Kaua'i
State of Hawai'i

Proclamation

NOW, THEREFORE, I, KIRK CALDWELL, Mayor of the City and County of Honolulu, do hereby proclaim September 2015, to be

HO'OULU KA 'ULU O HAWAI'I NEI MONTH

KIRK CALDWELL

Proclamation

"HO'OULU KA 'ULU O HAWAI'I NEI" MONTH

ALAN M. ARAKAWA
Mayor, County of Maui

Proclamation

In Recognition of

The Ho'oulu ka 'Ulu O Hawai'i Nei Initiative

WHEREAS, the ***Ho'oulu ka 'Ulu O Hawai'i Nei*** initiative is dedicated to lifting up *'ulu* (breadfruit) as an abundant, healthy, and affordable food; and

WHEREAS, *'ulu* is nutritious and a major staple throughout the Pacific, where it has been cultivated for more than 3,000 years; and

WHEREAS, prior to Western contact and changing diets, *'ulu*, like *kalo*, was a staple food and contributed significantly to the Native Hawaiian diet, making Hawaiians a well-nourished people; and

WHEREAS, the beautiful *'ulu* tree also offered many practical values, as a source of wood, craft materials and medicine, and played a major role in the spiritual and cultural life of native Hawaiians; and

WHEREAS, increasing the growing and consumption of *'ulu* can play a key role in increasing the percentage of staple foods grown in the State of Hawai'i and provide a substitute for imported foods; and

WHEREAS, *'ulu* can be as important today as it was in the past and addresses concerns about food self-sufficiency, hunger, health, and the agricultural economy, within the context of Hawaiian values; and

WHEREAS, the "*Ho'oulu ka 'Ulu*" project, led by the Breadfruit Institute of the National Tropical Botanical Garden and the Hawai'i Homegrown Food Network, is dedicated to revitalizing *'ulu* as an attractive, delicious, nutritious, abundant, affordable, and culturally appropriate food which addresses Hawai'i's food security issues;

NOW, THEREFORE, I, DAVID Y. IGE, Governor, and I, **SHAN S. TSUTSUI, Lieutenant Governor** of the **State of Hawai'i**, do hereby proclaim do hereby proclaim September, 2015:

"HO'OULU KA 'ULU O HAWAI'I NEI MONTH"

in Hawai'i, and encourage the people of the Aloha State to join us as we lift up and celebrate *'ulu* in the State of Hawai'i.

DONE at the State Capitol, in Executive Chambers, Honolulu, State of Hawai'i, this twentieth day of August 2015.

DAVID Y. IGE
Governor, State of Hawai'i

SHAN S. TSUTSUI
Lt. Governor, State of Hawai'i

COUNTY OF HAWAI'I

Proclamation

WHEREAS, the Ho'oulu Ka 'Ulu project is dedicated to lifting up 'ulu (breadfruit) as an abundant, healthy, and affordable food; and

WHEREAS, 'ulu is nutritious and a major staple throughout the Pacific, where it has been cultivated for more than 3,000 years; and

WHEREAS, prior to Western contact and changing diets, like kalo, 'ulu contributed significantly to the Hawaiian diet, making Hawaiians a well-nourished people. The beautiful 'ulu tree also provided a source of wood, craft materials and medicine; and

WHEREAS, 'ulu can be as important today as it was in the past. Increasing the growing and consumption of 'ulu can play a major role in increasing the percentage of food grown in the State of Hawai'i and helps address concerns about food self-sufficiency, hunger, health, and the agricultural economy, within the context of Hawaiian values,

NOW, THEREFORE, I, BILLY KENOI, Mayor of the County of Hawai'i, do hereby proclaim September, 2015, as the month to

HO'OULU KA 'ULU O HAWAI'I NEI - TO LIFT UP AND CELEBRATE ULU

in the County of Hawai'i and encourage everyone to celebrate the importance and significance of ulu.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the County of Hawai'i to be affixed. Done this 24th day of August, 2015, in Hilo, Hawai'i.

Billy Kenoi
MAYOR

Contact: hooulu@hawaiihomegrown.net

Chef Sam Choy recipes

‘Ulu (Breadfruit) Salad — Island Style

by Chef Sam Choy

4 cups cubed cooked ‘ulu (Peel, quarter and steam firm mature breadfruit and then cut into cubes)
2 cups cooked purple sweet potato
6 boiled eggs, chopped
½ cup onions, minced
½ cup celery, minced
1 can whole pitted olives
Salt and pepper to taste or ½ teaspoon of each
1 cup carrots, grated
3 cups mayo

In a large mixing bowl add all ingredients, adding the mayo last. Mix well and adjust with salt and pepper. Serve cold.

CHEF SAM CHOY, Hawai‘i’s Celebrity Chef—Sam Choy’s years of cooking alongside his parents gave him the skills and inspiration to make him a Hawaiian celebrity chef. His exceptional creativity, love of good food, and aloha for guests propelled him to the status of an internationally recognized chef. Choy’s colorful personality and welcoming smile have drawn customers to his multiple restaurants over the last 30 years, but it is his award-winning cooking that keeps them coming back! He characterizes his cuisine as “a melting pot of the freshest ingredients from every culture on the Hawaiian islands…true Hawaiian heritage cooking.”

‘Ulu Chowder with Bacon, Spam and Fresh Corn

by Chef Sam Choy

1 whole medium ‘ulu (Peel, quarter and steam firm mature breadfruit and then cut into cubes)
1 cup onions, diced
1 cup celery, diced
1 cup carrots, diced
2 large handfuls of kale
1 qt. light chicken stock or enough to cover all ingredients
1 can evaporated milk
Salt and pepper to taste
1 can of spam, diced large
½ lb. bacon, diced
2 fresh ears of corn, cut off of the cob

In a large sauté pan add bacon, onions, celery, kale. Sauté about 3 to 4 minutes, add chicken stock, and then add carrots, corn, spam. Add can of evaporated milk. Add ‘ulu last. Bring to boil, then simmer for 8 to 15 minutes. Serve hot.

CHEF SAM CHOY, Hawai‘i’s Celebrity Chef—Sam Choy’s years of cooking alongside his parents gave him the skills and inspiration to make him a Hawaiian celebrity chef. His exceptional creativity, love of good food, and aloha for guests propelled him to the status of an internationally recognized chef. Choy’s colorful personality and welcoming smile have drawn customers to his multiple restaurants over the last 30 years, but it is his award-winning cooking that keeps them coming back! He characterizes his cuisine as “a melting pot of the freshest ingredients from every culture on the Hawaiian islands…true Hawaiian heritage cooking.”

Contact: hooulu@hawaiihomegrown.net

Chef Sam Choy recipes

Pan Fried ‘Ulu Cakes with Salted Cod

by Chef Sam Choy

4 cups ‘ulu, boiled or steamed then diced
½ cup onions, minced
¼ cup green onions
1½ cup boiled and shredded salted cod fish
Oil for pan frying
Salt and pepper to taste

In a large mixing bowl add diced ‘ulu (precooked), onions, green onions, shredded cod fish, and salt and pepper. Save some of the liquid from cooking ‘ulu to soften the ‘ulu cakes, if necessary. Shape into cakes and pan fry until light brown.

CHEF SAM CHOY, Hawai‘i’s Celebrity Chef—Sam Choy’s years of cooking alongside his parents gave him the skills and inspiration to make him a Hawaiian celebrity chef. His exceptional creativity, love of good food, and aloha for guests propelled him to the status of an internationally recognized chef. Choy’s colorful personality and welcoming smile have drawn customers to his multiple restaurants over the last 30 years, but it is his award-winning cooking that keeps them coming back! He characterizes his cuisine as “a melting pot of the freshest ingredients from every culture on the Hawaiian islands…true Hawaiian heritage cooking.”

‘Ulu Poke

by Chef Sam Choy

4 cups ‘ulu, boiled or steamed then diced
2½ tablespoon shoyu
½ cup onions, diced
¼ cup green onions, chopped
¼ cup ogo, chopped
2 tablespoons oyster sauce
Sesame seed oil to taste
2 tablespoons roasted sesame seeds
2 Hawaiian chili peppers, minced
One block kamaboko fish cake, diced

In a large mixing bowl add cooked diced ‘ulu, shoyu, onions and green onion. Mix well then add the rest of the ingredients. Mix well and serve cold.

CHEF SAM CHOY, Hawai‘i’s Celebrity Chef—Sam Choy’s years of cooking alongside his parents gave him the skills and inspiration to make him a Hawaiian celebrity chef. His exceptional creativity, love of good food, and aloha for guests propelled him to the status of an internationally recognized chef. Choy’s colorful personality and welcoming smile have drawn customers to his multiple restaurants over the last 30 years, but it is his award-winning cooking that keeps them coming back! He characterizes his cuisine as “a melting pot of the freshest ingredients from every culture on the Hawaiian islands…true Hawaiian heritage cooking.”

Contact: hooulu@hawaiihomegrown.net

Chef Sam Choy recipes

‘Ulu kale salad

by Chef Sam Choy

2 lbs ‘ulu cooked until tender (about 20 min.) in lightly salted water with Hawaiian chili peppers and garlic. Drain and let cool.
1 lb kale, remove stem and cut into slices
2 med red onions, sliced
½ cup olive oil
1 cup Balsamic vinegar
4 tablespoons shoyu
3 tablespoons sesame seed oil
Local honey for sweetness
Juice from 6 local Meyers limes
Salt and pepper to taste

In a large pan add a little olive oil and saute red onions, then wilt the kale. In a bowl, mix a dressing of vinegar, sesame seed oil, rest of olive oil, lime juice, and honey to taste. Add dressing to ‘ulu and kale and serve cold. Adjust with salt and pepper.

CHEF SAM CHOY, Hawai‘i’s Celebrity Chef—Sam Choy’s years of cooking alongside his parents gave him the skills and inspiration to make him a Hawaiian celebrity chef. His exceptional creativity, love of good food, and aloha for guests propelled him to the status of an internationally recognized chef. Choy’s colorful personality and welcoming smile have drawn customers to his multiple restaurants over the last 30 years, but it is his award-winning cooking that keeps them coming back! He characterizes his cuisine as “a melting pot of the freshest ingredients from every culture on the Hawaiian islands…true Hawaiian heritage cooking.”

BRIEF BREADFRUIT BASICS

Pick it right!

Mature fruit has the best flavor and texture for most dishes where a potato-like consistency is desired. It’s perfect for eating plain or with a sauce, or for making breadfruit salad, stew, curry, fries and many more kinds of dishes.

Note: A firm, mature breadfruit will ripen and become soft in 1–3 days at room temperature (it can then be used for dessert dishes!). To store a mature fruit and delay ripening, put it in the refrigerator. The skin will turn brown, but the edible flesh will stay firm. Fruit can also be stored a few days fully submerged in cool water (put a weight on top so the fruit is completely underneath the water).

Ripe breadfruit is great for desserts

A ripe breadfruit is soft to the touch with a sweet, aromatic fragrance. Ripe fruit is perfect for cakes, pies, cookies, energy bars and other sweet treats. Ripe breadfruit is best used right away, although it can be kept in the refrigerator for a few days before using or stored in the freezer for later use.

Mature fruit: Look for greenish-yellow skin, a smooth surface, and brownish cracking between the surface segments. The flesh inside is firm and creamy white or pale yellow in color. Some varieties vary in maturity indicators.

Avoid immature green fruit. An immature, full size fruit is bright green and bumpy and the lines between sections are solid green. The flesh is pale green just beneath the skin. When cooked, the texture is rubbery and the flavor is watery.

Ho‘oulu ka ‘Ulu is a project to revitalize ‘ulu (breadfruit) in Hawai‘i. Breadfruit vs. Potato is co-sponsored with the State of Hawai‘i Department of Agriculture.

www.breadfruit.info www.breadfruit.org

HO‘OULU KA ‘ULU
Revitalizing Breadfruit

Anything you can do with potato, you can do with breadfruit...better

Contact: hooulu@hawaiihomegrown.net

Youth art contest announcement

Ho‘oulu ka ‘Ulu – Revitalizing Breadfruit in Hawai‘i

Breadfruit vs. Potato—Youth Poster and Video Contest

Submission deadline: March 13, 2015

Breadfruit vs. Potato

A key to increasing food self-sufficiency in Hawai‘i is to substitute locally grown staples for imported foods.

Breadfruit vs. Potato is a good-humored public education campaign with a goal of increasing the use of breadfruit (a cultural staple food) as a substitute for potato (an imported food). The campaign highlights traditional knowledge, culinary artistry, and the latest scientific nutritional findings. The campaign reaches out to adults and youth through a wide range of media, including print, radio, public access television, social media, online and electronic media. The outreach campaign will highlight the perspectives of Hawai‘i’s youth.

Illustrating Concepts with Art and Video: Invitation to Hawai‘i Students

We invite Hawai‘i students to celebrate the culture and taste of ‘ulu by submitting student-created poster artwork and videos on the theme of *Breadfruit vs. Potato*.

Cash prizes will be awarded for the first place in each age group (poster contest) and first place in video. Contest winners and others (at the discretion of judges) will be used in the *Breadfruit vs. Potato* public education campaign in print, radio, public access television, social media, online and electronic media.

Contact: hooulu@hawaiihomegrown.net

Youth art contest announcement

How to Get Involved: Eligibility and Submittal

The contest is open to student artists, in grades 7–12, who are full-time residents of Hawai‘i.

The contest divisions are:

1. Grades 7–9 (Posters)
2. Grades 10–12 (Posters)
3. Video (all ages, but must be done with a school or organization media program)

First place prizewinners will be awarded $250 in each of the three categories! Poster prizes will be awarded to the individual artist and the video prize will be awarded to the school media program.

Role of School/Organization in Submittal

A teacher from the school, homeschool or organization must pre-approve the student entries. There is a space on the submission form for teacher and school name.

Guidelines for Posters and Videos

Posters

- Original work by artist—no reproductions.
- Any 2D media (*no crayons please*)
- No maximum size, as long as you can submit a high quality, high-resolution digital image.
- Not mounted or matted until after judging (as that is easier to photograph and scan).

Note: Please retain original artwork and submit high-resolution photograph for entry (see online submissions below).

Video

- No longer than 4 minutes plus credits.
- Clear visual and audio content.
- Get creative: the video can promote breadfruit over potato through interviews, storytelling, documentary style or commercial advertising style.
- Please retain a broadcast quality HD (high definition) version on your hard drive, a copy of which we will request of the contest winner.

Online Submission by March 13, 2015

- All entries must be submitted online **by March 13, 2015.**
- Please follow instructions in the **online submission form**, which will include:
  - Sponsoring schoolteacher must sign form.
  - Posters must be photographed and uploaded as a high-resolution photo (upload link will be sent after submission).
  - Videos must be uploaded to YouTube, marked private and shared with hooulu@hawaiihomegrown.net.

Contact: hooulu@hawaiihomegrown.net

Youth art contest announcement

Subject Matter

Submissions (both posters and videos) must focus primarily on one of the following four key messages, as follows.

- **Key Message #1: Food Security**
  - ✓ Potato comes on a barge, breadfruit grows here on trees.
  - ✓ Over 25,000 tons of potato are imported to Hawaii every year, what would be the impact of we replaced even 10% of that?
  - ✓ If you grow ‘ulu, you can feed your family.
  - ✓ ‘Ulu—100% Hawaiian Grown, 100% Local.

- **Key Message #2: Easy to use and Tastes so good**
  - ✓ If you pick breadfruit when it’s mature, it’s delicious.
  - ✓ You can make many things with breadfruit. Anything you can do with potato you can do with breadfruit, and so much more (healthy recipes welcome!)
  - ✓ Breadfruit is really simple and easy to use!

- **Key Message #3: Healthy**
  - ✓ Breadfruit is gluten free and GMO free.
  - ✓ It has a moderate glycemic index (blood sugar shock) compared to white potato, white rice, white bread, and taro.
  - ✓ A half-cup of breadfruit provides 25% of the RDA for fiber, and 5–10% of the RDA for protein, magnesium, potassium, phosphorus, thiamine (B), and niacin (B_3).

- **Key Message #4: ‘Ulu is a traditional food of Hawai‘i**
  - ✓ Every culture has their traditional foods, and in Hawai‘i we are proud of ours: Eat ‘Ulu.
  - ✓ ‘Ulu has been cultivated in Hawai‘i for hundreds of years. Prior to Western contact and changing diets, breadfruit contributed significantly to the Hawaiian diet, making Hawaiians among the most self-sufficient and well-nourished peoples in the world.
  - ✓ The beautiful breadfruit tree plays a major role in the spiritual and cultural life of Hawaiians and it was a key staple food and a source of wood, craft materials and medicine.

Tone

- Messaging should be positive and engaging to both young and old. Both ‘ulu and potato need to be respected (no disrespecting).
- Remember, sometimes less is more! The simpler and clearer your message is the more likely that people will retain it.
- It is important for people to understand that breadfruit is easy to use.
- Picture your message appearing in both traditional media (newspaper and magazine) as well as in social media.

Resources and Inspiration

- The most comprehensive source of information on breadfruit varieties and nutrition is the Breadfruit Institute of the National Tropical Botanical Garden at www.breadfruit.org.
- The Ho‘oulu ka ‘Ulu website has informational publications and videos at www.breadfruit.info.

Contact: hooulu@hawaiihomegrown.net

Youth art contest announcement

Who We Are

Ho‘oulu ka ‘Ulu is a project to revitalize ‘ulu (breadfruit) as an attractive, delicious, nutritious, abundant, affordable, and culturally appropriate food that addresses Hawai‘i’s food security issues.

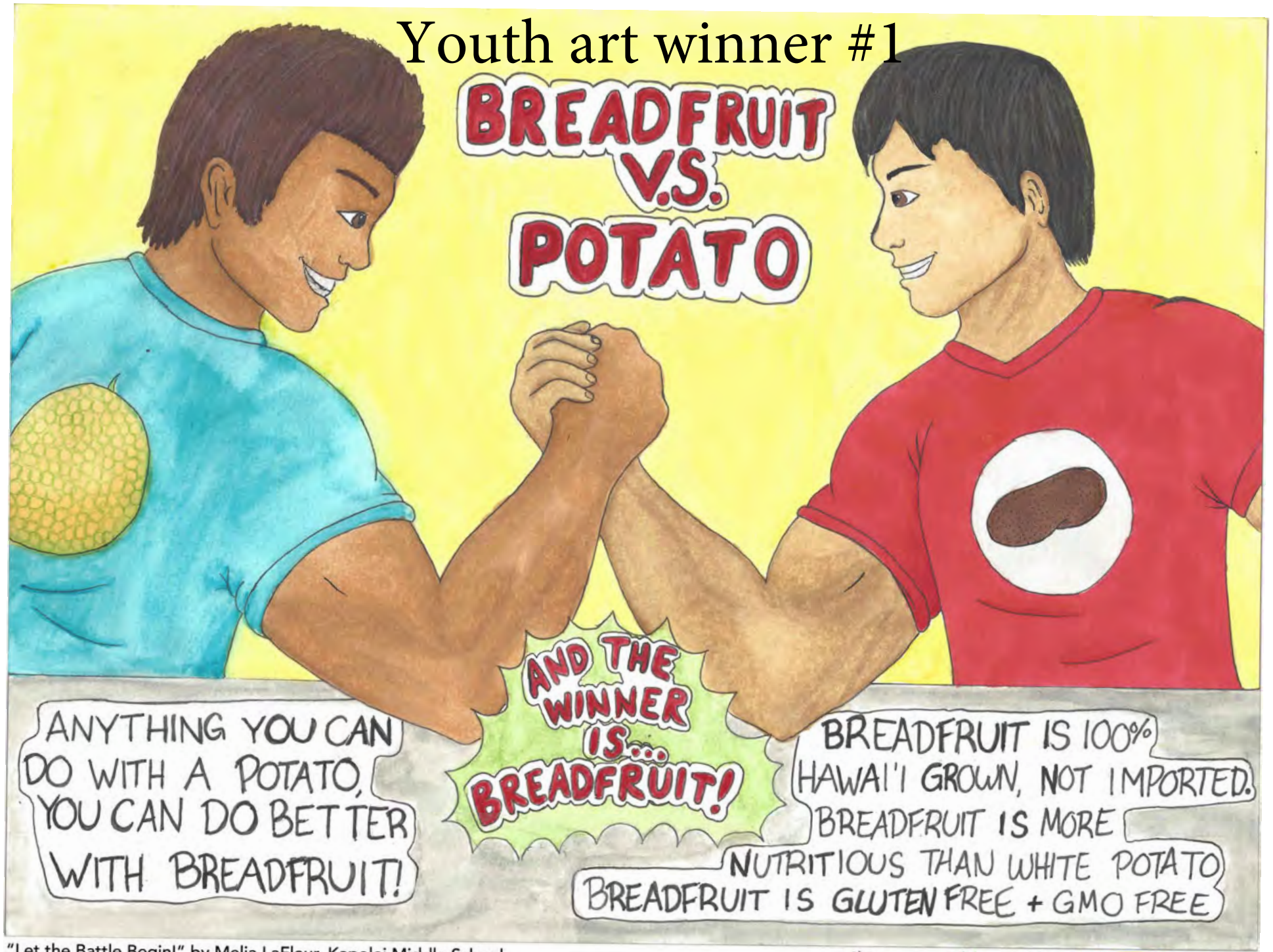
Ho‘oulu ka ‘Ulu is a project of the Hawaii Homegrown Food Network and the Breadfruit Institute of the National Tropical Botanical Gardens. The project is managed by Dr. Diane Ragone, Breadfruit Institute of the National Tropical Botanical Gardens, and Andrea Dean and Craig Elevitch of Hawai‘i Homegrown Food Network.

The *Breadfruit vs. Potato* project is funded through the Hawai‘i State Department of Agriculture Specialty Crops Block Grants program.

Questions or More Information

Andrea Dean 808-960-3727 hooulu@hawaiihomegrown.net

Youth art winner #1



"Let the Battle Begin!" by Melia LaFleur, Kapolei Middle School

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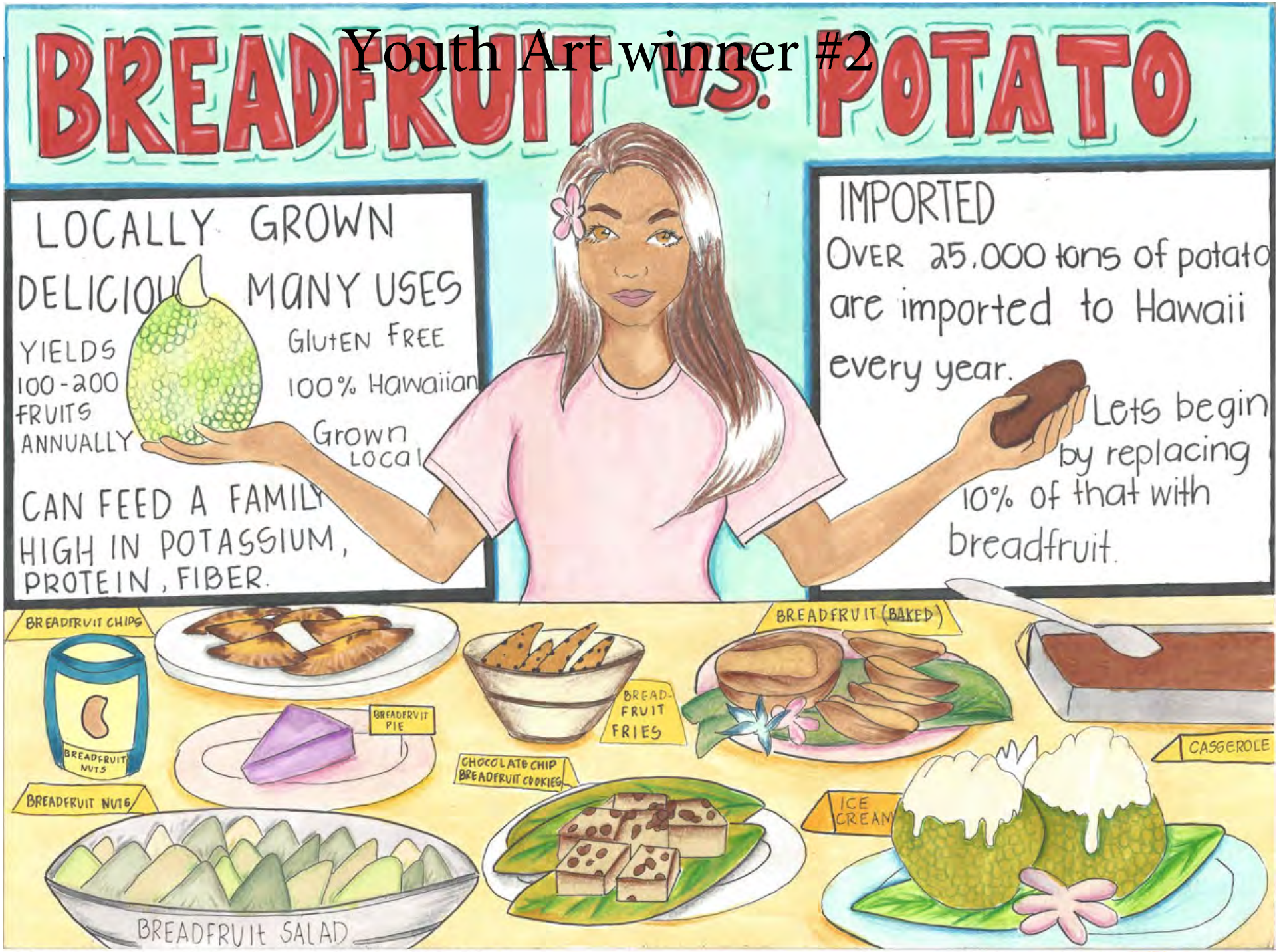
More info: www.breadfruit.info

Contact: hooulu@hawaiihomegrown.net

Youth Art winner #2



"The Choice is Yours" by Teah Laupapa, Kapolei Middle School

Ho'oulu ka 'Ulu is a project to revitalize 'ulu (breadfruit) as an attractive, delicious, nutritious, abundant, affordable, and culturally appropriate food that addresses Hawai'i's food security issues.

More info: www.breadfruit.info

Contact: hooulu@hawaiihomegrown.net

Contact: hooulu@hawaiihomegrown.net

LEARN TO COOK BREADFRUIT
with
CHEF JOHN CADMAN
Owner of Pono Pies and Maui ʻUlu Hummus

Sunday, September 20, 11 am – 1 pm

Whole Foods Market, Kahului


Anything you can do with potato, you can do with breadfruit...better!

Hoʻoulu ka ʻUlu is a project to revitalize ʻulu (breadfruit) in Hawaiʻi.
Breadfruit vs. Potato is co-sponsored with the
State of Hawaiʻi Department of Agriculture.

breadfruit.info breadfruit.org

NATIONAL TROPICAL BOTANICAL GARDEN • BREADFRUIT INSTITUTE

HOʻOULU KA ʻULU Revitalizing Breadfruit

HAWAIʻI HOMEGROWN® FOOD NETWORK

Breadfruit vs. Potato: A Public Education Campaign—Final Report

Contact: hooulu@hawaiihomegrown.net

Cooking demos

Above photos (clockwise from top left): Chef Sam Choy with Island 98.5 radio station crew; Choy at Whole Foods Market Kahala; Choy and Aunty Shirley Kauhaihao at Times Market in Lihue; Choy at Waianae Mall for the Eat Local Challenge event hosted by Waianae Coast Comprehensive Health Center; Chef John Cadman and Whole Foods Market in Kahului.

Contact: hooulu@hawaiihomegrown.net

Celebrate the 50th Anniversary of Community Health Centers with these

WAIANAE COAST COMPREHENSIVE HEALTH CENTER
www.wcchc.com

SPECIAL EVENTS

Ka Holo Hoolaulea Celebration Run

Mahalo to our sponsor AlohaCare For a healthy Hawaii.

5K RUN/WALK IN WAIANAE

Saturday, August 15, 2015
Begins at 7:00 AM
Waianae Mall *(86-120 Farrington Hwy)*

To register, go to www.wcchc.com/5K

Waianae EAT LOCAL CHALLENGE

EAT HEALTHY, SUPPORT LOCAL FARMERS & WIN PRIZES!

August 15 - September 12, 2015
Saturdays from 9:00 AM - 1:00 PM
Waianae Mall *(86-120 Farrington Hwy)*

Featuring Sam Choy!

'ULU FESTIVAL & WAIANAE EAT LOCAL CHALLENGE FINALE

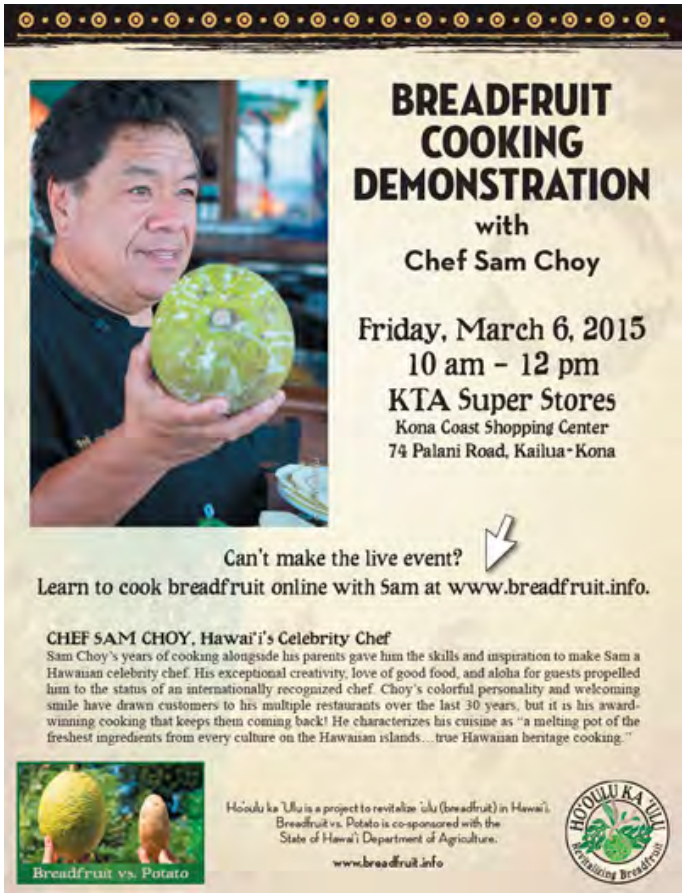
Saturday, September 12, 2015
9:00 AM - 1:00 PM
Waianae Mall *(86-120 Farrington Hwy)*

Kapolei & Waianae
MĀKEKE
Gather Together Grow Here

$tretch your $$$ with EBT DOUBLE BUCKS at our MĀKEKE FARMERS' MARKETS!

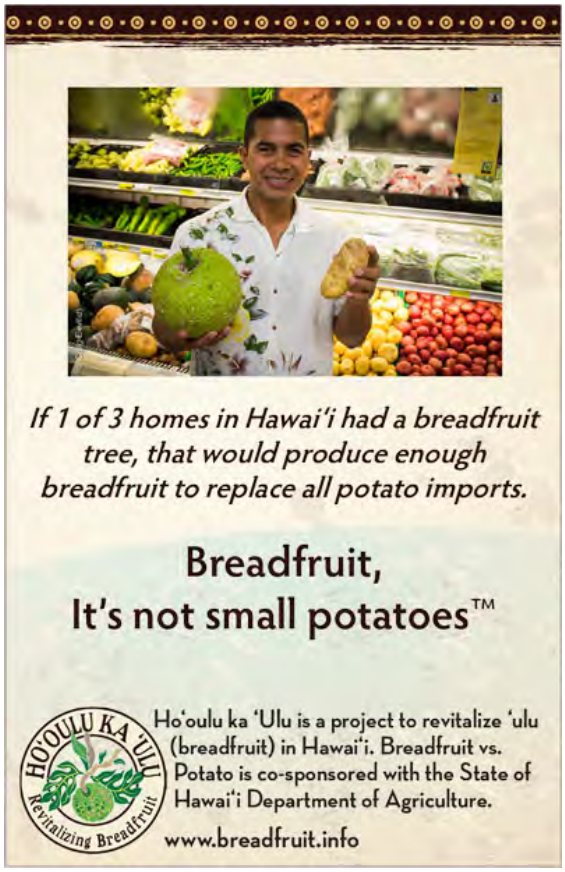
Every Saturday at Waianae Mall
86-120 Farrington Highway in Waianae
9:00 AM - 1:00 PM

Every Thursday at Kapolei High School
91-5007 Kapolei Parkway in Kapolei
3:00 PM - 6:30 PM



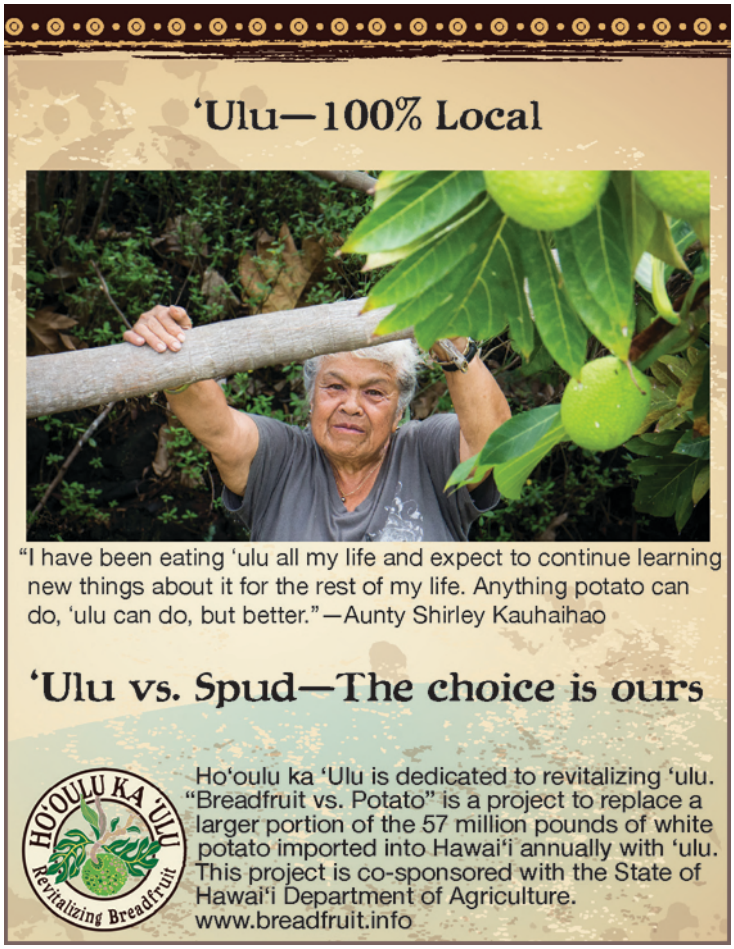
Poster for KTA Kona cooking demo— same template was used for cooking demonstrations on Kauai, and Oahu.

Contact: hooulu@hawaiihomegrown.net



Sample edugraphics that have been distributed through social media.

Contact: hooulu@hawaiihomegrown.net

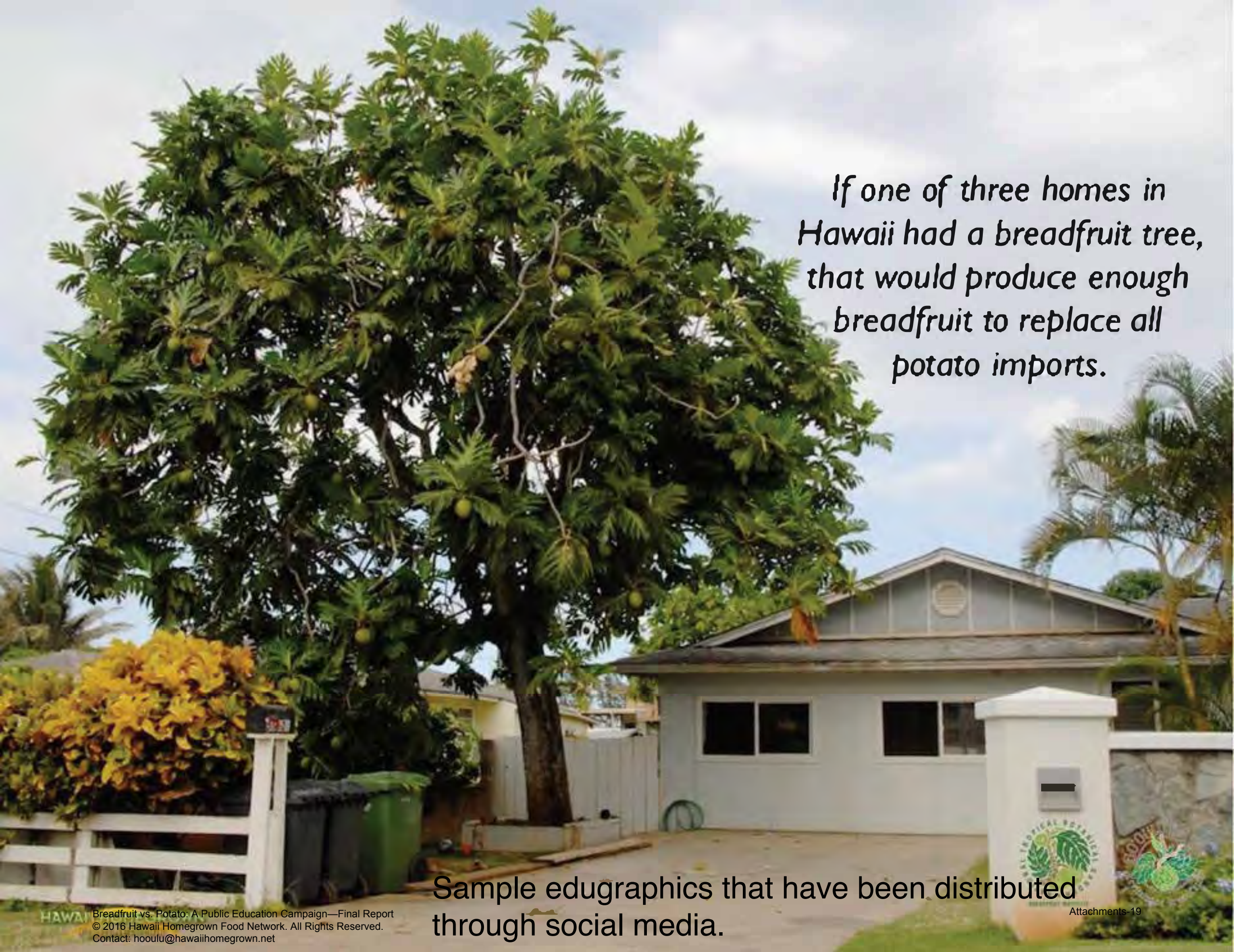


Ka Wai Ola paid advertisement

Contact: hooulu@hawaiihomegrown.net

Promoting Breadfruit vs. Potato at the 11th Annual Grow Hawaiian Festival at Amy Greenwell Ethnobotanical Garden, Captain Cook, Kona, on February 28, 2015.

Contact: hooulu@hawaiihomegrown.net



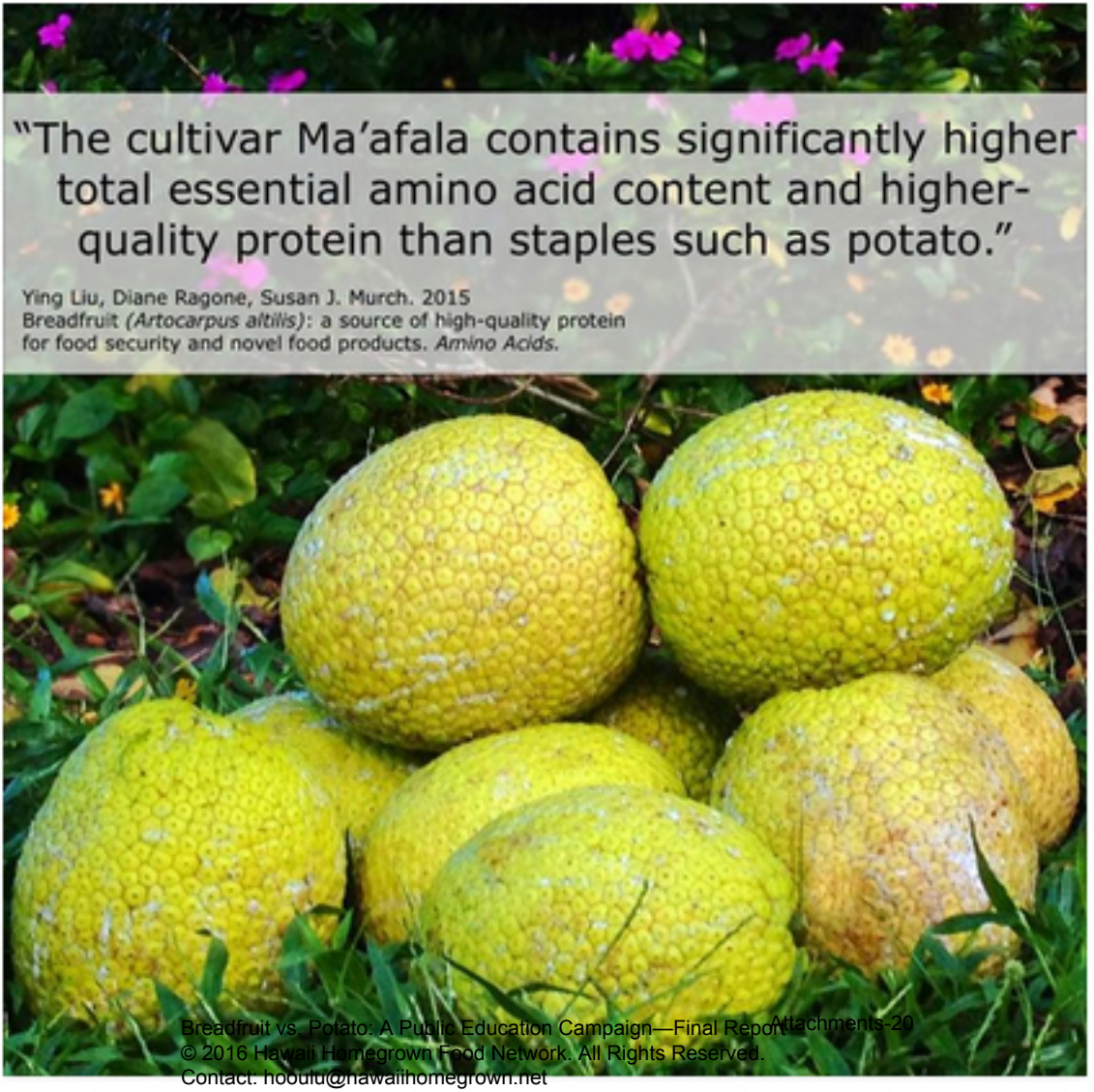
Sample edugraphics that have been distributed through social media.

Contact: hooulu@hawaiihomegrown.net

Breadfruit Institute, National Tropical Botanical Garden

September 13, 2015 ·

AND it tastes great! #BreadfruitvsPotato Facebook example



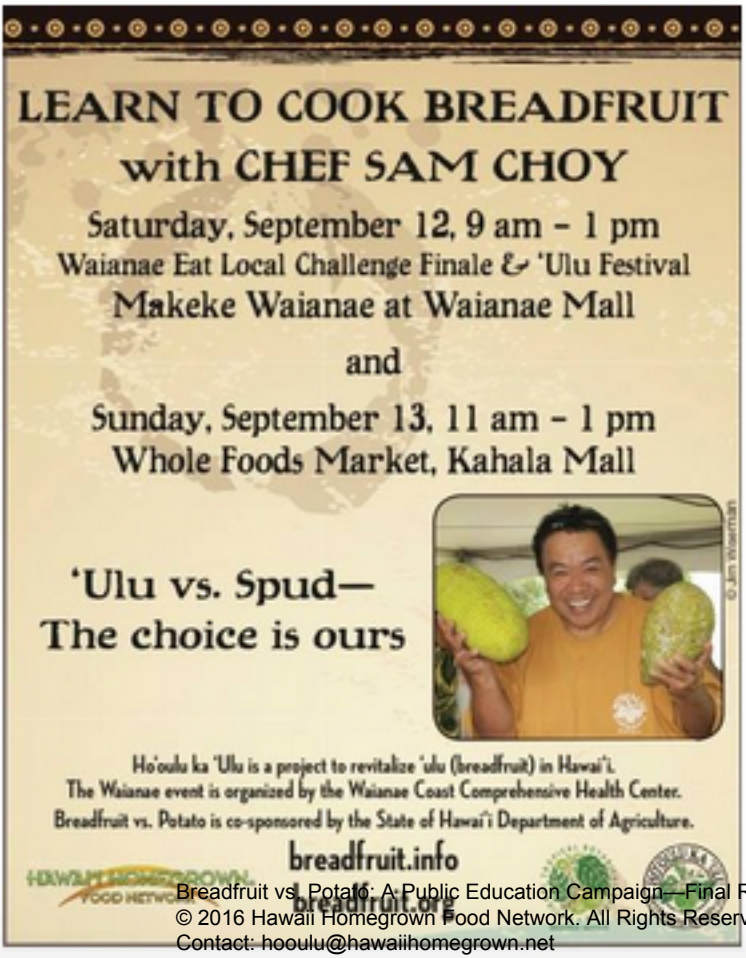
Contact: hoodlu@hawaiihomegrown.net

Breadfruit Institute, National Tropical Botanical Garden
September 11, 2015 ·

Facebook example

#BreadfruitvsPotato starts tomorrow on Oahu, and it's going to be AWESOME. If you don't live on Oahu, you can still celebrate September as the month to "Hoʻoulu ka ʻUlu O Hawaiʻi Nei"—to lift up and celebrate ʻulu (breadfruit) throughout Hawaiʻi. If you don't live in Hawaii, you can try to eat more locally grown food instead of imports. Just celebrate!

Thanks to partners Hawaii Department of Agriculture, Mākeke Wai'anae, a farmers' & green market, Waianae Coast Comprehensive Health Center, and Whole Foods!



Contact: hooulu@hawaiihomegrown.net

Breadfruit Institute, National Tropical Botanical Garden

September 6, 2015 ·

Facebook example

The best Au Gratin isn't made with potatoes! We're hosting Breadfruit vs. Potato events throughout Hawai'i to raise awareness about the incredible importance of learning to eat and grow local foods for a healthier lifestyle and abundant future. Try Breadfruit Au Gratin, by BFI Director Diane Ragone:

#BreadfruitvsPotato

Ingredients

1 firm, mature breadfruit (approximately 2 lbs.)... See More

#BreadfruitvsPotato

Contact: hooulu@hawaiihomegrown.net

Breadfruit Institute, National Tropical Botanical Garden
September 5, 2015 ·

Facebook example

Move over nectarines, and make room for breadfruit! Times Supermarket in Lihue, Hawaii carries breadfruit in the produce department for the first time. #BreadfruitvsPotato #ohnoweresurrounded #itsastart

Breadfruit Institute, National Tropical Botanical Garden

September 2, 2015 ·

#BreadfruitvsPotato #betterwithbreadfruit

Facebook example

57 million pounds of fresh and processed potato are imported into Hawaii each year.

Breadfruit vs Potato

You decide.

Contact: hooulu@hawaiihomegrown.net

Breadfruit Institute, National Tropical Botanical Garden
September 1, 2015 ·

Facebook example

Hawaii Governor David Ige and the mayors of all Hawaii counties proclaim September as the month to "He'oulu ka 'Ulu O Hawaii Nei"—to lift up and celebrate 'Ulu (Breadfruit) in the State of Hawai'i! In honor of this historic month, the Hawaii Homegrown Food Network and the Breadfruit Institute are launching the Breadfruit vs. Potato campaign, with exciting events planned for Kauai, Oahu, and Maui. Breadfruit vs. Potato is a good-humored public education campaign to increase awareness about breadfruit, a locally grown staple food, as a substitute for potato which is an imported food.

Join the Breadfruit Revolution! #BreadfruitvsPotato

Contact: hooulu@hawaiihomegrown.net

Hawaii Homegrown Food Network shared your photo.

Published by Andrea Dean [?] · September [illegible], 2015

Facebook example

Food prep for tomorrow's breadfruit cooking demo with the awesome folks from Mākeke Wai'anae, a farmers' & green market and Waianae Coast Comprehensive Health Center Breadfruit Institute, National Tropical Botanical Garden

Contact: hoolulu@hawaiihomegrown.net

Attachment A
3 pages.

Table 3-1 List of Approved Fresh Fruits, Herbs, and Vegetables from Hawaii—Authority 7CFR 318.13

Abiu T105-a-1 [1]
Aechmea bracteata (fruit bearing panicle)
Allium spp. (bulb)
Allium spp. (leafy green tops; commercial consignments only; continental US only)[2]
Aloe vera (above ground parts)
Alokon (inflorescence)
Anise (leaf, stem, seed)
Arrowhead [3]
Arrowroot
Artichoke, globe
Artichoke, Jerusalem
Asiatic pennywort (leaf, stem)
Asparagus
Atemoya T105-a-1 [1]
Avocado (commercial consignments only) T101-c-1 or T108-a
Avocado, Sharwil[4] (commercial consignments only) T101-c-1 or T108-a
Bamboo shoots
Banana (fruit) T105-a-1 [1] or T105 -a-2 [1 5]
Basil (leaf, stem)
Bay laurel (leaf, stem)
Bean sprout, mung and soy
Beet
Beremi (leaf, stem) (*Limnophila chinensis* ssp. *aromatica*)
Borage (leaf, stem)
Breadfruit (fruit) T105-a-1 [1 6 7] **or** T105-a-2 [6 8]
Broccoli
Brussels sprouts
Burdock
Burnet (leaf, stem)
Butterbur
Cabbage
Cannonball fruit
Carambola T105-a-1 [1]
Carrot
Cassava
Cauliflower
Celery (root, top)
Chervil (leaf, stem)
Chinese amaranth
Chinese cabbage
Chinese chives (leaf, stem)
Chinese water chestnut
Cilantro (leaf coriander)
Citrus T103-b-1 **or** T105-a-1 [1 9]
Coconut (unrestricted)
Corn
Corn-on-the-cob
Corn smut galls
Cowpea (pod) T105-a-2 [8 10]
Cucurbita spp. T105-a-1 [1]
Curry leaf (*Bergera koenigii*) D301.76 (a-1),D301.76 (a-2)[1], or D301.76(a-3)[11]
Cyperus corm
Dandelion
Dill (leaf, stem, seed)
Dragon fruit (fruit) T105-a-1 [1 12] **or** T105-a-2 [8 13]
Dropwort, water
Drumstick (leaf, inflorescence)
Durian
Edible flowers [14] (inflorescences only)
Eggplant T105-a-1 [1]
Eryngo (leaf)
Fennel (leaf, stem)
Galanga (rhizome)
Garden rocket (leaf, stem)
Garland chrysanthemum
Garlic chive
Guava (fruit; commercial consignments only) T105-a-2 [8 15]
Ginger bracts
Ginger root [16]
Gow-kee
Heckerea umbellata (leaf, stem)
Honewort
Heartleaf (leaf stem) (*Houttuynia cordata*)
Jackfruit (fruit) T105-a-1 [1 6 7] **or** T105-a-2 [6 8]
Japanese honewort (*Cryptotaenia japonica*)
Jicama
Knotweed
Kudzu
Lamb's quarters (leaf, stem)
Lemon balm (leaf)
Lemon grass (leaf, stem)
Lettuce
Lily bulb (*Lilium* spp.)
Litchi [17] T102-d, T105-a-1 [1], **or** T106-f
Longan [17] T102-d, T105-a-1 [1], **or** T106-f
Lotus root
Maguey leaf
Mahogany fruit
Malabar spinach
Mango T105-a-3
Mangosteen (fruit) T105-a-1 [1 18] **or** T105-a-2 [8 13]
Marigold (flower head)
Marjoram (leaf), *Origanum* spp. (leaf, inflorescence)
Matsutake
Melon (fruit) T105-a-1 [1 19] **or** T105-a-2 [8 19]
Mint (leaf, stem)
Moringa (pods) T105-a-1 [1 20] **or** T105-a-2 [8 20]
Mountain papaya, *Vasconcellea pubescens*, T106-b-3
Mugwort
Mushroom
Mustard greens
Oregano (leaf, stem) *Origanum vulgare*
Palm hearts (stem) peeled or trimmed (white to off-white)
Papaya T103-d-2, T105-a-1 [1], **or** T106-b-4, **or** T106-c
Parsley
Peanut
Pepper (*Capsicum* spp.) T105-a-1 [1]
Peppermint (leaf, stem)
Perilla
Pineapple T106-b-5 **or** T105-a-1 [1]
Pineapple, smooth Cayenne and hybrids with 50 percent or more smooth Cayenne parentage
Piper spp.
Pohole fern (leaf, stem)
Athyrium spp. and *Diplazium* spp.
Pomegranate arils
Poreleaf (leaf, stem)
Potato
Radish (*Raphanus sativus*)
Rambutan T103-e, T105-a-1 [1], T106-g
Rhubarb
Rosemary (leaf, stem)
St. John's Bread
Sage (leaf, stem)
Saluyut jute (leaf, stem, inflorescence)
Sapodilla T105-a-1 [1]
Sausage fruit
Savory (leaf, stem)
Screwpine (leaf)
Sea asparagus (tips) (*Salicornia bigelovii*) (commercial consignments into continental US only)
Singhara nut (*Trapa bispinosa*)
Sorrel (leaf, stem) *Rumex* spp.
Spinach
Sweet potato T101-b-3-1, T105-a-1 [1], T105-a-2 [1], or T106-h [21 22]
Tamarind bean pod
Taro
Tarragon (leaf, stem)
Thyme (leaf, stem)
Tomato T101-c-3, T105-a-1 [1 23]
Truffle
Turmeric (rhizome)
Turnip
Water-chestnut
Watercress
Yam

1 Must be irradiated at an approved facility in Hawaii.

2 A biometric sample must be inspected by APHIS following post-harvest processing. Inspect for chilli thrips (*Scirtothrips dorsalis*), Asiatic onion leafminer (*Acrolepiopsis sapporensis)*, and Oriental leafworm moth (*Spodoptera litura)*. If quarantine pests are found, PROHIBIT movement and REQUIRE treatment in accordance with 7 CFR 305.

3 *Sagittaria sagittifolia* — PROHIBIT movement unless the importer has a valid PPQ Form 526 Permit. This noxious weed is prohibited by 7CFR 360-Noxious Weed Regulations.

4 In lieu of treatment, Sharwil avocados may be moved interstate for distribution to specific northern states if harvested during the winter months of November 1 through March 31 and only if all conditions listed in 7 CFR 318.13-20 have been met. In addition, a compliance agreement detailing the requirements must be signed.

5 Treatment may be waived for green bananas of the cultivars 'Williams,' 'Valery,' Grand Nain standard, and dwarf 'Brazilian' after meeting the conditions of 7CFR 318.13-22(a). Irradiated bananas do not have to meet the varietal restrictions. Bananas to be treated with T105-a-1 (150 Gy) must be sampled and inspected (after the sampled bananas have been removed from the stalk) for the presence of banana moth (*Opogona sacchari*). If moth (eggs or larvae only) are found, refuse to certify for movement or require T105-a-2 (400 Gy). If adults or pupae of the moth are found, refuse to certify. Inspect plantains, cooking bananas, and bananas which differ from the usual bananas of commerce for internal feeders (fruit flies).

6 Fruit must be free from stems and leaves and must originate from an orchard previously treated with a fungicide appropriate for the fungus *Phytophthora tropicalis* or after irradiation, a post harvest fungal dip may be used.

7 Inspect for spiraling whitefly (*Aleurodicus dispersus*), inornate scale (*Aonidiella inornata*), red wax scale (*Ceroplastes rubens*), gray pineapple mealybug (*Dysmicoccus neobrevipes*), pink hibiscus mealybug (*Maconellicoccus hirsutus*), spherical mealybug (*Nipaecoccus viridis*), citrus mealybug (*Pseudococcus cryptus*), melon thrips (*Thrips palmi*), and signs of thrip damage. If any of these pests are found, prohibit entry or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy treatment must also either receive a post-harvest dip in accordance with treatment schedule T102-c as provided in 305.42(b), or originate from an orchard or growing area previously treated with a broad spectrum insecticide during the growing season, inspected and found free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is not required if the fruit undergoes irradiation at the 400 Gy dose.

8 Must be irradiated at an approved facility in Hawaii or in the mainland U.S. Certified facilities may be located in any state except Alabama, Arizona, California, Florida, Georgia (with the exception of Atlanta Hartsfield Airport), Kentucky, Louisiana, Mississippi (with the exception of maritime port at Gulfport), Nevada, New Mexico, North Carolina (with the exception of maritime port at Wilmington), South Carolina, Tennessee, Texas, and Virginia.

9 Inspect for freedom from the spherical mealybug (*Nipaecoccus viridis*) and a tuckerellid mite, (*Tuckerella ornata*).

10 Inspect for cassava red mite (*Oligonychus biharensis*) and adults and pupae of the order Lepidoptera before undergoing irradiation treatment. The pods must be free of stems and leaves. If infested with these pests or stems and leaves, REFUSE to certify.

11 D301.76(a-3) is a processing protocol conducted under the authority of Federal Order DA-2015-04. Refer to the Protocol for Interstate Movement of Fresh, Mature Leaves of Kaffir Lime, Curry, and Bael for detailed instructions.

12 For fruit presented for inspection, ensure that the sepals were removed and that the fruits are free from leaves and stems. Also inspect for the gray pineapple mealybug (*Dysmicoccus neobrevipes*), pink hibiscus mealybug (*Maconellicoccus hirsutus*), and citrus mealybug (*Pseudococcus cryptus*) before undergoing irradiation treatment at the 150 Gy dose. Fruit receiving the 150 Gy dose must also either receive a post-harvest dip in accordance with treatment schedule T102-c or originate from an orchard or growing area that was previously treated with a broad-spectrum insecticide during the growing season and a pre-harvest inspection of the orchard or growing area found the fruit free of any surface pests as prescribed in a compliance agreement. If infested with these pests, REFUSE to certify or treat with 400 Gy (T105-a-2). If you find stems and leaves, REFUSE to certify.

13 Consignment must be free from stems and leaves. If you find stems and leaves, REFUSE to certify.

14 Limited to *Calendula* spp. (pot marigold), *Tagetes* spp. (marigold), *Tropaeolum* spp. (nasturtium), and *Viola* spp. (johnny-jump-ups, pansies, and violets).

15 Each consignment must be inspected in Hawaii and found free of the red spider mite (*Eutetranychus orientalis*) and the cassava red mite (*Oligonychus biharensis*).

16 If, after inspection, ginger maggot (*Eumerus figurans*) or banana moth (*Opogona sacchari*) are found, treatment with irradiation at 400 Gy (T105-a-2) is REQUIRED.

17 May **not** be moved interstate into Florida. All cartons in which litchi or longan are packed must be stamped, "**Not** for importation into or distribution in FL."

18 Fruit presented for inspection must have the sepals removed in order to conduct the inspection. Sepals are allowed for those fruit **not** being inspected. Consignment must be free from stems and leaves. If you find stems or leaves, REFUSE to certify. Inspect for the gray pineapple mealybug (*Dysmicoccus neobrevipes*), pink hibiscus mealybug (*Maconellicoccus hirsutus*), citrus mealybug (*Pseudococcus cryptus*), and *Thrips florum* before undergoing irradiation treatment in Hawaii at the 150 gray dose. If infested with these pests, REFUSE to certify or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy dose also must either receive a post-harvest dip in accordance with treatment schedule T102-c as provided, or originate from an orchard or growing area found free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose.

19 Melons must be washed to remove dirt and must be free from leaves and stems. If the melons receive the 150 Gy dose, inspect the consignment for spiraling whitefly (*Aleurodicus dispersus*) before undergoing irradiation treatment at the 150 Gy dose. If infested with these spiraling whitefly, REFUSE to certify or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy dose also must either receive a post-harvest dip in accordance with treatment schedule T102-c or originate from an orchard or growing area that was previously treated with a broad-spectrum insecticide during the growing season and a pre-harvest inspection of the orchard or growing area found the fruit free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose. Regardless of irradiation dose, melons must be washed to remove dirt and must be free of stems and leaves.

20 Inspect the consignment for spiraling whitefly (*Aleurodicus dispersus*), inornate scale (*Aonidiella inornata*), and citrus mealybug (*Pseudococcus cryptus*) before undergoing irradiation at the 150 Gy dose. If any of these pests are found, PROHIBIT ENTRY or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy treatment must also either receive a post-harvest dip in accordance with treatment schedule T102-c as provided in § 305.42(b) or originate from an orchard or growing area that was previously treated with a broad-spectrum insecticide during the growing season and a pre-harvest inspection of the orchard or growing area found the fruit free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose.

21 Inspect for gray pineapple mealybug (*Dysmicoccus neobrevipes*), kona coffee-root knot nematode (*Meliodogyne konaensis*). Per the conditions of 7CFR 305.34(b)(7), sweet potatoes must be sampled, cut, and inspected in Hawaii and found free of ginger weevil (*Elytrotreinus subtruncatus*) before undergoing treatment in Hawaii. REJECT or treat with 400 Gy (T105-a-2) if the mealybug or ginger weevil is found. REJECT consignment if the nematode is found.

22 Vapor heat treatment may be used if the conditions of 7CFR 318.13-14(d) have been met. Sweet potato must be sampled, cut, and inspected and found free of ginger weevil (*Elytrotreinus subtruncatus*), gray pineapple mealybug (*Dysmicoccus neobrevipes*), kona coffee-root knot nematode (*Meliodogyne konaensis*) before undergoing treatment.

23 Tomatoes must meet the conditions listed in 7CFR 318.13-14(c).

Attachment B (1)

7 pages

3

Treatment Manual

Nonchemical Treatments

Irradiation

Contents

Introduction

This chapter provides background and general information for the use of irradiation as a phytosanitary treatment of plant pests. Irradiation was first approved by APHIS in 1997 for use on papayas from Hawaii for export to the U.S. mainland, Guam, Puerto Rico, and the U.S. Virgin Islands. In 2002, irradiation was approved as a phytosanitary treatment for all admissible fresh fruits and vegetables from all countries.

Authorities and Other Responsible Parties

- 7CFR 305.31 through 305.9
- Food and Drug Administration (FDA)

  The FDA is responsible for determining the labeling requirements for irradiated food.
- National nuclear regulatory authority of the country where the facility is located
- International Standard for Phytosanitary Measures #18 (ISPM)

  This International Standard provides technical guidance on the specific procedures for the application of ionizing radiation as a phytosanitary treatment for regulated pests or articles.

Treatment Objectives

The objective of phytosanitary treatments is to prevent the introduction or spread of regulated pests. As a phytosanitary treatment, irradiation may reduce the risk of introduction by achieving certain responses, known as "endpoints," in the targeted pest(s). These endpoints are:

- Inability to emerge or fly
- Inactivation or devitalization (seeds may germinate but seedlings do not grow; or tubers, bulbs or cuttings do not sprout)
- Mortality
- Sterility (inability to reproduce)

Efficacy

Unlike the Probit 9 mortality required for many chemical and nonchemical quarantine treatments, the use of irradiation as a phytosanitary measure presents a new paradigm to PPQ. The officer inspecting the treated consignment upon arrival in the U.S. may encounter living insects. However, this is to be expected since the treatment endpoint may not necessarily be mortality.

Treatment

There are three types of ionizing radiation:

- Electrons generated from machine sources up to 10 MeV (eBeam)
- Radioactive isotopes (gamma rays from cobalt-60 or cesium-137)
- X-rays (up to 5 MeV)

The unit of measure for absorbed dose from any type of radiation is gray (Gy).

Modified atmospheres, such as low oxygen, may reduce treatment efficacy at a prescribed dose. Do **not** treat commodities that are in an oxygen-deficient environment.

Treatment procedures should also ensure that the minimum absorbed dose (Dmin) is fully attained throughout the commodity to provide the prescribed level of efficacy. Owing to the differences in the configuration of lots being treated, higher doses than the Dmin may be received by some of the commodities to ensure that the Dmin is achieved throughout the configured commodity. All treatments must be certified by verifying Dmin with approved dosimetry systems.

The minimum absorbed dose for the most-tolerant unmitigated pest is required if more than one pest is present. Refer to *Table 3-8-1* on **page 3-8-4** to determine the required minimum absorbed dose. For example, if a shipment of grapes is infested with both Mediterranean fruit fly and codling moth, the commodity would be irradiated using a minimum dose of 200 Gy.

There may be additional treatment requirements specific to the pest/host complex. Refer to T105-a-1 on **page 5-2-72** for detailed information.

Table 3-8-1 summarizes the minimum required doses required for effective treatment of specific pests.:

Table 3-8-1 Pest-Specific Minimum absorbed dose (Gy)

Scientific Name	Common Name	Minimum Absorbed Dose (Gy)
Anastrepha ludens	Mexican fruit fly	70
Anastrepha obliqua	West Indian fruit fly	70
Anastrepha serpentina	Sapote fruit fly	100
Anastrepha suspensa	Caribbean fruit fly	70
Aspidiotus destructor	Coconut scale	150
Bactrocera cucurbitae	Melon fruit fly	150
Bactrocera dorsalis	Oriental fruit fly	150
Bactrocera jarvisi	Jarvis fruit fly	100
Bactrocera tryoni	Queensland fruit fly	100
Brevipalpus chilensis	Chilean false red mite	300
Ceratitis capitata	Mediterranean fruit fly	100
Conotrachelus nenuphar	Plum curculio	92
Copitarsia declora		100
Cryptophlebia ombrodelta	Litchi fruit moth	250
Cryptophlebia illepida	Koa seed worm	250
Cylas formicarius elegantulus	Sweet potato weevil	150
Cydia pomonella	Codling moth	200
Euscepes postfasciatus	West Indian sweet potato weevil	150
Grapholita molesta	Oriental fruit moth	200
Omphisa anastomosalis	Sweet potato vine borer	150
Pseudaulacaspis pentagona	White peach scale	150
Rhagoletis pomonella	Apple maggot	60
Sternochetus frigidus (Fabr.)	Mango pulp weevil	165
Sternochetus mangiferae	Mango seed weevil	300
	All other fruit flies of the family Tephritidae which are **not** listed above	150
	Plant pests of the class Insecta **not** listed above, except pupae and adults of the order Lepidoptera	400

Dosimetry

Dosimetry is the system used by the facility to determine absorbed dose. The absorbed dose is a quantity of radiation energy (measured in Gray (Gy)) absorbed per unit of mass of the commodity.

The dosimetry system should be calibrated in accordance with international standards or appropriate national standards (e.g. Standard ISO/ASTM 51261 *Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing*).

Dose Mapping

Prior to routine treatments, the region(s) of lowest and highest dose absorbance must be mapped for each treatment configuration. Configurations may be defined by a variety of criteria which may vary by facility. Factors that affect dose mapping commonly include:

- Density and composition of the material treated
- Orientation of the product, stacking, volume and packaging
- Shape and/or size

Dose mapping of the product in each geometric packing configuration, arrangement and product density that will be used during routine treatments should be required by APHIS prior to the approval of a facility for the treatment application. Only the configurations approved by the APHIS should be used for actual treatments.

The data obtained from the dose mapping is used to determine the proper number and placement of dosimeters during routine operations.

Facility Approval

Chapter 6-8 of this manual covers the requirements for Irradiation facility approval (*Certifying Irradiation Treatment Facilities* on **page 6-8-1**).

Documentation

The tracking and reporting of an irradiation treatment is critical to the integrity of the entire irradiation process. Treatment failure is linked to non-compliance, not pest detection. Consequently, an electronic database is being developed to standardize data entry, accurately and quickly produce data summaries and analysis, and allow access to a geographically diverse group of people.

Until this electronic database is fully operational, documentation requirements for precleared articles include the completion of the PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment.

The Irradiation Reporting and Accountability Database (IRAD) is a component of the Commodity Treatment Information System (CTIS) developed by USDA-APHIS-PPQ-CPHST-AQI. Access to this web-based system will be permitted depending on the user's specific role or function in the irradiation process. CPHST-AQI will assign individual usernames and passwords.

Terminology

absorbed dose—Quantity of radiation energy (in gray) absorbed per unit of mass of a specified target [ISPM No. 18]

dose mapping—Measurement of the absorbed dose distribution within a process load through the use of dosimeters placed at specific locations within the process load [ISPM No. 18]

dosimeter—A device that, when irradiated, exhibits a quantifiable change in some property of the device which can be related to absorbed dose in a given material using appropriate analytical instrumentation and techniques [ISPM No. 18]

dosimetry—A system used for determining absorbed dose, consisting of dosimeters, measurement instruments and their associated reference standards, and procedures for the system's use [ISPM No. 18]

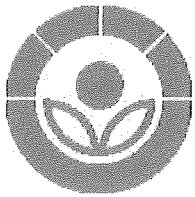
gray (Gy)—Unit of absorbed dose where 1 Gy is equivalent to the absorption of 1 joule per kilogram (1 Gy = 1 J.kg-1) [ISPM No. 18]

ionizing radiation—Charged particles and electromagnetic waves that as a result of physical interaction create ions by either primary or secondary processes [ISPM No. 18]

irradiation—Treatment with any type of ionizing radiation [ISPM No. 18]

minimum absorbed dose—The localized minimum absorbed dose within the process load [ISPM No. 18] (Dmin)

radura—internationally recognized symbol used to indicate when a food product has been irradiated



Attachment C
3 pages,

U.S. Department of Agriculture
Animal Plant Health Inspection Service
Plant Protection and Quarantine

Certificate of Treatment by Irradiation

1. Certificate Number 16203	**5. Date Loaded** 05/10/2016
2. Country of Origin/Phyto Number USA/	**6. Port of Export** Honolulu International Airport (HON), USA
3. Port of Entry Various, USA	**7. Carrier Identification** Air Freight
4. Shipper	**8. Consignee**

Commodity	Traceback Data	Number of Packages	Dose
Curry Leaf *(Rutaceae Murraya koenigii)* from USA	PUC: 28 PHC: 1012 TRT: 16959 FTID: 1012 Lot: 1012.131.28.3158-01	100 / 100	Dmin = 416 Gy

Treatment Facility Name and Location	TFC
Pa'ina Hawaii LLC: Kunia, Hawaii, USA. (1012)	1012
Official Signature	**Date Certificate Issued**
	05/10/2016

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE
Karen Ross, Secretary

DATE: March 7, 2013

TO: All County Agricultural Commissioners

FROM: Plant Health and Pest Prevention Services

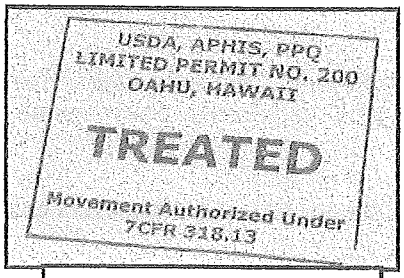
SUBJECT: **PEST EXCLUSION ADVISORY NO. 02-2013**
New Hawaiian Irradiation Facility, Pa'ina Hawai'i

Since 2000, the Hawaiian company Hawaii Pride LLC has been the only facility approved by the United States Department of Agriculture (USDA) to conduct phytosanitary irradiation treatment for fruits and vegetables being exported to California. A second USDA approved irradiation treatment facility located in Hawaii, ***Pa'ina Hawai'i*** is now fully operational and will also be treating commodities destined for California.

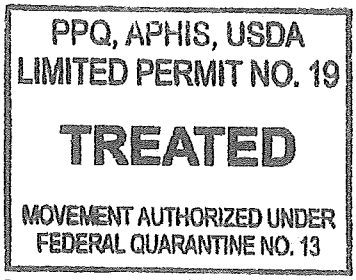
Federal regulations govern the movement of fruits and vegetables from Hawaii to the continental United States (7CFR 318.13) and provide packaging guidelines (7CFR 305.9) for irradiated shipments to ensure pest freedom and the integrity of pallet-loads of irradiated boxes. For more information concerning the radiation treatment and protocols, and for a list of pest-specific minimum absorbed doses, please see the USDA treatment manual, section 3-8(1-8).

Commodities treated at these irradiation facilities will be certified in the following two ways:

Limited Permit Stamp: This will be used on air cargo and maritime cargo bill of lading documents. The limited permit stamp is on each box of treated commodities either as or incorporated into the sealing tape itself or as a stamp impression across the tape. Please see examples below.



Pa'ina Hawai'i
Irradiation Facility Limited Permit
Stamp #200



Hawaii Pride LLC
Irradiation Facility Limited Permit
Stamp #19

Certificate of treatment by irradiation: Treatment certificates will accompany shipments of irradiated commodities entering California directly from Hawaii. Certificates may show the shipper and the consignee as the same and additional ports of entry and carrier identification listed as "Various". Only one certificate is issued for a treatment lot and copies can accompany multiple shipments destined to various consignees.

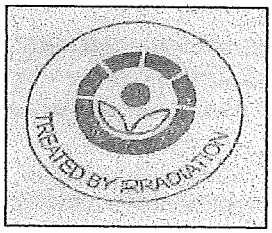
Each box that contains commodities treated via irradiation originating from Hawaii will have the following markings:

- **Tracking label (lot number)**

  The lot number may be on a printed sticker, or hand-written and it will match the lot number on the irradiation certificate. The tracking number allows each box to be tracked by grower, treatment date, and processing control number (PCN).

- **Radura symbol stamp**

  The international Radura symbol and the statement 'Treated by Irradiation' or 'Treated with Radiation' printed **OR** stamped on each box.



Phytosanitary irradiation treatments of commodities work by exposing consignments to low levels of ionizing radiation, typically just over 400 Grays (Gy). These treatments offer a safe and reliable alternative to traditional treatments such as fumigation. The energy that the produce is exposed to during the treatment will break chemical bonds in some molecules necessary for growth and development of insects, such as DNA and enzymes. This molecular damage can cause lethal or sub-lethal effects to susceptible insects present in the produce. Although some insects may still be alive after treatments, they will not be able to complete their development or reproduce. Most fruit and vegetable commodities are better able to tolerate irradiation than insects are, and the quality of produce is not affected. It should be noted that produce exposed to these treatments do not become radioactive because only energy, and not radioactive particles, passes through the produce.

Inspectors in California should use the following California Department of Food and Agriculture policy for shipments of fruits and vegetables from Hawaii that are found infested with live pests:

A. **Any** pest found inside the carton upon arrival can be assumed to have been irradiated.

B. If polyethylene sheet wrap was used to wrap the cartons on a pallet, any **mobile** pest that is found outside the cartons but underneath the pallet wrapping can be assumed to have been irradiated **IF** there are no openings (cuts, tears, etc.) in the wrapping that would allow the entry of a mobile pest.

C. If there are openings in the pallet wrapping, inspectors can assume with discretion that the mobile pests infested the shipment after irradiation and therefore were not subject to the treatment. Heavy infestations (inspector discretion) in such circumstances should result in rejection.

For questions regarding this advisory, please contact Erin Lovig at (916) 654-0312 or by e-mail at erin.lovig@cdfa.ca.gov.

Attachment D
12 pages.

Gmail

Lyle Wong <lwongpi@gmail.com>

Announcement for Kahuku Export Meeting.

7 messages

Lyle Wong <lwongpi@gmail.com> Tue, Oct 21, 2014 at 11:26 AM
To: Jari Sugano <extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>, Jari Sugano <suganoj@ctahr.hawaii.edu>, "Shitanishi, Jason - FSA, Aiea, HI" <Jason.Shitanishi@hi.usda.gov>
Cc: Po-Yung Lai <po.yung.lai@gmail.com>, sharon.k.hurd@hawaii.gov, michael@painahawaii.com, lina@painahawaii.com, Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>, Lyle Wong <lwongpi@gmail.com>

Thanks Jari for this help.

Please send out the attached notice of the Kahuku meeting to growers on your contact list.

If you would, please send out as a pdf file.

And Jason, thanks for your help as well.

Regards,

Lyle

--

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

Export grant (HDOA) (6).docx
1450K

Mail Delivery Subsystem <mailer-daemon@googlemail.com> Tue, Oct 21, 2014 at 11:26 AM
To: lwongpi@gmail.com

Delivery to the following recipient failed permanently:

suganoj@avax.ctahr.hawaii.edu

Technical details of permanent failure:
DNS Error: Address resolution of avax.ctahr.hawaii.edu. failed: Domain name not found

---- Original message ----

DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
d=gmail.com; s=20120113;
h=mime-version:date:message-id:subject:from:to:cc:content-type;
bh=EzgFIK6caQNQyiONd1IEQx8f59D0cZGj8ZnZwWFVUZA=;
b=bDpL3Zx5TkGjijYxjv+33jASC3M0UetiR3cKXiw3gWz1RgpMQEMwfAcSgb1VMv+kUy
gaWppZIygNJDEHZMGvJdR54ZrNEUndzX32Jqpj3gUc0zAgMSkKwsr3tMcG5uKUteidqi
XV/2nqLPGVP70KbdFPrRGoKvGjGIK/EFmT79nVMjYFRZfu5hfJfjokI81zKJ5zZa9/6A
VT9OOW8VMiY7WKttmk1NwXFxI5zLxC7Y//g/IOXRb1HVrqCQ+jsjYxCmSh5JX7NUE4+C
XHbMKVhxXgiORVu0hIL8NVIyPzmnzUcwqLoDCY+Ce8trHCT8mSsnsw+Ce5/XAZOtc1wm

9bog==
MIME-Version: 1.0
X-Received: by 10.202.77.75 with SMTP id a72mr30537106oib.8.1413926808691;
Tue, 21 Oct 2014 14:26:48 -0700 (PDT)
Received: by 10.60.175.163 with HTTP; Tue, 21 Oct 2014 14:26:48 -0700 (PDT)
Date: Tue, 21 Oct 2014 11:26:48 -1000
Message-ID: <CAF03BL_VkagkF=ONC0+DHkSbJS0Qg2FQhcMAqKZsUVCoEqYhSA@mail.gmail.com>
Subject: Announcement for Kahuku Export Meeting.
From: Lyle Wong <lwongpi@gmail.com>
To: Jari Sugano <extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>,
Jari Sugano <suganoj@ctahr.hawaii.edu>,
"Shitanishi, Jason - FSA, Aiea, HI" <Jason.Shitanishi@hi.usda.gov>
Cc: Po-Yung Lai <po.yung.lai@gmail.com>, sharon.k.hurd@hawaii.gov,
michael@painahawaii.com, lina@painahawaii.com,
Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>,
Lyle Wong <lwongpi@gmail.com>
Content-Type: multipart/mixed; boundary=001a113530822c2e250505f57da1
[Quoted text hidden]

Shitanishi, Jason - FSA, Aiea, HI <Jason.Shitanishi@hi.usda.gov> Tue, Oct 21, 2014 at 12:40 PM
To: Lyle Wong <lwongpi@gmail.com>, Jari Sugano <extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>, Jari Sugano <suganoj@ctahr.hawaii.edu>
Cc: Po-Yung Lai <po.yung.lai@gmail.com>, "sharon.k.hurd@hawaii.gov" <sharon.k.hurd@hawaii.gov>, "michael@painahawaii.com" <michael@painahawaii.com>, "lina@painahawaii.com" <lina@painahawaii.com>, Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>

Sorry, but that's not the time of the meeting that Mr. You suggested or agreed to.
Jason

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Tuesday, October 21, 2014 11:27 AM
To: Jari Sugano; jari Sugano; Jari Sugano; Shitanishi, Jason - FSA, Aiea, HI
Cc: Po-Yung Lai; sharon.k.hurd@hawaii.gov; michael@painahawaii.com; lina@painahawaii.com; Nick Lee; jake@painahawaii.com; Lyle Wong
Subject: Announcement for Kahuku Export Meeting.

Thanks Jari for this help.

[Quoted text hidden]

Sugano, Jari <SuganoJ@ctahr.hawaii.edu> Tue, Oct 21, 2014 at 2:11 PM
To: "Shitanishi, Jason - FSA, Aiea, HI" <Jason.Shitanishi@hi.usda.gov>
Cc: Lyle Wong <lwongpi@gmail.com>, "Cadelinia, Stephanie" <Extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>, Po-Yung Lai <po.yung.lai@gmail.com>, "sharon.k.hurd@hawaii.gov" <sharon.k.hurd@hawaii.gov>, "michael@painahawaii.com" <michael@painahawaii.com>, "lina@painahawaii.com"

<lina@painahawaii.com>, Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>

Lyle-
Is that am? That's a hard time for growers.

Sent from my iPhone
[Quoted text hidden]

Shitanishi, Jason - FSA, Aiea, HI <Jason.Shitanishi@hi.usda.gov> Tue, Oct 21, 2014 at 2:12 PM
To: "Sugano, Jari" <SuganoJ@ctahr.hawaii.edu>
Cc: Lyle Wong <lwongpi@gmail.com>, "Cadelinia, Stephanie" <Extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>, Po-Yung Lai <po.yung.lai@gmail.com>, "sharon.k.hurd@hawaii.gov" <sharon.k.hurd@hawaii.gov>, "michael@painahawaii.com" <michael@painahawaii.com>, "lina@painahawaii.com" <lina@painahawaii.com>, Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>

I think it's supposed to be a different time. Mr. You owner of the warehouse where the meeting will be held suggested 4:00 pm to 5:30 pm. The farmers are working in the fields, harvesting/packing, or out delivering throughout the day.

From: Sugano, Jari [mailto:SuganoJ@ctahr.hawaii.edu]
Sent: Tuesday, October 21, 2014 2:12 PM
To: Shitanishi, Jason - FSA, Aiea, HI
Cc: Lyle Wong; Cadelinia, Stephanie; jari Sugano; Po-Yung Lai; sharon.k.hurd@hawaii.gov; michael@painahawaii.com; lina@painahawaii.com; Nick Lee; jake@painahawaii.com
Subject: Re: Announcement for Kahuku Export Meeting.

[Quoted text hidden]

Po-Yung Lai <po.yung.lai@gmail.com> Tue, Oct 21, 2014 at 2:47 PM
To: Lyle Wong <lwongpi@gmail.com>
Cc: Jari Sugano <extension@ctahr.hawaii.edu>, jari Sugano <suganoj@avax.ctahr.hawaii.edu>, Jari Sugano <suganoj@ctahr.hawaii.edu>, "Shitanishi, Jason - FSA, Aiea, HI" <Jason.Shitanishi@hi.usda.gov>, Sharon Hurd <sharon.k.hurd@hawaii.gov>, michael@painahawaii.com, lina@painahawaii.com, Nick Lee <nicholas@painahawaii.com>, "jake@painahawaii.com" <jake@painahawaii.com>

Hi, Jari, Jason and Lyle:

I am sorry to learn that the time is not convenient to Mr. Yu and farmers. Is it too late to change the time as suggested? 4:00 - 5:30 pm???

Please advise,

Po-Yung
[Quoted text hidden]
--
Po-Yung Lai, PhD
Agricultural Liaison
Office of the Mayor
City and County of Honolulu
Phone: (808)768-4930 (Office)
(808)623-9664 (Home)

Email: plai@honolulu.gov
po.yung.lai@gmail.com

Cadelinia, Stephanie <Extension@ctahr.hawaii.edu> Tue, Oct 21, 2014 at 3:03 PM
To: Lyle Wong <lwongpi@gmail.com>

Hi, Mr. Wong:

Can you delete extension@ctahr.hawaii.edu from your list and change it to amstokes@hawaii.edu?

Ashley Stokes is the interim Associate Dean/Director for Extension.

Thanks,

Steph Cadelinia

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Tuesday, October 21, 2014 11:27 AM
To: Cadelinia, Stephanie; jari Sugano; Sugano, Jari; Shitanishi, Jason - FSA, Aiea, HI
Cc: Po-Yung Lai; sharon.k.hurd@hawaii.gov; michael@painahawaii.com; lina@painahawaii.com; Nick Lee; jake@painahawaii.com; Lyle Wong
Subject: Announcement for Kahuku Export Meeting.

Thanks Jari for this help.

[Quoted text hidden]

Enhancing Hawaii's Export Ready Agricultural Commodities to Be Exported to Mainland Markets

The Hawaii Department of Agriculture (HDOA), teaming up with Paina Hawaii and USDA-FSA, invites you to two scheduled meetings at Kunia and Kahuku to explain the project targeting the use of irradiation treatment to meet the quarantine requirements for Hawaii's export ready agricultural commodities to be exported to the mainland markets.

It is anticipated that production of fruits and vegetables in Hawaii will increase due to the increased availability of farmlands in the state. In keeping with this anticipated increase, the two meetings are organized to provide us an opportunity to learn whether you would be interested in expanding your marketing channels through exporting your farm products. Please come to join us at the meetings, we would like to learn from you.

The two meetings for Hawaii's export ready agricultural commodities are FREE and are scheduled as follows:

I. The 1st meeting
Location:
Date:
Time:

II. The 2nd meeting
Location:
Date:
Time:

Please contact plai@honolulu.gov for registration.

Gmail

Lyle Wong <lwongpi@gmail.com>

Driving Directions Aerial Map

1 message

Shitanishi, Jason - FSA, Aiea, HI <Jason.Shitanishi@hi.usda.gov> Wed, Nov 12, 2014 at 3:11 PM
To: Po-Yung Lai <po.yung.lai@gmail.com>
Cc: "Lai, Po-Yung" <plai@honolulu.gov>, "lwongpi@gmail.com" <lwongpi@gmail.com>, "sharon.k.hurd@hawaii.gov" <sharon.k.hurd@hawaii.gov>, "michael@painahawaii.com" <michael@painahawaii.com>

Hello again,

Sorry I forgot to confirm that the date is December 18. Attached is a driving directions template that you may want to place on the flyer. Jason

---

From: Shitanishi, Jason - FSA, Aiea, HI
Sent: Wednesday, November 12, 2014 2:08 PM
To: 'Po-Yung Lai'
Cc: Lai, Po-Yung; lwongpi@gmail.com; sharon.k.hurd@hawaii.gov; michael@painahawaii.com
Subject: RE: Draft announcement of the meeting on export ready ag commodities at Kunia

Thanks Po-Yung. It's my pleasure to assist. Good news, the space has been confirmed from 5:00 pm to 8:00 pm. HARC staff end work betw. 4:00 pm and 5:00 pm so you should have more than enough parking. They have 40 plus spaces. In addition, they have a podium, PA system, chairs, and tables. I have a sign that say's Farmer's Workshop that can be placed at the entrance gate.

I will start contacting farmers with a focus on farm operations from Kunia to Waianae. Have a great day! Jason

From: Po-Yung Lai [mailto:po.yung.lai@gmail.com]
Sent: Wednesday, November 12, 2014 1:24 PM
To: Shitanishi, Jason - FSA, Aiea, HI
Cc: Lai, Po-Yung; lwongpi@gmail.com; sharon.k.hurd@hawaii.gov; michael@painahawaii.com
Subject: Re: Draft announcement of the meeting on export ready ag commodities at Kunia

Thank you, Jason, for getting the meeting place arranged. I will copy this email to Lyle, but wonder if donation of $100 will be allowable under the grant. I am pretty sure paying rental fee for the meeting room will be OK. Regardless, I will follow up with Lyle after I send out this email to you.

Will get back to you with the result.

Po-Yung

On Wed, Nov 12, 2014 at 9:59 AM, Shitanishi, Jason - FSA, Aiea, HI <Jason.Shitanishi@hi.usda.gov> wrote:

It looks like they will be approving the use of the space. They have asked for an estimated head count and length of use. I provided an estimate of less than 50, and 3 hours for the use of the facility. I should be hearing back from them today. HARC is a non-profit organization so they request a $100 donation for the use of the facility. Jas

From: Po-Yung Lai [mailto:po.yung.lai@gmail.com]
Sent: Monday, November 10, 2014 4:08 PM
To: Shitanishi, Jason - FSA, Aiea, HI
Cc: Lai, Po-Yung; lwongpi@gmail.com; sharon.k.hurd@hawaii.gov; michael@painahawaii.com
Subject: Re: Draft announcement of the meeting on export ready ag commodities at Kunia

Aloha, Jason: You have been so efficient as always. Thank you for following up on this. Will wait for your further instruction before I finalize the announcement with the driving instructions.

Mahalo, indeed.

Po-Yung

On Mon, Nov 10, 2014 at 12:34 PM, Shitanishi, Jason - FSA, Aiea, HI <Jason.Shitanishi@hi.usda.gov> wrote:

Aloha Outreach Team!

I have requested the use of Hawaii Agricultural Research Center warehouse meeting space in Kunia for Dec. 18, 2014, and will let you know as soon as I hear back from them, along with earliest start time. I would recommend starting up outreach efforts as soon as the reservation is confirmed. Here is the address:

Hawaii Agriculture Research Center

94-340 Kunia Road

Waipahu, HI 96797

I have driving directions and a photo of the facility as shown below:

Driving Directions

From Honolulu

- H1 Freeway head West to Kunia/Ewa
- Take Exit 5B—Kunia (North) HI-750
- Turn right onto Kunia Road heading North. Get in left hand lane. (Hawaii Ag Research Center is across the street from "Wendy's" Drive-In)
- Take left into Hawaii Ag Research Center (HARC) entrance road. See photo below.
- Turn right into parking lot of large white warehouse (HARC).

-----Original Message-----
From: Lai, Po-Yung [mailto:plai@honolulu.gov]

Sent: Friday, November 07, 2014 4:17 PM
To: Shitanishi, Jason - FSA, Aiea, HI; 'lwongpi@gmail.com'
Cc: 'lwongpi@gmail.com'; 'sharon.k.hurd@hawaii.gov'; 'michael@painahawaii.com'; 'po.yung.lai@gmail.com'
Subject: RE: Draft announcement of the meeting on export ready ag commodities at Kunia

Thank you, Jason, again. I am using this opportunity to consult Lyle to see if the time from 5:30 - 6:30 pm on Thursday, December 18, at HARC be OK with him. If Lyle agrees to the location and time, I need your advice, Jason, as to the best time to send the announcement out. Two weeks, three weeks, or a month before the 18th???

Po-YUng

From: Shitanishi, Jason - FSA, Aiea, HI [Jason.Shitanishi@hi.usda.gov]

Sent: Friday, November 07, 2014 3:29 PM

To: Lai, Po-Yung

Cc: 'lwongpi@gmail.com'; 'sharon.k.hurd@hawaii.gov'; 'michael@painahawaii.com'; 'po.yung.lai@gmail.com'

Subject: RE: Draft announcement of the meeting on export ready ag commodities at Kunia

Yes, that sounds like a good idea. Given the ongoing problem of farm operations on Oahu growing the same crops in a limited market, and forced to throw away production because of low prices and/or insect infestation. What farm operation wouldn't want the opportunity to expand their market and decrease risk of pest rejection?

----Original Message----

From: Lai, Po-Yung [mailto:plai@honolulu.gov]

Sent: Friday, November 07, 2014 3:11 PM

To: Shitanishi, Jason - FSA, Aiea, HI

Cc: 'lwongpi@gmail.com'; 'sharon.k.hurd@hawaii.gov'; 'michael@painahawaii.com'; 'po.yung.lai@gmail.com'

Subject: RE: Draft announcement of the meeting on export ready ag commodities at Kunia

Thank you, Jason. It is OK with me for pushing back the time. When do you think would be more appropriate time to have it? Starting at 5:30 pm?

If there are Chinese speaking farmers in the audience, I would be able to handle that quite easily. I would, however, have difficulties with other languages, such as Lao, Thai or Cambodian. We'll see how to handle that. One thing we could do is to arrange a convenient time to follow up with those farmers who need special attention after December 18. What do you think?

I know that we are imposing on you for this request.

Po-Yung

From: Shitanishi, Jason - FSA, Aiea, HI [Jason.Shitanishi@hi.usda.gov]

Sent: Friday, November 07, 2014 2:51 PM

To: Lai, Po-Yung

Cc: 'lwongpi@gmail.com'; 'sharon.k.hurd@hawaii.gov'; 'michael@painahawaii.com'; 'po.yung.lai@gmail.com'

Subject: RE: Draft announcement of the meeting on export ready ag commodities at Kunia

Thank you Po-Yung,

I will contact the Hawaii Ag Research Center to reserve their warehouse meeting space. Sorry, but you may have to move the start time back a bit due to the fact that the meeting will be in a portion of their working space. They may still be working at 4:00 pm. I'm assuming they would not allow use until after normal working hours.

I would recommend contacting farm leaders in the area to assist with outreach efforts to farmers, especially immigrant farm operations. I believe that many, if not most of the farm operations for your target audience of farm operations producing crops that could be irradiated and exported are operated by immigrant farmers. Many speak English as a second language and cannot read English well. I would like to assist in this regard, but I do not have the knowledge or background in ag irradiation/export. Basically, I don't know how to adequately explain the benefits to farm leaders for them to turn around and explain to other farm operations. In addition, I am not authorized to officially promote a service that would provide monetary benefit to a private company.

Mahalo, Jason

From: Lai, Po-Yung [mailto:plai@honolulu.gov]

Sent: Friday, November 07, 2014 6:43 AM

To: Shitanishi, Jason - FSA, Aiea, HI

Cc: 'lwongpi@gmail.com'; 'sharon.k.hurd@hawaii.gov'; 'michael@painahawaii.com'; 'po.yung.lai@gmail.com'

Subject: FW: Draft announcement of the meeting on export ready ag commodities at Kunia

Good morning, Jason:

I forgot to attach the announcement. Sorry. Here it is.

Po-Yung

From: Lai, Po-Yung

Sent: Thursday, November 06, 2014 3:36 PM

To: jason.shitanishi@hi.usda.gov<mailto:jason.shitanishi@hi.usda.gov>

Cc: lwongpi@gmail.com<mailto:lwongpi@gmail.com>; sharon.k.hurd@hawaii.gov<mailto:sharon.k.hurd@hawaii.gov>; michael@painahawaii.com<mailto:michael@painahawaii.com>; po.yung.lai@gmail.com<mailto:po.yung.lai@gmail.com>

Subject: Draft announcement of the meeting on export ready ag commodities at Kunia

Aloha, Janson:

I am coming back to ask for your kokua in reviewing the announcement intended for the export ready commodity meeting at Kunia. Based on our discussion at Mr. You's warehouse, the time and date were tentatively picked at 4:00 - 5:30 pm, on Thursday, December 18, 2014. The venue is still to be decided. Would you mind taking a look at the announcement, which was edited to reflect this meeting at Kunia? Also, would appreciate the address for the meeting site and the map if you have one.

Lyle is traveling now and will be back this weekend.

You kokua will be greatly appreciated. Hope we can make the announcement earlier this time around.

Mahalo,

Po-Yung

–

Po-Yung Lai, PhD

Agricultural Liaison

Office of the Mayor

City and County of Honolulu

Phone: (808)768-4930 (Office)

(808)623-9664 (Home)

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–

Po-Yung Lai, PhD

Agricultural Liaison

Office of the Mayor

City and County of Honolulu

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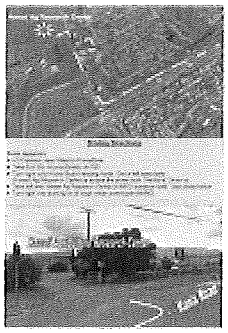


HARC Driving Directions.jpg
306K

Attachment E
15 pages.

10/30/2014

Welcome to this Meeting at You Farm

And Thank you Mr. You
For letting us use your facility
For this meeting

Lyle Wong, Pa'ina Hawaii
Po Yung Lai, C&C Honolulu/Pa'ina Hawaii

Enhancing Export of Export Ready Commodities

- Our title for today's meeting is "Enhancing Export of Export Ready Commodities".
- We will be meeting with other growers on Oahu as well as on the Island of Hawaii to identify export ready commodities that growers would like to ship to U.S. mainland markets.

Project

- This project is being funded by the Hawaii Department of Agriculture through a federal USDA grant to enhance agriculture in the State of Hawaii.
- The work effort is partnership between:
  - HDOA
  - Pa'ina Hawaii
  - City and County of Honolulu
  - UH, CTAHR

Why are we having this meeting

- Many crops grown in Hawaii can be shipped by growers to U.S. mainland markets.
- Some require quarantine treatment prior to shipment. (Tropical fruit for fruit flies)
- Others can be shipped without quarantine treatment. (Taro leaves & basil)
- All, however, must be inspected in Hawaii prior to shipment and will be inspected upon arrival in some states, as California.

- Export is an opportunity to increase production to service larger markets than available in Hawaii.
- To increase farm income and to expand diversified agriculture in Hawaii.

But there are risks!!!

- Your shipment could be rejected as a result of hitch hiking pests.
- Rejection could result in large loses to you.
- Rejections could also mean the lost of confidence in your ability to produce a quality product in Hawaii and your ability to do business in U.S. mainland export markets.

1.欢迎到许先生的农场参加这个会议
同时感谢许先生慨允借此会议场地

Lyle Wong, Pa'ina Hawaii
Po-Yung Lai, 火奴鲁鲁市政府

2.*计划
本计划经费由美国农业部透过夏威夷农业厅赞助 目的在于提升夏威夷州农业

*本计划蒙下列单位协助：
夏威夷农业厅
Pa'ina Hawaii
火奴鲁鲁市政府
夏威夷大学农业暨人力资源学院

3.*外销提供增产机会以利大于夏威夷现有市场之需求

*增加农场收入及提升夏威夷农业之多样化

4.促进列于准予外销清单上农产品之输出

*今天会议的主题是"促进列于准予外销清单上农产品之输出"

*我们亦计划与欧胡岛及夏威夷大岛上的其他农民讨论是否有意顾将上述农产品外销美国本土市场

5.本会议的目的在于:

*许多在夏威夷出产之农作品可外销到美国本土市场

*其中有些农产品需按规定经检疫处理后方能外销（如消除热带水果之果实蝇）

*有些农产品不经检疫处理即可外销（如芋头及九层塔）

*但，以上农产品均需在夏威夷受检后方能运出及在运抵美国本土如加州时需受检

6.但，仍有风险!!!

*你的输出之农产品有可能被退回因在农产品上附其他有害生物

*美国农业部检疫官通常由一百箱里随机抽取两箱检查，以确保输出农产品不含有害生物之虞

13.其他须知事项

*农产品需以符合运输规定之箱子装箱

*农产品需不含任何附着之有害生物

*箱外四周均需以胶纸封闭

*农产品输出者需列于美国农业部生产单位之资料库里

*农产品以辐射处理方法及剂量需经美国农业部测试及批准

14.山竺装在符合辐射处理规格之箱子及其排法

15.装在符合运输规定箱子之辣木叶

16.装在符合运输规定箱子之山竺

17.辣木叶

18.辣木叶装在符合辐射处理规格之箱子及其排法

19.芋头叶子装在符合运输规定之箱子

20.冲绳番薯

21.美国检疫官检查辐射处理前之番薯

22.芋头叶装在符合辐射处理规格之箱子及其排法

23.装在符合运输规定箱子之番薯

24.美国农业部检疫官员切割番薯以确定是否含有其他有害生物

25.装箱准备接受辐射处理之番薯

26.辐射处理后

Table 3-1 List of Approved Fresh Fruits, Herbs, and Vegetables from Hawaii—Authority 7CFR 318.13

Abiu T105-a-1 [1]
Aechmea bracteata (fruit bearing panicle)
Allium spp. (bulb, leafy green tops; commercial consignments only; continental US only)[2]
Aloe vera (above ground parts)
Alokon (inflorescence)
Anise (leaf, stem, seed)
Arrowhead [3]
Arrowroot
Artichoke, globe
Artichoke, Jerusalem
Asiatic pennywort (leaf, stem)
Asparagus
Atemoya T105-a-1 [1]
Avocado (commercial consignments only) T101-c-1 or T108-a
Avocado, Sharwil[4] (commercial consignments only) T101-c-1 or T108-a
Bamboo shoots
Banana (fruit) T105-a-1 [1] or T105 -a-2 [1 6]
Basil (leaf, stem)
Bay laurel (leaf, stem)
Bean sprout, mung and soy
Beet
Beremi (leaf, stem) (*Limnophila chinensis* ssp. *aromatica*)
Borage (leaf, stem)
Breadfruit (fruit) T105-a-1 [1 6 7] **or** T105-a-2 [6 8]
Broccoli
Brussels sprouts
Burdock
Burnet (leaf, stem)
Butterbur
Cabbage
Cannonball fruit
Carambola T105-a-1 [1]
Carrot
Cassava
Cauliflower
Celery (root, top)
Chervil (leaf, stem)
Chinese amaranth
Chinese cabbage
Chinese chives (leaf, stem)
Chinese water chestnut
Cilantro (leaf coriander)
Citrus T103-b-1 **or** T105-a-1 [1 9]
Coconut (unrestricted)
Corn
Corn-on-the-cob
Corn smut galls
Cowpea (pod) T105-a-2 [8 10]
Cucurbita spp. T105-a-1 [1]
Curry leaf (*Bergera koenigii*) T101-n-2 **or** T105-a-2 [1]
Cyperus corm
Dandelion
Dill (leaf, stem, seed)
Dragon fruit (fruit) T105-a-1 [1 11] **or** T105-a-2 [8 12]
Dropwort, water
Drumstick (leaf, inflorescence)
Durian
Edible flowers [13] (inflorescences only)
Eggplant T105-a-1 [1]
Eryngo (leaf)
Fennel (leaf, stem)
Foxhead
Galanga (rhizome)
Garden rocket (leaf, stem)
Garland chrysanthemum
Garlic chive
Guava (fruit; commercial consignments only) T105-a-2 [8 14]
Ginger bracts
Ginger root [15]
Gow-kee
Heckerea umbellata (leaf, stem)
Honewort
Heartleaf (leaf stem) (*Houttuynia cordata*)
Jackfruit (fruit) T105-a-1 [1 6 7] **or** T105-a-2 [6 8]
Japanese honewort (*Cryptotaenia japonica*)
Jicama
Knotweed
Kudzu
Lamb's quarters (leaf, stem)
Lemon balm (leaf)
Lemon grass (leaf, stem)
Lettuce
Lily bulb (*Lilium* spp.)
Litchi [16] T102-d, T105-a-1 [1], **or** T106-f
Longan [16] T102-d, T105-a-1 [1], **or** T106-f
Lotus root
Maguey leaf
Mahogany fruit
Malabar spinach
Mango T105-a-3
Mangosteen (fruit) T105-a-1 [1 17] **or** T105-a-2 [8 12]
Marigold (flower head)
Marjoram (leaf), *Origanum* spp. (leaf, inflorescence)
Matsutake
Melon (fruit) T105-a-1 [1 18] **or** T105-a-2 [8 18]
Mint (leaf, stem)
Moringa (pods) T105-a-1 [1 19] **or** T105-a-2 [8 19]
Mountain papaya, *Vasconcellea pubescens*, T106-b-3
Mugwort
Mushroom
Mustard greens
Oregano (leaf, stem) *Origanum vulgare*
Palm hearts (stem) peeled or trimmed (white to off-white)
Papaya T103-d-2, T105-a-1 [1], **or** T106-b-4, **or** T106-c
Parsley
Peanut
Pepper (*Capsicum* spp.) T105-a-1 [1]
Peppermint (leaf, stem)
Perilla
Pineapple T106-b-5 **or** T105-a-1 [1]
Pineapple, smooth Cayenne and hybrids with 50 percent or more smooth Cayenne parentage
Piper spp.
Pohole fern (leaf, stem)
Athyrium spp. and *Diplazium* spp.
Pomegranate arils
Poreleaf (leaf, stem)
Potato
Radish (*Raphanus sativus*)
Rambutan T103-e, T105-a-1 [1], T106-g
Rhubarb
Rosemary (leaf, stem)
St. John's Bread
Sage (leaf, stem)
Saluyut jute (leaf, stem, inflorescence)
Sapodilla T105-a-1 [1]
Sausage fruit
Savory (leaf, stem)
Screwpine (leaf)
Singhara nut (*Trapa bispinosa*)
Sorrel (leaf, stem) *Rumex* spp.
Spinach
Sweet potato T101-b-3-1, T105-a-1 [1], T105-a-2 [1], or T106-h [20 21]
Tamarind bean pod
Taro
Tarragon (leaf, stem)
Thyme (leaf, stem)
Tomato T101-c-3, T105-a-1 [1 22]
Truffle
Turmeric (rhizome)
Turnip
Water-chestnut
Watercress
Yam

17 Fruit presented for inspection must have the sepals removed in order to conduct the inspection. Sepals are allowed for those fruit **not** being inspected. Consignment must be free from stems and leaves. If you find stems or leaves, REFUSE to certify. Inspect for the gray pineapple mealybug (*Dysmicoccus neobrevipes*), pink hibiscus mealybug (*Maconellicoccus hirsutus*), citrus mealybug (*Pseudococcus cryptus*), and *Thrips florum* before undergoing irradiation treatment in Hawaii at the 150 gray dose. If infested with these pests, REFUSE to certify or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy dose also must either receive a post-harvest dip in accordance with treatment schedule T102-c as provided, or originate from an orchard or growing area found free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose.

18 Melons must be washed to remove dirt and must be free from leaves and stems. If the melons receive the 150 Gy dose, inspect the consignment for spiraling whitefly (*Aleurodicus dispersus*) before undergoing irradiation treatment at the 150 Gy dose. If infested with these spiraling whitefly, REFUSE to certify or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy dose also must either receive a post-harvest dip in accordance with treatment schedule T102-c or originate from an orchard or growing area that was previously treated with a broad-spectrum insecticide during the growing season and a pre-harvest inspection of the orchard or growing area found the fruit free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose. Regardless of irradiation dose, melons must be washed to remove dirt and must be free of stems and leaves.

19 Inspect the consignment for spiraling whitefly (*Aleurodicus dispersus*), inornate scale (*Aonidiella inornata*), and citrus mealybug (*Pseudococcus cryptus*) before undergoing irradiation at the 150 Gy dose. If any of these pests are found, PROHIBIT ENTRY or treat with 400 Gy (T105-a-2). Fruit receiving the 150 Gy treatment must also either receive a post-harvest dip in accordance with treatment schedule T102-c as provided in § 305.42(b) or originate from an orchard or growing area that was previously treated with a broad-spectrum insecticide during the growing season and a pre-harvest inspection of the orchard or growing area found the fruit free of any surface pests as prescribed in a compliance agreement. Post-treatment inspection in Hawaii is **not** required if the fruit undergoes irradiation treatment at the 400 Gy dose.

20 Inspect for gray pineapple mealybug (*Dysmicoccus neobrevipes*), kona coffee-root knot nematode (*Meliodogyne konaensis*). Per the conditions of 7CFR 305.34(b)(7), sweet potatoes must be sampled, cut, and inspected in Hawaii and found free of ginger weevil (*Elytrotreinus subtruncatus*) before undergoing treatment in Hawaii. REJECT or treat with 400 Gy (T105-a-2) if the mealybug or ginger weevil is found. REJECT consignment if the nematode is found.

21 Vapor heat treatment may be used if the conditions of 7CFR 318.13-14(d) have been met. Sweet potato must be sampled, cut, and inspected and found free of ginger weevil (*Elytrotreinus subtruncatus*), gray pineapple mealybug (*Dysmicoccus neobrevipes*), kona coffee-root knot nematode (*Meliodogyne konaensis*) before undergoing treatment.

22 Tomatoes must meet the conditions listed in 7CFR 318.13-14(c).

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE
Karen Ross, Secretary

DATE: March 7, 2013

TO: All County Agricultural Commissioners

FROM: Plant Health and Pest Prevention Services

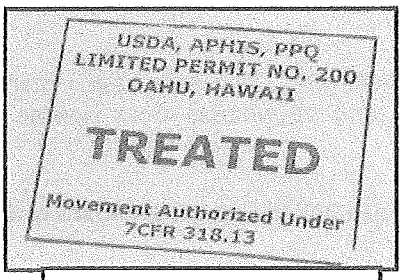
SUBJECT: **PEST EXCLUSION ADVISORY NO. 02-2013**
New Hawaiian Irradiation Facility, Pa'ina Hawai'i

Since 2000, the Hawaiian company Hawaii Pride LLC has been the only facility approved by the United States Department of Agriculture (USDA) to conduct phytosanitary irradiation treatment for fruits and vegetables being exported to California. A second USDA approved irradiation treatment facility located in Hawaii, ***Pa'ina Hawai'i*** is now fully operational and will also be treating commodities destined for California.

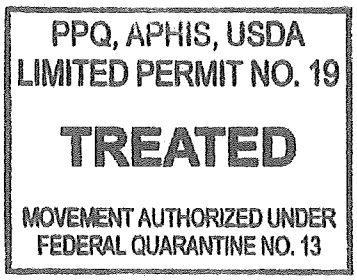
Federal regulations govern the movement of fruits and vegetables from Hawaii to the continental United States (7CFR 318.13) and provide packaging guidelines (7CFR 305.9) for irradiated shipments to ensure pest freedom and the integrity of pallet-loads of irradiated boxes. For more information concerning the radiation treatment and protocols, and for a list of pest-specific minimum absorbed doses, please see the USDA treatment manual, section 3-8(1-8).

Commodities treated at these irradiation facilities will be certified in the following two ways:

Limited Permit Stamp: This will be used on air cargo and maritime cargo bill of lading documents. The limited permit stamp is on each box of treated commodities either as or incorporated into the sealing tape itself or as a stamp impression across the tape. Please see examples below.



Pa'ina Hawai'i
Irradiation Facility Limited Permit
Stamp #200



Hawaii Pride LLC
Irradiation Facility Limited Permit
Stamp #19

Certificate of treatment by irradiation: Treatment certificates will accompany shipments of irradiated commodities entering California directly from Hawaii. Certificates may show the shipper and the consignee as the same and additional ports of entry and carrier identification listed as "Various". Only one certificate is issued for a treatment lot and copies can accompany multiple shipments destined to various consignees.

Attachment F

7 pages.

Supplemental Request

For Movement of Sweet Potato Leaves

Hawaii to U.S. Mainland Markets

Date: April 14, 2015

To: Neil Reimer, Ph.D.
Hawaii Department of Agriculture
Administrator, Plant Industry Division

From: Lyle Wong, Ph.D.
Pa'ina Hawaii

Subject: Request to allow movement of Sweet Potato leaves from Hawaii to U.S. mainland markets with Irradiation Quarantine Treatment

Background:

The movement of a fresh fruit or vegetable from Hawaii to the U.S. mainland requires USDA, APHIS, PPQ approval and the listing of the commodity in Table 3-1 ("List of approved Fresh Fruits, Herbs, and Vegetables from Hawaii – Authority 7 CFR 318.13") of the USDA, APHIS, PPQ Hawaii Manual.

The request to list a commodity in Table 3-1 of the Hawaii Manual requires the concurrence of the State (Hawaii) Department of Agriculture and a pest risk assessment. A post-harvest quarantine treatment may be required if a pest or pests of concern to U.S. mainland agriculture are identified through the PRA.

Sweet potato is currently listed in Table 3-1 of the Hawaii Manual. The listing is based on a request by the Hawaii DOA for the listing and the supporting documentation provided by the Hawaii DOA, Plant Pest Control Branch entitled, "Qualitative Pathway-initiated Pest Risk Assessment, Movement of Sweet Potato, *Ipomoea batatas*, from Hawaii into the Continental United States, dated, February 27, 2002.

The rule currently applies solely to the sweet potato tuber. Growers in Hawaii would like to export fresh sweet potato foliage (i.e., leaves) to U.S. mainland markets as well; the following is a request to include sweet potato foliage as an approved commodity in Table 3-1 of the Hawaii Manual.

Justification:

The Qualitative, Pathway-Initiated Pest Risk Assessment submitted by the HDOA in February 27, 2002, identified all known insect and plant pathogens of sweet potato in Hawaii on sweet potato plant parts, including, leaves (L), stems (S), roots , fruit (F), inflorescence (I), and seed (Sd).

Pa'ina Hawaii has reviewed the existing HDOA databased on sweet potato in Hawaii since 2002. That review has found only one new pest of sweet potato in Hawaii, the rough sweet potato weevil, *Blosyrus asellus* (Olivier).

The HDOA New Pest Advisory, dated March 2011, provides the following description of this insect (Coleoptera: Curculionidae):

"Introduction. Immature specimens of a rough sweet potato weevil, Blosyrus asellus (Olivier), were first collected in Hawaii at a commercial Okinawan sweet potato farm in Waipio, Oahu, on November 14, 2008. Identification was made by A. Samuelson of the Bishop Museum on January 23, 2009. This species occurs in Southeast and Eastern Asia, Philippines, Japan, Taiwan and China. It is not known to occur on the mainland U.S.

Description. Adult Blosyrus are ¼" (6 mm) long, brown, with their forewings (elytra) ridged and rough. There are several color forms of the adult weevil – brown and cark brown. Adults are foliage-feeding and create notches along the edges of the sweet potato leaves. However, like other Blosyrus, the white C-shaped grubs are more damaging as they live beneath the soil surface and gouge groves or channels along the surface of the storage root as they feed (Smit year unknown). Damage by the grubs reduces marketability."

Quarantine Treatment:

The listing of sweet potato in Table 3-1 of the Hawaii Manual allows the movement of sweet potato to U.S. mainland markets with irradiation quarantine treatment at a minimum absorbed dose of 150 Gray for the sweet potato weevil, West Indian sweet potato weevil and sweet potato vine borer and absorbed dose of 400 Gray for the ginger maggot, *Eumerus figurans.*

USDA, APHIS, PPQ has also established a dose of 400 Gray as a post-harvest quarantine treatment for "Plant pests of the class Insecta not listed, except pupae and adults of the order Lepidoptera". §305.31(a).

The movement of all consignments of sweet potato to U.S. mainland markets from Hawaii is subject to mandatory inspection prior to treatment.

The consignments are treated at 150 Gray for the sweet potato weevil, West Indian sweet potato weevil and sweet potato vine borer. Should the inspection identify the presence of other hitch hiking insect pests, e.g., leaf hoppers, grasshopper, or the ginger maggot, all cartons from the particular growers are required to be treated at a minimum absorbed

dose of 400 Gray. Interception of a rough sweet potato weevil would also require the treatment of the consignment at 400 Gray.

As noted above, the Hawaii Manual, Table 3-1 does not list sweet potato leaves for movement from Hawaii to the continental United States. As noted in the Appendix A (Pre-Requisite Requirements for Commodity Risk Assessments" of the Hawaii Manual:

"There are two reasons a fruit, herb, or vegetable may not be listed as approved for movement to other parts of the United States:

> PPQ has **not** studied the pest risk, or
> PPQ has studies the pest risk and there were no mitigations appropriate to address the pest risk.

With regards to point one, above, PPQ has studied the pest risk associated with the movement of sweet potato, *Ipomoea batatas*, from Hawaii into the Continental United States.

The Qualitative Pathway-Initiated Pest Risk Assessment conducted by the HDOA and submitted to USDA, APHIS, PPQ in February 2002 identified various insect and pathogen pests associated with sweet potato in Hawaii on various plant parts, including leaves and roots.

Based on this review, USDA, APHIS, PPQ promulgated a rule allowing the movement of sweet potato roots to U.S mainland markets with irradiation quarantine treatment at 150 Gray for the sweet potato weevil, the West Indian sweet potato weevil and the sweet potato vine borer and 400 Gray for other pests in insect class Insecta not listed, except pupae and adults of the order Lepidoptera. See Federal Register Volume 71, Number 18, Friday, January 27, 2006.

While the pathway-initiated pest risk assessment conducted by the HDOA in 2002 addressed pests of sweet potato in total, including all plant parts in Hawaii, the resulting quarantine movement regulation provided in the Hawaii Manual Table 3-1 appears to apply solely to the "root".

Therein, regarding point two of the above, PPQ has studied the pest risk and has determined that there is a mitigation measure deemed appropriate for the commodity, sweet potato, i.e., the root. The pest risk assessment also identified and provided a qualitative pest risk assessment for other plant parts of the sweet potato, including leaves. Consequently, Pa'ina Hawaii requests that USDA reassess the Pathway-Initiated Pest Risk Assessment to determine whether there is a mitigation measure deemed appropriate to address the pest risk for sweet potato leaves as well. A rule appropriate to mitigate the risk of plant pests of the class Insecta not listed, except pupae and adults of the order Lepidoptera has been established by USDA. Therefore, hitch hiking insect pests in consignments of sweet potato leaves would be treated at 400 Gray.

In support of the above, Pa'ina Hawaii provides the following specific information as requested in Appendix A of the Hawaii Manual for a USDA commodity risk assessment:

1. A description and/or map of the specific locations(s) of the areas in the exporting area where the commodity is produced.

Sweet potato (Ipomoes batatas) is produced in Hawaii on the islands of Hawaii, Oahu, Molokai, Maui, and Kauai. The largest commercial production of sweet potato for export to U.S. mainland markets is on the Island of Hawaii along the Hamakua coast.

2. The scientific name (including genus, species, and author names), synonyms, and taxonomic classification of the commodity.

Ipomoea batatas (L.) Lam.

3. Identification of the particular plant or plant part (i.e., fruit, leaf, root, entire plant, etc.) and any associated plant part proposed for interstate movement to other parts of the United States.

The root is currently approved for movement from Hawaii to U.S. mainland.

This request is to allow movement of sweet potato leaves to the U.S. mainland from Hawaii with post-harvest irradiation treatment at 400 Gray.

4. The proposed end use of the imported commodity (e.g., consumption, milling, decorative, processing, etc.)

For human consumption.

5. The months of the year when the commodity would be produced and harvested for interstate movement.

Year around.

6. Detailed information as to the projected quantity and weight/volume of the proposed importation, broken down according to varieties where applicable.

Growers estimate demand for sweet potato leaves in Asian (and other) markets will exceed thousands of 15- to 20-pound cartons per week.

7. Method of shipping and under what conditions, including type of conveyance, and type, size, and capacity of packing boxes and/or shipping containers.

Shipment will be by air freight to west coast and inland markets. Shipment by sea containers is not practical because of the delay to markets. Cartons will start card board

cartons for 15- to 20-pound lots for fresh leaves, likely to be in 1- to 2-pound individual plastic bags.

8. Scientific name (including genus, species, and author names) and taxonomic classification of arthropods, fungi, bacteria, nematodes, virus, viroids, mollusks, phytoplasmas, spiroplasmas, etc. attacking the crop.

See attached Qualitative, Pathway-Initiated Pest Risk Assessment, "Movement of Sweet potato, Ipomoea batatas, from Hawaii into the Continental United States", February 27, 2002, Hawaii Department of Agriculture (Thomas w. Culliney, Entomologist, Plant Pest Control Branch, Division of Plant Industry).

9. Plant part attacked by each pet, pest life stages associated with each plant part attacked, and location of pest (in, on, or with commodity).

See above PRA.

10. References

See above PRA.

11. Overview of agronomic or horticultural management practices used in the production of the commodity, including methods of pest risk migitation or control.

See attached document, "Sweetpotato Production Guidelines for Hawaii", by: Hector Valenzuela, Steven Fukuda, and Alton Arakaki, Experimental Station HITAHR, CTAHR, University of Hawaii at Manoa, RESEARCH EXTENSION SERIES 14603.94(2M)

12. Identification of parties responsible for pest management and control.

Growers are primarily responsible for pest survey, and pesticide use and best management pest practices. Supporting growers in the endeavor are the City and County of Honolulu, and the Cooperative Extension Service of the University of Hawaii, Collect of Tropical Agriculture and Human Resources.

Appendix A of the Hawaii Manual instructs applicants for a pest risk assessment review to submit all information to the Hawaii Department of Agriculture for review and approval. After approval, the APHIS PPQ State Plant Health Director's Office should submit the document to the RCC Unit to begin the review process.

Pa'ina Hawaii respectively submits this request to the HDOA for the initial review.

Lyle Wong

Gmail Lyle Wong <lwongpi@gmail.com>

Sweet Potato Leaves Pest Risk Assessment

1 message

Lyle Wong <lwongpi@gmail.com> Tue, Apr 14, 2015 at 5:21 PM
To: Neil Reimer <Neil.J.Reimer@hawaii.gov>
Cc: michael@painahawaii.com, Po-Yung Lai <po.yung.lai@gmail.com>, lina@painahawaii.com, Nick Lee <nicholas@painahawaii.com>, Vernon Harrington <Vernon.Harrington@aphis.usda.gov>, Dorothy.S.Alontaga@aphis.usda.gov
Bcc: Lyle Wong <lwongpi@gmail.com>

Neil,

We treat sweet potato tubers for export, out most significant tonnage.

Growers want to export the leaves as well, but the clearance for export with irradiation quarantine treatment appears to apply solely to the tuber not to leaves.

We have been advised that a Commodity Request is required and this goes through the HDOA for concurrence; if you agree, then the request goes to the State Plant Health Director (Harrington), and then on to the USDA, APHIS, PPQ.

I prepared the initial request to the HDOA (you) for your review and tried to make the point that the Pest Risk Assessment for all plant parts including leaves has already been made and completed and this was in 2002 when Tom Culliney prepared the Qualitative Pest Risk Assessment.

This is an important point since if accepted by USDA, much of the work has already been done, and no need to start from scratch.

Po Yung Lai is helping with this project; Po went through your files to see what new has appeared since 2002 and his search surfaced only one new pests, the rough sweet potato weevil, Blosyrus asellus.

I'm attaching my memo to you outlining our request; a copy of the 2002 PRA by Tom Culliney; the Table 3-1 from the Hawaii Manual; and guidelines from APHIS, PPQ for submitting a commodity request and the CTAHR report on sweet potato production in Hawaii. This may not all fit below, if not will send to by two or three e-mails.

Hope this make sense, I will call to discuss as well.

If additional information and/or review is required, will get on it.

Lyle

P.S., the Sweetpotato Production Guidelines for Hawaii by Valenzuela, Fukuda and Arakaki, can be best pulled from the Internet, I can't seem to attach.

--

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

4 attachments

Reimer Sweet potato leave PRA 041415.docx
29K

Sweet Potato PRA Feb. 27, 2002.pdf

11918K

Approved Fruits Veg List 112014.pdf
410K

Appendix A Hawaii Manual Prereq for commodity Risk Assessment.pdf
1068K

Attachment G
4 pages.

USDA PPQ Form 526 Federal Noxious Weed Permits for Movement of On-choy (*Ipomoea aquatica*) from Hawaii to U.S. Mainland, Concurring States:

State	Dated Issued
Missouri	2/3/15
Colorado	2/5/15
New York	2/6/15
Illinois	2/12/15
Minnesota	2/12/15
Nevada	2/24/15
Massachusetts	2/14/15
California	2/14/15
Michigan	2/14/15
West Virginia	3/23/15
Oklahoma	3/20/15
Oregon	3/24/15
South Dakota	4/19/16
Utah	Pending
Texas	Pending
New Jersey	Pending

Animal and Plant Health Inspection Service

Plant Protection & Quarantine

United States Department of Agriculture
Animal and Plant Health Inspection Service
4700 River Road
Riverdale, MD 20737

Permit to Move Live Plant Pests, Noxious Weeds, and Soil

Interstate Movement

Regulated by 7 CFR 360

This permit was generated electronically via the ePermits system

PERMITTEE NAME:	Michael Kohn	**PERMIT NUMBER:**	P526P-15-01032
ORGANIZATION:	Pa'ina Hawaii	**APPLICATION NUMBER:**	P526-140827-018
ADDRESS:	92-1780 V Kunia Road Kunia, HI 96759	**FACILITY NUMBER:**	N/A
MAILING ADDRESS:	P. O. Box 6 Kunia, HI 96759	**HAND CARRY:**	No
		DATE ISSUED:	02/24/2015
PHONE:	(808) 225-1047 Ext. L.Wong		
FAX:	(808) 834-0578	**EXPIRES:**	**02/24/2018**
DESTINATION:	CA		

Under the conditions specified, this permit authorizes the following:

Article Category: Federal Noxious Weeds

Regulated Article	Life Stage(s)	Intended Use	Shipment Origins	Originally Collected	Culture Designation
Ipomoea aquatica	Plant Parts	Consumption - Human	HI	Originally Collected from Foreign Locations	

PERMIT GUIDANCE

Guidance:

The permit holder is solely responsible for ensuring compliance with all statutory requirements and specifically listed permit conditions. Failure to comply with the terms and conditions of this permit is cause for the following:
(a) cancellation of this permit,
(b) cancellation of other permits issued to the permit holder,
(c) seizure and/or destruction of regulated organisms,
(d) denial of future permit applications by this permit holder,
(e) liability for civil penalties,
(f) criminal prosecution under provisions in the Plant Protection Act.

The permit holder must submit a new permit application at least three months prior to the expiration of this permit, and obtain a new permit to continue uninterrupted authorization for the Federal Noxious Weed approved under this permit.

Any alteration, forgery, unauthorized use of this permit and/or associated Federal Forms are subject to civil and criminal penalties including fines and imprisonment.

PERMIT CONDITIONS

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Donna Lee Crayle Donna Crayle	02/24/2015

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

AUTHORIZATION STATEMENT:

This permit authorizes the interstate movement of Ipomoea aquatica (Chinese water spinach) from Hawaii to California for Commercial re-sale and used as a vegetable for human consumption ONLY. Authorization is limited to vegetative material without flowers or seeds.

1. A copy of this permit must accompany each shipment.
2. The plant parts (foliage) must be free of plant pests.
3. The permit holder must be a legal United States resident.
4. This permit cannot be assigned or transferred to other persons.
5. This permit does not meet requirements of any other Federal or State regulatory authority.
6. Planting or releasing Ipomoea aquatica (Chinese water spinach) into local water bodies is prohibited.
7. The permit holder must maintain a valid permit for as long as the Federal Noxious Weed is in their possession.
8. The permit holder must notify all recipients that all materials must be SOLD/USED only in the STATE listed on this permit, and no plants may be transported to another STATE without a permit.
9. Material must be shipped in sturdy containers that will prevent the release of the plants and plant parts. The permit holder must instruct the shipper that plant material may not be sold in any state not authorized by this permit.
10. This permit does not authorize importation, interstate movement, possession, and/or use of strains of genetically engineered regulated organisms (created by the use of recombinant DNA technology).
11. The permit holder must:
    (a) comply with all requirements and permit conditions,
    (b) notify the permit unit of the receipt of unauthorized organisms,
    (c) maintain an official permanent work assignment at the address on this permit and
    (d) notify the permit unit in advance of any change in the permit holder's work assignment.
12. This permit does not authorize movement or use of plant pathogens listed in the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. If any organism listed as a Select Agent is identified from materials associated with this research, the permit holder is required to notify APHIS, Agricultural Select Agent Program (ASAP) immediately by phone at 301-851-3300, and within seven (7) days submit APHIS/CDC Form 4 (Report of Identification of a Select Agent or Toxin in a Clinical or Diagnostic Laboratory) to APHIS, ASAP; 4700 River Rd, Unit 2, Riverdale,MD 20737 (see instructions at: http://www.aphis.usda.gov/programs/ag_selectagent/index.shtml). Failure to comply with this requirement is a violation of the Agricultural Bioterrorism Protection Act of 2002.
13. If the permit holder ceases assignment/affiliation at the address identified on this permit, or personnel circumstances change in any way, then a compliance officer must be notified at the PPQ permit unit immediately (that is, within one business day) by either:
    (a) email to pest.permits@aphis.usda.gov,
    (b) fax to 301-734-4300 or 8700,
    (c) mail to USDA, PPQ, Permit Unit, 4700 River Road, Riverdale, MD 20737.
14. DROP SHIPPING IS NOT AUTHORIZED UNDER THIS PERMIT:

    This permit does not authorize drop shipping. Drop shipping encompasses any shipments of regulated organisms made to customers from other producers or suppliers. These shipments do not originate from your address. These shipments may include filling orders on your behalf. Each shipper must have a permit specifically issued to them authorizing the interstate movement of the specific regulated organism to each destination.

    IMPORTANT:

    As a permit holder, your permit does not cover the activities of other shippers. Each permit holder remains responsible for determining if another entity possesses a valid 526 Plant Pest Permit for each regulated organism prior to requesting any regulated organisms be shipped on their behalf.

Permit Number P526P-15-01032

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Donna Lee Crayle Donna Crayle	02/24/2015

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

END OF PERMIT CONDITIONS

Permit Number P526P-15-01032

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS. Donna Lee Crayle Donna Crayle	DATE 02/24/2015

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

Attachment H
5 pages.

Argument for inclusion of *Ipomoea aquatica* (aka, On-Choy) in IRAD for irradiation quarantine treatment: Federal Noxious Weed, allowed movement from Hawaii to U.S. mainland markets (i.e., concurring states) under PPQ Form 526 Permit.

Pa'ina Hawaii request the inclusion of *Ipomoea aquatica* (aka, On-Choy) in IRAD for irradiation quarantine treatment for movement from Hawaii to U.S. mainland markets.

Tables 3-1 of the USDA Hawaii Manual lists all fresh fruits, herbs and vegetables approved movement from Hawaii to the U.S. mainland.

The list includes products that can be shipped without quarantine treatment. Several of these products, which include basil, ginger, Culantro (= *Eryngo*) and taro, are treated by irradiation by Pa'ina Hawaii at the request of growers and shippers to mitigate high risks of hitchhiking pests or pests of concern detected in PPQ pre-shipment/treatment inspection.

It is our understanding that all commodities (i.e., articles) listed in Table 3-1 can be subject to post-harvest irradiation quarantine treatment. This understanding is based on the reasons enumerated as follows:

1) The current USDA, APHIS, PPQ Treatment Manual, Chapter 3, Nonchemical Treatments – Irradiation, includes the following general statement in the Introduction:

"In 2002, irradiation was approved as a phytosanitary treatment for all admissible fresh fruits and vegetables from all countries."

Prior to the revision of 7 CFR Part 305 by Federal Registry Notice, January 26, 2010, applicable sections contained in Part 305 addressed the USDA, APHIS, PPQ position/requirements for the use of irradiation as a phytosanitary treatment.

Part 305 – Phytosanitary Treatment, Section 305.2, Approved Treatments, states that:

" (h) Fruits and vegetables. (1) Treatment of fruits and vegetables from foreign localities by irradiation in accordance with Sec. 305.31 may be substituted for other approved treatments for any of the pests listed in Sec. 305.31(a). Treatment of fruits and vegetables from Hawaii, Puerto Rico, and the U.S. Virgin Islands by irradiation at the minimum doses listed in Sec. 305.31(a) and in accordance with Sec. 305.34 may be substituted for other approved treatments for any of the pest listed in Sec. 305.31(a)."

2) Sec. 305.31(a). Irradiation treatment of imported regulated articles for certain plant pests specifies that.

"(a) Approved doses. Irradiation at the following doses for the specified plant pests, carried out in accordance with the provisions of this section, is approved as a treatment for all regulated articles (i.e., fruits, vegetables, cut flowers and foliage)."

Table 3-1 further clarifies that the approved quarantine treatment doses for fruit flies and a host of other pests, including *Omphisa anastomasalis*, the sweet potato vine borer (i.e., 150 Gray), and Plant pests of the class Insects not listed, except pupae and adults of the order Lepidoptera (i.e., 400 Gray);

3) Under Section 305.34 Irradiation treatment of certain regulated articles from Hawaii, Puerto Rico, and the U.S. Virgin Islands, Table 1, "Irradiation for Plant Pests in Hawaiian Fruits and Vegetables", specifies approved treatment doses applicable to the following specific Hawaii commodities:

Commodity	Dose (Gray)
Abiu	150
Atemoya	150
Bell pepper	150
Carambola	150
Eggplant	150
Litchi	150
Longan	150
Mango	300
Papaya	150
Pineapple	150
Rambutan	150
Sapodilla	150
Italian squash	150
Sweet potato	400 or 150
Tomato	150

(2) Pest-specific doses. Any articles from Puerto Rico or the U.S. Virgin Islands, as well as any articles from Hawaii not listed in paragraph (a)(1) of this section, that are required by part 318 of this chapter to be treated or subjected to inspection to control one or more of the plant pests listed in Sec. 305.31(a) may instead be treated with irradiation. Articles treated with irradiation for plant pests listed in Sec. 305.31(a) must be irradiated at the doses listed in Sec. 305.31(a), and the irradiation treatment must be conducted in accordance with the other requirements of this section; and

4) The Final Rule revision of January 26, 2010 (FR Vol, 75, Nov. 16) removes the following section:

"...the lists of approved treatments and treatment schedules from the regulation, while retaining the general requirements for performing treatments and certification or approving treatment facilities. The Final Rule summary goes on to state: "Approved treatment schedules will instead be found in the Plant Protection and Quarantine Treatment Manual, which is available on the Internet. ..... We are harmonizing and combining the requirements for performing irradiation treatment for imported articles, articles moved interstate from Hawaii and U.S. territories, and articles moved interstate from an area quarantined for fruit flies. These changes will simplify and expedite our process for adding, changing, and removing treatment schedules while continuing to provide for public participation in the process. These changes will also simplify our presentation of treatments to public by consolidating all treatments into one document and eliminating reductant test from the regulations."

To this end, Sec. 305.9. "Irradiation treatment requirement", now reads:

"Irradiation, carried out in accordance with the provisions of this section, is approved as a treatment for any imported regulated article (i.e., fruits, vegetables, cut flowers, and foliage); for any regulated article moved interstate from Hawaii, Puerto Rico, the U.S. Virgin Islands, Guam, and the Commonwealth of the Northern Marianas Islands (referred to collectively, in this section, as Hawaii and U.S. territories); and for any berry, fruit, nut or vegetable listed as a regulated article in Section 301.32-2(a) of this chapter."

Based on the above, Pa'ina Hawaii has been issued PPQ Form 526 Permits for the movement of a Federal Noxious weed from Hawaii to U.S. mainland markets for human consumption.....*Ipomoea aquatica*, aka On-Choy. In Form 526 application, Paina Hawaii indicated the treatment of consignments by irradiation at 400 Gray to neutralize risks of hitchhiking pests.

A pest of concern to On-choy in Hawaii is *Omphisa anastomosalis*, the Sweet potato vine borer, a Lepidopteran pest species. USDA, APHIS, PPQ has approved 150 Gray as a suitable quarantine treatment for this particular Lepidopteran species (i.e., based on work by ARS, Dr. Peter Follett).

However, PPQ Permits denied Pa'ina Hawaii's request for the inclusion of irradiation treatment as a permit condition. This denial was apparently based on a determination that irradiation quarantine treatment is not a required condition for the movement On-choy from Hawaii to U.S. mainland markets.

We agree with this determination.

Therein, the applicable permit condition reads *"Item (2) The plant parts (foliage) must be free of plant pests."*

Pa'ina Hawaii has agreed to the permit condition as specified above. As such, Pa'ina Hawaii's Form 526 Noxious Weed Permit allowing movement of *Ipomoea aquatica* from Hawaii to U.S. mainland markets makes no mention of a quarantine treatment.

As holder of the permit for *Ipomoea aquatica*, it is Pa'ina Hawaii's intention to use the permit solely for consignments treated by Pa'ina Hawaii at 400 Gray for hitchhiking pests.

On-choy is a field grown crop in Hawaii with a high risk of hitchinghiking pests.

On-choy in Hawaii is also a known host for *Omphisa anastomosalis*, the Sweet Potato vine borer, which tunnels and develops in the hollow stem of *the Ipomoea aquatica* (On-choy) and is difficult to detect.

While considered as Federal Noxious Weed, *Ipomoea aquatica* cannot be listed in Table 3-1 of the Hawaii Manual. However, Paina Hawaii has been granted a PPQ Form 526 permit to move this article from Hawaii to specific 12 other concurring states, including California, New York, Texas, Illinois, etc.

In keeping with the permit, the consignment will be inspected by USDA, APHIS, PPQ inspectors at Pa'ina Hawaii to assure freedom from pests of quarantine concern.

Pa'ina Hawaii, thereafter, would like to treat consignment at 400 Gray to mitigate risk of pests prior to shipment; likewise, to mitigate risk of the propagation of a Federal Noxious Weed should a release occur of shipped product to an aquatic environment.

To provide the treatment, however, Pa'ina Hawaii will need to have an approved configuration for the treatment in IRAD.

This is a request that CPHST accept dosimetry data generated by Pa'ina Hawaii as a supportive evidence for the inclusion of On-choy (*Ipomoea aquatica*) into IRAD for treatment by irradiation prior to movement from Hawaii to U.S. mainland concurring states.

Attachment I
3 pages

Report on the Establishment of Ong Choy cuttings exposed to irradiation

From: Janice Y Uchida, PhD and Chris Kadooka, Research Associate
Department of Plant and Environmental Protection Sciences
Tropical Plant Pathology Program
University of Hawaii

Irradiation:
Two boxes were received on April 06, 2015 from the Paina Hawaii Irradiation Facility. Boxes contained ong choy samples to be shipped to the continent for consumption. Ong choy cuttings were in bunches of about 40 cuttings each and about 30 to 35 cm in length (over 12 inches); a few cuttings per bunch were shorter, 15 to 20 cm long (6 to 8 inches). Distribution of short cuttings was random and both boxes had them.
One box was irradiated and the other was the un-treated control box. The Irradiated box was treated for 16 mins and 30 seconds at 402 grays. The boxes were taken to the Magoon Greenhouse facility at the upper campus of UHM/CTAHR.

Planting:
In the greenhouse, on a clean vinyl table, cuttings were removed from the boxes and damaged leaves (leaves that were bent, chlorotic, or necrotic) were removed. A few cuttings were damaged at the location of the tie that held the bundles together (in total, 3-5). These occurred for the untreated and treated bundles and those cuttings were cut above that area to insure water transport and rooting. Overall the cuttings were about the same length but, within some of the bundles, there were some smaller cutting of about 15 to 20 cm. This occurred for both the untreated and treated boxes.
Sunshine Blend # 4 was used as the potting medium and all media were unused, new potting medium. New plastic pots (10 to 12 inches) were filled with moistened potting medium. Clean cuttings were inserted into the potting medium, with at least one or two nodes inserted within the medium. All the cuttings in a bundle (35 to 40 cuttings) were planted into one pot. Pots were watered well.

Greenhouse:
All cuttings planted in pots were placed on raised benches in a glass greenhouse with Saran that provided shade. The environment has minimal wind, good light,

with minimal to almost no insects, and is secured with locked doors. All untreated cuttings were cleaned and potted first. Then the box of treated cuttings were cleaned and planted. Each pot was tagged with the total number of cuttings planted in the pot

Monitored:
Plants were water daily and monitored for rooting. After a week, most of the controls were producing new leaves and were starting to root. The irradiated plants were severely defoliated with many brown, dead leaves. Survivors had green stems with tiny new leaves and only two stems had a few new leaves. After 11 days, the treated cuttings had 25% surviving green stems, while controls had over 95% survival and good new growth.

Results:
After two weeks, the cuttings were examined for percent rooted. All plants from each pot were removed and carefully separated. For the **untreated Ong Choy**, there was good rooting of the tall cuttings (Figure: 1). However, some of the smaller cuttings were dying and not rooted. These were shorter and may not have received enough sunlight as they were under the canopy of the taller plants; some of these plants had rotted stems which were soft rots. The **treated cuttings** had been dying for two weeks and none had established any roots (Figure 1, 2 and 3). The progress of cutting dying was: leaves became yellow and defoliated, stems turned brown then black, and rot moved up the stem. The entire stem became brown to black and soft. Others stems were black, dry, hard and had no leaves.

Summary:

Irradiated cuttings: 0% rooted and all dying or dead. A few stems that were left, were rotted in the medium and will not be growing.

Untreated cuttings: There was 82% germination. A few plants, mostly the smaller plants had rotted stems and failed to root.

Laboratory:
On **Monday**, after the plants had been evaluated, representative samples of the treated stems and control stems were taken back to the laboratory. The treated stems were washed and interphase sections between the green healthy tissue. In

the same way, samples of the untreated plants which failed to root were also washed, sectioned, surface sterilized and plated on agar.
Results on **Tuesday**: none of the samples produced any fungal growth. There were pools of bacteria surrounding the samples and this indicates that bacteria were the likely to be the cause of the black rot. As for the treated cuttings, most died from irradiation exposure and presence of the bacteria may have hastened the rotting process. Bacteria feed on damaged tissue and increase the speed of rots.
Results on **Wednesday**: For the untreated controls, 2 of 34 pieces had developed small colonies of *Fusarium* or 2 of 7 stem pieces plated out. For the treated stems, 6 of 8 stems had small colonies emerging from plated stems. *Fusarium* species were mixed. They are common saprophytes but can be pathogens as well. We would have to evaluate the field to know if the field is diseased. However, given the mixture of species that is less likely. The biology of the two batches were very different, as the untreated stems had a lot of nematodes and the treated stems had only a few.

Evaluation:

Although it was not documented, it seemed that there might be an irradiation level difference within the box. One of the bunches, located in the lower center section, appeared to have more dead leaves. If this test is run again perhaps we need to consider location within the box as a variable. Although at this point, since all plants died, it may not be necessary.

Attachment J
2 pages.

Irradiation Reporting and Accountability Database

Configurations - USA

Pa'ina Hawaii LLC

ID	Configuration Name	Commodity	Status	Action
124	Sweet Potato #1	Sweet Potato	Approved	View
125	Papaya #1	Papaya	Approved	View
126	Basil #1	Basil	Approved	View
127	Curry Leaf #1	Curry Leaf	Approved	View
128	Papaya #2	Papaya	Approved	View
129	Basil. 12 carton configuration with PacFresh Carton	Basil	Approved	View
131	basil carton #3 configuration	Basil	Approved	View
132	curry leaf carton #2 configuration	Curry Leaf	Approved	View
134	Papaya #1 150 Gray	Papaya	Approved	View
137	Moringa leaves 20 carton 400 Gy Configuration	Moringa Leaves	Approved	View
139	Sweet Potato 20 carton 400 Gy configuration	Sweet Potato	Approved	View
140	Moringa pods X cartons 400 Gray	Moringa Pods	Approved	View
141	100413 Aloun Basil 1.5 Riser	Basil	Approved	View
142	100313 Sweet Potato 150 Gy on Riser	Sweet Potato	Approved	View
143	100413 Moringa pod	Moringa Pods	Approved	View
147	Betel Garden Herbs Carton (Betel Leaves)	Betel	Approved	View
148	Papaya 42 cartons 400 Gray	Papaya	Approved	View
150	Ginger, 12 box configuration, 400 Gray	Ginger Root	Approved	View
151	Aloun Taro Carton, 12 cartons, 400 GY	Taro Leaves	Approved	View
152	Rambutan, 32 box configuration, 150 GY	Rambutan	Approved	View
153	Rambutan, 32 box configuration, 400 GY	Rambutan	Approved	View
154	Longan, 32 box configuration, 150 GY	Longan	Approved	View
155	Longan, 32 box configuration, 400 GY	Longan	Approved	View
156	Litchi, 32 box configuration, 150 GY	Litchi	Approved	View
157	Litchi, 32 box configuration, 400 GY	Litchi	Approved	View
170	Mangosteen, 32 box configuration 150 GY	Mangosteen	Approved	View
171	Mangosteen, 32 box configuration, 400 GY	Mangosteen	Approved	View
181	Single box- Honeydew	Honeydew melon	Approved	View
182	Single box- Taro leaves	Taro Leaves	Approved	View
183	Single box- Moringa leaves	Moringa Leaves	Approved	View
184	Single box- Basil leaves	Basil	Approved	View

185	Single box- Litchi	Litchi	Approved	View
186	Single box- Curry leaves	Curry Leaf	Approved	View
189	Aloun Farms Taro Leaves (in basil carton)	Taro Leaves	Approved	View
191	Moringa Pod 6 carton configuration	Moringa Pods	Approved	View
194	Culantro- 20 carton configuration	Culantro	Approved	View
199	NDT Moringa Pods	Moringa Pods	Approved	View
201	Sweet Basil	Basil	Approved	View
202	Thai Basil	Basil	Approved	View
219	Saluyut Jute	Saluyut Jute	Approved	View
220	Moringa Leaves	Moringa Leaves	Approved	View
258	Mango 16 carton, 400 GY	Mango	Approved	View
259	Breadfruit 12 carton, 400 GY	Breadfruit	Approved	View
260	Jackfruit 16 carton, 400 GY	Breadfruit	Approved	View
268	Eggplant 20 cartons 150 Gy	Eggplant	Approved	View
269	Ong-choy 20 carton (valid through expiration of permit 2/3/18)	Ong-choy	Approved	View
270	Longan 48 cartons 150 Gy	Longan	Approved	View
271	Longan 48 cartons 400 Gy	Longan	Approved	View
272	Rambutan 48 cartons 150 Gy	Rambutan	Approved	View
273	Rambutan 48 cartons 400 Gy	Rambutan	Approved	View
274	Eggplant 20 cartons 400 Gy	Eggplant	Approved	View
282	Cucurbitae spp. 25 cartons 150 Gy	Cucurbitae spp.	Approved	View
283	Cucurbitae spp. 25 cartons 400 Gy	Cucurbitae spp.	Approved	View
284	Abiu 32 cartons 150 Gy	Abiu	Approved	View
285	Abiu 32 cartons 400 Gy	Abiu	Approved	View
286	Guava 32 cartons 150 Gy	Guava	Approved	View
287	Guava 32 cartons 400 Gy	Guava	Approved	View
288	Dragon Fruit 32 carton 150 Gy	Dragon Fruit	Approved	View
289	Dragon fruit 32 cartons 400 Gy	Dragon Fruit	Approved	View

Attachment K
11 pages

Gmail

Lyle Wong <lwongpi@gmail.com>

Malaysian jackfruit - APHIS approved fungicide treatment

3 messages

Lyle Wong <lwongpi@gmail.com> Fri, Feb 12, 2016 at 5:57 AM
To: "David B. Lamb" <David.B.Lamb@aphis.usda.gov>
Cc: Dorothy.S.Alontaga@aphis.usda.gov, michael@painahawaii.com, Po-Yung Lai <po.yung.lai@gmail.com>

Hi David.

We have growers interested in moving jack and breadfruit to U.S. mainland markets from Hawaii.

For export there is a requirement (Hawaii Manual 3-1) for a fungicide application for Phytophthora control, in field during the growing season or post-harvest.

I can't seem to find an approved fungicide product for either crop.

In reviewing the Federal Registry, Malaysia growers can move jackfruit to U.S. mainland markets with irradiation quarantine treatment and a fungicide treatment for Phytophthora control.

Can you provide me with the list of APHIS approved fungicides that Malaysian growers can use under the final rule (3/19/14).

I believe APHIS was looking at copper-based fungicides as well as metalaxyl and mancozeb.

Regards,

Lyle Wong

--

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

Lamb, David B - APHIS <David.B.Lamb@aphis.usda.gov> Tue, Feb 16, 2016 at 4:17 AM
To: Lyle Wong <lwongpi@gmail.com>
Cc: "Alontaga, Dorothy S - APHIS" <Dorothy.S.Alontaga@aphis.usda.gov>, "michael@painahawaii.com" <michael@painahawaii.com>, Po-Yung Lai <po.yung.lai@gmail.com>

Hi Lyle,

I've done some asking around and have so far come up empty with regard to a listing of APHIS approved fungicidal treatments. More likely, the fungicides you have indicated below would probably be acceptable. I've also sent an inquiry to Stacy Scott who is a contact for the Phytophthora ramorum program. She may some suggestions.

Regards,

David B Lamb

Senior Regulatory Policy Specialist

USDA,APHIS,PPQ

Imports Regulations and Manuals (IRM)

Regulatory Coordination and Compliance (RCC)

4700 River Road

Riverdale, MD 20737

Phone: 301-851-2103

Fax: 301-734-3225

David.B.lamb@aphis.usda.gov

http://www.aphis.usda.gove/plant_health/

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Friday, February 12, 2016 10:57 AM
To: Lamb, David B - APHIS
Cc: Alontaga, Dorothy S - APHIS; michael@painahawaii.com; Po-Yung Lai
Subject: Malaysian jackfruit - APHIS approved fungicide treatment

[Quoted text hidden]

Lyle Wong <lwongpi@gmail.com> Tue, Feb 16, 2016 at 6:25 AM
To: "Lamb, David B - APHIS" <David.B.Lamb@aphis.usda.gov>, michael@painahawaii.com, Dorothy.S.Alontaga@aphis.usda.gov
Bcc: Po-Yung Lai <po.yung.lai@gmail.com>, Lyle Wong <lwongpi@gmail.com>

Thanks David for checking.

I'm suspecting that Hawaii may have a problem with both jack and bread fruit with the requirement for field or post-harvest fungicide treatment for Phytophthora control as the pesticide treatments will require a labeled product and labeled products may not exist for this application in the U.S.

The Malaysia jack fruit notice caught my eye because the proposed rule suggest data is available for the efficacy of copper based fungicides and metalaxyl and mancozeb but these products may not actually be available for use in the U.S on jack fruit (as well as breadfruit) and tolerances likewise may not have been established for the pesticides as well for the specific crops.

This puts us in a pickle for a State Special Local Needs Registration (24c) and in turn for the use of the Hawaii Manual Table 3-1 listing for jack and bread fruit with irradiation quarantine treatment as the additional declaration can not be met for Phytophthora control.

The other concern would be can APHIS approve the use of a treatment if not approved for use by EPA in the U.S. for the same crop, I don't know.

The Malaysian jack fruit proposed rule and final rule would suggest APHIS could make the approval.

Will continue to search for a Phytophthora treatment, I could very well be missing something here.

Regards,

Lyle
[Quoted text hidden]

Gmail Lyle Wong <lwongpi@gmail.com>

Jackfruit

9 messages

Lyle Wong <lwongpi@gmail.com> Mon, Mar 23, 2015 at 3:48 PM
To: "Bauske, Christina Y" <Christina.Y.Bauske@hawaii.gov>
Cc: michael@painahawaii.com

Christina,

A growers want to ship jackfruit to the U.S. mainland, but in addition to irradiation for fruit fly disinfestation, USDA regulations regard the post-harvest dip treatment of fruit in a fungicide appropriate for Phytophthora tropicalis.

Could you check the references for a fungicide product approved for use on Jackfruit post-harvest.

Hope all is going well.

Lyle

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

Bauske, Christina Y <Christina.Y.Bauske@hawaii.gov> Mon, Mar 23, 2015 at 5:50 PM
To: Lyle Wong <lwongpi@gmail.com>
Cc: "michael@painahawaii.com" <michael@painahawaii.com>

Aloha Lyle,

I'll look into this. A cursory search only brought up fungicides for foliar or soil treatment of jackfruit, not post-harvest.

Fludioxonil products have post-harvest uses, but I cannot find one with jackfruit on the label. I'll look deeper tomorrow.

Warm regards,

Christina Bauske Zimmerman

Environmental Health Specialist

Hawaii Department of Agriculture

Pesticides Branch

Registration & Technical Review Unit

1428 S. King Street

Honolulu, HI 96814

Phone: 808-973-9415

Fax: 808-973-9418

Pesticides Branch: http://hdoa.hawaii.gov/pi/pest/

Licensed Pesticide List: https://data.hawaii.gov/Health/Currently-Licensed-Pesticide-Listing/ufr5-uv4x

Department of Agriculture
STATE OF HAWAII

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Monday, March 23, 2015 3:48 PM
To: Bauske, Christina Y
Cc: michael@painahawaii.com
Subject: Jackfruit

[Quoted text hidden]

_yle <lwongpi@gmail.com> Mon, Mar 23, 2015 at 6:13 PM
To: "Bauske, Christina Y" <Christina.Y.Bauske@hawaii.gov>

Thanks Christina. Lyle

Sent from my iPhone

On Mar 23, 2015, at 5:50 PM, "Bauske, Christina Y" <Christina.Y.Bauske@hawaii.gov> wrote:

> Aloha Lyle,
>
> I'll look into this. A cursory search only brought up fungicides for foliar or soil treatment of jackfruit, not post-harvest.
>
> Fludioxonil products have post-harvest uses, but I cannot find one with jackfruit on the label. I'll look deeper tomorrow.
>
> Warm regards,
>
> Christina Bauske Zimmerman
>
> Environmental Health Specialist

Hawaii Department of Agriculture

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<image003.jpg>

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Monday, March 23, 2015 3:48 PM
To: Bauske, Christina Y
Cc: michael@painahawaii.com
Subject: Jackfruit

Christina,

A growers want to ship jackfruit to the U.S. mainland, but in addition to irradiation for fruit fly disinfestation, USDA regulations regard the post-harvest dip treatment of fruit in a fungicide appropriate for Phytophthora tropicalis.

Could you check the references for a fungicide product approved for use on Jackfruit post-harvest.

Hope all is going well.

Lyle

Lyle Wong, Ph.D.

lwongpi@gmail.com

(808) 225-1047

Bauske, Christina Y <Christina.Y.Bauske@hawaii.gov> Tue, Mar 31, 2015 at 10:41 AM
To: Lyle <lwongpi@gmail.com>

Aloha Lyle,

I consulted with Mike Kawate since he is more familiar with the minor crop uses and please see his response below:

> Post-harvest fungicides are few and far between. Only azoxystrobin has a tolerance in jackfruit, but no azoxystrobin products as a sole active ingredient are labeled for post-harvest uses. The only product available as a postharvest fungicide with azoxystrobin as one of the active ingredients is:
> GRADUATE A+ EPA REG NO: 100-1308
> NAME STATUS: PRIMARY NAME
> PRODUCT STATUS: ACTIVE REGISTRANT: SYNGENTA CROP PROTECTION, LLC 410 SWING ROAD GREENSBORO NC 27419
> FORMULATION: FLOWABLE CONCENTRATE
> SIGNAL WORD: CAUTION
> TYPES: FUNGICIDE
> PERCENT ACTIVE INGREDIENT 20.6000 Fludioxonil (71503) 20.6000 Azoxystrobin (128810)
> STATES REG: FL-16 AZ-16 CA-15 LA-13 TX-15
> ORIGINAL APPROVAL DATE: 04-17-09 MOST RECENT EPA UPDATE: 04-02-10 USES LAST UPDATED BY EPA: 08-27-12
>
> (Note: This product is not licensed for sale in HI. My search was for federal products.)
>
> As you already know, Scholar is a postharvest fungicide with fludioxonil as a sole active ingredient, but there's no tolerance for it in jackfruit. I don't have knowledge of its effectiveness against Phytophthora diseases. But, based on my NPIRS seach, Phytophthora is not a pest listed on any of the fludioxonil products. I'm not aware of any of the tolerance-exempt products' efficacy against postharvest diseases, and in particular, Phytophthora. I'm not sure if any of the peroxide or chlorinated products would be deemed "effective fungicides" by the regulators; probably not. Unfortunately, if the jackfruit are already infected, the peroxides or chlorinated products won't work at controlling Phytophthora. Not sure if Mann Ko has any ideas. (Is he still working for HDoA?)
> I'll think about this more, but in general, post-harvest fungicide treatments are limited.

I'll continue discussion with Mike and with Mann Ko, but the postharvest use option does not look promising. It seems that the Federal regulations (7 CFR 318.13-26)(a)(2) state that treatment of the orchard with a fungicide appropriate for Phytophtera is acceptable.

Why was this regulation established in this manner (e.g., post-harvest dip) if the options were limited or non-existent on what can be used?

Warm regards,

Christina Bauske Zimmerman

Environmental Health Specialist

Hawaii Department of Agriculture

Pesticides Branch

Registration & Technical Review Unit

1428 S. King Street

Honolulu, HI 96814

Phone: 808-973-9415

Fax: 808-973-9418

Pesticides Branch: http://hdoa.hawaii.gov/pi/pest/

Licensed Pesticide List: https://data.hawaii.gov/Health/Currently-Licensed-Pesticide-Listing/ufr5-uv4x

From: Lyle [mailto:lwongpi@gmail.com]
Sent: Monday, March 23, 2015 6:13 PM
To: Bauske, Christina Y
Subject: Re: Jackfruit

[Quoted text hidden]

Lyle Wong <lwongpi@gmail.com> Tue, Mar 31, 2015 at 1:40 PM
To: "Bauske, Christina Y" <Christina.Y.Bauske@hawaii.gov>, Mike Kawate <mike@hpirs.stjohn.hawaii.edu>, michael@painahawaii.com

Christina and Mike,

Thanks so much for the information, I'm in San Francisco waiting in a hospital for the delivery of our first grandchild, seems this will be a long day/night.

Post-harvest fungicide treatment is a USDA quarantine requirements, which seems to present a unique problem since phytophthora itself doesn't seem to be a quarantine problem therein requiring a post-harvest treatment for other products, e.g., papaya.

We treated jackfruit at 400 Gray which will be the target dose for hitch hiking insects; 400 Gray is also an effective treatment for phytophthora, doesn't eliminate the pathogen 100 % but makes the infestation of no consequence to the fresh fruit (papaya) for shelf life. Fruit will eventually tank but at that point would be overly ripe.

Will bring up the label problem with USDA and ask for options should only the one fungicide be available but not

as a solely active in a licensed product.

Again, thanks for research this, really appreciate.

Lyle .

P.S., I sent the above through my i-phone but lost it (I think), if not then you have two messages pretty much the same.

[Quoted text hidden]

--

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

Lyle Wong <lwongpi@gmail.com> Fri, Apr 3, 2015 at 8:22 AM
To: "Bauske, Christina Y" <Christina.Y.Bauske@hawaii.gov>, Mike Kawate <mike@hpirs.stjohn.hawaii.edu>, michael@painahawaii.com

Baby arrived, 6 lbs. 2 oz, a bit small, but all's well, baby starting feeding about a half hour after delivery, I didn't know babies did this.

Delivery was induced a week early because there was concern that the baby was small.....looked pretty normal to me.

As to the USDA requirement, the requirement actually reads: "Fruit must be free from stems and leaves and must originate from an orchard previously treated with a fungicide appropriate for the fungus Phyophthora tropicalis or after irradiation, a post harvest fungal dip may be used."

So the treatment can be field as well as post harvest.....but we have the same problem, no product solely with azoxystrobin.

Again, fruit flies are the quarantine concern, don't know why Phytophtora popped up....and what can be done about this, will inquire when I get back.

Regards,

Lyle w

[Quoted text hidden]

Bauske, Christina Y <Christina.Y.Bauske@hawaii.gov> Fri, Apr 3, 2015 at 10:02 AM
To: Lyle Wong <lwongpi@gmail.com>

CONGRATULATIONS!!!! Such a happy occasion. Sounds like a healthy baby to me. ☺

Warm regards,

Christina Bauske Zimmerman

Environmental Health Specialist

Hawaii Department of Agriculture

Pesticides Branch

Registration & Technical Review Unit

1428 S. King Street

Honolulu, HI 96814

Phone: 808-973-9415

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Pesticides Branch: http://hdoa.hawaii.gov/pi/pest/

Licensed Pesticide List: https://data.hawaii.gov/Health/Currently-Licensed-Pesticide-Listing/ufr5-uv4x

From: Lyle Wong [mailto:lwongpi@gmail.com]
Sent: Friday, April 03, 2015 8:23 AM
To: Bauske, Christina Y; Mike Kawate; michael@painahawaii.com
Subject: Re: Jackfruit

[Quoted text hidden]

Mike Kawate <mike@hpirs.stjohn.hawaii.edu> Mon, Apr 6, 2015 at 8:06 AM
To: Lyle Wong <lwongpi@gmail.com>

Hi Lyle,

Just want to say congratulations on being a new grandfather!

I sent Christina a possible fungicide product that jackfruit growers could use, in-field, for Phytophthora control. The concern has to do with label interpretation of the site, so I think that she's probably getting feedback from EPA. I'll follow up with her if I don't see any email from her this week.

-Mike
[Quoted text hidden]

Lyle Wong <lwongpi@gmail.com> Wed, Apr 8, 2015 at 9:25 AM
To: Mike Kawate <mike@hpirs.stjohn.hawaii.edu>

Thanks Mike.....

Appreciate the followup on the label.

Will be here in San Mateo for another week, then back to work.

Nice to be away to be new grandparents.

Regards,

Lyle

[Quoted text hidden]

Attachment M
6 pages.

Gmail

Lyle Wong <lwongpi@gmail.com>

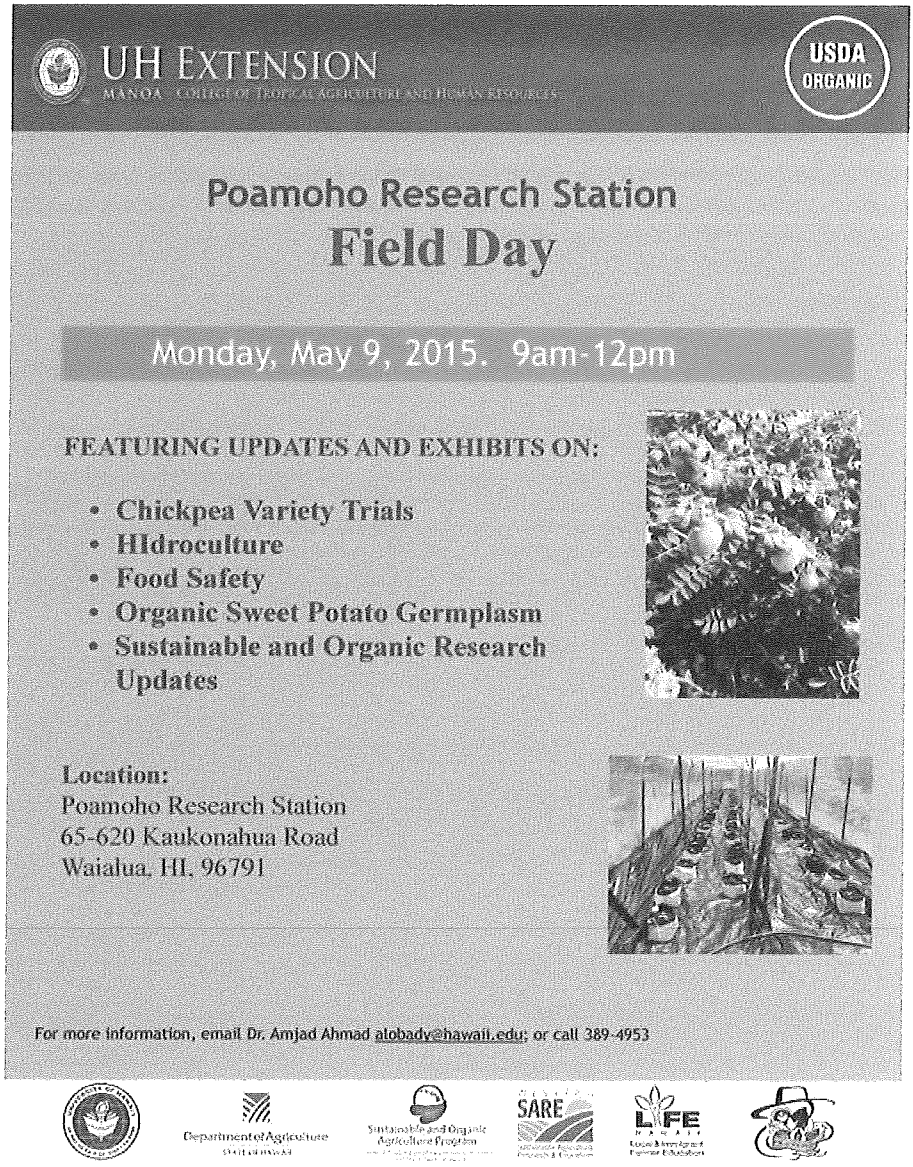
Oahu Cooperative Extension Updates-May

3 messages

Sugano, Jari <SuganoJ@ctahr.hawaii.edu> Tue, May 3, 2016 at 5:37 PM
To: "Sugano, Jari" <SuganoJ@ctahr.hawaii.edu>, "Ahmad, Amjad" <alobady@hawaii.edu>, "Radovich, Theodore" <theodore@hawaii.edu>, "Uyeda, Jensen" <juyeda@hawaii.edu>, Lyle Wong <lwongpi@gmail.com>, "Michael@Painahawaii.com" <Michael@painahawaii.com>, Sharon Hurd HDOA <Sharon.K.Hurd@hawaii.gov>, Po-Yang Lai <po.yung.lai@gmail.com>, Ken Rasti <krasti@hawaii.edu>, matt johnson <matt.johnson@sustainpromgmt.com>

Field Day at Poamoho Research Station

Monday, May 9, 2016
Poamoho Research Station
Time: 9:00 am -12:00 pm
Please see the attached flyer for more information.



Enhancing Export of Hawaii Export-Ready Commodities

Hawaii growers and shippers have an opportunity to move a wide range of fresh fruits, herbs and vegetables to U.S. mainland markets, some may require post-harvest quarantine treatment as host to specific pests (e.g., fruit flies), other fresh commodities can be moved without quarantine treatment based solely on product inspection prior to shipment. The Hawaii Department of Agriculture, Agricultural Development Division, recently funded a project to expand the number of USDA approved treatments for Hawaii fresh produce for export to U.S. mainland markets with irradiation quarantine treatment. Pa'ina Hawaii, one of two commercial irradiators in Hawaii, conducted the study.

To learn more about this project, click on the attachments or contact Lyle Wong, Pa'ina Hawaii, at 808-225-1047.

Ag Business Courses at Windward Community College

(with limited tuition waivers available)

Course Title: Creating an Ag Business in Hawaii
Course Hours: 16 per class
Course Location: Windward Community College

Course Description: This 8 module series will cover the essentials of a Small Business- Accounting, Analysis, Planning, Marketing, Financing, Presentation Skills with emphasis in Critical Thinking & Aloha in Business, and everything in between to take your business to the next level and beyond! Modules will focus on the following areas:

1. Entrepreneurship? Do I have the right DNA for it?
2. Business Modeling Creation & Marketing
3. Basic Business Structure
4. Market Analysis
5. Business Management & Financials
6. AgriBusiness Recordkeeping
7. Finance & Negotiating
8. Presentation

Our learners will also be introduced to work with key Ag industry leaders. We are planning to offer 3 classes: April through September 2016. The first class began on April 18, and will run every Monday and Wednesday, from 6:30 to 8:30 pm, through May 18, 2016, at Windward Community College. The second class is scheduled for June 6, 2016, and will run every Monday and Wednesday, from 6:30 to 8:30 pm, through June 29, 2016, at Windward Community College.

For more information, please contact:

Ken Rasti, Ch. E., MBA

Workforce/Professional Development Coordinator,
Leadership Training Program
Windward Community College
Faculty, Business Management Consultant
Cell: 808-366-7274
Phone: 808-235-7365

http://windwardcce.org/business-online.htm

2 attachments

Attachment PowerPoint Presentation 050316.pdf
597K

Poamoho_Field_Day_rev.pdf
1321K

Lyle Wong <lwongpi@gmail.com> Tue, May 3, 2016 at 7:37 PM

To: "Sugano, Jari" <SuganoJ@ctahr.hawaii.edu>
Cc: "Ahmad, Amjad" <alobady@hawaii.edu>, "Radovich, Theodore" <theodore@hawaii.edu>, "Uyeda, Jensen" <juyeda@hawaii.edu>, "Michael@Painahawaii.com" <Michael@painahawaii.com>, Sharon Hurd HDOA <Sharon.K.Hurd@hawaii.gov>, Po-Yang Lai <po.yung.lai@gmail.com>, Ken Rasti <krasti@hawaii.edu>, matt johnson <matt.johnson@sustainpromgmt.com>

Thanks Jari, the power point was the key attachment, will share the others with those that have an interest.

Regards,

Lyle
[Quoted text hidden]
—

Lyle Wong, Ph.D.
lwongpi@gmail.com
(808) 225-1047

Sugano, Jari <SuganoJ@ctahr.hawaii.edu> Tue, May 3, 2016 at 8:40 PM
To: Lyle Wong <lwongpi@gmail.com>
Cc: "Michael@Painahawaii.com" <Michael@painahawaii.com>, Sharon Hurd HDOA <Sharon.K.Hurd@hawaii.gov>, Po-Yang Lai <po.yung.lai@gmail.com>

The main overview ppt went through. The USDA / HDOA criteria, and Chinese translations didn't make it through.

Sent from my iPhone

On May 3, 2016, at 7:41 PM, Lyle Wong <lwongpi@gmail.com> wrote:

> Thanks Jari, the power point was the key attachment, will share the others with those that have an interest.
>
> Regards,
>
> Lyle
>
> On Tue, May 3, 2016 at 5:37 PM, Sugano, Jari <SuganoJ@ctahr.hawaii.edu> wrote:
>
> Field Day at Poamoho Research Station
>
> Monday, May 9, 2016
> Poamoho Research Station
> Time: 9:00 am -12:00 pm
> Please see the attached flyer for more information.
>
> <Image32079.jpg>
>
> [Quoted text hidden]
> [Quoted text hidden]

UH Extension
MĀNOA College of Tropical Agriculture and Human Resources

Advancing Oahu's Edible Crop Industries-Mini Conference

Turtle Bay Resort
May 24, 2016
9:00 am to 12:30 pm

RSVP required. Please register to Wahiawa Extension Office by May 19, 2016 by phone 622-4185 or email: wahiawa@ctahr.hawaii.edu

Tuesday, May 24, 2016	
8:30 am to 9:00 am	Registration and light refreshments
9:00 am	Welcome Ralph Makaiau, Turtle Bay Resort, Farm Development Office Jari Sugano and Jensen Uyeda, Oahu County Extension Agents
9:05 am -9:20am	The value of Hawaii's edible crop industry Kathy King, State Statistician, NASS
9:20 am-9:40 am	Health soils and locally produced fertilizer inputs Dr. Amjad Ahmad, UH CTAHR
9:40 am -10:00 am	Overview of common pest groups & variety trial summaries Jari Sugano, UH CTAHR
10:00 am- 10:20 am	Crop protection chemical resistance management program Jensen Uyeda, UH CTAHR
10:20 am- 10:40 am	BREAK (visit with educational booths)
10:40 am- 11:00	Organic and sustainable pest management options Dr. Koon Hui Wang, UH CTAHR
11:00 am- 11:20 am	Reflective mulch for vegetables Dr. Leyla Kaufman, UH CTAHR
11:20- 11:40 pm	Basil diseases-field trial summary Drs. Janice Uchida & Mike Kawate, UH CTAHR
11:40 a -12:00 pm	New pest on vegetables: Bagrada bug update Dr. Ronald Mau & Robin Shimabuku, UH CTAHR
12:00 pm-12:20	Post-harvest treatment options Lyle Wong, Pa'ina Hawaii
12:20 pm-12:30 pm	Wrap up and questions
	Lunch on your own

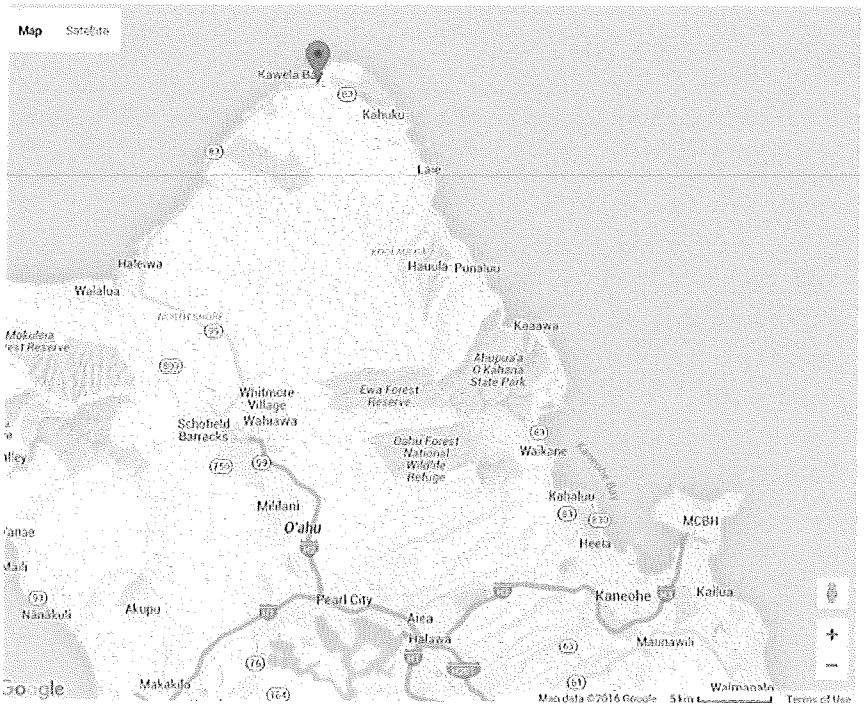
Directions to Turtle Bay Resort on Oahu's North Shore

57-091 Kamehameha Highway, Kahuku, Oahu, Hawaii 96731

Turtle Bay is located on the North Shore of Oahu.

From Leeward Oahu:
Take H1 from Honolulu to H2 North. Follow H2 until you pass Schofield Barracks and veer right to Hwy 99 (North Shore). Once you're on Highway 99, follow the pineapple fields and follow Hwy 83 (Kamehameha Hwy) all the way to Turtle Bay Resort, which is located on the left hand side of the road.

From Windward Oahu
From Kaneohe, follow Highway 83 (Kamehameha Hwy) passing Kahaluu, Kaaawa, and Kahuku. You will see Turtle Bay Resort on the right side of the road.



For information or to request an auxiliary aid or service (e.g., sign language interpreter, designated parking, or materials in alternate format), contact Jensen Uyeda (juyeda@hawaii.edu) or Jari Sugano (suganoj@ctahr.hawaii.edu) at (808) 622-4185 at least seven days before the activity/event (5/17/16).

Department of Agriculture
STATE OF HAWAII

Sustainable and Organic Agriculture Program
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

WESTERN SARE
Sustainable Agriculture Research & Education

LIFE HAWAII
Local & Immigrant Farmer Education