

ENHANCE THREE HAWAII VEGETABLE PRODUCTS FOR US MAINLAND MARKETS FY 2012

A unique situation in Hawaii's food supply system is the fact that most of the processed and packaged foods, as well as grains and feed supplies are shipped in from the US Mainland. As a result, many ocean containers are transported back to the west coast ports empty. In order to reduce the imbalance between imports and exports, three Hawaii crops that have been produced successfully and can be shipped by ocean transport were selected to develop as export items to the US west coast.

The purple Okinawa sweet potato tubers are doing very well in the Asian grocery stores in all the west coast states. The individually shrink-wrapped microwaveable package adopted from US patent 5665411 was presented to several growers/shippers of Okinawa sweet potato. The sweet potato tubers were cleaned and individually wrapped/sealed to avoid cross contamination. A test run with this packaging was conducted and samples were presented to APHIS in Honolulu. APHIS accepted the packaging as a replacement for irradiation.

The apple banana is expanding its share in the in-state market, due to consumers' appreciation of the apple banana taste over the regular banana and to a recent cost increase in imported bananas. Replacing imported bananas with Hawaii-grown bananas is a win/win situation for Hawaiian banana farmers and producers. Without paying for cargo shipping to the West Coast, the profit margin is greater to sell in Hawaii. Also, several fruit processors have started drying off-grade apple banana with its high sugar content. As a way to distinguish themselves from foreign imports Hawaii-made dry banana products do not use sulfite treatment. Most of the new banana farms are following organic practices to sell direct through the Internet to take advantage of higher profit margins, as well as expanding the market shares in Hawaii.

Cooked taro leaves (luau leaves): Cooked taro leaves are sold frozen in some ethnic stores on the US Mainland. Researchers discovered and validated that the varieties used in making luau leaves are high in water insoluble calcium oxalates which may cause kidney stone formation and joint pain. They advised that this product remains as an occasional eaten luau food and not to be marketed to the general public. Researchers will continue working with luau leaf producers to test other taro varieties which may have lower oxalate content and acceptable cooking quality.

FINAL REPORT

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Final Project Report

Project Title: Enhance Three Hawaii Vegetable Products for US Mainland Markets

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Outline of the Issue or Problem:

A unique situation in Hawaii's food supply system is the fact that most of the processed and packaged foods, as well as grains and feed supplies are shipped in from the US Mainland, thus many ocean containers are transported empty back to the west coast ports from Hawaii. In order to reduce the imbalance between imports and exports, three Hawaii crops that have been produced successfully and can be shipped by ocean freights were selected to develop as export items to the US west coast. These items are Okinawa purple sweet potato, cooked taro leaves and apple banana.

Description of how the issue was approached via the project.

1. For each of these 3 items, the best method of preparing for a distant market was evaluated based on eating quality, nutrition values and regulatory constraints.
2. An effective marketing of these items was developed by working with selected grocery outlets through in-store promotion of the Hawaiian products.
3. A website was developed to inform producers and consumers about the quality of these Hawaii products and the proper handling of them.

Description of the contribution of public or private agency partners in terms of the work performed.

The Hawaii Department of Agriculture (HDOA) was helpful in providing contacts on the west coast, especially in the southern California region. Through a separate "Buy Local" campaign in year 2014 (one year, \$99K budget), the project PI was able to work closely with Hawaii banana and sweet potato growers in increasing the in-state planting of these crops and make available more products for out-of-state shipping.

Summary of results, conclusions, and lesson learned.

1. **The purple Okinawa sweet potato tubers** are doing very well in the Asian grocery stores in all the west coast states (California, Oregon, and Washington). Through this project

and the assistance from HDOA, we conducted in-store promotions at various Marukai Market, Nijiya Market and 99 Ranch Market locations with the help of store management. These stores have reported increasing demand of the purple sweet potato after our in-store promotion by giving out nutrition information and recipes. The individually shrink-wrapped microwaveable package we adopted from US patent 5665411 was presented to several growers/shippers of Okinawa sweet potato. We made a test run with this technology and presented the sample to APHIS office in Honolulu. It was positively accepted as a replacement of irradiation, because the sweet potato tubers, employing this procedure, were cleaned and individually wrapped/sealed to avoid cross contamination. The produce shippers were evaluating this option using the following summary table we put together (based on year 2014 figures):

TABLE 1. Summary of Okinawa Sweet Potato Market Survey (year 2014).

	<u>(A) Group Stores</u>	<u>(B) Group Stores</u>	<u>Hawaii Stores</u>
Max. Retail Price	\$3.99	\$2.99	\$2.79
Acceptable Landed Price	\$2.40	\$1.25	\$1.80 (store deliver)
Irradiation Treatment	OK	No	not needed
Organic Certification	irrelevant	must	preferred
Hawaii Origin	preferred	preferred	must

The Asian stores (A Group) we surveyed were Marukai, Nagatoshi Produce, May Produce, Nijiya, and 99 Ranch Stores (19 stores in total).

The Other Groceries (B Group) in the survey were Albertsons, Trader Joe’s, Bristol Farms, Gelson’s, and Vons (15 stores in total).

There were 21 grocery stores in Hawaii, including Foodland, Times, Safeway, Down-To-Earth, Whole Foods Hawaii surveyed.

The pricing and consumer attitude information was mostly obtained through person to person interview as shown below, or via phone calls. Most produce managers at stores are more willing to share information than purchase managers/buyers in head office.



The above photo shows research associate Laura Schulman “talking story” with randomly selected customers at a Safeway grocery store in Southern California.

As the report was being written, the business decisions from produce shippers seemed to be:

- a) Expanding the shipping volume to these Asian stores where irradiation is not a concern and the ethnic and Hawaii appeals allow higher pricing and faster turnaround of the produce. Our survey of the Hawaii shippers indicated a 12% year to year increase in 2014.
- b) The individual wrapped tubers may have an advantage in direct mailing/shipping business and internet sales where quality demand (including non-irradiated) and greater margin can justify the higher costs in cleaning and packaging.



Asian stores such as the one shown here are main outlets for Hawaii’s taro and sweet potato products. The concern about products been irradiated is not a major factor.

2. **The apple banana in Hawaii** is expanding its share in the in-state market, due to Hawaii consumers’ appreciation of apple banana taste over the regular banana and a recent cost increase in imported bananas. Thus, we accomplished a cargo reduction by way of “import replacement.” The acreage of apple banana has increase by approximately 30% in year 2014 (HDOA estimation). Some of this increase was at the expense of the Cavendish variety. The apple banana share of the Hawaii planting has shifted from less than 20% (while 80% were Cavendish or Williams banana) in 2011 to approximately 40% two years later. Some have estimated that the Hawaii banana planting to be at a 50/50 split between apple banana and Cavendish banana in current year (2015). Our survey on the same stores on the west coast states on apple banana pricing and demand may shed some light on this situation:

TABLE 2. Summary of Apple Banana Market Survey (2013 to 2014).

	(A) Group Stores	(B) Group Stores	Hawaii Stores
Max Retail Price	\$1.49	\$1.99	\$1.89
Acceptable Whole Sale	\$1.00	\$1.20	\$0.90
Irradiation Treatment	I-----	Not Required	-----I
Organic Certification	irrelevant	preferred	preferred
Hawaii Origin	irrelevant	preferred	must

(A) Group Stores were the same 19 Asian stores surveyed and (B) Group Stores were the same 15 stores surveyed as being mentioned in Table 1. There were 35 grocery stores surveyed in Hawaii for the compilation of this table.



The photo was a table-top display of Hawaii apple banana in a Vons grocery store in Los Angeles. The samples disappeared in no time. “No Irradiation” treatment of bananas shipped from Hawaii was the most important message to customers at Vons. The retail price of \$1.99, doubling the other banana in that store was a deterring factor in purchasing.

The results explain that “import replacement” is the win/win situation for both banana farmers and producers. Without paying for cargo shipping to the West Coast, the profit margin is greater to sell in Hawaii. Also, several fruit processors have started drying apple banana for the off-grade yet high sugar-content fruits. All Hawaii made dry banana products do not use sulfite treatment to distinguish themselves from foreign imports. Uncle Mickey Dry Fruits in Kauai, for instance, has projected its 2015 sales to reach \$2 million dollars with dried banana to account for approximately 50% of its sales. Most of the new banana farms are following organic practices to sell direct through Internet for higher profit margins, as well as expanding the market shares in Hawaii.

3. Cooked Taro leaves (or referred as *luau* leaves): With a close collaboration with HFP Foods (Hawaii Food Products Company), we were able to monitor and sample taro leaves before and after pressure cooking. With extensive use of the HPLC technique, our lab works monitor the changes in oxalate content in both soluble and insoluble forms. The over 50% decrease in soluble oxalates in cooked leaves (from raw) explained the diminishment in acidity (or astringent to some) taste, but the insoluble oxalates remained in cooked samples. Below is a

summary of the oxalates along with calcium and moisture content we monitored in 8 randomly collected samples for each condition:

TABLE 3. The Oxalates and Other Content Changes in Raw and Pressure-Cooked Taro Leaves.

	<u>Raw/uncooked</u>	<u>Cooked</u>
Moisture content	92%	84%
Calcium	249mg/100g	208mg/100g
Total Oxalates	736mg/100g	514mg/100g
Insoluble	381mg/100g	362mg/100g (70.4% of the remaining)
Soluble	355mg/100g	152mg/100g (29.6% of the remaining)

The calcium content of over 200mg per 100g cooked weight was quite impressive for a non-dairy item, however, a majority of the calcium probably existed as the water insoluble calcium oxalate, based on the data shown above. Using the molecular weight numbers of 40 for calcium and 90 for oxalic acid in calculation, the 362 mg of insoluble oxalate could bind approximately 160mg of calcium, thus only 50mg calcium may be bioavailable. In the meantime the remaining soluble oxalates still could bind the other minerals such as magnesium, zinc and the free calcium thus yielding the cooked taro leaves an undesirable dietary item in providing mineral nutrients.

Because our first-hand finding in this study (not reported in previous progress reports due to the availability of HPLC equipment and time-consuming validation) that the taro leaves being used in Hawaiian *luau* are reducing the bioavailability of calcium and other minerals, we have advised the two major *luau* producers not to promote this product as a dietary calcium source. We still consider occasional use of *luau* leaves in Hawaii cultural dinner is acceptable and the cooked leaves do provide dietary fibers. But we have stopped introducing the *luau* leaf recipes to the general public and not promoting this product to grocery stores in Mainland.

Discussion of current or future benefits to be derived from the project.

1. The significant increase (over 30%) in apple banana planting acreage in Hawaii in the past two years has built up an export capacity not seen before. Most of the new plantings are either certified organic or are following the organic practices so the products can be sold in stores where organic fruits are preferred and the retail prices are higher.

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2. The individually wrapped “microwaveable” sweet potato packing we introduced to Hawaii farmers has provided an alternative to irradiation for exporting. Although deemed to be too expensive right now, due to patent loyalty costs, packaging material and production scale issues, we believe this is still a possible way to provide reasonable shelf-life without irradiation if a sizable packing facility can be established for several export-oriented farms in a vicinity.



The photo shows clean, blemish-removed sweet potato tubers in microwaveable package can be inspected by APHIS and shipped from Hawaii to California without irradiation treatment. Instead of individual wrap, a portion-sized (500 grams in this case) approach was adopted in our trial to avoid being a “me-too” product (to “Micro-Baker” individual potato wrap). Also, without trimming, the irregular shape of Okinawa purple makes it difficult to wrap.

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3. The County of Honolulu has started a dehydration project in which the PI is serving as its main technical consultant and we have identified apple banana and purple sweet potato tubers, along with ginger roots, as the main items in the first phase of the endeavor. The dehydrated sweet potato can be exported without irradiation treatment and the shipping costs will be greatly reduced. The dehydrators are to be connected with photovoltaic panels to reduce the electricity costs of drying in Hawaii. The website (exporthawaiiproducts.com) that this project started has been maintained with funding

from Honolulu County to update our progress and continuous effort in building a sustainable export market for Hawaii's agricultural produce.

4. The cooked taro leaves (luau leaves) are sold frozen in some ethnic stores on the US Mainland. Our discovery and validation that the varieties used in making luau leaves are high in calcium oxalates (the water insoluble form and may cause kidney stone formation and joint pain) should be a reason that this product remains as an occasional eaten luau food and not to be marketed to the general public. We will continue working with the luau leaf producers to test other taro varieties which may have lower oxalates in leaves while the cooking quality is acceptable. (The main reason for luau producers to use a certain taro variety is currently based solely on weight yield after pressure cooking.)

Recommendations for future research:

- 1) Building up the dehydration capacity in Hawaii is crucial for export-oriented agricultural products. The counties of Honolulu and the Big Island of Hawaii have both initiated procurement of community based dehydrators to dry various products including banana, sweet potato, ginger/turmeric, papaya, breadfruit, pineapple, dragon fruits, etc. Our project personnel are closely involved in these endeavors providing technical know-how and training sessions to beginning farmers. It is important to teach farmers how to select off-grades that are suitable for dehydration as the criteria are different from the fresh market.

Dehydration of off-grade items as well as surplus production can avoid irradiation treatment which is required for some Hawaii produce, as well as extending the shelf-life for out-of-state shipping. We have secured over \$150K funding from local and federal sources to help develop the dehydrated products.

- 2) The costs of doing business in Hawaii is high. Farmers and producers clearly gravitate toward markets that appreciated Hawaii's special attributes and therefore willing to buy at a higher price. This, plus the regulatory requirement of irradiation on some agricultural products, are major deciding factors in future promotional activities. Thus, tropical spices or health products such as turmeric, wasabi/horse radish, saffron, etc. that have inherently higher value may be better export items for Hawaii's agricultural industry.

Description of the project beneficiaries:

Producers (Farms) in Hawaii:

The *Hamakua* Spring LLC (in Hilo), the largest shipper of Okinawa sweet potato from Hawaii and a major banana grower. The firm has significantly increased apple banana acreage in year 2014. Due to the close proximity to the first irradiation treatment plant in Hawaii, *Hamakua* Spring is the main provider of Okinawa sweet potato to the Asian grocery stores on the west coast. The apple banana production is mainly an import replacement in Hawaii due to recent disease problems in South America.

The Veggie Farm in *Pepeekeo*, Hawaii has been focusing on direct mail order of irradiated purple sweet potato from Hawaii.

Hawaii Crown (Honolulu): started selling apple banana in Oahu grocery stores in year 2014.

L&R Farms in *Molokai*: Grows family bred Mokuau purple sweet potato. Stopped exporting due to the irradiation requirement and the increasing demand from its loyal following in the Hawaii market.

The Kauai organic farms have increased apple banana planting and have obtained organic certification of this produce.

In all, we have reached 18 farms, mostly small operation of less than 20 acres during the project period to provide pricing information, technique know-hows and nutrition information. The Hamakua Spring operates a farm of 700 acres in Hilo and the L&R farms operates on 200 acres in Molokai, both areas are considered as economically depressed regions in Hawaii.

Processors in Hawaii:

HFP Foods and subsidiaries were the original project collaborator. In addition to collaborating in the cooked taro leaves research, HFP Foods are growing taro and purple sweet potato in making chips. The company, a Honolulu food processor, is also working on the new dehydration project with the project PI.

Additional information generated by the project (publications, presentations and websites).

A manuscript on the oxalates in raw and cooked taro leaves is being prepared for submission to the Journal of Food Processing and Preservation.

A website (ExportHawaiiProducts.com) was established with funds from this project in year 2013 and now being maintained by new funds from the County of Honolulu.

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