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2011 REGULAR SESSION
STATE OF HAWAII

ANNUAL REPORT ON THE

AGRICULTURAL DEVELOPMENT AND FOOD SECURITY SPECIAL FUND

ACT 73, SLH 2010

PREPARED BY:

HAWAII DEPARTMENT OF AGRICULTURE

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TABLE OF CONTENTS

Section	Description	Page No.
I	**Background**	
	A. Act 73, 2010 Session Laws of Hawaii	1
	B. Agricultural Development and Food Security Special Fund	1
	C. Role of the Hawaii Department of Agriculture	1
II	**Process and Deliberations**	
	A. Programs and Activities Development Process	3
	B. Concept Development Activities	3
	C. Stakeholder Concerns	3
III	**Description of Possible Projects and Activities**	
	A. The awarding of grants to farmers for agricultural production or processing activity	5
	B. The acquisition of real property for agricultural production or processing activity	5
	C. The improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity	5
	D. The purchase of equipment necessary for agricultural production or processing activity	6
	E. The conduct of research on and testing of agricultural products and markets	7
	F. The funding of agricultural inspector positions within the department of agriculture (includes related activities)	11
	G. The promotion and marketing of agricultural products grown or raised in the state	12
	H. Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.	13
	I. Estimated Cost Per Fiscal Year for Agricultural Development & Food Security Special Fund Projects	18
Appendix		
A	Planning Participants	22
B	Proposals	24

SECTION I

Background

A. Act 73, 2010 Session Laws of Hawaii

In an effort to address Hawaii's over reliance on imported food and energy (~85-90%) and the vulnerability that this creates in energy and food security, as well as negative impacts on biosecurity and our economy, the Hawaii State Legislature approved HB 2421, H.D. 2, S.D. 2, C.D.1., which was enacted as Act 73, 2010 SLH. Act 73 provided for the creation of an energy and food security tax in the amount of $1.05 which is to be levied "on each barrel or fractional part of a barrel of imported petroleum product sold by a distributor to a retailer or end user". Fifteen cents of the tax is to be deposited into a new Agriculture Development and Food Security special fund; fifteen cents is to be deposited into the new Energy Security special fund; ten cents is to be deposited into the new Energy Systems Development special fund; five cents is to be deposited into the existing Environmental Response revolving fund; and sixty cents is to be deposited into the general fund. In addition to the establishment of the new special funds, Act 73 also created the Hawaii Economic Development Task Force whose purpose is to "facilitate the accelerated adoption and completion of renewable-energy projects, energy-efficiency programs, agricultural infrastructure and development, and other measures to meet the purposes of this Act".

B. Agricultural Development and Food Security Special Fund

Part IV, Section 7 describes the Agricultural Development and Food Security Special Fund and the responsibilities of the Hawaii Department of Agriculture (HDOA).

"§141- Agricultural development and food security special fund; establishment. (a) There is established within the state treasury the agricultural development and food security special fund.

(b) The following moneys shall be deposited into the special fund:

(1) The portion of the environmental response, energy, and food security tax specified under section 243-3.5;

(2) Any appropriation by the legislature into the special fund;

(3) Any grant or donation made to the special fund; and

(4) Any interest earned on the balance of the special fund.

(c) Subject to legislative appropriation, moneys in the special fund may be expended for the following purposes:

(1) The awarding of grants to farmers for agricultural production or processing activity;

(2) The acquisition of real property for agricultural production or processing activity;

(3) The improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity;

(4) The purchase of equipment necessary for agricultural production or processing activity;

(5) The conduct of research on and testing of agricultural products and markets;

(6) The funding of agricultural inspector positions within the department of agriculture;

(7) The promotion and marketing of agricultural products grown or raised in the state; and

(8) Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.

C. Role of the Hawaii Department of Agriculture

(d) The department of agriculture shall submit a report to the legislature no later than twenty days prior to the convening of each regular session on the status and progress of existing programs and activities and the status of new programs and activities funded under the agricultural development and food security special fund. The report shall also include:

(1) The spending plan of the agricultural development and food security special fund;
(2) All expenditures of agricultural development and food security special fund moneys;
(3) The targeted markets of the expenditures, including the reason for selecting those markets;
(4) The persons to be served using the expenditures; and
(5) The specific objectives of the expenditures, including measurable outcomes."

This report includes a description of the status and progress made in implementing Act 73 as of November 30, 2010 and a plan for new programs and activities proposed through the period ending June 30, 2015.

SECTION II

Process and Deliberations

A. Program and Activities Development Process

A two-phase process was designed by HDOA. The goal of the first phase was to create an awareness of Act 73 and solicit program and activities concepts from agriculture stakeholders. Phase II included the development of concepts into program and activity proposals, the review of the proposals by the stakeholders and the completion and submittal of this report.

B. Concept Development Activities

The Deputy Director of HDOA convened three meetings with stakeholders. The first was held on October 11, 2010 and included Administrators, Managers, Supervisors and staff of the HDOA and its Chairperson.

The second meeting was held on October 18 and included the Agriculture Specialists from the Counties of Hawaii, Maui, and Kauai, the President of the Hawaii Agriculture Research Center (HARC), the Interim Dean of the University of Hawaii College of Tropical Agriculture and Human Resources, the Executive Director of the Agribusiness Development Center, the HDOA Chairperson, the HDOA Planner, and the HDOA Administrator for the Agriculture Resource Management division.

The third meeting was held on October 25 and included the former as well as the newly elected Hawaii Farm Bureau Federation (HFBF) Presidents along with an HFBF staff member, the President of the Hawaii Cattlemen's Council, the President of the Hawaii Coffee Growers Association, the President of the Hawaii Florists and Shippers Association, the President of Kau Farm and Ranch, and the Manager of the HDOA Livestock Disease Control branch.

Other organizations that were invited but were not able to attend were the Hawaii Crop Improvement Association, City and County of Honolulu, and the Hawaii Macadamia Nut Association.

Each of the meetings was conducted by the HDOA Deputy and recorded by his secretary. Participants were also encouraged to follow-up by submitting more detailed proposals developing the ideas they proposed. Those proposals or more detailed descriptions received are included in Appendix B of this report.

C. Stakeholder Concerns

At each of the three meetings, stakeholders recognized that while significant, the amount of funding (estimated to be $3.3 million for each of five years) was not sufficient to address more than a small fraction of the needs of the industry. This is made clear by the estimated cost of proposed projects and projects whose costs have yet to be determined included in this report which far exceeds the expected annual funding. It was the general consensus of the participants that the funds should be regarded as an investment for the future, particularly to begin to address issues that if not addressed, pose threats or lost opportunities for the industry. To address this concern, stakeholders agree that:

1. The Hawaii Economic Development Task Force should review whether Section 7 shall be repealed on June 30, 2015 as provided for in Part IX, Section 14 and instead consider an extension or make the deposit of funds permanent.

2. The Task Force should review whether the funds currently diverted to the general fund should instead be deposited into the environmental response, energy and agricultural development and food security special funds as originally intended. For purposes of this report, we are assuming that funds from the general fund will be re-allocated to the agricultural development and food security special fund in the amount previously anticipated, i.e. .30/barrel in FY 12-FY 15.
3. Stakeholders agree that funds from the special fund should be used to supplement existing funds for agriculture appropriated by the legislature and should not supplant current funding. Funds should be used for innovation of new products and technologies, to explore new markets, to train new farmers, and to support and protect the sectors of Hawaii agriculture that have established competitive advantages and market share.
4. Stakeholders agree that it is appropriate that projects that address common needs of energy and food producers be co-funded from both the energy and agricultural development and food security special funds. The items that address agricultural land and water should be considered for co-funding since both food and biofuels production would benefit.
5. While the legislature appropriated funds presumably from the Agricultural Development and Food Security special fund through budget provisos in FY 11, the Department of Budget and Finance said that the funds were not properly appropriated and therefore couldn't be expended. HDOA has requested the Attorney General's advice in order to determine if the funds were properly appropriated and can be expended out of this special fund in FY11 or otherwise to advise as to the appropriation language necessary to authorized expenditures from this fund. Budget and Finance has established the special fund, however, since this question hasn't been answered yet, this report assumes that the tax collections will accumulate in this special fund and spending will not commence until July 1, 2011 at the earliest.
6. Stakeholders recognize the legislature's important role in ultimately deciding how the special funds will be appropriated. In this regard, we have presented a number of suggestions for consideration which represent a great deal of thought and effort provided by a broad cross section of the agricultural community. We hope that you will give these suggestions the careful and objective consideration they deserve.

SECTION III

Description of Possible Projects and Activities

Section III contains descriptions of projects and activities suggested by stakeholders. The suggestions are organized under the allowable uses found in HRS Chapter 141 establishing the agricultural development and food security special fund. The suggestions have not been prioritized within each allowable use, however, those concepts that have reference numbers next to them have more detailed explanations or proposals corresponding to those reference numbers found in Appendix B. Also, because some the suggestions were made without a budget figure attached, we did our best to estimate the cost of such programs shown in the table at the end of this section.

A. The awarding of grants to farmers for agricultural production or processing activity;

- Re-establish the Livestock Feed Reimbursement program to assist struggling livestock producers in Hawaii;
- Grants to farmers to address pest issues;
- Identify opportunities to encourage on-farm use of alternative energy sources and renewable fuels through a grant program to be used in conjunction with HDOA's renewable energy loan program;
- Irrigated pasture project. Establish an irrigated pasture pilot project to provide grants to subsidize the cost of irrigation water for cattle producers in the service area of the Lower Hamakua ditch during periods of low rainfall. The pilot project would be modeled after the Livestock Feed Reimbursement program and administered by the Hawaii Cattlemen's Council. Grant funds would also be available for the equipment necessary to irrigate approximately 600 acres of pasture to be used in the project. Conditions would be established to adhere to water allocation limitations and user priorities as established in the EIS and Hawaii Administrative Rules. Estimated average annual cost for 4 years: $140,000. Range of $370,000 in FY 12 to $110,000 in FY 15.

B. The acquisition of real property for agricultural production or processing activity;

- Acquire private lands through fee purchase or rent subsidy and designate public lands to develop grass-fed beef product;
- Fund purchase of agriculture lands and easements in partnership with other government agencies and non-profit organizations

C. The improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity;

- County Mapping of IAL. The counties' responsibility of identifying IAL has not yet occurred with the exception of the current efforts of Kauai County. Funding will be provided to reimburse the cost to the counties of identifying potential IAL in accordance with Section 205-47, HRS. Draft enabling language is provided: "There is appropriated out of the agricultural development and food security special fund, $200,000 for FY 12 to FY 15 for the purpose of assisting the counties of Kauai, Oahu, Maui, and Hawaii to complete the identification and mapping of potential Important Agricultural Lands in accordance with Section 205-47, HRS. Counties may request funding from the special fund not to exceed 50 % of the total cost. "

- Private irrigation systems. The preservation and maintenance of private irrigation systems (including dams and reservoirs) is critical to expanding the inventory of usable agricultural lands and therefore Hawaii's ability to achieve greater food and energy security through local production. If Hawaii is to achieve its renewable energy goal of 70% of its energy being produced from renewable sources and conservation by 2030, more of the privately held agricultural lands must be put into production; otherwise, greater production of renewable energy may result in decreased production of food and floriculture. HDOA proposes changes to the Irrigation Repair and Maintenance special fund legislation found in Chapter 167.24, HRS. The special fund was never used for its intended purpose because a federal match was never obtained. HDOA proposes that funds from the Agricultural Development and Food Security special fund and the Energy Security special fund in the amount of $2.0 million annually from each fund be used to provide a match for a landowner doing capital improvements to their agricultural irrigation systems including dams and reservoirs that primarily serve lands designated as IAL.

- Provide funding to use Schofield wastewater and pipe to the Kunia side;

- Funding for well infrastructure renovation in Ka'u;

- Funding for water tunnel renovations and distribution pipelines on Kauai, and for Kalepa and Kekaha dams which are becoming inoperable;

- Assist with costs for dam and reservoir safety certification;

- Authorize, establish and fund additional irrigation system workers to better maintain state irrigation systems;

- Fund value added facilities (certified kitchens, etc.);

- Fund development of consolidation and marshalling facilities at the ports; Provide better storage, distribution, and refrigeration at ports of entry to prevent food spoilage and address food safety requirements;

- Fund improvements to Kula Vacuum Cooling Plant;

- Provide subsidy for transportation costs; particularly the high cost of container transportation to and from Molokai.

D. The purchase of equipment necessary for agricultural production or processing activity;

- Establish mobile slaughterhouse and processing unit in cost share arrangements with livestock producers on all islands. Estimated cost: $400,000;

- Kamuela Vacuum Cooling Plant repairs. Replace vacuum cooling units at the Kamuela Vacuum Cooling Plant. The units have reached the end of their useful life and are frequently breaking down. They have been in operation since the late 1970's. A volunteer farmer must be present whenever a load of produce is in the cooler in the event of breakdown. Cost of repair is exorbitant and requires a repair person to travel 1.5 hrs. each way from Hilo and back. Without an ability to rapidly cool agricultural produce, shelf life is degraded and food safety risks increase. Buy Local marketing programs has increased demand for locally produced products and many Lalamilo farmers cannot keep up with demand. If the Cooling Plant were to close because of the equipment breakdown, farmers would be faced with the decision to put in their own coolers or change crops, both of which are expensive and disruptive actions. Estimated cost: To be determined.

- Provide funds to replace, repair, or renovate aging processing facilities;

- Fumigation chamber for exporting crops;

E. The conduct of research on and testing of agricultural products and markets;

- Distribution of New Varieties of Coffee Tissue Culture to Growers. (Appendix B #1) HCGA and HARC have developed promising Hawaii coffee cultivars through breeding and selection programs over the past 10 years. Together, they have identified new Arabica varieties with nematode resistance, and expect to have new cultivars with coffee leaf rust resistance in a couple of years. These new cultivars will be distributed to coffee growers to further select them for adaptation to different environments and growing conditions. Tissue culture derived new cultivars will be distributed to growers on all 5 coffee producing islands in Hawaii and evaluated for their field performance and cupping quality. Estimated annual cost: $45,000.

- Selecting Vegetable Germplasm Adapted to Tropical Organic Farming Systems. (Appendix B #2) More than 80% percent of Hawaii's food is imported, and the State is thought to have less than a seven day supply of many foods, particularly perishables (Leung and Loke, 2008). Although most experts agree that it is not feasible to eliminate food imports, import substitution has been identified as an important component of food security for Hawaii. There is a strong need to develop recommendations for the selection of vegetable varieties for optimal performance under low nitrogen conditions, particularly under tropical conditions. Select vegetable genotypes that differ significantly in growth parameters and resistance indices will be planted in the field to evaluate relative yield performance under organic and conventional management conditions. The emphasis will be on import replacement. Estimated average annual cost: $51,600. Range from $63,000 in FY 12 to $49,000 in FY 15.

- CTAHR Coffee Research. (Appendix B #3) Flower synchronization is not going to be an immediate solution but it has potentially high economic payback. Research should be initiated on plant regulation mechanisms specifically the activation of genes associated with flowering that build on what is known about drought conditioning for coffee fruit synchronicity. Estimated annual cost: $45,000.

- PBARC Coffee Research. (Appendix B #4) Efficacy of *Beauveria bassiana* sprays. Mortality data on coffee berry borer will be collected from intact coffee cherries, and those picked from the ground, in *Beauveria*-treated and areas where no sprays were applied. Berries will be dissected to determine mortality. Evaluation of *Beauveria* strain composition in coffee plantations and surrounding areas before and after commercial biopesticides are applied. Molecular techniques (PCR analysis, followed by DNA sequencing) will be used to identify strains. Samples will be collected from leaves, berries, coffee berry borers and soil. Results will support regulatory decision making and may identify more virulent strains which can be commercially developed. Efficacy of entomogenous nematodes (*Steinernema carpocapsae*). Commercially available nematodes will be imported and tested at the standard rate of 1 billion nematodes per acre. Mortality data on coffee berry borer will be collected from intact Coffee cherries and those picked from the ground. Berries will be dissected to determine mortality, and beetles will be dissected to confirm nematode infections. Growth regulators to synchronize flowering. Cherries will be sampled in treated and untreated areas and dissected to determine the degree to which synchronous fruit production reduces problems with coffee berry borer. Estimated annual cost: $105,000.

- Protecting the Hawaiian Coffee Industry Against Coffee Leaf Rust. (Appendix B #5) This project will result in new, rust-resistant coffee cultivars introduced into the Hawaiian coffee breeding program and new, resistant plants that can be made available to farmers. Coffee rust disease is caused by the parasitic fungus, *Hemileia vastatrix* Berk. & Br. This fungus attacks the leaves of coffee trees causing severe defoliation, reduction in photosynthesis and consequent loss of vigor and yield of coffee trees. In the areas where it occurs, the disease has resulted in expensive control measures, from attempts to quarantine or eradicate it, to fungicide spray programs and resistance breeding programs (Kushalappa and Eskes, 1989). Today it is found in all coffee growing areas worldwide - except Hawaii (Schenck, 1990). Seeds will be collected from progeny of the HARC crosses. Import permits will be obtained from Portugal and required treatments to seeds will be made for their safe transport and introduction into that country. They will be sent to Dr. Vítor Várzea at the Instituto de Investigação Cientifica Tropical (IICT)- Centro de Investigação das Ferrugens do Cafeeiro(CIFC), Portugal. The seeds will be germinated in the Institute and grown to suitable size in their greenhouses. Susceptible seedlings will be eliminated and resistant ones will be kept and repropagated to produce disease free seedlings. In this way, Hawaiian cultivars selected for quality and Hawaii's various environments can also be selected for resistance to rust. Promising varieties could then be reimported under strict quarantine conditions and introduced into the Hawaiian farms. Any imported resistant seedlings to Hawaii from this program in Portugal, will be certified disease free. All required state and federal permits regarding import and quarantine procedures will be obtained prior to introduction. The research project described above will begin yielding results within the first year as the existing progeny maintained from prior funded projects can be tested as soon as shipments can be arranged and screening completed at IICT. Whether the quality would be acceptable to the industry would still need to be determined. Once the marketability of any new cultivar is determined, it will be cloned to increase the new material. We will produce progeny of "proven" rust resistant new varieties and further select the best for cupping quality and rust resistance over the next three years (Yr3-5). Concurrent with selection for superior rust resistant varieties, selection for superior cupping quality with high yield will be pursued. Estimated annual cost: $80,000.

- Coffee processing affects cup quality. (Appendix B #6) Specialty coffee roasters are currently seeking coffees processed by non-traditional means because these coffees have unusual and complex flavors. There is a poor understanding of how Hawaii coffees respond to varying processing techniques. Estimated annual cost: $30,000.

- Re-establish annual research funding for agriculture and aquaculture. Suggested projects include:
  - Increase development of new varieties of fruits, vegetables, and flowers;
  - Feed research – open up to every potential source for import substitution, not only biofuel by-products;
  - Crop production/crop improvement – increase quality and variety;
  - Research on alternative methods of carcass disposal (e.g. Australia uses chemicals, remains after chemical treatment can be used for fertilizer);
  - Gain understanding of how a small country like Holland can become #2 exporter of ag. products in the world; Israel is another innovator and exporter of ag. products. Hawaii should learn from these examples;
  - Establish a grant program to accelerate research on utilization of biofuel byproducts for animal and fish feed, and fertilizer.

  Estimated annual cost: $1 million a year for research for floriculture and food crops;

- Improvement of food security and reduction of food safety practices. (Appendix B #7) Funds for sensor testing focused on improving inspectors' efficiency with technology capable of controlling shipment temperatures and detecting invasive species and chemical and biological contaminants: Goal is to reduce ever spiraling food inspection and transportation costs, returns and shipment bottlenecks by improving control over food transportation. Estimated average annual cost: $130,000. Range of $50,000 in FY 12 to $200,000 in FY 15.

- Preventing contaminated, locally produced foods from entering the supply chain. (Appendix B #8) Funds to support farm level water and produce testing as a means of providing farmers with the tools to control chemical and biological contaminants. Goal is to enable farmers to better manage critical business processes and move to farm level HACCP. Estimated average annual cost: $143,000. Range of $35,000 in FY 12 to $275,000 in FY 15

- Controlling Seasonal Production and Fruit Quality Problems in Pineapple. (Appendix B #9) The change in the variety of pineapple grown in Hawaii to low-acid hybrids has brought with it, a number of interrelated problems. It has become obvious that the application of growers' production experience with high acid canning varieties does not always have the desired result when applied to the low-acid hybrids. Additionally, the environmental effects have meant that experimental results and commercial practices developed in other production areas have frequently lead to significant cost increases without improvement in fruit yield and quality.

  Losses of fruit from natural flowering has been reported to be upwards of 100% with the new low-acid hybrid varieties at a significant cost to the plantations. Translucency losses of 30 to 40% also occur. Reduction of these losses will increase their profitability and promote the long-term survival of the industry. The expected outputs from this project would be:

  * Identify optimum aviglycine application rate and frequency of application
  * Identify the nature and extent of fruit deformities caused by aviglycine
  * 1-MCP application and 1-MCP-aviglycine protocols to delay flowering
  * Effect of Aviglycine on vegetative growth and fruit size.
  * Calcium and potassium application on fruit translucency incidence and severity.
  * Role of ABA on fruit calcium uptake, and the occurrence and severity of fruit translucency.

  Hawaii pineapple industry and consumers will benefit by reducing costs and providing a uniform supply of high quality fruit. Estimated average annual cost for 3 years: $89,438

- Sustainable Tropical Vegetable Production Systems and Community Well-Being. (Appendix B #10) Greater vegetable production and consumption within the context of diets based on staple root crops and vegetables is one of the most effective means of improving community health and nutrition, but the availability of vegetables is often very limited. The cultivation and germplasm of vegetables is being lost, there is a low diversity of vegetables being grown on many islands and production is wholly dependent on imported seeds. Therefore, opportunities for cash income from vegetable production and trade need to be developed to help service local and tourism-derived needs and capacity strengthening is required to make these interventions sustainable. This project provides an integrated approach to tackle these problems.

  This project will have the following attainable and measurable outcomes for enhanced food security with increased rural and urban well-being: sustainable integrated tropical cropping systems, optimal land use, improved environmental quality, reduced pesticide use, increased competitive advantages, enhanced output, better import substitutions, increased

profitability, increased consumer satisfaction, improved quality, improved food security, and empowered disadvantaged communities with greater self-reliance. Knowledge gained from tropical crop production systems in Hawaii has direct global relevance to other tropical communities.

An educational component will involve the development and implementation of appropriate production and wellness training from small farms through to disadvantaged consumers. These include stimulating interest and training of young farmers, working with educators to expand the 'Aina in the Schools' program for Oahu schools through the Urban Garden Center, and local K-12 schools. The project will also involve the current Hawaii food and nutrition programs (EFNEP & SNAP-Ed) that teaches food skills to limited resource populations, and facilitates consumer foods and nutrition education and integrated with 4H programs. The primary beneficiaries will be Hawaii small vegetable farmers and consumers. Consumers will benefit by have a regular supply of vegetable sustainable grown in Hawaii. Estimated average annual cost for three years: $106,500

- Taro Acridity: Development of a Quantitative Assay for Use in Plant Breeding and Food Processing. (Appendix B #11) Taro and other edible *Aroids* are a major staple food of about 500 million people. However, the leaves and corms of taro and other edible *Aroids* are acrid. As a result, when eaten without cooking, symptoms of itchiness, pain, and swelling of lips, mouth, and throat occur. The stumbling block to research and the lack of success in determining the nature of this acridity in taro is the absence of a chemical or molecular assay. The current bioassays require human volunteers to place a sample on their forearm or to eat possibly acrid materials. This bioassay severely limits the number of samples that can be evaluated. The problem is compounded by apparent instability of the acridity factor when isolated.

  The goal of this project is to develop assays for acridity in taro that can be used in plant breeding and during commercial processing. The assay will improve food quality and enhance economic opportunities for agricultural producers. Hawaii taro industry and consumers will benefit by reducing processing costs and providing a uniform supply of high quality taro products. Estimated average annual cost for 3 years: $85,766. Costs range from $93,100 in Yr. 1 to $82,100 in Yr. 3.

- Microbial And Pesticide Concerns With Leafy Vegetables Grown By Small Farmers In Hawaii. (Appendix B #12) In 2007, Hawaii had 7,521 farms. This number includes animal ranches, flower nurseries, commercial seed farms, and orchard crops such as macadamia nut and coffee, and produce crops (lettuce, basil, taro, ginger, etc.). At least 1,200 (possibly as high as 4,000) of these farms grow food crops that are of potential concern when it comes to on-farm food safety.

  In Hawaii, one of the largest growing populations of farmers and the largest growth in acreage is coming from Traditionally Underserved Farmers (TUF). Unfortunately, the news coverage of on-farm food safety does not often reach TUF who are non-English speakers, do not read newspapers, or do not have access to or do not use the Internet to look for such information. For many growers in Hawaii, even the non-ethnic farmers, it is simply not a high priority issue as they try to survive economically. To add to this, with Hawaii's geographical isolation, we do not have the same commercial peer pressure that might come from growers in the state next door. Thus, many Hawaii growers are simply unaware of the reasons, risks and solutions to food-borne problems that could very well be originating on their farms. This lack of knowledge clearly puts many Hawaii small growers at a disadvantage when compared to the hundreds of larger more organized growers in California and Arizona who have signed onto Western Growers Association's (WGA) new, Leafy Greens Good Agricultural Practices (GAP), requirements that may become the *de facto* standard for commercial produce production in the United States.

The purpose of this multidisciplinary collaboration effort between applied research and outreach professionals is to reduce microbial and pesticide risks of leafy vegetables from production through marketing, to the retail level. This integrated will quantify the type and levels of microbial and pesticide contamination and an outreach component to provide information and training so that producers, wholesalers and retailers are able to recognize production and marketing risks and minimize them. In addition, the applied research will evaluate rapid assays for pesticide residues found on fresh leafy and fruit vegetables which can be utilized in the market chain to assist growers to meet market needs' for safe products. Estimated average annual cost for 3 years: $136,500. Range from $144,500 in Yr.1 to $132,500 in Yr. 3.

F. The funding of agricultural inspector positions within the department of agriculture. (Statutory language should be expanded to include all biosecurity-related positions and activities in HDOA);

- Funding of Plant Quarantine and Commodities Inspector positions until such time that sufficient general funds are available. Estimated annual cost for salaries and fringe benefits for 10 PQ inspectors and 5 Commodities specialists: $1,018,456;

- Industry requested more HDOA positions for the following:
  - Neighbor Island inspectors;
  - HDOA Inspectors for Molokai livestock;
  - Position needed with LDC for swine industry;
  - HDOA coffee inspectors for Kau.
  - Assign one PQ inspector for Kau coffee.
  - Development of a rapid response team for the HDOA;

- Purchase more reference materials;

- Work on Invicta database;

- Maui Biosecurity. Hawaii Department of Agriculture Biosecurity Program provides a comprehensive approach to addressing the viability of our farmers and ranchers. As part of this program, hiring more ag inspector positions will help the overall agricultural industry reduce and deter unwanted pests and diseases from entering our state as well as interisland. Performance measure could be how many interceptions have taken place and its potential impact to the agricultural industry.

  To effectively implement Act 236 (Biosecurity Law), Maui County needs immediate funding and expert resources to design, build, and integrate the Kahului Harbor Inspection, Treatment, & Distribution System. The overall system design must include facilities, processes, policies, and personnel for Kahului, Lanai, and Molokai. To ensure efficient use of resources, this plan should be added to the current Harbor Improvement Plan, with the additional funding required for simultaneous implementation. Infrastructure Improvements at Kahului Harbor are needed to provide covered and/or climate controlled freight sheds at the Kahului harbor that protect perishables and other products arriving/departing from exposure that could degrade food safety or destroy the shipment. At least three marshalling areas for both imports and exports are necessary: Simple weather exposure protection (covered, not climate controlled), Refrigerated, and Frozen.

  Maui County's primary goal is to consistently inspect 100% of containers with "high-risk" cargo by December 2013. We will treat or destroy import/export/interisland shipments that carry invasive species. Each year 10% of all shipments through Kahului Harbor are deemed "high-risk" by virtue of the items, the producer, or the geography from which they originate.

Our plan includes:

-Identifying those "high-risk" shipments to regulate a manageable scope for inspection;

-Incentives for importers who get shipments pre-inspected at the point of origin, or who use pre-certified "safe" or "low-risk" providers;

-Treatment & eradication facilities to minimize environmental threat and landfill contamination, including services such as animal dips, equipment wash-down areas, insect and coqui frog treatment, etc.;

-Consideration of employing a distributed inspection and treatment model as well as use of third-party providers to alleviate congestion and delivery delays; and

-Innovative technology use to automate, track, and accelerate the process with less staff and overhead.

Estimated cost: TBD

G. The promotion and marketing of agricultural products grown or raised in the state;

- Hawaii Tea Industry. (Appendix B #13) Hawaii is one of three states in the U.S. currently growing tea. UHCTAHR estimates more than 100 small farms are growing tea currently. More than a dozen tea farms are selling locally grown and processed teas this year. To date Hawaii has established America's first generation of Hawaii grown Camellia sinensis tea farms. The critical need for an emerging Hawaii tea industry now is to establish an international reputation of premium quality teas. To reach this goal, we must establish regular tea evaluation sessions to ensure continued improvement in cupping quality of locally produced teas. We need to submit our top quality teas to international tea competitions. Winning in the international tea competitions will build our reputation among the international tea community, and enhance the marketability of Hawaii produced teas. Estimated average annual cost: $120,710. Range of cost from $114,504 in FY 11/12 to $128,350 in FY 15.

- Hawaii Coffee Growers Association Trade Shows. (Appendix B #14) The Hawaii Coffee Growers Association (HCGA) was formed in the late 1980's and represents approximately 70% of the producing acreage within the State of Hawaii. The members come from many separate farms with at least one member from each island that produces coffee. There is a real need to have a better way to market Hawaiian coffees worldwide.

  To better compete in the world green coffee market; Hawaii needs to be visible at international and domestic trade shows. Most areas of the world that produce coffee are supported by their national government (e.g. Columbia, Costa Rica, Kenya). Hawaii is the only state in the US that produces coffee and for the most part, the presence of the Hawaii coffee industry at these trade shows is largely the responsibility of the individual farms. Estimated annual cost: $40,000.

- Hawaii House in Shanghai. The China Ministry of Commerce (MOFCOM) has extended an invitation to the State of Hawaii to establish a "Hawaii House" in Shanghai to highlight Hawaii products to Chinese importers. MOFCOM will direct the Beijing International Brand Management Center to provide comprehensive services to Hawaii businesses and Chinese buyers which will include assisting the Hawaii businesses to obtain orders and setting up a distribution system and after-sales customer service. As of June 2010, Hawaii is the only state that has been offered this opportunity. A formal agreement is expected to be signed between the two parties later this year.

In order to explore this opportunity, a delegation consisting of individuals from the HDOA, UHCTAHR and floriculture industry visited Shanghai and Beijing in June 2010 to meet with government officials and potential buyers. The delegation was supported by funding from the USDA, Foreign Agricultural Service, Emerging Markets Program, Quick Response Marketing Fund. The delegation was strongly encouraged at these meetings to meet with Chinese importers and better understand the quality standards expected by Chinese buyers by setting up meetings in Hong Kong, Guangzhou, and Kunming where many of the buyers and growing areas are located. The same delegation went to these areas at the end of October to mid-November. Funding for this follow-up trip was again provided by the USDA, Foreign Agricultural Service, Emerging Markets Program, Quick Response Marketing Fund. Results from this second trip indicate that there is a demand for unique Hawaii agricultural products, particularly certain new varieties of cut and potted flowers. Relationships were established that will facilitate the import of these products to China. Funding in the amount of $50,000 will be made available to follow up on this opportunity through annual visits of Hawaii growers, University of Hawaii researchers, and HDOA officials with Chinese importers and distributors.

- Public education, marketing and promotion:
  - Funding to educate public and raise awareness of agriculture issues and importance of supporting agriculture;
  - Build on Buy Fresh It Matters;
  - Website that can serve as a clearing house for informative, accurate and timely educational material, and that can link to information from the counties' economic development offices;
  - Promotional money for Buy Local programs. This year Maui County spent $800K supporting local agriculture. More funding and long-term planning and funding are required at the state and county levels to establish youth and adult vocational training and agriculture development.
  - Increase marketing support for food processing and manufacturing;
  - Build awareness for the importance of import replacement for cut flowers and other high risk crops for invasive species;

- Funding to increase agriculture education programs including FFA;
  - Funding for a school garden program at Ka'u High School;
  - Creating opportunities for K-12 youth exposure to agriculture is critical in establishing the next generation workforce: Student and school gardens, Farm Bureau education and outreach, career pathway awareness, and "Ag in the Classroom" programs are all worth pursuing.

- Showcase and sell local products at a permanent central location:
  - Farmers market in Kakaako;

H. Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.

- Funding of Entomologist positions until such time that sufficient general funds are available. Estimated annual salary and fringe benefit cost for 2 Entomologist IV: $255,995

- Energy & Food Security Planners. Act 159, SLH 2007 established within the Department an energy feedstock program to encourage the production of energy feedstock in the state and establish milestones and objectives for energy feedstock to be grown to meet Hawaii's energy requirements. Act 159 authorized the Chairperson to hire one or more temporary positions. We propose that at a minimum two senior planners be hired using funds from the Agricultural Development & Food Security Special Fund. The Planner positions will be temporary positions responsible for coordinating the department's efforts to contribute to

Hawaii's goal of 70% of its energy needs being provided by renewable energy by 2030 while at the same time enhancing Hawaii's food security. It is anticipated that much of the renewable energy will be provided by biomass and biofuels produced on agricultural lands. The Planner positions will work on land and water issues, labor, and other factors affecting agricultural production in order to maintain a balance between feed and energy producers on agricultural lands. A significant responsibility will be advocating the designation of Important Agricultural Lands and assisting with the transfer of public lands meeting the criteria of IAL to the HDOA, providing comments on IAL applications submitted to the LUC, and conducting the certification functions that landowners require in order to receive the IAL tax credit. In addition, the Planners will be expected to write grants for federal funding and perform the monitoring functions specified in Act 159, provide assistance in obtaining energy permits, and establish and maintain a database of land use and availability in Hawaii. Funding in the amount of $214,286 per year is required for these two positions and related costs.

- New Plant Distribution Center (NPDC): Statewide Program to Enhance the Global Competitiveness of Hawaii's Floriculture and Nursery Industry. NPDC comprises a statewide extension program to develop and promote Hawaii's potential as producer of high-value new ornamentals and to create a global presence for its products. Based on UH Manoa and utilizing current lab infrastructure, this project aims to enhance the competitiveness of Hawaii's floriculture and nursery (F&N) industry. Hawaii is known as a rich source of new ornamental varieties that are found in the natural environment or are collected, bred, or created by growers and CTAHR researchers. Unfortunately, a great deal of the economic profits from the sale of new varieties is not captured by local growers or even the state's economy, and in fact the F&N industry has been losing competitiveness in global and national markets despite being significant contributors to diversified agriculture in Hawaii. This project proposes a program of collaboration between growers, CTAHR, and the Department of Agriculture that incorporates technological advances in the production of disease-free high-value new ornamentals and strategic business implementation to curtail the losses of some of its major product lines, maintain its global competitiveness, and to improve its contribution to the state's economy through sales and employment generation.

  The general objective is to revitalize Hawaii's floriculture and nursery industry by reducing production costs, expanding markets, and facilitating the creation and distribution of new high-value ornamentals. Capitalizing on the expertise of the project director this project will develop efficient, cost-effective micropropagation and transformation protocols for high-value ornamentals using thin-cell-layer (TCL) and temporary immersion bioreactors (TIBs) to improve the supply chain of new plant materials to Hawaii F&N growers. The initial focus will be on dracaena, proteacea, palms, anthuriums, and orchids. Estimated average annual cost: $196,275. Range from $198,675 in Yr. 1 to $190, 675 in Yr. 5.

- Establish fumigation station for the Coffee Berry Borer. The coffee berry borer (CBB) has been found in Kona. This pest is considered among the worst threats to the economic viability of coffee growing.

  To achieve control of this insect many different avenues need to be explored. There is not one measure that will halt or eradicate this insect. Eradication will probably not be possible however control of the insect is achievable. Much work on this insect has been done around the coffee world and much information is available.

  The main methods of control are sanitation, pruning, fungal sprays and fruit synchronization. HCGA proposes a multi-task, multi-organization approach to addressing the problem of the coffee borer.

HDOA requirements will determine the cost. A self contained fumigation station is estimated at $50,000 plus installation. If "self containment" is not a requirement a 20 foot container would be adequate and a substantially less expensive alternative.

- Implement sanitation measures to reduce coffee berry borer. (Appendix B #16)

  - Cutting down of wild coffee and prevent re-growth (service traps)
  - Assist in cleanup of abandoned farms
  - General Sanitation measures
  - Trap construction and servicing
  - Monitoring of infestation

  CTAHR would deploy engineering, horticultural, and entomology resources to develop economical procedures and equipment for each of these methods. Estimated annual cost: $127,000.

- The Hawaii Master Beef Producer Program. (Appendix B #17) The program will allow for the certification of producers as a "Hawaii Master Beef Producer" after completing a series of educational sessions that have been developed based on the identified needs of the cattlemen (personal communications and the Beef Industry Strategic Plan, 2007), the goals of the CTAHR Beef Initiative (CTAHR Beef Initiative Impact and Final Report, 2008), the Action Plan of the HDOA (Report to the 25th Legislature 2010 Regular Session, HDOA), and publications documenting evaluations of Master Beef Producer Programs in other states ("Perceptions of the Effectiveness of the Louisiana Master Cattle Producer Program" a Master's Thesis by LJ Lirette, May 2010; "Management Practices Associated with Beef Quality Assurance/Master Beef Producer Certification Among Cattle Producers" by F Hopkins et al, 2008). The addition of the Hawaii Master Beef Producer Program to the beef industry and the CTAHR Beef Initiative will greatly contribute to the success of these producers and will allow for concentrated and in-depth education in key areas to:

  - Increase their profitability (i.e. efficiency of production and cost effective processing, increase profitability and quality of the grass-finished product for local market, financial strategies to increase real income, efficient use of agricultural loans, subsidies, and cost-share programs)
  - Improve food safety (i.e. biosecurity, proper antibiotic use for assurance of public health)
  - Advance marketing strategies (i.e. promotion of products and value-added goods, identification of market opportunities, status as certified Hawaii Master Beef Producer to demonstrate commitment of the ranch to best practice management thus building consumer confidence, provide industry feedback to cooperating agencies regarding activities in target and markets, encourage producers to seek certified organic status as market dictates)
  - Ensure animal health and welfare (i.e. technique certification for handling and procedures at weaning; continuing education regarding current health recommendations, beef quality assurance training)
  - Better prepare for and respond to disasters (i.e. natural disasters, prevention of foreign animal disease)
  - Increase participation in reporting as part of the National Animal Identification System (i.e. traceability, risk assessment, increase consumer confidence and use of products in institutional food programs)
  - Minimize environmental impacts while contributing to the pastoral landscape and ecotourism industry

- Contribute to research efforts (i.e. collaborations within the CTAHR Beef Initiative to in turn allow the progressive development of best production practices tailored for Hawaii beef producers)

Estimated average annual cost: $198,868.

- CTAHR Farm Food Safety Coaching. (Appendix B #18) In Hawaii at the present time, only about 65 of 1200+ produce farms have current, internationally-recognized food safety certifications as administered by a third-party auditor. The purpose of this project is to increase on-farm food safety through individualized, on-site coaching of Good Agricultural Practices to all Hawaii produce farms. Critical areas of a produce farm operation that are reviewed include:

  - Making sure the farm has a well-maintained toilet and has potable water for hand washing.
  - Using a proactive pest management strategy for rodents, birds, deer, pigs, and slugs and snails.
  - Using the right crop protection chemicals, fertilizers and composts according their labeled (legal) directions, and recording every use. And, that they are following US EPA Worker Protection Standard rules.
  - Using sanitized harvest baskets and tools and making sure that harvest bins with holes do not come in contact with soil.
  - Making sure that employees are washing their hands before harvesting and handling produce.
  - Keeping animals and their fresh manures away from active fields and orchards.
  - Using appropriate quality water for irrigation and crop rinse as indicated by a test of their water at an approved laboratory.
  - Making sure the packing shed, food contact packing surfaces, and refrigerators are well maintained and not a potential source of contamination.
  - Labeling each case/carton with "Grown in Hawai'i" and the appropriate information to allow trace back to a specific field within 24 hours. Estimated average annual cost: $237,709. Range of $237,568 in Yr. 1 to $240,893 in Yr. 5.

A. Workforce Expansion. Hawaii farm workers receive the highest agricultural wages in the country contributing to the frequently higher price of Hawaii grown vs. imported products. More importantly to the farmers, there is a real scarcity of workers and lack of housing further complicates matters. Recent highly publicized legal problems with foreign workers make this source of labor problematic.

   HDOA proposes to develop a partnership with the Public Safety Department to utilize inmates on selected HDOA projects, (e.g. periodic cleaning of irrigation systems) and as an alternative labor pool for farmers. An example of a farmer-PSD partnership is the one formed by Maui Land and Pine (MLP) and the Maui Community Correction Center. MLP provided a dormitory for workers and other benefits. While the partnership may have different benefits for different types and sizes of farms, it could prove useful for some of the biomass/biofuel operations and it would not draw labor away from the existing agriculture operations. Estimated average annual cost: $12,000.

B. Need help with getting product registration in China;
C. UH-CTAHR extension service needs more support to assist and resolve the critical production issues impacting the farmers and ranchers. The CTAHR extension service transcends the highly technical research and transfers it to real application on the farm. They are the only link between research and the farm;
D. Develop agricultural worker transitional housing at HARC site in Kunia;
E. Work with various government and social service groups to employ suitable members of the homeless population for agricultural labor;

F. Work with Public Safety Department to establish farm labor program for farmers to hire screened and qualified inmates;
G. Devote most of funds in the next 5 yrs. to educating the public and decision makers on the importance of agriculture-we need to tell the story better;
H. Federal, state, and county government cooperation is critical. Should have a common message of support for agriculture;
I. Loans to farmers on pest issues (emergency funding);
J. Training for farmers – collecting samples and data for early warning on new pests;
K. Expand HDOA Ag. loan programs; lines of credit, receivables financing, micro loans, emergency grants.

- State-Level Food Ombudsman. Funding a state-level food ombudsman is the first step in creating an organized system to develop Hawaii food system. This position would:
  -act as a intermediary between state agencies and stakeholders;
  -work across agencies and departments to streamline food-system-regulatory approaches and licensing requirements at the federal, state and county levels;
  -provide a centralized source of information for small-scale diversified farmers, food entrepreneurs and others;
  -harmonize different rules governing food and farming sectors

  Estimated cost: TBD

I. Estimated Cost Per Fiscal Year for All Agricultural Development & Food Security Special Fund Projects Organized by Allowable Uses (HRS Ch. 141)

Note: Priorities for HDOA operations are shown in bold.
Note: ** denotes funding from both the Agricultural Development & Food Security and Energy Security special funds.
Note: Appendix B contains any proposals that were submitted. The numbers in parenthesis in the table below indicate the proposal # in Appendix B.

		FY 12	FY 13	FY 14	FY 15	Total
A. The awarding of grants to farmers for agricultural production or processing activity						
	Livestock Feed Reimbursement program (2 yrs)	2,000,000	2,000,000			4,000,000
	Grants to farmers to address pest issues, alternative energy	TBD				TBD
	Irrigated pasture	$370,000	110,000	110,000	110,000	700,000
B. The acquisition of real property for agricultural production or processing activity						
	Acquire private agriculture lands or ag. easements	1,000,000	1,000,000	1,000,000	1,000,000	4,000,000
C. The improvement of real property, irrigation systems and transportation networks necessary to promote agricultural production or processing activity						
	County IAL mapping	200,000	200,000	200,000	200,000	800,000
	Private irrigation systems serving IAL -matching funds for CIP **	$4,000,000	4,000,000	4,000,000	4,000,000	16,000,000
	Pipe Schofield R-1 wastewater for agriculture use in Kunia	TBD				TBD
	Well infrastructure renovation in Ka'u	TBD				TBD
	Water tunnel renovations and distribution pipelines on Kauai	TBD				TBD
	Assist with costs for dam safety certification	TBD				TBD
	Fund additional irrigation workers for state irrigation systems	TBD				TBD
	Value added facilities, certified kitchens	TBD				TBD
	Consolidation and marshalling facilities at the ports	TBD				TBD
	Improvements to Kula Vacuum Cooling Plant	TBD				TBD
	Subsidize transportation costs	TBD				TBD

D. The purchase of equipment necessary for agricultural production or processing activity						
		FY 12	FY 13	FY 14	FY 15	Total
	Establish Mobile slaughterhouse and processing unit	400,000				400,000
	Fund Kamuela Vacuum Cooling Plant repairs	TBD				TBD
	Funding to renovate aging processing facilities	TBD				TBD
	Fumigation chamber for export crops	TBD				TBD
E. The conduct of research on and testing of agricultural products and markets						
	New Varieties of Coffee (Appendix B #1)	45,000	45,000	45,000	45,000	180,000
	Selection of vegetable varieties (App.B #2)	63,000	53,000	49,000	49,000	214,000
	Coffee flower synchronization (App B #3)	45,000	45,000	45,000	45,000	180,000
	PBARC Coffee research (Appendix B #4)	105,000	105,000	105,000	105,000	420,000
	Rust-resistant coffee cultivars (App B #5)	80,000	80,000	80,000	80,000	320,000
	Coffee processing improvements (App B #6)	30,000	30,000	30,000	30,000	120,000
	Annual research funding for ag and aquaculture	1,000,000	1,000,000	1,000,000	1,000,000	4,000,000
	Improvement of food security and reduction of food safety problems (Appendix B #7)	50,000	100,000	100,000	200,000	450,000
	Farm level water and produce testing (Appendix B #8)	35,000	65,000	120,000	220,000	440,000
	Controlling Seasonal Production and Fruit Quality Problems in Pineapple (Appendix B #9)	90,105	89,105	89,105	0	268,315
	Sustainable Tropical Vegetable Production Systems (Appendix B #10)	106,500	106,500	106,500	0	319,500
	Taro Acridity (App B #11)	93,100	82,100	82,100	0	257,300
	Microbial And Pesticide Concerns With Leafy Vegetables (App B #12)	144,500	132,500	132,500	0	409,500

F. The funding of agricultural inspector positions within the department of agriculture. (Statutory language should be expanded to include all biosecurity-related positions and activities in HDOA.)						
		FY 12	FY 13	FY 14	FY 15	Total
	Funding of PQ and commodities inspector positions	**1,018,456**	**1,018,456**	**1,018,456**	**1,018,456**	**4,073,824**
	Additional HDOA positions requested by industry	TBD				TBD
	Continue Invicta database development	**200,000**	**200,000**			**400,000**
	Maui Biosecurity harbor infrastructure improvements	TBD				TBD
G. The promotion and marketing of agricultural products grown or raised in the state						
	Developing a Hawaii Grown Tea Industry (Appendix B #13)	114,504	117,654	122,332	128,350	482,840
	Hawaii Coffee Growers Association Trade Shows (Appendix B #14)	40,000	40,000	40,000	40,000	160,000
	Hawaii House in Shanghai	50,000	50,000	50,000	50,000	200,000
	Public education, marketing and promotion	TBD				TBD
	Agricultural Education in schools	TBD				TBD
	Permanent locations to showcase agriculture	TBD				TBD
H. Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.						
	Funding of Entomologist positions	**255,995**	**255,995**	**255,995**	**255,995**	**1,023,980**
	Energy & Food Security Planners **	**214,286**	**214,286**	**214,286**	**214,286**	**857,144**
	New Plant Distribution Center (Appendix B #15)	198,675	200,675	200,675	190,675	790,700
	Coffee berry borer fumigation station	50,000	0	0	0	50,000
	Sanitation measures to reduce coffee berry borer (App B #16)	127,000	127,000	127,000	127,000	508,000

H. Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.						
		FY 12	FY 13	FY 14	FY 15	Total
	Hawaii Master Beef Producers (Appendix B #17)	198,868	198,868	198,868	198,868	795,472
	Farm Food Safety Coaching(Appendix B #18)	237,568	234,618	236,689	238,780	947,655
	Workforce Expansion	12,000	12,000	12,000	12,000	48,000
	State-Level Food Ombudsman	TBD	TBD	TBD	TBD	TBD
	Total Expenditures	12,574,557	11,912,757	9,770,506	9,558,410	43,816,230

Appendix A

Planning Participants

Organization	Name
Agribusiness Development Corporation	Alfredo Lee
County of Hawaii	Dayday Hopkins
County of Kauai	Bill Spitz
County of Maui	Clark Hashimoto
Green Point Nursery	Eric Tanouye
HC&S	Mae Nakahata
Hawaii Agricultural Research Center	Stephanie Whalen
Hawaii Cattlemen's Council	Alan Gottlieb
Hawaii Coffee Grower's Association	Dan Kuhn
Hawaii Department of Agriculture	Sandra Lee Kunimoto, Chairperson
Hawaii Department of Agriculture	Duane Okamoto, Deputy Director
Hawaii Department of Agriculture	Earl Yamamoto, Planner
Hawaii Department of Agriculture	Lyle Wong, Plant Industry
Hawaii Department of Agriculture	Matthew Loke, Agricultural Development
Hawaii Department of Agriculture	John Ryan, Quality Assurance
Hawaii Department of Agriculture	Brian Kau, Agricultural Resource Management
Hawaii Department of Agriculture	Brian Kau, Agricultural Resource Management
	Jason Moniz, Livestock Disease Control
Hawaii Department of Agriculture	Neil Reimer, Plant Pest Control
Hawaii Department of Agriculture	Kevin Yokoyama, Agriculture Loan
Hawaii Department of Agriculture	Carol Okada, Plant Quarantine
Hawaii Department of Agriculture	Domingo Cravalho, Plant Quarantine
Hawaii Department of Agriculture	Jeri Kahana, Commodities
Hawaii Department of Agriculture	Becky Azama, Plant Pest Control
Hawaii Department of Agriculture	Todd Low, Aquaculture Development
Hawaii Department of Agriculture	Amy Takahashi, Plant Quarantine
Hawaii Department of Agriculture	Keevin Minami, Plant Quarantine
Hawaii Department of Agriculture	Darcy Oishi, Plant Pest Control
Hawaii Department of Agriculture	Daryl Arai, Agriculture Loan
Hawaii Department of Agriculture	Glenn Sakamoto, Plant Quarantine
Hawaii Department of Agriculture	Vernon Nakamoto, Plant Quarantine
Hawaii Farm Bureau Federation	Myrone Murakami
Hawaii Farm Bureau Federation	Brian Miyamoto
Kau Farm & Ranch	Chris Manfredi
University of Hawaii, College of Tropical Agriculture & Human Resources	Sylvia Yuen

Other Invitees

Organization	Name
City & County of Honolulu	Ann Chung
Hawaii Crop Improvement Association	Fred Perlak
Hawaii Macadamia Nut Association	David Rietow
Monsanto, Inc	Alan Takemoto

Appendix B

Detailed Proposals

1. New Varieties of Coffee

HCGA and HARC developed promising Hawaiian cultivars by breeding and selection programs over the past 10 years. We identified new Arabica varieties with nematode resistance, and we expect to have new cultivars with coffee leaf rust resistance in a couple of years. These new cultivars will be distributed to coffee growers' fields to further select them for adaptation to different environments and growing conditions to become successful new commercial cultivars. Tissue culture technology allows us to produce large numbers of uniform plants. Tissue culture derived new cultivars will be distributed to growers on all 5 coffee producing islands in Hawaii and evaluated for their field performance and cupping quality.

Provide newly selected hybrid coffee cultivars to Hawaii coffee growers for further selection of the best cultivars for different soil, weather /micro- climates and agricultural practices.

The Hawaii Coffee Industry Organizations (HCA and HCGA) have been promoting the quality of Hawaii-grown coffee (Hawaiian Coffee Association brochures, www.hawaiicoffeeassoc.org) and Kona coffee commands among the highest coffee price in the world (green bean and roasted). During the past 25 years, six new coffee areas (Kauai, Oahu, Molokai, Maui, Hamakua and Kau) have emerged outside the traditional Kona district. Production of coffee outside of the Big Island is 53% of the total (as harvested acreage, 2007-08, Hawaii Agricultural Statistics Service). Hawaiian-produced coffees outside of the Kona district (except for Kau district) receive a significantly lower market value. The farm gate value is only 26% of that for Kona coffee. There is a need to develop uniquely Hawaiian cultivars, with distinctive qualities, in order to be competitive in the local and international market place. HCGA has recognized the need for new cultivars unique to Hawaii and has worked with and supported HARC's coffee breeding and selection for the past 10 years.

A coffee breeding and selection program designed to develop unique coffee cultivars for Hawaii was initiated in 1997 with the support of the HCGA and the State Department of Agriculture (Nagai et al., 1998, Nagai et al., 2001). Hawaii has the only commercially grown 'mokka' cultivar of Arabica coffee (originally from Yemen), currently grown by Maui Grown Coffee, Inc, Kaanapali, Maui. The cupping quality of the 'mokka' hybrid is considered excellent (Kaanapali Coffee, unpublished data, personal communication with SCAA professional cuppers); however, its bean size is very small (about 30-40% of 'red catuai' beans). In 1999, HARC scientists embarked on a breeding program to achieve high yielding and unique flavor quality in Hawaii (Honolulu Advertiser, 2003). New hybrid families include cultivars with larger bean size while maintaining the unique 'mokka' flavors. The first field trial of hybrid 'mokka' progeny and other selected hybrids was initiated on Kauai in 2004 following initial selection at the HARC field selection in Kunia (Nagai et al., 2005).

The top 5 groups (families) of coffee hybrids were selected by HARC and HCGA based on growth, seed evaluation and cupping tests (by HCGA and UCC Company, Japan) from the Kauai Coffee Trial (2004-2008). Seeds/seedlings of selected hybrids were distributed to selected HCGA members to evaluate in their fields in 2007.

Coffee cultivar development takes a very long time compared to common crops such as corn and tomatoes. It will take 7-8 generations to reach uniform genetic type as a cultivar. Tissue culture technology has been applied to shorten the period. Tissue culture is an efficient cloning method just like cutting or grafting. It has already produced millions of coffee clones in Central America and other regions. Tissue culture was initiated from 5 elite mother trees from

5 selected hybrid families at Kauai Trial at HARC (2006-2007), and HARC established a reliable protocol to produce large cloned plants for field planting. During 2010 HCA and HCGA received $35,000 funding from a Specialty Crop Block Grant Program- Farm Bill (SCBGP- FB), FY 2009 to start producing tissue culture plants for growers.

Hawaii coffee growers are committed to plant new cultivars and to work together with coffee breeders and cuppers. HARC has an opportunity to apply plant micro propagation (tissue culture) to maintain important genetic coffee resources and to provide growers in the state of Hawaii with new and promising cultivars. Field testing by growers in different areas of the state will hopefully identify cultivars with good quality characteristics and improved rust resistance. In times of a poor economy it is important to assure a high quality product which will allow growers to maintain a share of the world market.

Beneficiaries

There are currently about 700 coffee farmers in Hawaii. These farmers will be the direct beneficiaries of this project. In addition to the coffee growers, the large number of coffee wholesalers and retailers in Hawaii will also be positively impacted.

This project will make cultivars that have a high cupping quality available to coffee growers. If growers establish these new cultivars on their farms, within 3-4 years they will produce high quality coffee that can be sold for a higher price. Wholesalers and retailers of Hawaii coffee will also be able to sell this coffee for a higher price and will enjoy the benefits of Hawaii coffee being firmly established in the gourmet coffee niche of the world market.

A higher quality coffee bean will result in a higher market value for Hawaii coffee. The higher the cupping quality of the coffee, the better the reputation of Hawaii coffee in the world market. This will boost the economic standing of the Hawaii coffee industry, but might also have an impact on other connected industries in Hawaii, such as agro-tourism and the restaurant industry.

Objectives and Outcomes

Growers will have new coffee cultivars planted in their fields. New hybrid plants will be planted in growers' fields in spring 2012 to 2017. In 2012 the tissue culture plants delivered will be mostly new hybrids for improved quality. After 2014, new cultivars with leaf rust resistance will be delivered.

Performance and the outcomes will be monitored by HCGA. HCGA has quarterly meetings and progress can be reported at the meetings.

Individual growers will be responsible for reporting how a given cultivar performs under their individual field conditions. This data will be collected and a comparison made with varieties currently grown by each grower. This data will be freely available to all involved parties and should allow field performance of new cultivars across the micro-climates to be evaluated. Ultimately HCGA and the growers will select cultivars best suited to growing in each area and capable of producing a high quality product.

A. Production of tissue culture plants

Tissue culture derived plants of 3 top varieties, H99-153, H99-150 and H99-160 will be produced at HARC tissue culture facility. Current funds obtained from HCA and HCGA from a Specialty Crop Block Grant Program- Farm Bill (SCBGP- FB) has been used to start producing and multiplying tissue culture plants. During 2010 HARC will produce about 500 plants of 3 hybrids which will be acclimated in HARC's acclimation growth room. These plants will be

shipped to growers in early 2011. Tissue culture (somatic embryos) of selected plants including these 3 varieties will be initiated and multiplied according to HARC's protocol based on Sondahl's method (1977). The target number of plants will be about 10,000/year. A Rita system (Albarran J. et al. 2005) will be used to increase plant multiplication from somatic embryos.

During Yr1 and Yr2 all the tissue culture plants will be from selected hybrids with high cupping quality, including Ethiopian Arabica with nematode resistance (Aoki, MS thesis 2010). In Yr3-Yr5 we will start producing clonal plants of new hybrids with rust resistance. These plants are expected to be available in 2012 (see Plant Breeding proposal).

B. Grow plants in acclimation nursery-HARC

Roots will be induced and plants will be grown to the size at least 1 inch in height. These plants will be kept in HARC's acclimation growth room until the stage of plants with 4 pairs of leaves (about 2 inch in height) before transferring to growers' regular nursery

C. Ship tissue culture derived plants to HCGA growers.

Tissue culture plants should be large enough to be kept in the growers' nursery. Acclimated plants will be shipped to participating growers by air.

Timeline

	FY 12	FY 13	FY 14	FY 15
A: Production of tissue culture plants Production of clonal plants from hybrids selected for quality	X	X	X	
B. Grow plants in acclimation nursery		X	X	
C. Ship tissue culture derived plants to HCGA Growers;		X	X	X
Production of clonal plants from leaf rust resistant varieties			X	X

Budget

Personnel: Dan Kuhn, HCGA's President, will act as the administrator for the project and will be responsible for coordinating activities of growers and HARC.

(A) Labor includes .10 FTE of Project leader, tissue culture scientist and .50 FTE of tissue culture technician. The project leader will be responsible for all the tissue culture related work and reports to HCGA for progress as scheduled.

(B) Supplies include tissue culture/ somatic embryo propagation supplies ($3,000) and purchase of Rita semi automatic tissue culture system supplies. Additional supplies and equipment and use of facilities such as autoclave, tissue culture rooms, and coffee seed wet and dry mill will be provided through in-kind support by HARC.

(c)Travel: Inter-Island Travel funds (@$200/trip x 2/year) are requested for the project leader to attend HCA and/ or HCGA meetings. HCA and HCGA will provide ground transportation as needed.

[D]Shipment: Shipment of plants from HARC facility to 4 other islands @$125 x 2/ year/island

In kind contributions:
HARC's tissue culture facility including growth rooms and transfer lab and existing equipment including autoclave and lamilar hoods will be in kind contribution to the project.

Industry Support:
Participating HCGA farms (about 7 locations at Kona, Kau, Oahu, Kauai and Maui) will provide nursery space, irrigation, fertilizers, and weed control as in- kind matching funds.

Item	Yr1	Yr2	Yr3	Yr4	Total
Labor including fringe benefit [A] PI (10%) Technician (50%)	 13,520 26,080	 13,520 27,580	 13,520 27,580	 13,520 27,580	 54,080 108,820
Materials & Supplies[B]	3,000	3,000	3,000	3,000	12,000
Inter Island Travel [C]	400	400	400	400	1,600
Equipment[B]	2,000				2,000
Shipment [D]		500	500	500	1,500
Total	45,000	45,000	45,000	45,000	180,000

Project partners

HCA (Hawaii Coffee Association) and HCGA coffee growers. Dan Kuhn, HCGA's President, and HARC's project leader for tissue culture will jointly oversee the project activities. The progress will be reported quarterly at HCGA meetings.

Sustainability

During the 5 years of the project HARC will provide new tissue culture plants to growers. In return financial support will help to make coffee tissue culture at HARC more productive and allow maintenance of these coffee genetic resources. It will be possible for HARC to continue to provide plants to coffee growers on an individual basis once each grower selects which cultivar(s) performs best for him. Therefore the project will be self sustaining, with individual growers placing orders for plants.

2. Selecting Vegetable Germplasm Adapted to Tropical Organic Farming Systems.

More than 80% percent of Hawaii's food is imported, and the State is thought to have less than a seven day supply of many foods, particularly perishables (Leung and Loke, 2008). Although most experts agree that it is not feasible to eliminate food imports, import substitution has been identified as an important component of food security for these islands.

Beneficiaries

Potential exists for the identification of varieties specifically adapted to tropical, low-input environments which will expand the types of crops available for cultivation by organic farmers. For example, reports of genotype x nitrogen level interactions with respect to yield and nitrogen use efficiency suggest that selection of these traits should be conducted in the target environment (i.e. low nitrogen conditions). The greatest potential for the identification of cultivars specifically adapted to low nitrogen conditions lies in the selection of available germplasm in the target environment employing systematic selection and screening techniques. However, almost all of the work conducted to-date has been with grain crops (Le Gouis et al. 2000; Ortiz-Monasterio et al., 1997), and there is a strong need to develop recommendations for the selection of vegetable varieties for optimal performance under low nitrogen conditions, particularly under tropical conditions. Genotypes that are uniquely adapted to tropical low-input/organic systems have recently been identified as a particularly important priority (Radovich et al., 2009).

Objectives & Outcomes

Select vegetable genotypes that differ significantly in growth parameters and resistance indices will be planted in the field to evaluate relative yield performance under organic and conventional management conditions. The emphasis will be on import replacement. Examples of management strategies for the contrasting systems are given in Table 1. Correlative values between yield performance differences, crop biochemistry and growth parameters and resistance indices will be determined. The strength of these relationships will be evaluated to determine the value of each as a potential marker for performance under low nitrogen conditions.

Table 1

Example of Management of Organic and Conventional Plots for Germplasm Evaluation

Management	Conventional	Organic
Fertility	150 kg•ha^{-1} N as complete fertilizer.	150 kg•ha^{-1} N as compost.
Insect and disease control	As needed with registered pesticides.	As needed with approved organic inputs (i.e. neem, soap etc.).
Weed control	Herbicide	Mulch, manual removal
Other	Per standard conventional practices.	Per USDA National Organic standards.

Timeline

Activity	FY12	FY 13	FY 14	FY 15
Species selection and Screening	X	X		
Field trials		X	X	X
Data Analysis and Publication		X	X	X

Budget

	FY12	FY 13	FY 14	FY 15	Total
Personnel	$35,000	$35,000	$35,000	$35,000	$140,000
Travel (domestic)	$3,000	$6,000	$6,000	$6,000	$21,000
Supplies	$15,000	$12,000	$8,000	$8,000	$43,000
Equipment	$10,000	0	0	0	$10,000
Other	0	$1,000	$1,000	$1,000	$3,000
Total	$63,000	$53,000	$49,000	$49,000	$214,000

Project Partners

Dr. Ted Radovich CTAHR/TPSS
Dr. J.P. Bingham CTAHR/MBBE
Dr. Russell Nagata CTAHR/Hawaii County
Dr. Kevin Crosby Texas A&M

Sustainability

Project is expected to be self-sustaining after 5 years via successful extramural funding leveraged from this project.

3. Coffee Flower Synchronization

CBB (coffee berry borer) has been identified as established in Kona. This pest is considered among the worst threats to the economic viability of coffee growing. The main methods of control are sanitation, pruning, fungal sprays and fruit synchronization.

Flower synchronization is not going to be an immediate solution but it has potentially high economic payback. Research should be initiated on plant regulation mechanisms specifically the activation of genes associated with flowering that build on what is known about drought conditioning for coffee fruit synchronicity.

Research Personnel	$ 30,000
Supplies	$ 8,000
Travel	$ 7,000
Annual Total	$ 45,000

4. PBARC Research

The scientific literature indicates that the fungal entomopathogen *Beauveria bassiana* is the most important natural enemy of coffee berry borer. In studies measuring natural infection levels in the field, mortality levels can be as high as 60%. Dr. Tracie Matsumoto-Brower has found coffee cherries in the Kona district in which all of the beetles inside were dead, apparently due to fungal infection. Identification of the fungus responsible is pending. The Hawaii Department of Agriculture is planning to administer a program involving the importation and testing of commercial quantities of biopesticides containing *Beauveria bassiana* for use in coffee against coffee berry borer. Continued and expanded availability of biopesticides containing this fungus may depend upon documentation of the occurrence of native *Beauveria* strains in and around coffee plantations. PBARC scientists have the prior research experience, skill sets and equipment to document the composition of *Beauveria* strains in the environment, and evaluate whether naturally occurring *Beauveria* or *Beauveria*

spray applications are impacting coffee berry borer populations. Entomogenous nematodes are another natural enemy of coffee berry borer which could be used to control the pest either before or after infested berries fall to the ground. Biopesticides containing *Steinernema carpocapsae* are legal for importation and use in Hawaii, and Dr. Robert Hollingsworth has already carried out research with this nematode species for control of banana moth. Dr. Fernando Vega, an Agricultural Research Service entomologist who is an expert on coffee berry borer believes that the use of nematodes holds promise for Hawaii, and more research is needed. Finally, research on growth regulators to synchronize flowering in coffee is already underway by Dr. Tracie Matsumoto-Brower, and it is imperative to find out to what degree synchronized flowering will reduce coffee berry borer problems by interrupting the life cycle of the pest.

Objectives and Outcomes

(1) Efficacy of *Beauveria bassiana* sprays. Mortality data on coffee berry borer will be collected from intact coffee cherries, and those picked from the ground, in *Beauveria*-treated and areas where no sprays were applied. Berries will be dissected to determine mortality.
(2) Evaluation of *Beauveria* strain composition in coffee plantations and surrounding areas before and after commercial biopesticides are applied. Molecular techniques (PCR analysis, followed by DNA sequencing) will be used to identify strains. Samples will be collected from leaves, berries, coffee berry borers and soil. Results will support regulatory decision making and may identify more virulent strains which can be commercially developed.
(3) Efficacy of entomogenous nematodes (*Steinernema carpocapsae*). Commercially available nematodes will be imported and tested at the standard rate of 1 billion nematodes per acre. Mortality data on coffee berry borer will be collected from intact coffee cherries, and those picked from the ground. Berries will be dissected to determine mortality, and beetles will be dissected to confirm nematode infections.
(4) Growth regulators to synchronize flowering. Cherries will be sampled in treated and untreated areas and dissected to determine the degree to which synchronous fruit production reduces problems with coffee berry borer.

Budget

Item	**Cost (annual)**	**Assumptions**
ARS Post-doctoral scientist, co-supervised by Robert Hollingsworth and Tracie Matsumoto	$75,000	Will be stationed in the Kona district. Duties will include field evaluations of biopesticides and growth regulator effects on coffee berry borer
ARS STEP Student Hire	$10,000	To partially pay the salary of Mariel Mogote, who will be isolating *Beauveria bassiana* from field-collected samples
Travel	$5,000	To cover travel of post-doctoral scientist and occasional overnight stays in west Hawaii island by ARS technicians based in Hilo
Supplies	$15,000	To cover costs of PCR primers, reagents, DNA sequencing services, containers and cages used for experiments with insects
Total	$105,000	

5. Protecting the Hawaiian Coffee Industry Against the Global Fungal Disease, Coffee Leaf Rust

Beneficiaries

This project will result in new, rust-resistant coffee cultivars introduced into the Hawaiian coffee breeding program and new, resistant plants that can be made available to farmers.

Coffee rust disease is caused by the parasitic fungus, *Hemileia vastatrix* Berk. & Br. This fungus attacks the leaves of coffee trees causing severe defoliation, reduction in photosynthesis and consequent loss of vigor and yield of coffee trees. In the areas where it occurs, the disease has resulted in expensive control measures, from attempts to quarantine or eradicate it, to fungicide spray programs and resistance breeding programs (Kushalappa and Eskes, 1989). Today it is found in all coffee growing areas worldwide - except Hawaii (Schenck, 1990).

It is of utmost importance that, if the disease enters the islands, it does not encounter fields of very susceptible trees and spread "like wildfire". But, since the disease does not exist here and researchers are not willing to introduce it even under very controlled conditions, it is impossible at present to inoculate seedlings to select for resistant coffee cultivars.

A coffee breeding program was initiated in 1997 at HARC with the support of the Hawaii Coffee Growers' Association (HCGA) and the State of Hawaii (Nagai et al. 2001). About 1000 progeny were produced and have been maintained from crosses between rust resistant Catimor cultivars T5175, T8667 and Hawaiian cultivars.

Scientists at an international coffee research facility in Portugal, the Instituto de Investigação Cientifica Tropica (IICT), are willing to accept coffee seedlings from Hawaii for testing and screening for resistance to most of the 45 known rust races that they have on hand. The Institute has already released many resistant varieties to several other countries as sources for resistance for breeding.

Objectives and Outcomes

Seeds will be collected from progeny of the HARC crosses. Since it was recently reported that resistance of Catimor varieties at IICT-CIFC was broken by new pathotypes of coffee rust (Varzea et al. 2004), the Catimor parents along with the progeny seedlings will be tested. Import permits will be obtained from Portugal and required treatments to seeds will be made for their safe transport and introduction into that country. They will be sent to Dr. Vítor Várzea at the Instituto de Investigação Cientifica Tropical (IICT)- Centro de Investigação das Ferrugens do Cafeeiro(CIFC), Portugal. The seeds will be germinated in the Institute and grown to suitable size in their greenhouses. Cultures of all known races of *H. vastatrix* are kept at the Institute and will be used to inoculate the seedlings with rust. This will be done under controlled temperature and humidity by placing viable fungal spores on the coffee seedling leaves. Susceptible seedlings will be eliminated and resistant ones will be kept and repropagated to produce disease free seedlings. In this way, Hawaiian cultivars selected for quality and Hawaii's various environments can also be selected for resistance to rust. Promising varieties could then be reimported under strict quarantine conditions and introduced into the Hawaiian farms. Furthermore, the Portuguese institution already has some coffee germplasm available for testing in Hawaii that has proven to be resistant to a spectrum of the *H. vastatrix* races.

Any imported resistant seedlings to Hawaii from this program in Portugal, will be certified disease free. All required state and federal permits regarding import and quarantine procedures will be obtained prior to introduction.

The research project described above will begin yielding results within the first year as the existing progeny maintained from prior funded projects can be tested as soon as shipments can be arranged and screening completed at IICT. Whether the quality would be acceptable to the industry would still need to be determined. Once the marketability of any new cultivar is determined, it will be cloned to increase the new material. We will produce progeny of "proven" rust resistant new varieties and further select the best for cupping quality and rust resistance over the next three years (Yr3-5). Concurrent with selection for superior rust resistant varieties, selection for superior cupping quality with high yield will be pursued.

Timeline

A. Rust resistance evaluation of Catimor based hybrids:
1. Harvest seeds at HARC Kunia Substation: FY 12
2. Rooting of cuttings from cultivars T5175 and T8667: FY 12
3. Ship seeds and cuttings to CIFC, Portugal for rust inoculation (bioassay): FY 13
4. Receive and quarantine resistant seedlings from Portugal: FY 13-FY 14
5. Seedling selection for vigor and bean quality: FY 14-FY 15
6. Back- crossing to Hawaiian varieties: FY 15

B. Identification of resistant progeny by molecular markers:
1. DNA extraction from 500 parent and progeny plants: FY 12
2. Run PCR assays and identify resistant and susceptible progeny by molecular markers associated with rust resistance: FY 12
3. Harvest seeds from resistant plants: FY 13-FY 14
4. Analyze AFLP markers of seedlings. Verify DNA marker based resistance by bioassay at IICA: FY 13-FY 14
5. Analyze progeny of Hybrids between Hawaiian varieties and *liberica* based resistant
6. varieties: FY 15

C: Import of new rust resistant varieties from IICA and produce new hybrids of rust resistance:
1. Import new rust resistant varieties from IICA including *liberica* based genotypes: FY 12
2. Grow plants in DOA quarantine for 12 months :FY 12-FY 13
3. Plant seedlings at field : FY 13
4. Make crosses with Hawaiian varieties FY 14
5. Select seedlings of rust resistant varieties by molecular markers (see B5) :FY 14
6. Collect cherries from field planted rust resistance varieties for cupping evaluation: FY 16

Coffee progeny with durable rust resistance for breeding stock for development of Hawaiian coffee cultivars with both resistance and high cupping quality. After FY 15 evaluation of cupping quality will continue at coffee growers' fields.

Budget

	FY 12	FY 13	FY 14	FY 15	Total
Professional staff: Plant Breeder Plant Pathologist Molecular Biologist 0.1 FTE each Benefits included	28,560	29,425	30,300	30,900	151,285
Field technician .2 FTE, with benefits	9,600	9,880	10,180	10,490	50,850
Lab technician .3 FTE, with benefits	21,840	22,285	22,720	23,410	114,355
Shipping cost	1,000	1,500	1,000	0	3,500
Lab supplies For DNA analysis	5,000	5,000	5,000	4,800	24,400
Field maintenance	10,000	10,000	9,800	9,000	46,800
Greenhouse supplies	900	1,110	900	900	3,810
DOA Quarantine Room usage		200	100		300
Interisland Travel (3 times/year)	600	600		500	2,200
Travel to IICT	2,500	0	0		2,500
Total	$80,000	$80,000	$80,000	$80,000	$400,000

Project Partners

PI: Dr. Chifumi Nagai, HARC , Plant Breeder
CoPI: Dr. Susan Schenck, HARC Plant Pathologist
CoPI Dr. MingLi Wang, HARC Molecular Biologist
CoPI: Dr. Vítor Várzea
Instituto de Investigação Cientifica Tropical(IICT)
Centro de Investigação des Ferrugents do Caffeiro(CIFC:International Coffee Rust Research Center) Quinta do Marqués 2784-505, Oeiras, Portugal

In kind contribution

HARC lab: Standard equipment for molecular biology such as PCR machine, -80C freezer, centrifuge, freeze drier, etc.
HARC Plant pathology lab: microscope, autoclave and other standard equipment for Plant Pathology
HARC Kunia Station: Greenhouse and field space with full irrigation system

Sustainability

To be determined following evaluation of cupping quality in FY 16.

6. Coffee Processing Affects Cup Quality

Objectives and Outcomes

Specialty coffee roasters are currently seeking coffees processed by non-traditional means because these coffees have unusual and complex flavors. There is a poor understanding of how Hawaii coffees respond to varying processing techniques. Research is needed to understand how the organoleptic quality of coffee varies when wet processed/fermented for 14, 24, and 38 hours at various ambient temperatures. Other processing techniques that must be explored are demucilaging, pulped naturals (aka honey process), on the tree raisins, sun and mechanically dried cherry for dry processing.

Budget

Research Personnel	$ 20,000
Supplies	$ 6,000
Travel	$ 4,000
Annual Total	$ 30,000

7. Improvement of food security and reduction of food safety problems

Funds for sensor testing focused on improving inspectors' efficiency with technology capable of controlling shipment temperatures and detecting invasive species and chemical and biological contaminants: Goal is to reduce ever spiraling food inspection and transportation costs, returns and shipment bottlenecks by improving control over food transportation.

FY 12: $50,000 - extended shakedown of current work
FY 13: $100,000 - Expansion phase to cover 3000 pallets of cold chain food in temp/sensing control system
FY 14: $100,000 - Same as year 2
FY 15: $200,000 - Doubling of year 2 and 3 effort - includes evaluation of years 1-3 results
Project: $$450,000 for 4 years
Assumption: Technology is currently available at $35/pallet including GS1 database support.

8. Farm level water and produce testing

Preventing contaminated, locally produced foods from entering the supply chain: Funds to support farm level water and produce testing as a means of providing farmers with the tools to control chemical and biological contaminants. Goal is to enable farmers to better manage critical business processes and move to farm level HACCP.

- Year 1: $35,000 - Testing and lab analysis working with - water only.
- Year 2: $65,000 - Water same as year 1 but with adding chemical testing to some farms
- Year 3: $120,000 - Expansion of testing depending on demand at farm level
- Year 4: $220,000 - Expansion from year 3 - includes evaluation of years 1-3 results
- Year 5: $275,000 - Expansion from year 4
- Project: $715,000 for 5 years -
- Assumption 1: Testing estimated at $55/test for bacteria and $365/test for chemical
- Contaminants.

Assumption 2: HDOA will work with J. Hollyer's group or HFBF trainers.

9. Controlling Seasonal Production and Fruit Quality Problems in Pineapple

The change in the variety of pineapple grown in Hawaii to low-acid hybrids has brought with it, a number of interrelated problems. It has become obvious that the application of growers' production experience with high acid canning varieties does not always have the desired result when applied to the low-acid hybrids. Additionally, the environmental effects have meant that experimental results and commercial practices developed in other production areas have frequently lead to significant cost increases without improvement in fruit yield and quality. Two interrelated problems that are facing the production of high-quality fruit and are greater in low-acid hybrids are natural flowering and fruit translucency.

Natural flowering can reduce average fruit size and yield, spreads the harvesting peak increasing harvest costs, and disrupts fruit marketing. This flowering is tied to short day lengths and ethylene synthesis by the apex. The related problem is fruit translucency and acidity. Fruit induced by natural flowering have a higher incidence of translucency because of the fruit develops at a time when it is more prevalent. Translucency whose symptoms are water soaked flesh, makes the fruit very fragile. Overall losses are approximately 10% of fresh fruit and can exceed 30% during the cool wet season. Fruit loss occurs because the fruit is not either harvested or damaged during shipping. Preliminary results suggest that insufficient calcium and potassium uptake during the middle fruit growth phase make fruit flesh more "leaky" and prone to translucency.

To carry out research based upon initial data that suggests that both plant growth regulators (PGRs) and field management significantly affects the occurrence of natural flowering and translucency. In translucency, both PGRs and fertilization practices play a role. The field research planned will evaluate different application rates and timing of PGRs and fertilizer on the incidence and severity of natural flowering and translucency.

Beneficiaries

Hawaii pineapple industry and consumers by reducing costs and providing a uniform supply of high quality fruit.

Objectives and Outcomes

Losses of fruit from natural flowering has been reported to be upwards of 100% with the new low-acid hybrid varieties at a significant cost to the plantations. Translucency losses of 30 to 40% also occur. Reduction of these losses will increase their profitability and promote the long-term survival of the industry. The expected outputs from this project would be:

* Identify optimum aviglycine application rate and frequency of application
* Identify the nature and extent of fruit deformities caused by aviglycine
* 1-MCP application and 1-MCP-aviglycine protocols to delay flowering
* Effect of Aviglycine on vegetative growth and fruit size.
* Calcium and potassium application on fruit translucency incidence and severity.
* Role of ABA on fruit calcium uptake, and the occurrence and severity of fruit translucency.

Timeline

Objective	Months 0	12	24	36
Objective 1 - Chemical Treatments				
Aviglycine spray applications	---------->			---------->
1-MCP spray applications	---------->			---------->
Aviglycine and 1-MCP flowering evaluation		----->		-------->
Fruit evaluation			---->	--->
Aviglycine on vegetative development and fruit	---------->		---------->	
Objective 2 -Calcium & Potassium Translucency				
1st test installed - Time + Rate application	---------->			
2nd & 3 rd tests installed based on earlier results.		---------->		
Objective 4 ABA and Fruit Translucency				
1st test installed - Time of application		---------->		
2nd & 3rd tests evaluated, rate and time application			---------->	

Budget

	Year 1	Year 2	Year 3
Personnel costs including fringe benefits	$ 83,305	$ 83,305	$ 83,305
Travel to Maui	$ 800	$ 800	$ 800
Materials & Supplies Includes truck rental	$ 6,000	$ 5,000	$ 5,000
TOTAL	$ 90,105	$ 89,105	$ 89,105

In-Kind Contribution

Dole has in the past provided the fields for the research proposed in this project, at no cost to the project. The loss of income associate with field trials runs about 700 fruit or 70 cartons at $15 per carton $1050 per 1,000 sf of trial for each trial the total in-kind contribution is about $17,000. This in-kind contribution does not include management costs associated with ensuring that the trial plots are treated as a special area and managed differently from the rest of the block. Similar in-kind costs are expected for our Maui collaborator.

Project Partners

Dole Foods Company and Hali'imaile Pineapple Company Limited are the two major partners.

Sustainability

Implementation of positive research findings will be self-sustaining after 5 years.

10. Sustainable Tropical Vegetable Production Systems and Community Well-Being

Hawaii and Pacific Island Territories are highly dependent on imported foodstuffs that, in addition to creating a large carbon footprint, can result in reduced food security due to natural disaster or labor disputes. This reliance has marginalized the importance of agriculture in these islands and has adversely shifted the diet of the native populations, resulting in a disproportionate incidence of diet-related illnesses within these communities.

Greater vegetable production and consumption within the context of diets based on staple root crops and vegetables is one of the most effective means of improving community health and nutrition, but the availability of vegetables is often very limited. The cultivation and germplasm of vegetables is being lost, there is a low diversity of vegetables being grown on many islands and production is wholly dependent on imported seeds. Therefore, opportunities for cash income from vegetable production and trade need to be developed to help service local and tourism-derived needs and capacity strengthening is required to make these interventions sustainable. This project provides an integrated approach to tackle these problems.

Beneficiaries

The primary beneficiaries will be Hawaii small vegetable farmers and consumers. Consumers will benefit by have a regular supply of vegetable sustainable grown in Hawaii.

Food security includes three major dimensions: (1) Availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports; (2) Access by households and individuals to adequate resources to acquire appropriate foods for a nutritious diet; and, (3) Utilization of food through adequate diet, water, sanitation, and health care. This project will focus on all three dimensions. CTAHR will be the linchpin to involve communities in developing sustainable cropping systems and increase the availability of locally produced nutritious. Most farms in the tropics are small and frequently disadvantaged. These small farmers need to cope with additional crop management stresses not common in subtropical and temperate agriculture. These stresses include year round insect and disease pressure, variable soils often highly weathered, variable water availability and high cost of imported inputs. Weather conditions may also be harsh including excessive rain, high humidity, salt laden winds and drought-- all of which can combine to make the production environment of vegetable crops difficult and thus marketable yields are lower and more irregular.

Objectives and Outcomes

This project will have the following attainable and measurable outcomes for enhanced food security with increased rural and urban well-being: sustainable integrated tropical cropping systems, optimal land use, improved environmental quality, reduced pesticide use, increased competitive advantages, enhanced output, better import substitutions, increased profitability, increased consumer satisfaction, improved quality, improved food security, and empowered disadvantaged communities with greater self-reliance. Knowledge gained from tropical crop production systems in Hawaii has direct global relevance to other tropical communities.

An educational component will involve the development and implementation of appropriate production and wellness training from small farms through to disadvantaged consumers. These include stimulating interest and training of young farmers, working with educators to expand the 'Aina in the Schools' program for Oahu schools through the Urban Garden Center, and local K-12 schools. The project will also involve the current Hawaii food and nutrition programs (EFNEP & SNAP-Ed) that teaches food skills to limited resource populations, and facilitates consumer foods and nutrition education and integrated with 4H programs.

Increase the local production of tropical vegetables and fruits and to encourage the development of local, sustainable agriculture through established educational programs.

1. Improved varieties of tomato, pepper, cucumber, pumpkin and leafy crucifers adopted by local farmers in Hawaii.
2. Reduced reliance on on-farm inputs for pest and disease control in these communities.
3. Increased consumption by community members of locally grown vegetables with high phytonutrient content.
4. Data from trials will be published on-line, as extension bulletins and as refereed journal articles.
5. Building on current school, university extension and community programs. Through coaching sessions, demonstration sites, and field days, an expanded network of agricultural educators will be trained to teach others how to grow and sustainably maintain food crops.
6. Expanded availability of information in basic sustainable pest control methods for a large variety of marketable fruits and vegetables adapted to Hawaii.
7. Greater number of NRCS, CES and non-traditional agricultural educators.
8. To equip master gardeners, agriculture teachers at community colleges and high schools and nonprofits who are equipped with science-based information and hands-on experience.
9. Posters and other Eat-Your-Colors materials will be distributed to local K-12 schools.

Timeline

	FY 12	FY 13	FY 14
Objective 1. Vegetable Varietal Evaluation	----------	---------->	
Objective 2. Vegetable production practices	----------	----------	------>
Objective 3. Pesticide use reduction	----------	----------	---------->
Objective 4. Educational material development	------	----------	---------->
Objective 5. Educational outreach		-------	---------->

Budget

	FY 12	FY 13	FY 14
Personnel costs including fringe benefits	$ 85,000	$ 85,000	$ 85,000
Travel	$ 1,500	$ 1,500	$ 1,500
Materials & Supplies Includes truck rental	$ 15,000	$ 15,000	$ 15,000
Other - truck rental	$ 5,000	$ 5,000	$ 5,000
TOTAL	$ 106,500	$ 106,500	$ 106,500

Project Partners

Project partners would include public programs (CES, NRCS) and other organizations (AVRDC, Pacific Gateway Center, Kohala Center) to engage key stakeholder groups (Hawaii Farm Bureau Federation, Hawaii Organic Farmers Association) and individual stakeholders (especially immigrant farmers). These collaborators will coordinate participatory appraisal among stakeholders to characterize project locations in Hawaii in terms of vegetables/fruits commonly grown, dietary preferences, soil types, seed systems, climate, etc.

Sustainability

Project will be self-sustaining after 5 years.

11. Taro Acridity: Development of a Quantitative Assay for Use in Plant Breeding and Food Processing

Taro and other edible *Aroids* are a major staple food of about 500 million people. However, the leaves and corms of taro and other edible *Aroids* are acrid. As a result, when eaten without cooking, symptoms of itchiness, pain, and swelling of lips, mouth, and throat occur. The stumbling block to research and the lack of success in determining the nature of this acridity in taro is the absence of a chemical or molecular assay. The current bioassays requires human volunteers to place a sample on their forearm or to eat possibly acrid materials. This bioassay severely limits the number of samples that can be evaluated. The problem is compounded by apparent instability of the acridity factor when isolated.

Project Beneficiaries

Hawaii taro industry and consumers by reducing processing costs and providing a uniform supply of high quality taro products. Providing a tool to quickly assay for acridity.

Objectives and Outcomes

We have evidence that the acridity is due to a protein on the surface of the raphides. The raphide-associated proteins will be separated using 2D gel electrophoresis and selected proteins sequenced. The amino acid sequences will be used to isolate full-length cDNA clones. Selected cDNAs will be expressed in *E. coli* to obtain sufficient protein to further test the selected protein's acridity. PCR-based and antibody diagnostic will be developed as potential assays. The assays will be evaluated on samples from taro that differ in acridity and during corm processing.

The knowledge generated can be used to select material for lower acridity in a breeding program developing varieties with desired disease resistance and agronomic characters. The assay can also be used to ensure that taro products are only cooked sufficiently to inactivate the acridity thus saving energy and preserving quality.

To carry out research identified by plant breeders, extension agents, growers and food processors.

The goal of the proposed integrated project is to develop an assay for acridity in Aroids and other species and show that this assay can be used commercially. The availability of the assay will assist plant breeders and biotechnologists in developing varieties with reduced acridity and allow food industry processors to ensure that acridity is destroyed with a minimum of processing. The benefits would be to improve taros' and other acrid species' potential as crops on small farms, to improve quality and human nutrition for customers. The anticipated results and outcomes from this objective are:

- An assay based upon unique amino acid sequence data that shows significant antigenicity and for which antibodies can be produced
- Antibodies will be produced for the selected proteins
- PCR primers will be a potential assay for acridity
- Antibodies will be useful acridity assay tool

Timeline

	FY 12	FY 13	FY 14
Objective 1. Separate Raphide Proteins	----------	------->	
Extraction of raphides	---->		
2D gel electrophoresis	---------->		
Raphide unique spots identified	---------->		
Mass Mapping - peptide sequencing	---------->		
BLASTp protein prediction	-------	------>	
Antigenicity determination	-----	--------->	
Objective 2. Antibodies & PCR Assays	----------	----------	------>
Antibody production	----------	------->	
Protein blotting	------	---------->	
Expression in *E. coli*	---	---------->	
Sequencing of selected cDNAs	------	---------->	---------->
cDNA library construction	------	---------->	
Primer construction and screening	--	---------->	
Bioassay of acridity - PCR & Antibodies		----------	------>
Objective 3. Commercial testing		----------	---------->
Evaluation during poi processing		---------->	
Evaluation of speciality taro products		-------	---------->

Budget

	FY 12	FY 13	FY 14
Personnel costs including fringe benefits	$ 72,000	$ 72,000	$ 72,000
Travel to Maui	$ 0	$ 800	$ 800
Contractual	$ 0	$ 0	$ 0
Materials & Supplies Includes truck rental	$ 11,600	$ 9,300	$ 9,300
Equipment	$ 9,500	$ 0	$ 0
Other	$ 0	$ 0	$ 0
TOTAL	$ 93,100	$ 82,100	$ 82,100

In-Kind Contribution

Admittance to commercial processing plants to allow sampling of products to check validity of the acridity assay.

Project Partners

HPC Foods, Ltd. and Maui Taro Company are the two major potential partners.

Sustainability

Project will be self-sustaining after 5 years.

12. Microbial And Pesticide Concerns With Leafy Vegetables Grown By Small Farmers In Hawaii.

In 2007, Hawaii had 7,521 farms. This number includes animal ranches, flower nurseries, commercial seed farms, and orchard crops such as macadamia nut and coffee, and produce crops (lettuce, basil, taro, ginger, etc.). At least 1,200 (possibly as high as 4,000) of these farms grow food crops that are of potential concern when it comes to on-farm food safety. Nearly 40 of the at least 1,200 small farms have been coached and passed a third-party audit in the past two years. In our direct experience, included in the potential risk factors on many of Hawaii's produce farms are those found on a GAP audit and range from the lack of toilet facilities and hand wash sinks for employees, to pathogen-contaminated irrigation and produce wash water, and, inadequate or no recording keeping.

In Hawaii, one of the largest growing populations of farmers and the largest growth in acreage is coming from Traditionally Underserved Farmers (TUF). Unfortunately, the news coverage of on-farm food safety does not often reach TUF who are non-English speakers, do not read newspapers, or do not have access to or do not use the Internet to look for such information. For many growers in Hawaii, even the non-ethnic farmers, it is simply not a high priority issue as they try to survive economically. To add to this, with Hawaii's geographical isolation, we do not have the same commercial peer pressure that might come from growers in the state next door. Thus, many Hawaii growers are simply unaware of the reasons, risks and solutions to food-borne problems that could very well be originating on their farms. This lack of knowledge clearly puts many Hawaii small growers at a disadvantage when compared to the hundreds of larger more organized growers in California and Arizona who have signed onto Western Growers Association's (WGA) new, Leafy Greens Good Agricultural Practices (GAP), requirements that may become the *de facto* standard for commercial produce production in the United States.

Beneficiaries

Residents: The Asian population in Hawaii (~ 55%) is by far the highest in the nation. This population's diet includes a high component of green leafy vegetable by comparison with the mainland (Hawaii Department of Business and Economic Development, 2008a). And, with the Hawaii State Government and the HFBF pushing consumers to Buy Fresh / Buy Local, making sure that produce is safe has a great deal of value to Hawaii's 1,283,400 residents.
Visitors: Being out of compliance with the voluntary GAP standards also puts Hawaii's multibillion dollar visitor economy at risk. Hawaii's tourism-based economy is very sensitive to media reports and disasters, especially if the visitors are coming from Asia. Hawaii's multibillion dollar visitor economy hosts more than five million visitors each year and there is currently a significant push by the HFBF and the HDOA to encourage residents as well as visitors, and now restaurateurs, to Buy Fresh / Buy Local. Locally-grown produce must be as safe if we are to protect Hawaii's fragile visitor economy. According to the HDOH, Hawaii has had a number of food-borne illness cases, though it is unclear/unknown how many are directly attributable to Hawaii-grown produce.

As communities embrace the notion of buying "local" there has been, an increase in farmers markets in Hawaii. In the past five years, the Hawaii Farm Bureau Federation (HFBF) has created a number of new markets; the most visible is near Waikiki beaches that attracts thousands of local buyers and tourists each Saturday morning. These markets, as it turns out, are also somewhat of a concern to us because there are currently no best practices for this type of sales methodology. Most of the new growers have no understanding of GAP and Good Handling Practices (GHP) and are not typical clients of the University of Hawaii's Cooperative Extension Service (UH-CES).

Hawaii growers are primarily using non-potable water (29%) and municipal water (26%) as

their source of irrigation water. Other sources of irrigation water include recycled water and rainwater. The majority of growers completing the water-use survey are also producing multiple crops, including tomatoes, cucumbers, and eggplant (~ 23%), followed by lettuce and leafy greens (~ 22%), and leafy crucifers (~ 20%). In Hawaii where year-round production occurs; potential contaminating each crop is a very real threat. The situation would be made worse if the grower was unaware that his field was contaminated.

Hawaii's tropical climate allows year-round crop production which for vegetables could be four or five crops per year; however, the major constraint is year-round pest pressure. This pest pressure can require growers to spray organophosphates or carbamates almost weekly. Growers who have a poor understanding of pest control often over-spraying, and pesticides are seen as a quick fix to the problem. Immigrant farmers used pesticides even though they have very limited knowledge of identifying pests, and are unable to read pesticide labels.

Objectives and Outcomes

The purpose of this multidisciplinary collaboration effort between applied research and outreach professionals is to reduce microbial and pesticide risks of leafy vegetables from production through marketing, to the retail level. This integrated will quantify the type and levels of microbial and pesticide contamination and an outreach component to provide information and training so that producers, wholesalers and retailers are able to recognize production and marketing risks and minimize them. In addition, the applied research will evaluate rapid assays for pesticide residues found on fresh leafy and fruit vegetables which can be utilized in the market chain to assist growers to meet market needs' for safe products.

To carry out research to 1. Determine the type and level of the microbial contamination on the farm, in the packing shed and during marketing and retailing. The potential sources of contamination to be evaluated include: irrigation water, wildlife, fertilizer and compost, postharvest washing, preparation and packing, worker hygiene and health. 2. Determine the extent and type of pesticide residues found on Hawaii vegetables produced by small growers, and the utility of the rapid pesticide bioassay during production and postharvest and at the wholesale/retail levels as a rapid screening technique. 3. Define, develop and communicate microbial and pesticide hazard practices that can result in contamination by developing extension material based upon the results of the applied research in Objectives 1 and 2 for farm, wholesale and retail via workshops, individual contacts, field days and written and video materials in various languages.

- Research data on the microbial profile of local leafy vegetables found in Hawaii's markets;
- Evaluation of the changes in the profiles and level of microbial contamination at different points in the chain from the field to the consumer;
- Variation in microbial profile on leafy vegetables thought-out the year will be quantified;
- Sources of contamination from the field through to the consumers' sales point will be determined;
- An evaluation of the microbial contamination on leafy vegetables sold to consumers;
- Analysis of potential control points where efforts need to be increased to improve microbial food safety through better application of GAP and GHP;
- The applied real-world research planned in this proposal on microbial will give us a significant;
- Determination of the effectiveness of the rapid pesticide tests system as a screening method for locally grown produce arriving at wholesalers and retailers including farmers' markets and Chinatown stalls;
- Quantitative data on the occurrence of pesticide residues on selected leafy vegetables on locally grown products;
- The chemical profile and amount of pesticide detected that read positive on the rapid pesticide tests assay;

• Risk data as to the source of potential pesticide residues where extension outreach activity is needed to minimize this risk and provide a safer product to consumers;
• We will transform at least 20 traditionally underserved farmers statewide to GAP users each year;
• Each grower will have considerably more knowledge about why their farm was creating a risk and what they need to do to remove that risk, and to maintain a low-risk business;
• Each business we transform will be able to hold onto their existing market, if not grow their market share as a result of our coaching;
• While it will be difficult to quantify what the reduction in the risk factor to Hawaii agriculture or a specific consumer for each farm that successfully passes their third party audit, we know that tainted food from even one farm or unhealthy employees can result in deaths, losses to the particular operation, and severe impact on the commodity in the area that the crop is grown;
• Each successful coaching client will be in a better position to avail themselves of U.S. Federal programs such as SARE;
• The number of farmers who begin and who stay with the process, paying particular attention to the stages at which people may choose to leave the training;
• Anecdotal comments and conversations with farmers will be used as an evaluation tool;
• Demographic data on the traditionally underserved farmers served will be collected;
• After the participant has passed the on-farm food safety audit, the farmer will be asked to evaluate this training program with a survey designed to rate the program on a variety of parameters, including the quality and value of the information, the coaches, the educational materials, as well as other aspects of the program. These evaluations will be used to review and assess each phase of the project, both to build on the strengths, and to identify areas that need to be improved.

Timeline

Objectives 1 - Microbial	FY 12				FY 13				FY 14			
Sampling at consumer outlets.	■		■		■		■		■		■	
Selecting farmers and wholesalers	■	■										
Sampling from Farm to Sale		■	■	■	■	■	■	■	■	■		
Sample processing		■	■	■	■	■	■	■	■	■	■	
Microbial analysis		■	■	■	■	■	■	■	■	■	■	
Analysis of data		■	■	■	■	■	■	■	■	■	■	
Report update preparation			■	■	■	■	■	■	■	■	■	■
Objective 2 - Pesticides												
Sampling at consumer outlets.			■		■		■		■		■	
Sample processing			■		■		■		■		■	
RBPR analysis			■		■		■		■		■	
Analysis of data			■		■		■		■		■	■
Multiresidue pesticide analysis			■		■		■		■		■	■
Report preparation			■		■		■		■		■	■
Objective 3 - Outreach												
Translate Materials	■	■	■	■	■	■	■	■	■	■	■	■
Network Establishment	■	■	■	■	■	■	■	■	■	■	■	■
Product Safety Guidelines	■											
Coaching	■	■	■	■	■	■	■	■	■	■	■	■
Evaluation				■				■				■

Budget

	FY 12	FY 13	FY 14
Personnel costs including fringe benefits	$ 115,000	$ 115,000	$ 115,000
Travel to Maui	$ 5,500	$ 5,500	$ 5,500
Contractual	$ 0	$ 0	$ 0
Materials & Supplies Includes truck rental	$ 12,000	$ 12,000	$ 12,000
Equipment	$ 12,000	$ 0	$ 0
TOTAL	$ 144,500	$ 132,500	$ 132,500

Project Partners

Potential partners include Hawaii DOA, Hawaii Farm Bureau and Hawaii Organic Farmers Association and vegetable wholesalers.

Sustainability

Project will be self-sustaining after 5 years.

13. Developing a Profitable Hawaii Grown Tea Industry

Tea drinking started in China almost five thousand years ago. Today, after water, tea is the most widely consumed drink in the world. The Dutch Eastern India Company first imported green tea into Europe in 1610. The Dutch brought the teas to New Amsterdam, its colony in America in 1650, earlier than tea's introduction to England. Consumption of tea in America dropped drastically after the Boston Tea Party started the revolt against British taxation on tea import. The heavy tea tax had prompted Americans to switch to coffee drinking as an expression of freedom. The impact still exists today: U.S. per capita consumption of tea is just 0.2 kg, and more than 4 kg of coffee. In comparison, per capita consumption of tea is 2.3 Kg, and 2.4 kg of coffee for U.K. In an increasingly obese population, promoting healthy living is currently being emphasized. Tea contains less than half of the caffeine in coffee, and is packed with cancer preventing antioxidants, and other vitamins and minerals. Tea drinking is gradually become an important part of a healthy life style. Tea sells by the ounce and coffee sells by the pound. Therefore, tea is an ideal crop for Hawaii because it uses less input and generates more output. Production of tea uses less energy, water, and labor than coffee. Tea is much lighter, thus, cost much less to ship. Potentially, tea can exceed coffee in sales, and can contribute significantly in tax revenues to the state.

Camellia sinesis was first introduced to Hawaii in 1887. The Hawaiian Coffee and Tea Co. established a five-acre plantation in Kona in 1892, but it was eventually abandoned due to economic reasons. Interest revived in the 1960s when researchers planted several tea selections. A small planting was established at the UH CTAHR Waiakea Research Station by Dr. Philip Ito. These plants are a mixed population of big leaf type. CTAHR's Dr. Yoneo Sagawa imported four tea cultivars from Japan in 1978, and established them at the UH Lyon Arboretum on Oahu. Alexander & Baldwin, C. Brewer, and Amfac investigated the potential of tea as a commodity and conducted test plantings on all four major islands. A&B even formed a partnership with the Thomas J Lipton Company and did field trials between 1984 and 1994. They concluded that the high cost of production in Hawaii and low world market prices made this crop unprofitable for Hawaii. In 1993, John Cross planted an acre of tea, two big leaf hybrids he selected from an earlier C Brewer trial planting of 180 clones, on his farm in Hakalau on the Hamakua Coast. Additional cultivars were obtained from Taiwan and Japan in

1999. A germplasm collection was established in CTAHR's Volcano Research Station, and later expanded to the Mealani Research Station in Waimea. It has been almost 20 years since Camellia sinensis tea was reintroduced to Hawaii's farming community. During this past decade of tea farming and production practices we here in Hawaii have utilized a small-scale approach. Farmers have used this period to select specific tea cultivars that best serve production yield and establish product viability. Many farms have developed skills in cultivation and product development creating hand harvested, hand processed whole leaf teas. These farms now offer Hawaii an invaluable resource of acquired information on plant growth, cultivation practices and specialty crop tea products while providing constant refinements on methodologies to analyze present yields and processing needed to stay competitive for the rising demand of specialty teas world wide.

Hawaii is one of three states in the U.S. currently growing tea. South Carolina has one farm growing tea (Charleston), and Washington has one farm growing tea. California will have one tea farm planted soon. There are no official statistics to track the number of tea growers or acreage planted. However, based on the tea cutting distributions by the College of Tropical Agriculture and Human Resource, UH Manoa, USDA Pacific Basin Agriculture Research Center, and the Hawaii Tea Society, we estimate more than 100 small farms are growing tea currently. More than a dozen tea farms are selling locally grown and processed teas this year. As more tea plants become mature and productive in the next several years, sales will increase rapidly.

The critical need for an emerging Hawaii tea industry now is to establish an international reputation of premium quality teas. To reach this goal, we must establish regular tea evaluation sessions to ensure continued improvement in cupping quality of locally produced teas. We need to submit our top quality teas to international tea competitions. Winning in the international tea competitions will build our reputation among the international tea community, and enhance the marketability of Hawaii produced teas.

It is our vision to formulate our own tea cultural heritage for a Hawaii tea industry. Over the last two years marketing research and product evaluations conducted by industry professionals have concluded that Hawaii grown tea is a unique product representing a new place of origin as a domestic leader participating in world tea. Successful niche marketing of Hawaii grown tea has enabled Hawaii tea producers to form business opportunities that are economically viable, sustaining production output and expansion. To date Hawaii has established America's first generation of Hawaii grown Camellia sinensis tea farms.

Within the United States there is one tea industry trade show and conference called the World Tea Expo (WTE) that takes place once a year. In 2010, the WTE was held June 11th - 13th, 2010.
http://www.worldteaexpo.com/index.php?option=com_content&view=category&layout=blog&id=71&Itemid=58
The World Tea Expo will facilitate Hawaii's delegation in reaching the goal of a high profile presence in the world tea industry, and to educate the American public that has recently become Hawaii's consumer base, through networking and quality marketability.

With partial support from the HDOA's Matching Marketing Funds, a delegation of four Hawaii tea growers attended the 2010 World Tea Expo in Las Vegas. Products from the following seven Hawaii tea growers were displayed at the Expo:
Kimberly Ino – Hawaii grown tea producer, Hawaii County – Mauna Kea Tea
Mike Riley – Hawaii grown tea producer, Hawaii County– Volcano Tea Garden
John Cross – Hawaii grown tea producer, Hawaii County – Johnny's Tea Garden
Eva Lee – Hawaii grown tea producer, Hawaii County – Tea Hawaii & Company
Michelle Rose – Hawaii grown tea producer, Kauai County - Cloud Water Farm
Liam Ball – Hawaii grown tea producer, Maui County –Naliko Tea

Alex Wood – Hawaii grown tea producer, Hawaii County – Volcano Winery & Tea
Collectively these Hawaii farms represent 50% of what is presently in commercial production. At this stage 10 acres of Hawaii grown tea is producing 100 lbs per acre (1000 lbs/10 acres) a year marketed at $160 per lb, generating a total revenue of $160,000 at the wholesale level. The retail price is three to four times the wholesale price.

Present Hawaii production of 100 lbs per acre is based on the hand processing methods these producers use. Their farms presently have the capability to provide enough yield to produce 300 lbs per acre. Each farm is expanding with machine assist production in the near future. Many newly planted tea farms will be ready to process and market their products in the next several years.

Eva Lee of Hawaii Tea & Company was an invited speaker at the 2010 World Tea Expo. Lee spoke on "Hawaii Grown Tea – Why is it so important". She gave a presentation on the history of the agricultural community involved in Hawaii tea farming, ongoing tea research conducted by CTAHR and the significant role that the Hawaii tea culture plays in America's popular culture. Attendees came from all over the globe. There were industry businesses from USA, Europe and Asia, retail consumers, researchers, scientists, media and visitor industry professionals, and tea growers from China, Japan, Taiwan, India, Malawi, India, Indonesia, Sri Lanka, Korea, Viet Nam and more.

Now that Hawaii has established itself as the leading domestic producer of fine tea, interest from consumer groups, tea associations, retailers, industry professionals, and foreign research institutions of tea producing countries continue to call upon us for updates on our progress in order to provide them with current developments on Hawaii grown tea.

Objectives and Outcomes

Therefore, we propose:

- To organize and conduct Hawaii Tea Cupping Workshops.
- To conduct an annual Hawaii Grown Tea Competition. Three internationally reputable cuppers will be invited to Hawaii as judges.
- To submit teas from our annual competition to the North American Tea Championship.
- To send a Hawaii tea delegation comprised of the winners from the annual cupping competition to attend the World Tea Expo.

This project is dedicated to improving and expanding the production of Hawaii Grown brands of Camellia sinensis tea and to increase the popularity and availability of this product.

CTAHR has invested many resources in our efforts to establish a viable tea industry in Hawaii. The collaborations between Dr. Francis Zee and CTAHR faculty (Dwight Sato, Stuart Nakamoto, Randy Hamasaki, and Milton Yamasaki) and Eva Lee of the Hawaii Tea Society, have helped to lay a strong foundation in educating the Hawaii tea farming community based on the island of Hawaii, and now statewide.

Unfortunately, with the budget cuts in the last several years, and through faculty retirements, we have lost several faculty members who were active members of our tea group. To move Hawaii tea to the next level will need additional investments which CTAHR does not have. Funding for this project will help launch the Hawaii tea industry onto the world tea stage.

The budget includes support for one half-time staff person to manage the project. The budget also requests support for the expenses associated with bringing in six international professional cuppers to conduct three cupping workshops and one cupping competition each

year. Consultation fees are needed to secure the service of world class professional cuppers. The budget also requests support for the expenses associated with sending a five-member delegation comprised of one staff and four tea growers to the annual World Tea Expo. One laptop computer and associated software are required for workshops and competition use. A booth rental fee at the World Tea Expo is a required expense for this project. Professional grade tea cupping sets, water heaters, thermometers, timers, and trays are also needed for the cupping competitions and workshops and space rentals will be needed for the competitions and cupping workshops.

Measurable outcomes

- Increased number of participants in the Hawaii Grown Tea Cupping Workshops;
- Increased entries in the annual Hawaii Grown Tea Competition;
- Improved average scores in cupping evaluations;
- Increased number of winners in the North American Tea Championship
- Competition;
- Increased sales of Hawaii grown teas.

Beneficiaries

Hawaii tea growers are capable of growing the best tea plants in the world. However, we have a lot to learn in producing the best teas in the world. Bringing in world class professional tea cuppers to evaluate the Hawaii grown teas will enable local tea growers to improve their processing skills in a short period of time. Continuing to increase the quality of Hawaii grown teas is paramount to the premium price Hawaii teas can and should command. These international tea experts will be exposed to the fine Hawaii grown teas and will serve as our ambassadors to the tea world. We anticipate that valuable free publicity will be generated from their visits to Hawaii.

The impact of the Expo booth presence of the Hawaii delegation of tea producers will result in a heightened awareness for a constructive dialog to take place amongst the Hawaii tea producers and the public. The Hawaii delegation will educate the public, form business relations, market tea and tea related products and network with visitor industry professionals to include Hawaii agro-tourism activities. The Hawaii delegation booth will provide the public with taste sampling of Hawaii grown white, green, oolong and black teas and other value added tea products. It will have on display images of Hawaii tea farms, brochures, handouts, cards and promotional materials. It will conduct a survey during the Expo/Conference to analyze how important is domestically produced Hawaii grown tea for today's consumer.

The outcome of a Hawaii delegation participating at the World Tea Expo will result in increased sales of Hawaii Grown tea from farms representing three Hawaii counties sustaining increased production in tea farming.

Timeline

2011
March
Conduct first Hawaii Tea Cupping Workshop.

June
Delegation travel to World Tea Expo held in Las Vegas. Set up booth display, and engage in exhibition event activities.
Conduct second Hawaii Tea Cupping Workshop.
Conduct first Hawaii Tea Cupping Competition.

July
Submit Hawaii Grown Teas to the North American Tea Championship competition.

September
Conduct third Hawaii Tea Cupping Workshop.

December
Conduct second Hawaii Tea Cupping Competition.
File first progress report.

2012

February
Submit Hawaii Grown Teas to the North American Tea Championship competition.

March
Conduct fourth Hawaii Tea Cupping Workshop.

June
Delegation travel to World Tea Expo held in Las Vegas. Set up booth display, and engage in exhibition event activities.
Conduct fifth Hawaii Tea Cupping Workshop.
Conduct third Hawaii Tea Cupping Competition.

July
Submit Hawaii Grown Teas to the North American Tea Championship competition.

September
Conduct sixth Hawaii Tea Cupping Workshop.

December
Conduct fourth Hawaii Tea Cupping Competition.
File second progress report.

2013

February
Submit Hawaii Grown Teas to the North American Tea Championship competition.

March
Conduct seventh Hawaii Tea Cupping Workshop.

June
Delegation travel to World Tea Expo held in Las Vegas. Set up booth display, and engage in exhibition event activities.
Conduct eighth Hawaii Tea Cupping Workshop.
Conduct fifth Hawaii Tea Cupping Competition.

July
Submit Hawaii Grown Teas to the North American Tea Championship competition.

September
Conduct ninth Hawaii Tea Cupping Workshop.

December
Conduct sixth Hawaii Tea Cupping Competition.
File third progress report.

2014

February
Submit Hawaii Grown Teas to the North American Tea Championship competition.

March
Conduct tenth Hawaii Tea Cupping Workshop.

June
Delegation travel to World Tea Expo held in Las Vegas. Set up booth display, and engage in exhibition event activities.
Conduct eleventh Hawaii Tea Cupping Workshop.
Conduct seventh Hawaii Tea Cupping Competition.

July
Submit Hawaii Grown Teas to the North American Tea Championship competition.

September
Conduct twelfth Hawaii Tea Cupping Workshop.

December
Conduct eighth Hawaii Tea Cupping Competition.
File fourth progress report.

2015

February
Submit Hawaii Grown Teas to the North American Tea Championship competition.

March
Conduct thirteenth Hawaii Tea Cupping Workshop.

June
Delegation travel to World Tea Expo held in Las Vegas. Set up booth display, and engage in exhibition event activities.
Conduct fourteenth Hawaii Tea Cupping Workshop.
Conduct ninth Hawaii Tea Cupping Competition.

July
Submit Hawaii Grown Teas to the North American Tea Championship competition.

September
Conduct fifteenth Hawaii Tea Cupping Workshop (last workshop supported by this grant)

December
Conduct tenth Hawaii Tea Cupping Competition (last competition supported by this grant).
File final report.

Budget

Personnel costs including fringe benefits: $41,104; $43,654; $45,207; $47,468; $49,842.
Travel: $50,000; $52,500; $55.125; $57,882; $60,776
Contractual (consultant fees): $6.000; $7,500; $7,500; $8,000; $8,000
Materials & Supplies: $6,000; $5,000; $5,000; $5,000; $5,000
Equipment: $3,000; $0; $0; $0; $0
Other (Space rentals): $8,500; $9,000; $9,500; $10,000; $11,000
Total: $114,504; $117,654; $122,332; $128,350; $134,618

Eva Lee of Hawaii Tea & Company will serve as an industry liaison to assist in identifying professional cuppers to serve as evaluation judges, and workshop hosts.

Hawaii Tea Society will assist in setting up workshops and competitions, as well as distributing announcements to its members.

Sustainability

It is anticipated that there will be sufficient tea growers generating enough income to afford their attendance at the annual World Tea Expo, and submitting their teas for international competition at the Expo.

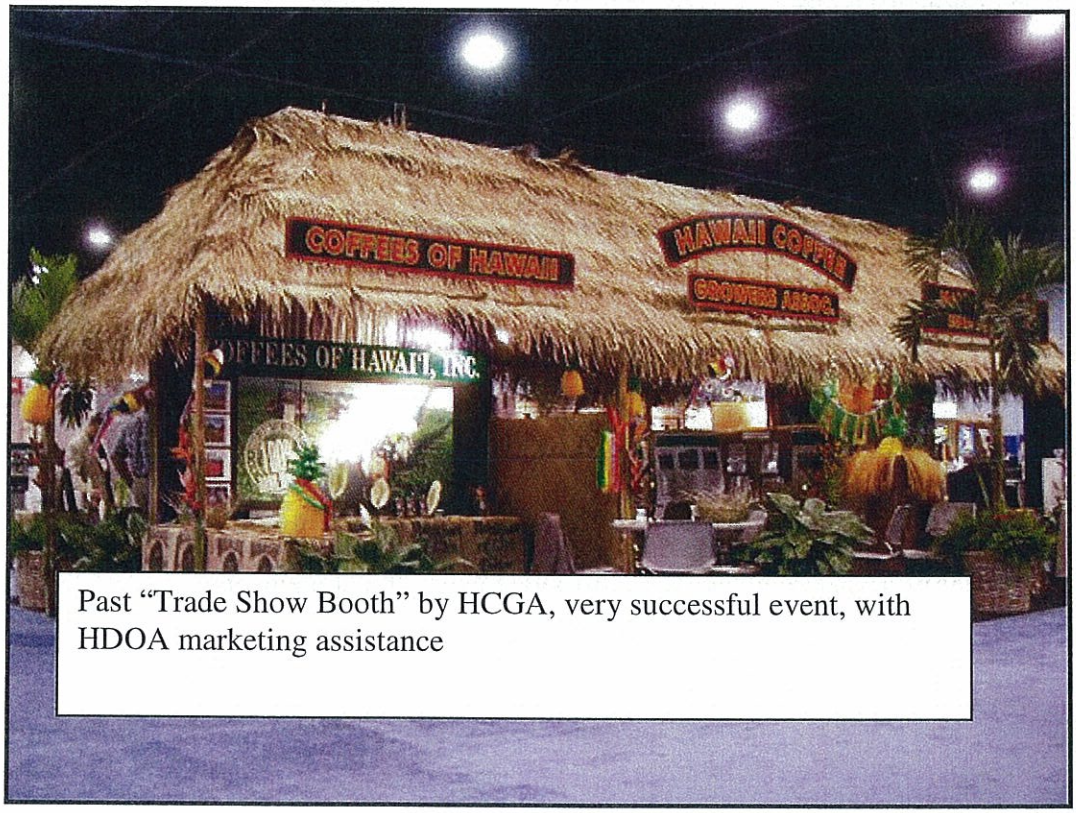
Project Director:

Dr. Ching Yuan Hu
Associate Dean for Research
College of Tropical Agriculture and Human Resources
University of Hawaii at Manoa
3050Maile Way, Gilmore Hall 202
Honolulu, HI 96822-2279
Phone: 808-956-9585
Fax: 808-956-9105
Email: chinghu@hawaii.edu

14. Hawaii Coffee Growers Association Trade Shows

The Hawaii Coffee Growers Association (HCGA) was formed in the late 1980's and represents approximately 70% of the producing acreage within the State of Hawaii. The members come from many separate farms with at least one member from each island that produces coffee. There is a real need to have a better way to market Hawaiian coffees worldwide.

To better compete in the world green coffee market; Hawaii needs to be visible at international and domestic trade shows. Most areas of the world that produce coffee are supported by their national government (e.g. Columbia, Costa Rica, Kenya). Hawaii is the only state in the US that produces coffee and for the most part, the presence of the Hawaii coffee industry at these trade shows is largely the responsibility of the individual farms.



Past "Trade Show Booth" by HCGA, very successful event, with HDOA marketing assistance

Budget

Annual expenditure of $40,000 for 5 years with HCGA member contribution $8000. - Per year.

Year 1:

1. $20,000 Asia (Japan, Korea, China)
   One show per year/ location rotates.

- $5,000 Booth Development

$ 10,000 Conference costs (exhibitor fee, Conference center costs i.e. electricity, interpreter, other utilities, attendee registration), shipping.

- $5,000 Marketing materials (printing, brochures, other sales materials)

HCGA contribution: $4,000 attendee travel/lodging/meals.

2. $20,000 Europe/USA
   One show per year/location rotates.

- $5,000 Booth Development
- $10,000 Conference Costs (see above)
- $5,000 Marketing materials (see above)

HCGA contribution : $4,000 attendee travel/lodging/meals.

Year 2:
Same as above

Year 3 -5:
Booth development cost now shifts to Advertising budget of $10,000/yr.
(Ads in trade magazines, direct mail, other promotional materials)

- $20,000 Conference costs (2 trade shows/ Asia, Europe or USA)
- $10,000 Marketing materials
- $ 8,000 HCGA Contribution: attendee travel/lodging/meals.

15. New Plant Distribution Center (NPDC): Statewide Program to Enhance the Global Competitiveness of Hawaii's Floriculture and Nursery Industry

The F&N Industry in Hawaii is Economically Resilient and Growing. While the national agricultural market value increased 48% in 10 years, Hawaii's corresponding value was only 3% growth. In contrast, the F&N market value in Hawaii increased by 63% during the same time period, an average of 5% per year (NASS, and Statistics of Hawaii Agriculture, various issues). F&N products contributed about $99 million to the state's economy in 2008 and have become an important contributor to Hawaii's diversified agriculture. The share of the F&N industry in Hawaii's total agricultural market value increased from 13% to 21% (Figure 1). A portfolio analysis of Hawaii's agricultural sectors found F&N to be a "star" industry with desirable characteristics and outstanding contribution to the stability and growth of the entire agricultural sector considering 40 years of data. Hawaii also has an above average revealed competitive advantage in the production of Anthurium and cut orchids.

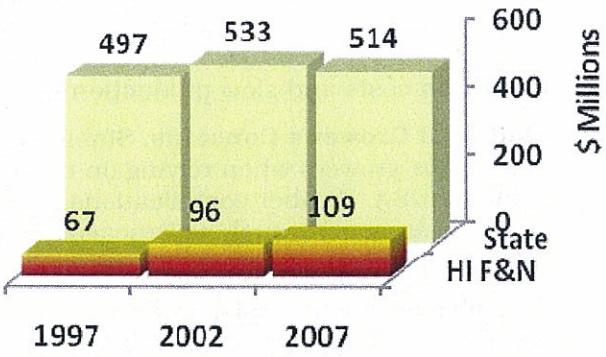
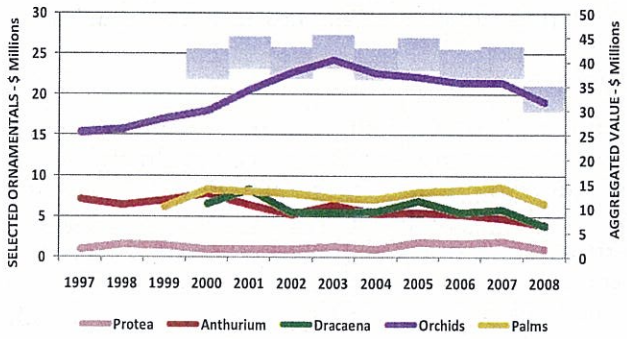


Figure 1. F&N increasing share of Hawaii's agricultural market value.

The Growers Need for New Plants. A stakeholders survey this summer that included 46 F&N growers determined the need for new plants among the top three priority needs of nursery growers in research and extension for the sector. The process of stakeholder input organized by the project director found that growers want greater access and availability of protea, Dracaena, ornamental palms, Anthurium, and Orchid varieties (

Figure 2). The average market sales value of these selected ornamentals was $43 million/year from 2000 to 2008, 45% average share of F&N market value, which decreased from 52% to 36% reflecting the challenges these varieties are facing.

Figure 2. Hawaii market value of sales of selected ornamentals.



How The Growers Lose Profits. Strategic management of the lifecycle of new products rewards the major producers with the largest market shares and profits derived from novel products. Every year, commercial growers from mainland USA, Europe, South America, and Southeast Asia travel to Hawaii to collect new plants for their businesses. Hawaii is known as a rich source of new ornamental varieties that are found in the natural environment or are collected, bred, or created by growers and CTAHR researchers. Over the last 40 years, Hawaii researchers & growers have been very creative in producing new varieties but rarely the state, the local F&N industry, researchers or growers are the ones to capture the greatest economic benefits from their own creations. When Hawaii growers sell new plants they have propagated

or bred by conventional methods for only a few thousand dollars, the opportunity to capture global gains and market share to the state or local economy from large-scale production of high-value plants is foregone. Out-of-state or oversea buyers may then spend two to three years multiplying these plants to a large scale, releasing them to world markets to realize potential economic gains and to capture market share at very competitive prices. On the other hands, Hawaii growers are unable to be competitive in international markets due to high production costs and slow production rates.

Additional Grower's Concerns. Stability of supply and security of new plant varieties remains an issue for growers when relying on tissue culture laboratories in Southeast Asia and even mainland USA. Further complications arise from the lack of expertise on the propagation of specific ornamentals such as Dracaena, palms, Protea, hibiscus, bamboo, or other plants which are rarely propagated by commercial service labs.

The global economic crisis, crop losses to volcanic emissions and adverse weather conditions, as well as the high cost of farming had significant detrimental effects on the F&N industry and contributed to declining revenues, number of farms, and exports. Discretionary spending has been declining affected by higher energy and food prices that reduce demand, while growing imports continue to put pressure on the national F&N sector.

The Opportunity for This Project. Technological developments and strategic business realignment are required to curtail Hawaii's F&N losses of some of its major product lines, maintain its global competitiveness, and to improve its contribution to the state's economy through sales and employment generation. To be competitive in global markets Hawaii must become one of the centers of new plant distribution, which is currently missing and desperately needed. A center that will multiply new plants cost effectively to large numbers, sell them at cost to all Hawaiian growers and implementing global marketing that will benefit local growers instead of large international producers.

Objectives and Outcomes

The general objective is to revitalize Hawaii's floriculture and nursery industry by reducing production costs, expanding markets, and facilitating the creation and distribution of new high-value ornamentals. Capitalizing on the expertise of the project director this project will develop efficient, cost-effective micropropagation and transformation protocols for high-value ornamentals using thin-cell-layer (TCL) and temporary immersion bioreactors (TIBs) to improve the supply chain of new plant materials to Hawaii F&N growers.

Purpose of Expenditures

This project is based on applied plant biotechnology, and its major expenditure lines fall on the qualified labor required to carry out the tasks needed during the development of plant tissue culture and transformation protocols. The project director, who is employed by the University of Hawaii, will use her expertise to direct and supervise a small research team of 2 junior researchers, and 3 student helpers. The junior researchers will be carefully selected based on their level of skills, knowledge, and experience on tissue culture, transformation, bioreactors, and advanced techniques such as thin-cell-layer cultures; most likely a post-doc position and a technician. This project will make use of existing facilities at the University of Hawaii that include tissue culture laboratories, equipment, and greenhouse space. Additional funds will be secured from various sources for tissue culture and liner production expenditures when new plants are ready to be released to growers for commercial production.

A provision for income generation is also considered by charging the growers at cost prices for new plant liners when released for commercial production. Since the technology of bioreactors tends to reduce significantly production costs the growers will benefit by acquiring new plants at lower cost. When the NPDC is well established other possible collaborative contracts and agreements are possible such as royalties to compensate growers who supply their own

creations for commercial release. Income to the NPDC from sale of new releases can be used to continue funding its operations and possibly expanding its staff and facilities.

Initially the research will focus on the following groups of plants, as requested by growers:

Dracaena. Hawaii sales market value fell 41% from $6.6 million in 2000 to $3.9 million in 2008. Its average sales for the period were over $6 million per year, peaking in 2001 with $8.4 million. As foliage for landscape and indoor ornamentals has gained worldwide popularity demand for ornamental foliage has increased over the last decade.

Proteacea. Commercial species within this family include proteas, Leucospermum, leucadendron, and banksias among others. Hawaii sold an average of $1.5 million per year over the 12-year period, increasing a modest 12% from $1.2 million in 1997 to $1.3 million in 2008. However it had a peak year in 2007 with sales of $2.1 million followed by a drop of 38% in 2008. Their average wholesale and retail out-of-state sales amounted to $1.9 million, declining 26% from $2 million to $1.5 million over the period. Hawaii has one of the highest gross values per hectare of planted Proteacea along with Israel, well over $50,000/ha, followed by South Africa, Zimbabwe, and New Zealand. Potential economic opportunities arise from water shortages in California, the state with the largest production and area and significant declining production areas in Australia a major player in the export markets.

Palms. From 1999 to 2008 this group's market value of sales averaged $7.8 million per year, increasing 6% from $6.3 million to $6.7 million. Its peak year for sales in 2007 reached $8.7 million.

Anthurium. Hawaii market value of sales of Anthuriums cut and potted averaged over $6 million per year over the most recent 12-year period of data available. Its value of sales declined 44% from $7.3 million in 1997 to just about $4 million in 2008. Cut Anthuriums averaged 91% share of sales of all Anthuriums for the period. Interestingly, wholesale and retail out-of-state sales have steadily declined 47% to $5.8 million in 2008, averaging $8.3 million per year.

Orchids. As a group, Hawaii's cut and potted products have increased their market value by 24% from $15.5 million in 1997 to $19.1 million in 2008, although they peaked in 2003 at $24.4 million. For the period they averaged over $20 million per year in market sales value. Dendrobium is the main commercial genera, contributed an average of 48% of the total market sales of the group over the period, starting with a share of 62% in 1997 and declining to 36% by 2008. Dendrobium's value of sales dropped 28% from $9.7 million to $6.9 million.

NPDC Structure and Development. Main roles to revitalize Hawaii's nursery business (Figure 3):

- Provide a support network and channels for growers and researchers to speed up the introduction of their new varieties to global markets.
- Strengthen export mix of high-value ornamentals by forming an international marketing team.
- Continuously create new varieties via application of biotechnologies such as induced mutation, somaclonal variation, and genetic engineering.

Successful establishment of the NPDC will be carried out in phases (Figure 4):

Phase 1

Set-up greenhouse space for collection, development and evaluation of new plants collected or created by TPSS faculty, agents, and growers. Incentive programs will be set in place to reward new plant collectors.

Phase 2

Set-up of the tissue culture lab where initiation of new plants begins. All varieties will be multiplied to 1000 plants, transferred to greenhouse for evaluation. After evaluation the plants will be transferred to production lab and nurseries for large scale production. Particular attention shall be given to the development of protocols for commercially valuable but known recalcitrant species.

Phase 3

Set-up of tissue culture production lab where new plants will be multiplied to large numbers.

Phase 4

Creation of statewide distribution channels in Oahu, Big Island, Maui, and Kauai to grow tissue culture plants into liners which at 3-4 months old will then be made available to the growers at low cost.

Phase 5

Set-up an international marketing team organized by NPDC to assist growers market their new plants through international marketing and sales channels. Increasing Hawaii's market share in international markets will benefit not only the growers but also the state's value exports.

Figure 3. Structure and components of the NPDC program.

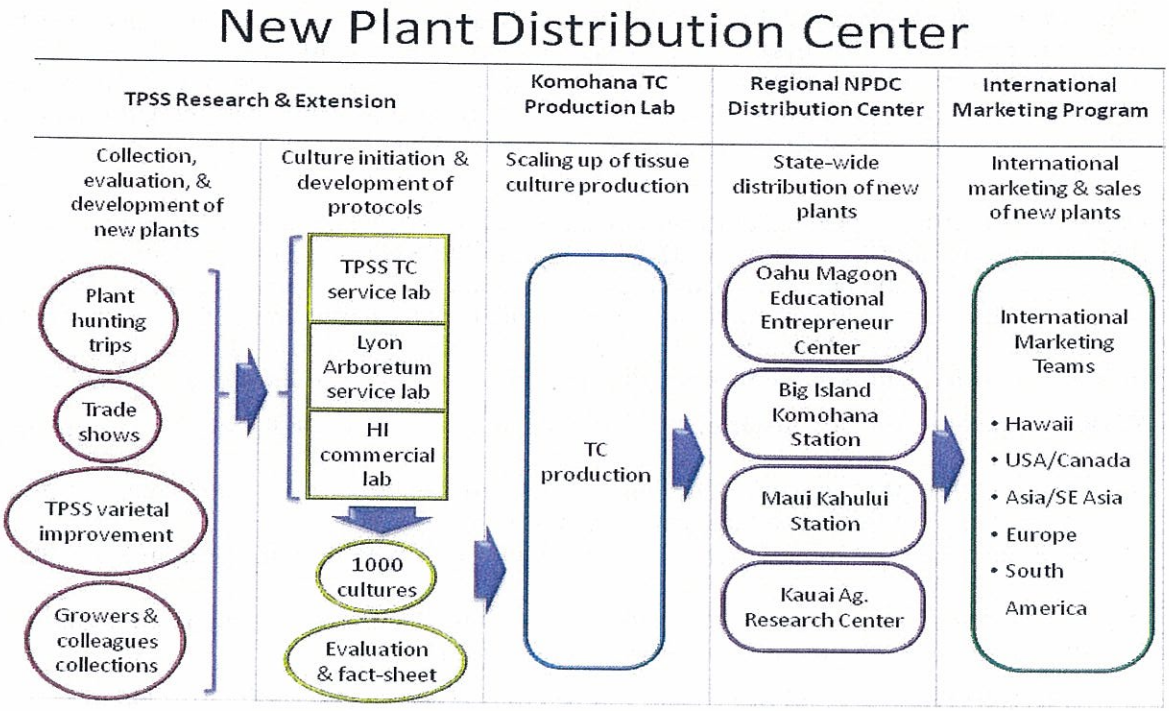
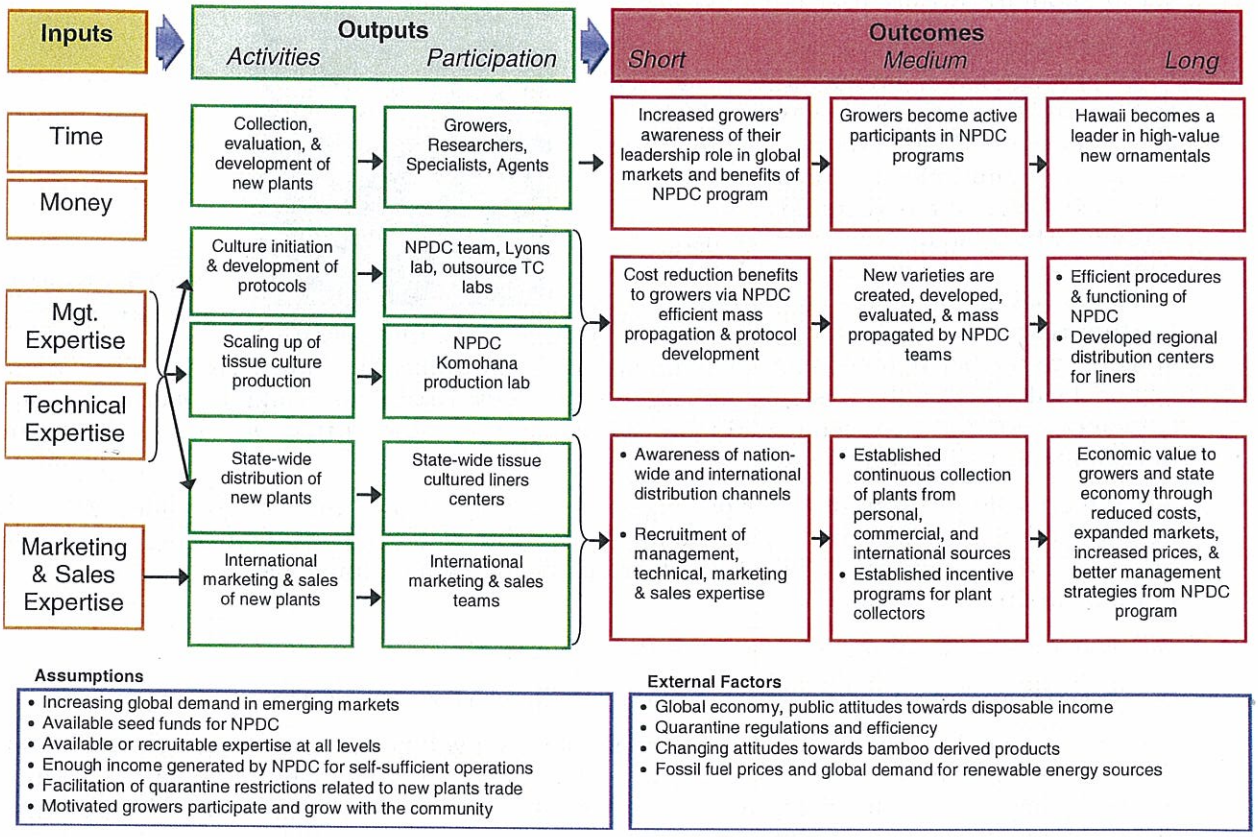


Figure 4. Strategic development of the NPDC.



Applied Ornamental Plant Biotechnology

A barrier to wider acceptance and use of tissue culture technology for the average ornamental grower in Hawaii is its high operating costs; in particular labor costs and materials. Current micropropagation protocols can amount up to 60% of total lab production costs given the low multiplication rates, non-optimized and prolonged protocols, and labor intensive processes. The use of bioreactor systems and technology reduces labor and operation costs by completely eliminating the subculture stage in vitro, the stage that makes micropropagation labor-intensive and costly. In addition, improved micropropagation techniques have reduced fears of large somaclonal variation. Rapid and efficient protocols for multiplication using bioreactors have been developed for many crops, and their high efficiency and relative ease of operation make them the most promising system for industrial plant propagation.

Advances in regeneration techniques (e.g., TCL systems) have increased the usefulness of modern, smaller, TIB in which the tissue is held over a raft support system inside the culture vessel allowing for more control over short-term exposure of plant growth regulators for the induction of embryogenesis and organogenesis. TIB allow for simplified handling of plants and medium, improved plant nutrition, gas exchange, reduction in hyperhydricity, and greater control over morphogenetic phases. It must be noted that a successful bioreactor system does not apply to all species, research is necessary to adapt the method to the specific requirements of a given species.

TIB Micropropagation Protocol Development. Published tissue culture protocols using conventional methods will be modified to suit the use of TIB systems as appropriate. Due to space limitations only two examples are included here for Dracaena and Leucospermum.

Dracaena. While cuttings are a common form of propagation in Dracaena, faster and efficient micropropagation protocols are being developed to capitalize on its global market appeal and on its spontaneous mutations.

Figure 5. Dracaena in bioreactor, PD's lab.

The PD's ongoing research on micropropagation of Dracaena J. Craig 'Liza' (Hatch project 810) has shown positive preliminary results (Figure 5). In comparing growth and multiplication rates a RITA™ bioreactor system has resulted in labor reduction by a factor of 5 and increased multiplication rate by a factor of 4 over a conventional method on solid medium. Further research is needed to improve synchronization of multiplying cultures to further reduce labor cost and speed up multiplication rates. The resulting model protocol will then be the basis for propagation of a new Dracaena 'Waikiki'. Micropropagation of Dracaena 'Waikiki' has been found to be slower than the other 4 new Dracaena varieties on development, half multiplication rate.

A common solid medium used for propagation of Dracaena J. Craig 'Liza' includes MS + Myo-inositol 100 mg/l + Adenine Sulfate 80 mg/l + $NaHPO_4$100 mg/l + Kinetin 2 mg/l, IAA 2 mg/l + Su 3% + 0.6 g/l agar, at pH 5.6. A 3x3 factorial design will be implemented to optimize multiplication:

- Kinetin 2, 5, & 10 mg/l with IAA 2, 3, & 4 mg/l
- Substitute Kinetin with other cytokinins such as TDZ, BA, and 2iP.

For each on solid medium, 20 stem segments of 5 mm will be cultured under 16 hrs of light. Bud production will be measured over 12 weeks, the number of adventitious buds produced from each stem segment. Medium with the highest number of uniform buds will be adopted for development of bioreactor system.

Each RITA™ bioreactor vessel will receive 10 pieces of multiplying cultures, and 10 TIB will be used. The cultures will be maintained 16 h d-1 photoperiod under 35 µmol m-2 s-1 PPF (fluorescent lamps) and immersed 30 min every 6 h. A subculture factor of 2 will be used each month. The rate of multiplication will be measured over 12 weeks, and the number of hours taken for subculturing per month. After 3 months all the buds will be transferred to shoot elongation media composed of ½ MS + Myo-inositol 100 mg/l + Su 3% for an estimated period of 4 weeks. Shoots will be transferred to rooting media, same as shoot elongation media with NAA 0.1 mg/l added, for 4-6 weeks. Rooted plantlets will be transferred to soil at the Komohana Station for evaluation.

Proteacea. Growers in Hawaii are interested in cloning of new cultivars of commercial value. Commercial production faces propagation and cultivation difficulties, lengthy growth periods, and high production costs. Tissue culture has been widely used for rapid mass propagation of disease-free plants in other production areas around the world, showing great potential for commercial mass propagation. Rooting and acclimatization issues have been reported in *Leucospermum*, although some protocols have been partially developed. The variety Leucospermum 93 'Blanche Ito' was selected by growers because of short supply and great demand.

The initial tissue culture protocol will be based on Thillerot et al. (2006). Stock plants will be selected from a commercial nursery in Ocean View, Hawaii (Flowers by Kona Scent) and maintained as potted plants at the University of Hawaii at Manoa. Plant materials will be pretreated with fungicide for 4 weeks before in vitro initiation. All leaves will be removed, leaving attached 1–2 mm petiole. A washing solution of 5% NaOCl with Tween-20 for 10 min followed by three rinses with sterile water will be applied for disinfection. Explants will be

cultured in MS medium supplemented with 30 g/l sucrose, and 6 g/l agar for 4 weeks at 25°C, photoperiod of 16 h d-1 under 35 µmol m-2 s-1 PPF (fluorescent lamps)

Initiation of cultures. Apical and axillary buds from young sprouts will be used as explants and cultured on an MS or WPM medium supplemented with 4.54 µM TDZ, with or without supplemental GA3, in a concentration of 5.8 µM. Different types of cytokinins such as BAP, Kinetin and 2iP at various concentrations will be tested.

Induction of multiple adventitious buds. To optimize the rate of multiplication a factorial experimental design to optimize cytokinins will be setup based on results of the previous stage. Medium producing the largest number of uniform adventitious buds will be used to design the bioreactor system protocol for commercial production.

Proliferation of multiple buds. Each RITA™ bioreactor vessels will receive 10 pieces of multiplying cultures, and 10 TIB will be used. The cultures will be maintained 16 h d-1 photoperiod under 35 µmol m-2 s-1 PPF (fluorescent lamps) and immersed 20 min every 6 h. A subculture factor of 2 will be used each month. The rate of multiplication will be measured over 12 weeks, and the number of hours taken for subculturing per month.

Bud elongation. After 3 months all the buds will be transferred to shoot elongation media composed of MS medium supplemented with 4.4 µM BAP for 4 weeks.

Rooting. Shoots will be transferred to rooting media, same as shoot elongation media with NAA 0.1 mg/l added, for 4-6 weeks. Rooted plantlets will be transferred to soil at the Komohana Station for evaluation.

Palms. Palms have proved difficult to understand in their development and propagation potential and until recently most palms could only be propagated by seeds and off-shoots slowing down any breeding, genetics, crop improvement, and expansion of commercial plantings. In addition seed propagation tends to be non-uniform and plant growth is slow. Most of the tissue culture research has focused into the oil and fruit producing palm varieties, however some of that research could be applied to ornamental varieties. For large scale micropropagation the use of bioreactors and automation applications have become of interest.

Anthurium. With more than 600 species Anthurium has been commercially propagated by tissue culture over 35 years using leaf, petiole, spadix, spate, lateral bud and shoot tips as explants (Yu et al., 2009). Its main species, Anthurium andraeanum, has been well received as an ornamental plant for many years due to its size, color, and durability of its inflorescences. Efforts to refine rapid propagation systems for Anthurium andraeanum are motivated by the relatively slow methods available based on bud cultures, disease elimination, and other issues such as browning (e.g., Wang et al., 2005; Dhananjaya & Sulladmath, 2006; Beyramizade et al., 2008; Yu et al., 2009; Zhang & Deng, 2009; Qi et al., 2010). Yu et al. (2009) suggest considering their efficient regeneration system in mass propagation using bioreactors. Reductions in labor, materials, contamination, and increased yields and plant quality have been reported using TIB.

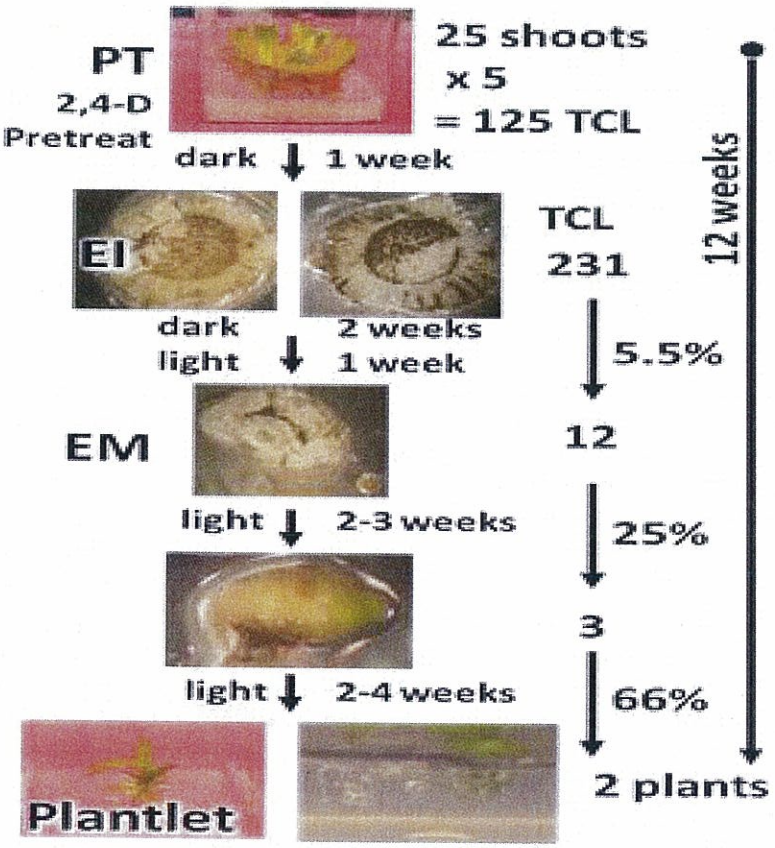
Orchids. Tissue culture using a variety of explants such as flower stalks, flower buds, shoot tips has been described and research continues since callus induction tends to be slow, difficult, time dependent, and inconsistent.

Development of Transformation Protocols for Dracaena and Cattleya Using TCL. The ornamental foliage and flowering plant market has traditionally been driven by the development and introduction of new varieties, supported in the last few decades by tissue culture technology enabling faster propagation.

TCL is a plant regeneration technique in which transverse or longitudinal thin layers of cells (0.2-0.4 mm) are programmed by controlling its growth conditions to form various morphogenetic patterns such as somatic embryogenesis, adventitious shoots, or floral organs from explants. It has been widely used in organogenesis and embryogenesis studies in

ornamental and floricultural species. This technique has allowed the study of morphogenesis and transgenic expression for over 35 years, and is an important part of crop improvement along with molecular and genetic engineering tools. It is also a resource saving technology that produces efficient micropropagation systems, successfully applied to regeneration of rice, carnation, daylilies, orchids, sugarcane, and many other plants. Recent success in transgenic sugarcane using TCL of leaf discs has been reported to result in a substantial time reduction of 40%, reducing labor and production costs.

Figure 6. Direct embryogenesis from TCLs in pineapple.



The PD has applied TCL of stem segments in direct embryogenesis of pineapple as an alternative tissue culture pathway for plant transformation (unpublished work). Somatic embryos were produced directly from tTCLs after cultured on embryo induction medium with 2-4 D for 2 weeks. The embryos were transferred to appropriate media for germination and shoot elongation, producing plantlets in 4-8 weeks. The process from pretreatment of mother stock to whole plant development took only 12-14 weeks. The efficiency of direct embryo induction was only 5% and this is the area that needs further improvement (Figure 6).

Development of Thin-Cell-Layer System.

- Determination of ideal explants and orientation for TCL - Stem segments, internode shoot tips or young leaves.
- Thickness of TCL will be tested at 0.5, 1 mm on various concentrations of auxin (NAA, 2,4 D) in combination with TDZ.
- Manipulation of the morphogenetic pathways of TCL explants by auxin and cytokinin.

Development of transformation protocols using TCL.

Transformation protocols will be based on developed TCL systems. Success factors affecting the transformation efficiency will be studied using *Agrobacterium* carrying the Gus reporter system.

- Optimization of plant competent cells for transformation.
- Optimization of gene transfer conditions such as composition of agro culture medium, infection, co-cultivation medium, and duration for co-cultivation.
- Induction of PLB protocorm-like bodies (Cattleya) and Adventitious buds (Dracaena) from transformed TCLs.
- Efficient regeneration systems via TIB for faster embryo to plantlet development.
- Selection of putative transformants using bioreactors to speed up selection process.
- Regeneration of transgenic plants.

Orchids. The lack of an efficient transformation system has been a bottleneck for the routine production of transgenic orchids, a key step on the innovation supply chain. Genetic transformation is the fastest way to generate large numbers of new varieties. For example, transgenic Dendrobium with early flowering gene has already been developed but it entails a lengthy process of about 18 months. Recent studies with thin cell layer culture can be practical and valuable to commercial growers and breeders yielding up to 5 times faster than conventional protocols. Given the commercial success of its many genera and problems with somaclonal variation orchids have received much research in micropropagation, development of efficient protocols, transformation, and use of novel techniques such as thin cell layer culturing and bioreactors.

Expected Outcomes & Impacts

Short-Term	• Increased growers' awareness of their potential leadership role in global markets. • Awareness of statewide distribution channels of new plants – NPDC at CTAHR.
Medium-Term	• Cost effective system for rapid multiplication of 5 new ornamental plants. • Cost reduction benefits to growers via efficient mass propagation & protocol development. • Hawaii growers gain access and availability to new plants cloned locally, affordably and at faster rate. • Growers magnify their income by increasing sales of new plants to larger markets. • Enhanced F&N industry production by expediting introduction of new plants.
Long-Term	• Hawaii becomes a leader in high-value new ornamentals. New varieties are created, developed, evaluated, and mass propagated. • Continuous supply of novelty high-value ornamentals available via CTAHR. • Growers gain competitive advantage in national and global markets. • Economic value to growers and state economy through reduced costs, expanded markets, increased prices, and better management strategies. • Enhanced regional economic growth.

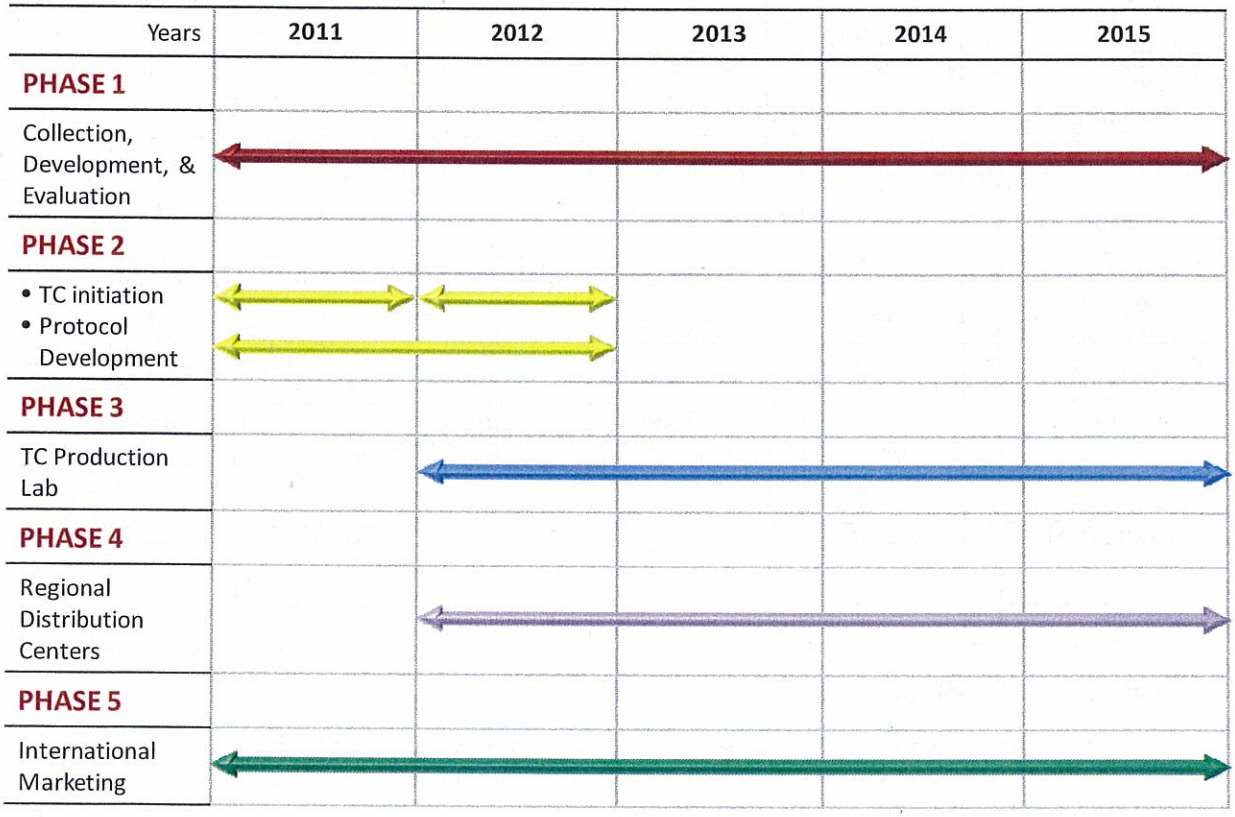
Measurable Indicators

Expected Outcome	**Outcome Indicators**
Hawaii becomes a leader in high-value new ornamentals.	• Number of new plants collected, produced, and distributed by the NPDC over time. • Number of growers/nurseries participating in NPDC over time. • Total annual sales of new ornamentals.
Efficient operation and functioning of NPDC.	• Lower production costs per plant over time. • Capacity of production over time. • Time from plant collection to plant sales. • Yearly qualitative assessment of needs and desired changes in NPDC services from participating growers and nurseries.
NPDC contribution to overall economic growth of Hawaii agribusiness.	• Total annual sales by nurseries of plants produced by NPDC program. • Number of employees working in nurseries participating in NPDC program per year. • Yearly qualitative assessment of economic impacts by interviews with participating nurseries/growers.

Project Beneficiaries

NPDC	Stakeholders
Phase 1	• Hawaii growers, individual high-value plant collectors. • CTAHR faculty holding discovered or created high-value plants.
Phase 2	• Other scientists working on developing protocols for the same plants. • Students and technicians learning commercial tissue culture techniques. • Small local service labs receiving outsourcing jobs from NPDC. • NPDC service fees from initiation of cultures.
Phase 3	• New employees at Komohana TC service lab. • Revenues from sales of TC plants for NPDC program operation.
Phase 4	• Enhanced participation by county and TPSS agents. • New employment opportunities to local residents.
Phase 5	• Growers/nurseries benefit from revenues of sales of high-value plants. • CTAHR increased international recognition as leader of new plant introduction. • Economic benefits to Hawaii and the nursery industry from increased sales of nursery crops and exports.

Timetable



Budget

		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	SUBTOTAL
PERSONNEL											
Item	#		#		#		#		#		
Jr. Researcher	2	90,000	2	90,000	2	90,000	2	90,000	2	90,000	
40.52%		36,468		36,468		36,468		36,468		36,468	
Student Help	3	30,000	3	30,000	3	30,000	3	30,000	3	30,000	
0.69%		207		207		207		207		207	
		156,675		156,675		156,675		156,675		156,675	783,375
EQUIPMENT											
Bioreactors											
RITA		8,500		8,500		8,500					
Plantima		1,500		1,500		1,500					
		10,000		10,000		10,000					30,000
TRAVEL											
Travel		5,000		5,000		5,000		5,000		5,000	
Asia Promotion											
		5,000		5,000		5,000		5,000		5,000	25,000
OTHER											
Mat. & Supplies		20,000		20,000		20,000		20,000		20,000	
Marketing		5,000		5,000		5,000		5,000		5,000	
Publication				2,000		2,000		2,000		2,000	
GH Rental		2,000		2,000		2,000		2,000		2,000	
		27,000		29,000		29,000		29,000		29,000	143,000
SUBTOTAL		198,675		200,675		200,675		190,675		190,675	
TOTAL											981,375

Outreach and Technology Transfer

Research and extension in this plan of work are intertwined. To reach growers acceptance of the business model, their active participation in terms of supplying their valuable new plants and helping them reach global markets requires extension work. The motivation for this grant application is the result of the expressed needs of the major grower associations in Hawaii, HENA, BIAN, MFGA, HFNA, DOGAH, and ONGA, which the project director has been closely working with.

Outreach and technology transfer will be accomplished in a variety of forms:

- Workshops to bring awareness of cost-effective TIB systems for cloning of new plants.
- Plant distribution. Upon completion of cloning 1,000 tissue culture liners per variety will be released to growers via the growers associations.

- Publications or training programs for technology transfer of TIB systems and protocols to local tissue culture labs to continue TC cloning at larger scale.
- Publications on transformation protocols for Dracaena and Cattleya will provide a basic model for future research on creation of novel transgenic plants of commercial value such as virus, insect or disease resistance, and variegated leaf patterns.
- The NPDC website is on development and will provide general information over the progress and achievements in the creation of new ornamental varieties, within a strategic business context of relevance to Hawaii's ornamental growers.

The first group of plants to be released through NPDC are Dracaenas collected by John Griffis from overseas (Figure 7).

Figure 7. New Dracaena varieties waiting to be released.

These 5 varieties are in the process of cloning via cuttings by Andrew Kawabata (Co-PD) at Komohana experimental greenhouse in Hilo. So far, only about 70 cuttings of D. 'Ruth Luka' have been released to HENA growers for market evaluation (Figure 8).

As shown in the attached supporting documents there are a number of growers waiting to have their plants cloned and scaled up for commercial release.

Figure 8. A new Dracaena variety released to HENA growers.

Jun 25 '10 – Release to growers

Project Director/Principal Investigator (PD): Kheng T. Cheah
Position/Title: Associate Specialist
Organization Name: College of Tropical Agriculture and Human Resources
Mailing Address: 3190 Maile Way, St. John 102
Mailing City/State/Zip: Honolulu, HI 96822-2279
PD Phone: (808)956-7902
PD Fax: (808)956-3894
PD Email: kheng@hawaii.edu

Hawaii Export Nursery Association

October 15, 2010

Dear T-STAR Special Grant Review Team,

Aloha!

On behalf of the Hawaii Export Nursery Association (HENA), I am writing to express our appreciation for the work that's been done from Dr. Kheng Cheah on behalf of our organization and the foliage industry in Hawaii.

With the unstable economic climate we are facing, the Hawaii foliage industry needs to revive its reputation as the Ag leader of Hawaii. One way to do that is through a New Plant Distribution Center that Dr. Cheah has plans to develop. The distribution center will also house tissue culture labs. The tissue cultures will help growers to increase their profits with an incentive to collectors with potential income. In that regard, HENA supports the work proposed by Dr. Cheah and we agree to be a collaborator in her project.

We certainly appreciate her efforts with our 2010 15th annual MIDPAC Horticultural Conference and related events, and consider her contribution as both a presenter and as Moderator for the day as key factors in our success.

Dr. Cheah is a great asset to our industry with her knowledge and abilities to help solve many of our issues, and for volunteering her time and efforts to assist in the creation of new plant varieties to help further the sales and growth of our industry.

Again, we would like to express our deep appreciation for all the efforts of Dr. Kheng Cheah in regards to HENA and the nursery industry. We encourage you to support her research project and her T-STAR research proposal entitled "Technological Synergy of Thin-Cell-Layer, Bioreactors and Plant Transformation: Enhancing Hawaii's Ornamental Industry" which is a vital part of our future. HENA and our members look forward to working closely with Dr. Cheah to advance our industry.

Sincerely yours,

Malcolm Saxby

Malcolm Saxby
President

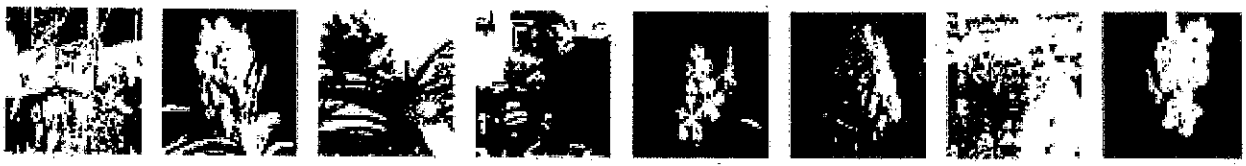
P.O. Box 11120 * Hilo, HI 96721 * Phone & Fax 808-969-2088 * Email: info@hena.org * Web: www.hena.org

Forwarded Message: Vandas for possible cloning

Tuesday, October 26, 2010 1:56 PM

Vandas for possible cloning

From: "Neill Sams" <htdd@aloha.net>
To: khang@hawaii.edu
Cc: "'Roy Yamakawa'" <yamakawa@hawaii.edu>
8 Files (5783KB)



renanthera (ORC - 082 \ Vanda Fuchs Vanda Fuchs Vanda OA H Vanda Robe Neill with Va ooi 'Orchid A

Aloha Dr. Cheah,

It was a pleasure meeting you in Hilo at the HTFC program. I am sending you some pictures of my fragrant Vanda hybrid, and some awarded Vandas that are certainly clone worthy. We had a photo shoot this weekend & will have other possible candidates to show you later this week. Let me know what you think.

Neill Sams

16. Sanitation Measures to Reduce Coffee Berry Borer

- Cutting down of wild coffee and prevent re-growth (service traps)
- Assist in cleanup of abandoned farms
- General Sanitation measures
- Trap construction and servicing
- Monitoring of infestation

Budget

	FY 12	FY 13	FY 14	FY 15
Personnel (3 @ $20/HR.)	74,000	74,000	74,000	74,000
Trap Construction, Placement and Maintenance.	26,000	26,000	26,000	26,000
Supplies	24,000	24,000	24,000	24,000
Truck	3,000	3,000	3,000	3,000
Total	127,000	127,000	127,000	127,000

17. Hawaii Master Beef Producer Program and CTAHR Beef Initiative

The beef industry of Hawaii began with a gift in 1793 as seven cows and two seasick bulls landed on the island of Hawaii. Since that time, beef production has been one of the longest-lasting agricultural industries for our State contributing approximately $1.8 billion to the economy in direct and in-direct contributions (Statistics of Hawaii Agriculture 2005, USDA-NASS) and has enriched the culture and traditions of these islands. As of the latest report there are over 1,100 cattle producers in the State representing approximately 65,000 head that sold for $26 million (USDA-NASS, 2009). This highlights the importance of our citizens of Hawaii in agriculture and the need for continued support to ensure economically viable, environmentally sustainable, and culturally important agricultural industries for our future. The importation of vast amounts of agricultural products also highlights opportunities to further develop local industries to meet the changing needs of our population and the beef industry is well poised to increase local grass-fed beef availability to our local markets. This will in turn decrease the need for importation of beef and will lead to stimulation of the local economy, increase food security, while encouraging future generations to continue as high quality beef producers. The beef industry is primarily composed of cow-calf operations and ranchers are stewards of more than 1 million acres of land in Hawaii. During the mid-1980's Hawaii's cattle market shifted to shipping out-of-state after weaning, however, in 2007 a state task force was formed to consider long-term solutions to protect this industry and redevelop finishing of cattle in-state. (Protecting the Livestock Industry in Hawaii, Report of the HDOA to the State Legislature, 2007). The investment of resources as part of the Agricultural Development & Food Security Special Fund will allow for reinvigoration of our efforts to lead the beef industry in an advanced model of beef production practices.

Beneficiaries

The CTAHR Beef Initiative has been a very effective collaboration of extension agents and specialists, researchers, graduate students, and other contributors with many cooperating agencies such as the Hawaii Department of Agriculture, Hawaii Department of Hawaiian Home Lands, Hawaii Cattlemen's Council, Inc., and the USDA Animal and Plant Health Inspection Service to name a few. The Beef Initiative group has received 24 grants totaling over $1.4

million, produced over 30 publications ranging from internationally-recognized journals to educational articles for local producers, and presented nearly 50 field-day, state, national, and international presentations, all within a 5-year window. The objectives of the Beef Initiative are: to improve the competitiveness, profitability, and sustainability of the beef industry by developing and implementing effective research and innovative extension programs for animal production in Hawaii; improving communications among the beef industry, interagency partners, and CTAHR; and supporting the industry on legislative and other governmental issues, policies, and partnerships. We believe that the beef industry will continue to be a leader for the vision of pastoral livestock agriculture in Hawaii and remain an important contributor to diversified agriculture, the State's economy, and Hawaii's cultural heritage. This local industry has a high revenue growth potential and can have tremendous growth in both the general market as well as target or niche markets.

As noted in the 2010 annual report to the legislature the mission statement of the State of Hawaii Department of Agriculture is to develop and promote agriculture as a significant and respected driver of Hawaii's economy with goals including to conserve and develop essential agricultural resources and infrastructure, develop local markets for Hawaii's agricultural products, to promote Hawaii's food self-sufficiency, ensure state animal health, support funding for research, and to raise awareness of the importance of agriculture to the State's economy and environment. The CTAHR Beef Initiative shares these goals and wants to continue the close relationship with the HDOA and other collaborating agencies in the promotion, education, and growth of the beef industry of Hawaii to ensure this industry will be competitive in a long-term sustainable manner.

Objectives and Outcomes

The Hawaii Master Beef Producer Program will allow for the certification of producers as a "Hawaii Master Beef Producer" after completing a series of educational sessions that have been developed based on the identified needs of the cattlemen (personal communications and the Beef Industry Strategic Plan, 2007), the goals of the CTAHR Beef Initiative (CTAHR Beef Initiative Impact and Final Report, 2008), the Action Plan of the HDOA (Report to the 25th Legislature 2010 Regular Session, HDOA), and publications documenting evaluations of Master Beef Producer Programs in other states ("Perceptions of the Effectiveness of the Louisiana Master Cattle Producer Program" a Master's Thesis by LJ Lirette, May 2010; "Management Practices Associated with Beef Quality Assurance/Master Beef Producer Certification Among Cattle Producers" by F Hopkins et al, 2008). The addition of the Hawaii Master Beef Producer Program to the beef industry and the CTAHR Beef Initiative will greatly contribute to the success of these producers and will allow for concentrated and in-depth education in key areas to:

- Increase their profitability (i.e. efficiency of production and cost effective processing, increase profitability and quality of the grass-finished product for local market, financial strategies to increase real income, efficient use of agricultural loans, subsidies, and cost-share programs);
- Improve food safety (i.e. biosecurity, proper antibiotic use for assurance of public health);
- Advance marketing strategies (i.e. promotion of products and value-added goods, identification of market opportunities, status as certified Hawaii Master Beef Producer to demonstrate commitment of the ranch to best practice management thus building consumer confidence, provide industry feedback to cooperating agencies regarding activities in target and markets, encourage producers to seek certified organic status as market dictates);

- Ensure animal health and welfare (i.e. technique certification for handling and procedures at weaning; continuing education regarding current health recommendations, beef quality assurance training);
- Better prepare for and respond to disasters (i.e. natural disasters, prevention of foreign animal disease);
- Increase participation in reporting as part of the National Animal Identification System (i.e. traceability, risk assessment, increase consumer confidence and use of products in institutional food programs);
- Minimize environmental impacts while contributing to the pastoral landscape and ecotourism industry;
- Contribute to research efforts (i.e. collaborations within the CTAHR Beef Initiative to in turn allow the progressive development of best production practices tailored for Hawaii beef producers).

The effectiveness of Master Beef Producer Programs in other states has recently been evaluated and the outcomes are outstanding. A 2008 survey of Tennessee beef producers found that 35% were certified TN Master Beef Producers after only 3 years since inception of the program and that those who had completed the program were significantly more likely to be in compliance with and knowledgeable of best management practices (i.e. observance of withdrawal times, appropriate use of antimicrobials, animal health management; Hopkins et al, 2008). Since the publication of this survey, the University of Tennessee Extension driven Tennessee Master Beef Producer Program has continued to grow with producer completion rates continuing to increase and the productivity of the UT Beef faculty members escalating in sponsored research, publications, presentations, and educational outcomes. As is our goal, the Tennessee program collaborates with their respective DOA and other agencies to ensure integrated goals are met as part of the certification to become a Tennessee Master Beef Producer. Louisiana State University Extension started the Louisiana Master Cattle Producer Program in 2004 and an evaluation of this program was completed in 2010 to find, from the producers' perspective, the effectiveness of this program. They found that ranchers are voluntarily willing to learn approaches to decrease environmental impact, improve animal welfare, and increase profitability (Lirette, 2010). It should be noted that prior to submission of this proposal, communications with Hawaii producers revealed they want to see a program such as this in the State and they have participated in directing some of the content of the courses (i.e. animal health and welfare, forage systems (i.e. strategies during drought), economics and marketing, breeding and genetics). The Louisiana Survey found that after completing the certification training, Louisiana producers reported they were significantly more likely to follow best production practices in a number of key areas and that they scored the training as of "high value" to their production management. This survey also found that demographics (i.e. education level, age, gender) did not correlate with willingness to adopt new strategies. This is important since there is a wide range of demographics within the State of Hawaii that raise beef cattle and lends confidence that the Hawaii Master Beef Producer Program will be effective across all types of producers. The demographics that had some correlation in a positive manner were farm size and number of years in the industry, which is to the advantage of the industry since the large producers are often first to adopt new strategies with smaller, newer producers to follow. The overall finding of the Louisiana survey of their Master Cattle Producers Program is that producers felt that they "made large gains in their practice adoption" due to training in the program. As a self reported outcome, this speaks volumes for the effectiveness of a program such as this and is very supportive for Hawaii to develop a program of our own.

The Hawaii Master Beef Producers Program will consist of 9 sessions (including hands-on workshops) that will encompass:

- Animal Health and Welfare
- Nutrition
- Reproduction
- Genetics and Successful Trait Selection
- Beef Quality Assurance
- Pasture Management and Forage Systems
- Economics and Marketing
- End Product and Food Safety
- Environmental Sustainability

These training sessions will be conducted by members of the CTAHR Beef Initiative team and will be conducted on the islands of Hawaii, Maui, Oahu, and Kauai. The team members have extensive expertise in these topics:

Agents and Specialists
Glen K. Fukumoto, MS; Sustainable Livestock Programs, Kona, Hawaii, HNFAS, CTAHR
Michael DuPonte, MS; Reproduction, Genetics and Livestock, Hilo, Hawaii, HNFAS, CTAHR
John S. Powley, MS; Sustainable Livestock Programs, Maui, HNFAS, CTAHR
Mark S. Thorne, PhD; Pasture and Forage Management, Hawaii, HNFAS, CTAHR
Matthew Stevenson, MS; Livestock Programs and Range Science, Kauai, HNFAS, CTAHR
Linda J. Cox, PhD; Community Economic Development, Oahu, NREM, CTAHR
C.N. Lee, PhD; Reproductive and Environmental Physiology, Oahu, HNFAS, CTAHR
Ashley M. Stokes, DVM, PhD; Animal Health Veterinarian, Welfare, Oahu, HNFAS, CTAHR
Proposed member; Nutrition and Livestock Management, Hawaii, HNFAS, CTAHR

Researchers
Dr. Jinzeng Yang, Animal Biotechnology, Oahu, HNFAS, CTAHR
Dr. Yong S. Kim, Muscle Biology, Oahu, HNFAS, CTAHR
Dr. Soojin Jun, Food Engineering, End Product and Value-Added, Oahu, HNFAS, CTAHR

Cooperating Agencies and Organizations

Hawai'i Department of Agriculture, Food Safety, Animal Health Information and Resources
Hawai'i Department of Hawaiian Home Lands, Cultural Sustainability
Hawai'i Department of Land and Natural Resources, Environmental Sustainability
USDA Natural Resources Conservation Service, Pasture Management Information and Resources
USDA APHIS, Food Safety, Animal Health Information and Resources
Hawaii Cattlemen's Council, Inc., Hawaii Beef Industry Assessment
Hawaii Cattlemen's Association, Hawaii County Beef Industry Assessment
Maui Cattlemen's Association, Maui County Beef Industry Assessment
Hawaii Grazing Land Conservation Initiative Coalition, Grazing Land Information and Resources
Hawaii Cattle Producers Cooperative Association, End Product and Marketing Information

To receive certification as a Hawaii Master Beef Producer, attendees must complete all sessions. Upon completion, they will receive a certificate as well as a sign to hang at their ranch. Completion of this program will demonstrate each producer's commitment to improved profitability, animal health and welfare, environmental sustainability, and contribution to the State's economy through successful business practices. Among many benefits, the public perception of producers that have voluntarily completed certification as a Hawaii Master Beef

Producer is very valuable in consideration of market conditions and consumer expectations concerning livestock.

It is our opinion that the ranchers are our greatest asset to move the cattle industry, and therefore agriculture, forward. This requires the acquisition of resources, development of training opportunities, and continued communication regarding the challenges facing the industry to be successful. We are ready to make this step with the industry.

The CTAHR Beef Initiative has been very successful in acquisition of research funding, completion of both basic science and applied research, publication of research findings ranging from peer-reviewed journals to producer-oriented articles, publication of scientific abstracts, and presentation of research outcomes at local, State, National, and International meetings (Appendix CTAHR Beef Initiative Impact and Final Report 2008). The Beef Initiative is certain that research productivity will increase substantially with receipt of the Agricultural Development & Food Security Special Funds. The Beef Initiative meets regularly and has identified research opportunities associated with grass-fed beef production that will contribute globally and locally in our knowledge of these areas (Appendix CTAHR Beef Initiative Integrated Research and Extension Project Current and Future Directions):

- Genetics improvement and DNA technology (J Yang, M DuPonte, M Stevenson)
- Pastoral systems, grass-fed beef trials, increasing forage yield, intra-ruminal physiology of grass-fed beef (M Thorne, C Lee, M Stevenson, J Powley, G Fukumoto)
- Economics and marketing of grass-fed beef in Hawaii (L Cox)
- Meat science and technology, meat quality and flavor of grass-fed beef, composition of gain in growth phases of grass-fed production, Best Management Practices survey (Y Kim, G Fukumoto, M Stevenson)
- Veterinary programs, improving reproductive efficiency, herd health, optimizing grass-fed animal health, reproduction interaction at time of implantation (A Stokes, C Lee)
- Value-added product development (S Jun)
- Pacific region and international projects (all members)

The addition of funds, personnel (including graduate students), and the Hawaii Master Beef Producer Program will facilitate these collaborations and completion of studies that are directly applicable to the beef producer in Hawaii.

Evaluation of the CTAHR Beef Initiative, the Hawaii Master Beef Producers Program, content of each session, and level of implementation of best production practices is necessary for us to continually improve and, therefore, advance the beef industry of Hawaii. Based on comments from other State's evaluations that did not perform surveys before training started, we will have the opportunity to use a pre-training survey to more accurately assess knowledge gained as well as adoption of best practices. Additional measurements will be accomplished through evaluations during each session, a survey at the completion (to serve as the comparison to the pre-training survey), and a follow-up survey 1 year after completion of training and certification. We will also follow the market and take opportunities at every level to capture impacts. Other outcomes will be number of producers enrolled/certified, demographics obtained as part of surveys, a web-site linked to the CTAHR Beef Initiative that highlights the Hawaii Master Beef Producer Program, content-driven web-sites and information to serve as resources for our producers that focuses on grass-finished beef production practices, publications ranging from internationally-recognized journals to those intended for Hawaii's producers, and use of these funds as leveraging to obtain additional grants and contracts.

Personnel:
Considering the substantial size (~1,100 producers) and proposed scope of work, personnel are essential for the duration of the grant for program success. The addition of an assistant

extension agent will allow for an additional team member that can focus on the development of the Hawaii Master Beef Producer Program and will be an integral member of the CTAHR Beef Initiative for extension and research activities. The expertise that an extension agent will bring is key to the success of this program because of the content-driven nature of the certification program. This extension agent will also collaborate with 4-H program to encourage our youth to serve in the future of this important industry for Hawaii. The extension agent would be most likely located on the island of Hawaii due to the concentration of the beef industry on this island and the location of the Mealani Research Herd. The graduate students will also play important roles in the development, but more importantly in addressing identified production issues that require research in the area of grass-finishing beef in Hawaii. The appointment of a staff member for beef extension and research support is also important for the success of this program because of the coordination a staff member can provide for multiple trainings, workshops, participant enrollment, student organization/supervision, producer contacts/requests, etc. This will allow for more focused work by the extension agent and graduate students. The current members of the CTAHR Beef Initiative group are: Human Nutrition Food and Animal Sciences Glen Fukumoto, Michael Duponte, John Powley, Mark Thorne, Linda Cox, CN Lee, Jinzeng Yang, Yong Kim, Soojin Jun, Matthew Stevenson, and Ashley Stokes. Together, this group is a forms a strong team with diverse expertise pertaining to the beef industry and production. This group has demonstrated tremendous productivity and the receipt of these funds would launch even greater activity.

Budget

Salary for Assistant Extension Agent			$ 57,000.00
	Fringe benefit rate	0.3668	20,907.60
Salary for 1 Master's Student			15,552.00
	Fringe benefit rate	0.0753	1,171.07
Salary for 3/4 Extension and Research Support Staff	75% appointment	$42,000/year	31,500.00
	Fringe benefit rate	0.3668	11,554.20
Student Labor - to assist with program web-site	384 hours @ $9/hour		3,456.00
Student Labor - for assistance with extension and research activities	384 hours @ $9/hour	2 students	6,912.00
Annual Total Personnel			148,052.87

Training Manual Printing and Certification Sign For Farm

Professional quality and comprehensive certification manuals for the Hawaii Beef Producer Program will be developed and given to each participant to serve as a resource for production practices. Producers that complete the program and become Certified Hawaii Master Beef Producers will receive a sign for their farm to display their status as well as a certificate to frame. During the grant period of 5 years, 60 producers/ year will be subsidized for the cost of materials. Additional producers per year will be accommodated as funds are available, and remaining participants will pay the enrollment fee to cover the cost of materials.

Printing of Certification Materials (scholarships for producers)

$85/notebook, sign, and certificate	60 producers	5,100.00
Annual Total Materials		5,100.00

Travel

CTAHR Beef Initiative members (extension agents, specialists, staff, and collaborating members) will conduct the training sessions as part of the certification process for the Hawaii Master Beef Producer Program. The goal will be to conduct an initial round of programs to complete certification on 2 islands per year. Trainings will continue each year to producers that could not attend in previous years or that are new to the industry. As part of continuing education for producers, which is a specific request by producers that have completed programs such as this, nationally-recognized speakers will participate in field-days and/or workshops 3 times per year. To enhance national and/or international collaborations by our team members and to increase our knowledge of cutting-edge and effective production practices, we will send 3 CTAHR Beef Initiative members to national/international meetings per year. Both the introduction of speakers to our meetings and the participation of our team members at the national/international level will truly enrich and refine beef production in the State of Hawaii.

Interisland travel for training team (2 rounds of program training/year with 9 team members)		
	$540/member/program	9,720.00
Domestic travel for guest speakers (CE for producers; 3 speakers/year)		
	$2,200/speaker	6,600.00
Domestic travel for 3 team members to attend National/International meetings (incl. registration)		
	$2,465/member/meeting	7,395.00
Annual Total Travel		23,715.00

Other

The Hawaii Master Beef Producers Program training will be centered around hands-on training for certain aspects of the certification program (i.e. animal handling, proper vaccination techniques, quality assurance, artificial insemination/reproductive techniques) that will require replacement costs and use fees. Also as part of the training sessions, there will be needed equipment, supplies, and other materials. These animals, equipment, and supplies will also serve the CTAHR Beef Initiative graduate students, agents, and specialists in research activities.

Equipment, facility rental, and animal expenditures for workshops/trainings		
	Animal related expenses	9,500.00
	Equipment and facility expenses	12,500.00
Annual Total Other		$ 22,000.00

The Hawaii Master Beef Producers Program and other activities of the CTAHR Beef Initiative team will be committed to fulfillment of this proposed work for the 5-year duration of this Agricultural Development & Food Security Special Fund granting period.

Annual budget			$ 198,867.87
	5-years of activities	Total Budget	$ 994,339.33

Sustainability

The first 5 years of the proposed work will be the most costly and therefore Agricultural Development & Food Security Special Funds are needed to ensure the program's success. Afterward, enrollment fees and other fees generated by the CTAHR Beef Initiative will maintain the Hawaii Master Beef Producers Program.

From: Dr. Ashley M. Stokes [mailto:amstokes@hawaii.edu]
Sent: Monday, November 15, 2010 1:57 PM
To: Char, Caren
Subject: Fwd: Master beef Program

LETTERS OF SUPPORT

Begin forwarded message:
From: Alex Franco <afrancokaupo@gmail.com>
Date: November 10, 2010 12:29:33 PM HST
To: amstokes@hawaii.edu
Cc: gregf@haleakalaranch.com
Subject: Master beef Program
Dr. Ashley M. Stokes, DVM PhD,

Thank you for the time and effort you are putting into this project. The Hawaii cattle industry is very efficient when it comes to producing wean calves, unfortunately the industries ability to get these calves to finish weights on grass has not had much success on an industry wide basis. But we do have a few small producers that has been successful in finishing cattle on grass for the local market for a long time, so it can be done.

Now with the expansion of a local market, I believe the Master Beef Program could provide information and training needed so more producers could look at finishing cattle on their operations for this growing market. I'm in agreement with Greg Friel on key points that he felt that the program could help with from a production stand point and would like to touch on a couple of points from a marketing stand point.

The impact of drought conditions on cattle supply:

Develop a safety net to where calves and animals being finished can be moved off of the ranch, giving mother cows more acreage to graze, building more time to get through drought conditions. This safety net needs to be economical and keep animals in the local market pipe line. This past drought forced all of our partners to sell weaned calves to the mainland and feed heavier cattle in the feed yard at a very high price.

The Impact of this year's drought.

1) Reduction in numbers and carcass weight during the drought (year one)

2) The market impact that will be felt by shortage of cattle in year two

3) The shortage of cattle on year three caused by a drop in conception rate during the drought

Tenderness:

Genetics: A lot of time and money has been spent on improved genetics nation wide. I really feel that we need to evaluate good performing acclimated seed stock that is presently in Hawaii and take an inventory on DNA tenderness values on cattle that have been here for several generations, from operations that are moving toward a grass finish market.

Study the correlation between live grass finished cattle DNA tenderness values and compare it to its carcass tenderness. Use this information along with the grazing management and nutrition of this animal prior to slaughter to evaluate tenderness bottlenecks that can impact tenderness other than just genetics.

The Master Beef Program can be a tremendous help to our industry, and the local consumers here in Hawaii. Maui Cattle Company sees this as a benefit to our program.

Thank You,

Alex Franco
Maui Cattle Company, LLC.

November 4, 2010

Ashley M. Stokes, DVM, PhD
Associate Extension Veterinarian
Pre-Veterinary Advisor
Dept. of Human Nutrition, Food and Animal Sciences
College of Tropical Agriculture and Human Resources
University of Hawaii
1955 East-West Road, Agriculture Sciences 314G
Honolulu, HI 96822

Subject: Hawaii Master Beef Producers Program

Dear Dr. Ashley Stokes, DVM, PhD,

I appreciate you taking the time out of your busy schedule to meet with us here at Haleakala Ranch Company while you were working on Maui. As we had discussed, I see a definite need for the local beef industry to have a Hawaii Master Beef Producers Program. Currently, our partners in the Maui Cattle Company have been transitioning back to a local grass-fed market. In addition, we have also been working with CTAHR extension agents as well as national and international sources in order to increase our knowledge base.

With the introduction of a Hawaii Master Beef Producers Program, I can envision the local beef producers gaining access to valuable information in the following areas:

- Grazing management and grazing planning
- Developing genetics within a herd that meets the producer's specific environmental and marketing needs
- Animal nutrition and health
- Animal handling and behavior
- Beef Quality Assurance methods
- Implementation of a Ranch Biosecurity Program
- Possibilities of cooperative marketing of beef products

Given the ability to utilize this library of information, I believe this program will greatly benefit the local producers by helping them improve the quality and profitability of their livestock. If I can provide any assistance for this project, please do not hesitate to contact me.

Sincerely,
Greg Friel
Livestock Manager

18. CTAHR FARM FOOD SAFETY COACHING

The purpose of this project is to continue to increase on-farm food safety through individualized, on-site coaching of Good Agricultural Practices (GAPs or also called, *Food Safety Certification or Food Safety Certified*), to all Hawaii produce farms. GAPs have been available to all US farmers since President Clinton promulgated them via the US FDA in 1998 (FDA, 1998).

In Hawaii at the present time, only about 65 of 1200+ produce farms have current, internationally-recognized food safety certifications as administered by a third-party auditor. Without exception, every one of the farms our coaching team has been on would have failed an audit on the first visit had an audit spontaneously occurred (as in the case of a food recall and an outbreak investigation). Critical areas of a produce farm operation that are reviewed include:

- Making sure the farm has a well-maintained toilet and has potable water for hand washing.
- Using a proactive pest management strategy for rodents, birds, deer, pigs, and slugs and snails.
- Using the right crop protection chemicals, fertilizers and composts according their labeled (legal) directions, and recording every use. And, that they are following US EPA Worker Protection Standard rules.
- Using sanitized harvest baskets and tools and making sure that harvest bins with holes do not come in contact with soil.
- Making sure that employees are washing their hands before harvesting and handling produce.
- Keeping animals and their fresh manures away from active fields and orchards.
- Using appropriate quality water for irrigation and crop rinse as indicated by a test of their water at an approved laboratory.
- Making sure the packing shed, food contact packing surfaces, and refrigerators are well maintained and not a potential source of contamination.
- Labeling each case/carton with "Grown in Hawai'i" and the appropriate information to allow traceback to a specific field within 24 hours.

A 2009-2010 joint CTAHR-HDOA farm produce sampling project, funded by the Hawaii Department of Agriculture and the Hawaii Farm Bureau Federation, provides evidence that some Hawaii-grown produce is going to market with adulteration (human pathogens and agricultural chemicals. Final report available upon request). This was the case in 2008 with a Kauai produce farm that sold salad greens directly to a local restaurant and a number of visitors were sickened (http://www.marlerblog.com/legal-cases/e-coli-outbreak-traced-to-lettuce---hawaii-ranchers-urged-to-prevent-crop-tainting/).

Beneficiaries

Those who will benefit from Hawaii's produce farms being coached, and hopefully following through to the audit, will be:

- Hawaii's residents and visitors
- Hawaii's professional produce growers, and
- The food producing part of the agricultural sector as a whole.

Objectives and Outcomes

The general lack of knowledge and/or compliance of GAPs by Hawaii food growers puts Hawaii's nearly 1.3 million residents and over 6.5 million visitors at varying levels of risk if they eat locally-grown produce. The lack of local attention to GAPs can also put Hawaii's diversified agriculture industry in jeopardy as any food-borne outbreak can create so much fear in consumers minds' that they avoid certain products for an extended period of time (this was the case for some consumers in 2008 after four Rat Lungworm cases on fresh produce on Hawaii Island). This has, and continues to be somewhat today, the case with California spinach where a 2006 outbreak killed four and injured 205 and the outbreak cost the spinach industry hundreds of millions of dollars (http://www.foodsafetynews.com/2009/09/meaningful-outbreak-7-dole-spinach-e-coli-outbreak/).

For those innovative growers who want to export their Hawaii-grown product to the US Mainland, Canada, and Europe, they are exporting into a global marketplace where third-party audits are quickly becoming the norm. Developing countries like Mexico, Peru, and Brazil are able to export their fresh produce to large retailers such as Costco, Safeway, Albertson's, because they have their third-party farm (and packing house) audits.

Finally, there are two fairly new activities to be viewed in light of farm food safety: a push to replace imports with Hawaii-grown products and a similar push to sell more local produce into the school system, where typically it has mostly come from US Mainland suppliers. Leafy greens from California represent about 50% of the nations' needs. In the new California (and Arizona) Leafy Greens Marketing Agreement, 99% of California farms participate in their strict audit program where compliance needs to be 100% of the audit points, 100% of the time (http://www.caleafygreens.ca.gov/about-us; http://www.caleafygreens.ca.gov/certification/member-status/certified-members). Currently, Hawaii leafy green growers cannot make the same claims as their California competition and that puts them at a competitive disadvantage (even before price is considered) whether they are selling to restaurants, stores or schools.

Our coaching work is straightforward: we go to a farm to do the first walk around with the grower using our "Blue Sheet" (4-pages of questions). The Blue Sheet is a little less precise than the actual 22-page audit and it gives growers a good understanding what they need to work on and what items they will need to purchase. We typically take their water sample at this time. Within a few days to a few weeks the grower contacts us again and we go out and take a look around and review their Blue Sheet. If they are ready, we do a "mock audit" using the actually audit tool. The mock audit might also come on their next visit depending on their progress. Once they get a good score on the mock audit and avoid any of the nearly a dozen "automatic failure" questions, they are ready to make contact with the auditors, typically the Hawaii Department of Agriculture. Once the audit takes place we get a copy of their score for our records and the Hawaii Department of Agriculture posts their company name at our joint GAPs audit website: http://www.hifarmsafe.org/. The grower can then choose to use our free logo to demonstrate their adherence to GAPs for a one-year period.

Our project will improve the food safety situation in Hawaii because each grower we coach will have considerably more knowledge about why their farm is creating a risk and what they need to do to mitigate that risk, and to maintain a low-risk from a GAPs perspective, farming business. Each business we help to transform will be able to hold onto their existing market, if not, grow their market share as a result of our coaching (if they choose to actively market themselves). They have to choose to undergo the audit, however, as we cannot force them to do so.

While it will be difficult to quantify exactly what the reduction in the risk to Hawaii agriculture or a specific consumer for each farm that successfully passes their third party audit, we know that tainted food from even one farm or unhealthy employee can result in sicknesses and deaths, losses to the particular operation, and severe impact on the commodity and the area where that the crop has been grown (region, state, country). A March 2010 Pew Charitable Trusts study, *Health-Related Costs From Foodborne Illness in the United States*, puts Hawaii at the top of the nation for the highest per capita cost of food borne illness; $2,008/case (Scharff, 2010). Similarly, a 2003 GAO study, *School Meal Programs: Few Instances of Foodborne Outbreaks Reported, but Opportunities Exist to Enhance Outbreak Data and Food Safety Practices*, lists Hawaii as the highest state in the nation for food borne outbreaks per 100,000 people during 1973-1999 at 66.0 incidents/100,000 people; Washington State was next highest with 37.1 per 100,000 people (US GAO, 2003). Certainly, not all of these incidents can be traced back to farmers, but that is where the food safety continuum starts and where we have the expertise to be of assistance. At this point, many different agricultural commodities do have ways to produce (and handle) food safer and it behooves Hawaii agriculture to embrace those better ways. A list of specific best practices for many high risk crops are found at the Western Growers Association website: http://www.wga.com/default.php?id=812. They include leafy greens, green onions, tomatoes and melons.

Funds will be used for coaches' salaries and fringe, transportation, water tests, a $100 subsidy for first time farmers doing their audit, and other operational costs.

The success of the project is measured in our community outreach efforts and our individualized coaching. In the past six months, our community outreach efforts have resulted in 36 new clients for our farm food safety coaching program. Of the new clients, we have already conducted 21 site visits, coaching the growers on Good Agricultural Practices, conducting water testing for coliforms, and providing personalized guidance on farm food safety issues, such as health, hygiene, and field sanitation. Our staff (of three .50fte coaches) encourages farmers and growers to develop a farm safety manual, keep documentation of farm practices, and eventually, undergo a third-party farm safety audit. These activities all contribute to an overall lessening of risk of a foodborne illness outbreak, which is good for the public, and the produce industry, and these activities lessen the risk to the farmer (and his/her small business) by lessening the risk of legal liability.

Funding for this project includes allowances for water quality testing, and a small amount of funds ($100/farm) to offset a portion of the cost for our clients to complete the food safety process and undergo the certification process through HDOA. PrimusLabs is an internationally recognized third-party auditing and certification organization that promotes food safety (i.e. risk management) through safe food handling and packaging practices, employer/employee safety, and field/greenhouse sanitation. We expect that many more farms will choose to voluntarily undergo third-party food safety auditing.

Timeline

Task	FY 12	FY 13	FY 14	FY 15
Coach 50 farms				
Report as required				

Budget

University of Hawaii	FY 12	FY 13	FY 14	FY 15	Total
Salaries and Wages					
a. Full-time Food Safety Coach for Oahu (& Program Manager)	$75,000	$75,750	$76,508	$77,273	$304,531
b. Full-time Food Safety Coach for Hawaii	$50,000	$50,500	$51,005	$51,515	$203,020
c. Half-time Food Safety Coach for Maui (inc Molokai and Lanai)	$25,000	$25,250	$25,503	$25,758	$101,511
a. Clerical support (.25fte)	$10,000	$10,000	$10,000	$10,000	$40,000
Total Salaries and Wages	$160,000	$161,500	$163,015	$164,545	$649,060
Fringe Benefits (Fringe rate of 36.68% set by ORS)					$0
a. Full-time Food Safety Coach for Oahu (& Program Manager)	$27,510	$27,785	$28,063	$28,344	$111,702
b. Full-time Food Safety Coach for Hawaii	$18,340	$18,523	$18,709	$18,896	$74,468
c. Half-time Food Safety Coach for Maui (incl. Molokai and Lanai)	$9,170	$9,262	$9,354	$9,448	$37,234
2. Other Personnel					$0
a. Clerical support (.25fte)	$3,668	$3,668	$3,668	$3,668	$14,672
Total Salaries, Wages and Fringe Benefits	$218,688	$220,738	$222,809	$224,900	$887,135
Travel (domestic)					$0
a. Airfare to Kauai to serve clients (same-day travel) (12 rt flights)	$2,700	$2,700	$2,700	$2,700	$10,800
b. Rental car for Kauai (12 rentals)	$480	$480	$480	$480	$1,920
c. Traveler per diem (12 same-day trips)	$240	$240	$240	$240	$960
d. Other travel expenses (airport parking, mileage, gas, etc. - est. $30/trip)	$360	$360	$360	$360	$1,440
e. In-state Mileage (300 miles/coach/month @ .50/mi))	$5,400	$5,400	$5,400	$5,400	$21,600
Total Travel	$9,180	$9,180	$9,180	$9,180	$36,720
Contractual					$0
a. PrimusLabs audit subsidy performed by HDOA (50 farms/year @ $100 *)	$5,000	$5,001	$5,002	$5,003	$20,006
b. Water testing by Food Quality Labs (50 farms/year @ $50**)	$2,500	$2,500	$2,500	$2,500	$10,000
Total Contractual Costs	$7,500	$2,500	$2,500	$2,500	$15,000

Materials and Supplies					
a. Printer toner cartridges (4 x $150)	$600	$600	$600	$600	$2,400
b. Office supplies	$500	$500	$500	$500	$2,000
Total Materials and Supplies	$1,100	$1,100	$1,100	$1,100	$4,400
All Other Direct Costs					
a. Wireless connectivity (3G WiFi access, unlimited use) ($75/mo)	$900	$900	$900	$900	$3,600
b. Publications (1 publication / 500 copies) (.40/page color)	$200	$200	$200	$200	$800
Total Other Direct Costs	$1,100	$1,100	$1,100	$1,100	$4,400
Total	$237,568	$234,618	$236,689	$238,780	$947,655

In-kind contribution

We will continue to seek other funding for this critical work. The University of Hawaii provides this project with office space and a telephone.

Project Partners

Our main partners are the farmers themselves. We also believe organizations such as the Hawaii Farm Bureau Federation, Hawaii Farmers Union, Malama Kauai, Economic Development Boards, Haleiwa and Hawaii Kai Farmers Markets, Costco, Disney, islands wholesalers, among others, are critical partners in encouraging their members to adopt Good Agricultural Practices and to be audited annually for compliance with those GAPs.

Sustainability

Our goal is to have all produce farms in Hawaii passing their third party audits, at least once, by Year 5. It is our experience that once a conscientious grower has gone through coaching and a third party audit, and they keep up their records throughout the year, they do not need coaching to do their subsequent audits. Therefore, there should be no need for additional funding for coaching past Year 5.