HARC

Hawaii Agriculture Research Center

ANNUAL REPORT 2009

Board of Directors

EXECUTIVE DIRECTOR'S LETTER

To our Board of Directors, Members, Clients and Friends,

Hawaii Agriculture Research Center completed its first year as a community-based non-profit agricultural scientific organization. Consequently, its annual report is being formatted to more closely resemble that type of organization. Historically, it has been more of a technical report on the research conducted during the prior year: initially focusing on sugarcane but evolving over the years to include many other crops and activities.

This 2009 Annual Report marks a major change in format focusing more on its mission, community benefits and financial condition while continuing to provide a summary of research accomplishments. The scientific projects, technical details and results will be available on our website. We will continue our 100-years ago highlights.

The 115th year was another remarkable year of transition for the organization, this time in its facilities. Culminating a 3-year effort, HARC successfully dedicated its Kunia Experiment Station's 108-acre field site to agriculture use in perpetuity. Funding for this agricultural conservation easement was provided by the state partnering through the Agribusiness Development Corporation and the Legacy Land Conservation Program with the USDA-NRCS Farm and Ranch Land Protection Program to preserve agricultural lands. In July at Kunia a new laboratory facility was completed allowing co-location again of field and laboratory staff to improve research efficiencies.

Also during this year, HARC was the recipient of another 119 acres through the generosity of James Campbell LLC as it sought to reduce its agriculture holdings in the state. This land is the site of the former Del Monte Fresh Foods Hawaii headquarters, community housing infrastructure and associated agricultural facilities. It is a unique opportunity for HARC to preserve the infrastructure support that the diversification of agriculture sorely needs: a site for affordable agricultural housing, reasonable tenure for agricultural businesses and for centralizing public and private agricultural support organizations.

Just as other non-profits have struggled during this difficult economic period, HARC's finances also have been strained. We are very appreciative of those who have donated materials for the new laboratory facility and landscaping at its sites and other donations of time and materials. We are looking forward to your support in a capital campaign anticipated for 2010.

Respectfully,

Stephanie A. Whalen
President and Director

100 YEARS AGO: 1909

The Hudson Motor Car Company was founded; construction of the RMS Titanic began; Louis Bleriot became the first man to fly across the English Channel; Pearl Harbor naval base was founded; the first forestry school was incorporated at Kent, OH; workers start pouring concrete for Panama Canal; the first Lincoln head pennies were minted; President Taft was inaugurated as 27th President during a 10" snowstorm; the University of Hawaii played its first football game; 7000 Japanese plantation workers went on a 4-month strike at major plantations on Oahu, resulting in HSPA's decision to raise wages and abolish the system of setting wages by nationality; U.S. Navy commander Robert Peary reached the North Pole; Hawaiian molasses was studied as a source of alcohol; HSPA's entomological work on the leaf-hopper was recognized by German scientists; Hawaii produced its largest sugar tonnage to that point; Born: Katherine Hepburn and Ethel Merman (American actresses), Linus Pauling, Burl Ives; Died: Geronimo, Frederic Remington (American western artist and sculptor).

MILESTONES

Constructed New Lab:

After years of planning, HARC's 20,000 square-foot laboratory is up and running at HARC's long used Kunia Experiment Station. To minimize incurring additional rent at the former Aiea facility, the staff worked extremely hard to relocate equipment, files, etc. They were preceded by HARC's administrative staff relocating from Aiea to the former Del Monte office at Kunia, followed by HARC's chemistry, pathology, and sugar technology operations to the existing but newly renovated Multi-Purpose building on the Experiment Station site.

HARC is grateful to the following companies for their donations:

SteelTech (canopy); Mililani Agricultural Park, LLC (Wayne Ogasawara, landscaping material); Brian Cordero (landscaping trees); Delta Construction (ground leveling, boulder removal, rock crushing); Kimball Development Group, LLC (John Kimball, two roll up doors); AgroResources (David Rietow, macadamia nut trees); Green Point Nurseries (Eric Tanouye, cut floral decorations for open house); Alluvion, Inc. (Susan Matsushima, nursery plants, floral decorations for open house); Hawaiian Sugar Technologists (stained-glass panels at the building entry); Pacific Island Nurseries (Richard Marques, cut floral decorations for open house); and Group Pacific (Hawaii), Inc. (Steve Graef, project design management).

Preserved 100 Acres in Agriculture in Perpetuity:

HARC's lower Kunia site is situated to the NW of the H-1/Kunia Road intersection, a location heretofore primed for urban expansion. HARC sold its rights to develop the area through the federal Farm and Ranch Lands Protection Program. Both the Natural Resources Conservation Service and the State's Agribusiness Development Corporation through the Legacy Land Conservation Program purchased the conservation easement thereby preserving the land in agriculture in perpetuity and bringing another epic project to closure.

Procured Former Del Monte Property:

James Campbell, LLC, in keeping with their long supportive role of agriculture in the state, transferred to HARC ~119 acres of agricultural land consisting of Kunia Village and its associated community and agricultural buildings:

PROPERTY	AREA	DESCRIPTION
Agricultural accessory buildings	Over 140,000 square feet under roof	Including offices, warehouses workshops, and tractor shed
Village	~53 acres	121 agricultural dwellings ranging from 1- to 4-bedroom units
Other structures		Country store, 2 chapels, gymnasium, manager's house, dormitory, wastewater treatment plant
Agricultural land	~35 acres	Open

Centrally located in the heart of Central Oahu, this site can serve agriculture's infrastructure needs: providing affordable housing and affordable long-tenure space for agricultural businesses. It also is providing a centralized permanent location for public agencies and private organizations that support agriculture.

Sugarcane:

Sugarcane breeding and research continue for the long-term success of Hawaii's sugarcane industry. HARC continues to develop and test new cultivars for commercial production. We collaborate in seed production and molecular marker development research.

For variety production, we generated progeny by melting pot crosses (modified poly crosses) at the Maunawili Station. Clones with high yield and disease resistance were selected by the selection program (FT1-FT7) on the island of Maui.

Varieties from Louisiana were imported to the quarantine station at Kunia; 15 crosses resulted in the successful production of seeds for national uses.

We continue collaborating with University of Illinois for improvement of fuel stock grasses. F2 populations of *S. officinarum* and *S. robustum* were produced from selected F1 parents. About 280 F2 genotypes are being evaluated on Maui. An FT7 yield trial was installed to evaluate sugar and biomass yield of commercial varieties and energy canes.

In recent years, sugar yields have declined, in part due to the sugarcane yellow leaf virus (SCYLV). In addition, drought is the most serious environmental factor limiting the productivity of agricultural crops, including sugarcane. We are undertaking a proven transgenic technology to develop drought-tolerant and virus-resistant sugarcane.

Beverage Crop:

New coffee cultivars selected for cupping quality and bean size are being tested at Hawaii coffee growers' fields. Clonal propagation of these varieties by tissue culture is underway. We identified Ethiopian arabica varieties resistant to nematodes, *M. konaensis*, through collaboration with the University of Hawaii. Cupping quality of the resistant varieties was evaluated and progeny of selected varieties were obtained.

For molecular biology, we are currently verifying the functions of a coffee gene expressed differently in two coffee varieties using transgenic arabidopsis. Additional AFLP molecular markers were identified in arabica mapping population.

Three years data collection of cacao population at Waialua was completed. Molecular characterization of these trees is under way at USDA-Miami. Selected superior trees were planted for further selection of highly productive trees in Hawaii.

For cacao fermentation we built on all previous years' work by scaling up to commercial levels in collaboration with University of Hawaii. We successfully inoculated industry fermentation vessels which produced over 1000 lbs of cacao. These samples will be sent for quality evaluation. We achieved measurable differences compared to industry procedures for heat temperatures.

Microorganisms were isolated and characterized for test fermentations. Unique chocolate flavor profiles were shown using set combinations of microbes.

Tropical Fruit:

Genomic approaches are being used to study several important traits in papaya. The major gene controlling yellow or red flesh color in papaya was identified and the associated DNA markers were developed for marker assisted selection. The DNA sequencing of the male-specific regions of Y chromosome and the corresponding X region are nearly complete. Identifying sex determination genes would put us one step closer to the production of true hermaphrodite breeding trees, which will be a major breakthrough in papaya cultivation. Genome-wide analysis of *papaya genomic database* reveals a small resistance gene family size but structurally diverse, making it suitable for functional studies aimed at a broader understanding of papaya disease resistance. Seven molecular markers linked with *Phytophthora palmivora* tolerance in papaya were identified and markers are being developed for selection of resistance or tolerant varieties in papaya breeding. Proteomics analyses enable us to identify the differential expressed proteins involved in papaya's defense or stress-related responses. In addition to the papaya research, a paper describing a new method for production of transgenic pineapple plants was published.

Forestry:

Between 2006 and 2009, more than 150 koa families were evaluated for their potential resistance to Koa wilt. Most of the seed lots came from wild populations. However, several seed lots were from survivors of family level progeny trials at HARC's Maunawili Field Station. A composite of five virulent isolates of a pathogen were used for inoculation. Seedling wilting and mortality in the greenhouse was monitored over a 90-day period for each test. Seedling mortality among seed lots varied widely (4 to 100%) and averaged 61.5%. These initial results indicate that natural resistance is low within native koa populations.

A 10-year old Koa at the Maunawili Seed Orchard, now producing disease-resistant seed for use in future plantings

Miscellaneous Crops:

Collaborating with the USDA Pacific Basin Agricultural Research Center (PBARC) and the Hawaii Anthurium Grower Association, HARC continues to provide transformed plants for nematode and greenhouse testing in Hilo. Micropropagation techniques are being improved to speed the availability of desired cultivars.

Biofuels have long been of interest to the sugar industry and the state. HARC's jatropha research began with the establishment of germplasms from Madagascar, India, China, and Honduras. Field trials in Hawaii are being conducted to select for rapid growth and reproduction, which will allow HARC researchers and their collaborators to rapidly make improvements through traditional breeding procedures.

Co-product revenue streams are critically important to the economic viability of any biofuel business model, and jatropha presents unique problems compared to many commercial oilcrops like soybean and canola. HARC worked with a commercial company to identify additional possible income streams from commercial production of jatropha.

HARC is also participating in sweet sorghum research trials as sorghum will continue to be evaluated as a promising feedstock crop for biomass and sugar production for conversion into energy and ethanol. HARC has identified old varieties that showed superior adaptation to our special growing conditions. It was determined that further research may be warranted.

HARC is also working on other Hawaiian botanic crops, such as noni whose fruits and foliage have been used for medicinal purposes for centuries. In addition, HARC is working on bioremediation fungi that are natural degraders of PCBs and that could be used for decontamination of metal surfaces.

See www.harc-hspa.com for more details.

Combined Statement of Activities

For the Fiscal Year Ending June 30, 2009 (in thousands)

REVENUES		**$ 2,438**
EXPENSES		
Program Expenses		$3,243
Supporting Services Expense		$911
TOTAL EXPENSES		**$ 4,154**
EXCESS OF EXPENSES OVER REVENUES	**-**	**$ 1,716**
HFAR LOSSES ON INVESTMENTS		-$ 1,944
HARC PENSION-RELATED CHANGES		-$ 3,712
NET ASSETS AT BEGINNING OF YEAR		**$16,930**
NET ASSETS AT END OF YEAR		**$ 9,558**

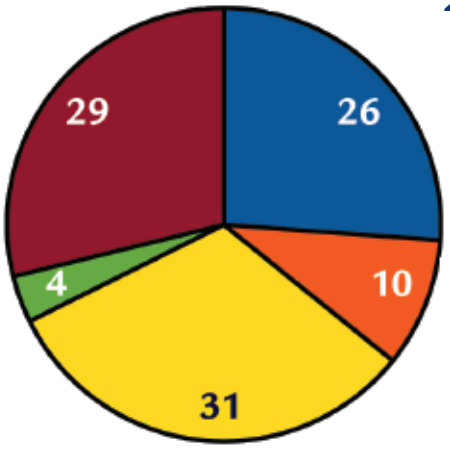
For the year ending June 30, 2009, HARC had an operating loss of $1,716,032 compared to a budgeted operating loss of $1,087,339. Half of the $628,693 variance resulted from lost revenue on projects that were either deferred or canceled and unplanned expenditures relating to our new research facility; the acquisition of the former Del Monte plantation site accounted for the other half. Stock market conditions accounted for a combined $4,600,966 decrease in the value of the HFAR and Pension Fund investments; pension benefit payouts and fees totaled $1,034,681.

Tasseling sugarcane with the Koolau Mountains behind Maunawili as a backdrop

Sponsors

Fundraising plans are in the making. Stay tuned.

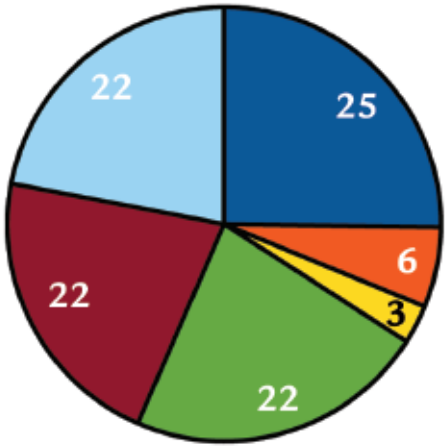
2009 - Income by Source



- FEDERAL (USDA)
- STATE & LOCAL GOVERNMENT
- HFAR
- OTHER
- NON GOVERNMENT

For fiscal year 2009, 65% of HARC's revenue came from its business operations (active research projects and services), 31% from its foundation (the Hawaii Foundation for Agriculture Research or HFAR), and 4% from rents and contributions (Other).

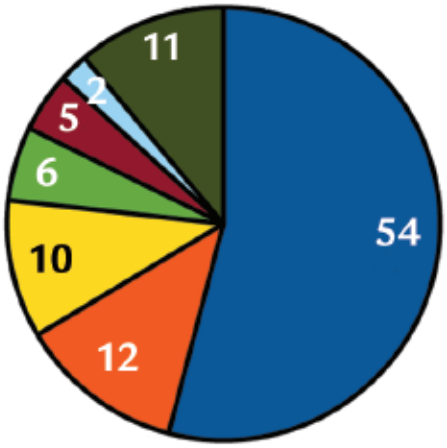
2009 - Expenses by Project Type



- SUGARCANE
- COFFEE
- FORESTRY
- PAPAYA
- OTHER CROPS & TECHNICAL SERVICES
- SUPPORTING SERVICES

All expenses are posted either directly to specific projects (a direct expense) or to general ledger accounts (as indirect expenses). Later, all the indirect expenses are allocated among all of the cost centers, including Support Services. After allocation, Sugarcane-related projects accounted for 25% of the firm's costs whereas Forestry-related projects only 3%. HARC's support costs (admin, HR, accounting, facilities) represented 22% of the firm's total costs. Other crops and Technical Services (22%) included banana, pineapple, cacao, sorghum, noni, taro, anthurium, chemistry, pathology and field trial-related projects.

2009 - Functional Expenses



- SALARIES & BENEFITS
- RENT
- PROJECT COSTS
- DEPRECIATION
- INSURANCE
- SUBSTATIONS
- OTHER

Salaries and benefits totaling $2,246,471 account for 54% of all expenses. With completion of the new Kunia research facility, Rent expenses ($512,800) will be eliminated; however, depreciation expenses ($229,852) will be increasing. Substation expenses ($90,653) include costs to operate and maintain the Maunawili, Kunia and Maui field stations. This includes utilities, supplies and minor building and equipment repair work, but not salaries and benefits. Other ($460,750) includes professional fees, supplies, taxes, communications, vehicles, maintenance and repair, and so forth.

HARC Officers

Ms. Stephanie A. Whalen
Executive Director

Dr. Blake Vance
Assistant Director

Mr. David Kula
Controller

HARC's Mission

To support a viable agricultural sector by researching and applying relevant science and technology to achieve practical solutions and by identifying new agricultural opportunities.

HARC's Purpose

1) to perform scientific research in production agriculture;

2) to develop and demonstrate appropriate technologies in support of production agricultural research in order to promote rural community economic vitality through agriculture;

3) to educate the public regarding the scientific research and the practice of agriculture by providing information and training in agricultural and natural resource conservation principles;

4) to provide training and rehabilitation programs for agricultural workers;

5) to support the development of agriculture in general by development of agribusiness opportunities.

Cultivars of Hawaiian sugarcane (Saccharum officinarum)
- photo courtesy of Maui Nui Botanical Gardens, Kahului, Maui

Administration and Support Staff

Stephanie Whalen, Executive Director
Dr. Blake Vance, Assistant Director/Facilities Administrator
David Kula, Controller
Janet Ashman, Environmental Specialist
Florida Chow, Human Resources
Becky Clark, Bookkeeper
Ryan Funayama, Accountant
Ladislao Gonzalez, Watchman, Maintenance
Michael Kaufmann, Forestry Assistant
Ann Marsteller, Librarian
Patrick Nakoa, Building Maintenance
Cynthia Pinick, Executive Secretary

Staff

Nicklos Dudley, Forester
Dr. Mel Jackson, Director of Product Development and Services
Dr. Chifumi Nagai, Director of Beverage Crops Research
Michael Poteet, Assistant Agronomist
Lance Santo, Agronomist/Field Coordinator
Dr. Susan Schenck, Plant Pathologist
Ben Somera, Sugar Technologist
Dr. Ming-Li Wang, Molecular Biologist
Aileen Yeh, Hawaii Coordinator
Dr. Qingyi Yu, Plant Molecular Biologist
Dr. Y. Judy Zhu, Biochemist

Research Associates

Dr. Andrea Blas
Dr. Xiaoling He
Dr. Heather McCafferty

Laboratory Research Assistants and Experimentalists

Arlene Lewis, Laboratory Assistant
Susan Ancheta, Laboratory Assistant
Josephine Buenafe, Experimentalist
Jamie Clayton, Research Assistant
Rebecca Heinig, Research Assistant
Tyler Jones, Research Assistant
Walter Kitagawa, Laboratory Assistant
Terryl Leong, Special Projects Assistant
Josienellie Rosete, Laboratory Assistant
Sachiko Saito, Laboratory Assistant
Eric Tong, Research Assistant
George Yamamoto, Special Projects Assistant

Kunia and Maunawili Substations

Rudy Dizor, Experimentalist
Angel Galvez, Experimentalist
Roland Fernandez, Experimentalist
Roger Styan, Experimentalist, Supervisor

Maui Substation

Albert Arcinas, Sugarcane Program Manager
Artemio Bacay, Field Worker
Edison Bacay, Field Worker
Teodoro Bonilla, Field Worker
Romeo Cachola, Field Worker
Wilson Galiza, Foreman

Kauai Substation

Fernando Garcia, Field Worker
Narciso Garcia, Field Worker

Students

Dr. Ruizong Jia, University of Hawaii
Dr. Brad Porter, University of Hawaii
Ratnesh Singh, University of Hawaii
Ching Man Wai, University of Hawaii

Collaborators

Dr. Maureen Fitch, Plant Physiologist
Dr. Paul Moore, Plant Physiologist

Emeritus

Dr. Kuo-Kao Wu
Dr. Robert V. Osgood

Affiliated Scientist

Dr. Ray Ming

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