



C/T/A/H/R
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Plan of Work

Annual Report of Accomplishments and Results

Federal Fiscal Year 2006

A handwritten signature in cursive script, reading 'A. G. Hashimoto'.

Andrew G. Hashimoto
Dean and Director

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A. Planned Programs

National Goal #1:

An agricultural system that is highly competitive in the global economy.

Through research and education, empower the agricultural system with knowledge that will improve the competitiveness in domestic production, processing, and marketing.

OVERVIEW

CTAHR researchers, specialists, and county agents continue to work in tandem and with sister agencies to help Hawaii farmers to be more competitive in the global economy. Areas of focus for the College were in: grass finished beef production, agriculture tourism, new and old diversified crops, bioenergy and biofuels crops, invasive species, sustainable agriculture, ornamental and flower crops, integrated pest management, plant nutrient management, waste management, youth development, health and nutrition, and personal financial management. More recently bioenergy and biofuels crops have surfaced as top priority and the college is gearing up for a major integrated project to commence.

The downsizing of plantation agriculture continues with the surprise closing of Del Monte's operations on Oahu. This adds to the more than 100,000 acres former lands in sugar and pineapple that are now available for diversified agriculture and other uses. CTAHR continues to play a critical role in conserving these important agricultural lands with a special effort in promoting and assisting the local diversified agriculture industry in Hawai'i. CTAHR has been involved in identifying new crops, the most suitable varieties, production techniques, pest management, post harvest handling and treatment, marketing and many other areas. The spike in world oil prices, the mandated inclusion of 10% ethanol in gasoline sold in Hawai'i, and the renewed interest in bioenergy and biofuels is causing the college to review and redirect some of its resources in this area. Hawai'i relies on over 90% of its energy resources, highest in the nation, on petroleum. A biofuel industry can expand the state's agricultural and technology sectors, keeping cash in the local economy while conserving green countryside. The 5 year increase in farm value based on most current data available, the value of diversified agriculture increased from \$342.8M in 1999 to \$438.1 in 2005 for a 27.8% increase. Noteworthy sectors were Vegetables and Melons \$44.9M in 2000 to \$67.7M in 2005 for a 50.8% increase; Tropical Specialty Fruits: \$1.3M in 2000 to \$2.7M in 2005 for a 140% increase; and Floriculture and Nursery \$75.7M in 1999 to \$100.6M in 2005 for a 32.9% increase. Not all sectors have fared as well due to continued impact by introduced insects, diseases and other pests as well as from foreign competition.

Research continues in the area of growing edible ginger root in non-circulating hydroponic systems as a means of producing disease free propagation materials (rhizomes) to avoid the bacterial wilt organism. Bacterial wilt caused by *Ralstonia solanacearum* is a major limiting factor and disease free seed is essential for the industry to survive.

The annual “A Taste of the Hawaiian Range” and Agricultural Festival continues to grow with a record 2,150 people attending in 2006. The food show celebrates and focuses attention to the best of Hawaii’s agriculture and is a forum to educate the culinary industry, food service buyers, general public and visitors about the diversity of quality products grown in Hawai‘i. Although the focus has been on grass finished livestock, local farmers who produce a variety of new, traditional crops and products are a major component of the event. Twenty-eight restaurants were represented at this 11th annual event, along with 37 food service vendors, vegetable and ranch industry promotional booths. The show was featured in a regional television show from San Francisco hosted by former Miss Universe, Brook Lee. According to local media, this food show is rated as one of the best in the State of Hawai‘i. Attendees came from 27 mainland states and two foreign countries (12.5%), 8.4% were from neighbor islands and 20.9% were tourists and other visitors. The number of cattle kept in Hawai‘i for local sales through November 2006 increased 16.9% as compared to the same period in 2005 for a total of 9,700 head.

By conservative estimates, Hawai‘i’s landscape related industries has an annual worth of nearly \$500 million and employs more than 10,000 people, adding 130 jobs each year. To meet this demand, CTAHR collaborates with the Landscape Industry Council of Hawai‘i to train and certify landscape professionals. Established in 2000 the Certified Landscape Technician program currently operates on Oahu, Hawai‘i, and Kaua‘i islands.

Extension workers held 304 workshops/conferences/demonstrations with 15,765 people in attendance. Over 171,612 direct contacts and 12,270 indirect contacts were made with stakeholders providing them with assistance, educational materials, or training. One hundred ninety one volunteers provided 5237 hours of volunteer time worth (at \$17/hour value) \$89,029 towards accomplishing GPRA Goal 1.

CTAHR has 232 projects under the National Goal #1 in the CRIS database. We selected 7 projects from 7 key themes to highlight in this year’s report. The major selection criteria are the quantifiable outcome and impact. We provide only the summary output data in this section, and will present outcome and impact information under individual key themes below.

Research results have been shared through refereed journal articles, abstracts, books and book chapters; theses, local, regional, national and international meetings, symposia and workshops; and an array of web pages. CTAHR faculty published 423 various publications last year under goal 1.

Allocated Resources -- Goal 1:

Fiscal Year	Research Hatch Funds (\$)	Research State Funds (\$)	Research Other Fed & Non Fed Funds (\$)	Research Total Funds (\$)	Research Scientist Years (SY)
2006	746,546	5,556,460	518,942	6,672,781	25.50

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2006	419,256	1,567,408	502,731	2,489,395	24.00

ASSESSMENT:

All units in the College of Tropical Agriculture and Human Resources are required to conduct regular performance evaluation of their faculty members. These reviews are conducted based on goals established during previous year's reviews. Since all faculty members with CTAHR research FTE are required to establish their Hatch projects, regular performance evaluation serves a good vehicle to assess our progress toward the goals in our plan of work. CTAHR has made good progress in meeting these goals.

KEY THEME: Animal Production Efficiency

ISSUE OR PROBLEM

Thirty years ago, 30% of the beef consumed was produced locally where currently more than 90% of beef is imported. The globalization and transformation of the world beef market to boxed beef has gradually converted Hawai'i ranching to cow/calf operations. CTAHR is taking the lead to reverse this trend through research and breeding programs to improve the meat quality of grass finished cattle. Outreach programs, including food shows, field days, educational workshops, websites, and extension publications. The project involves coordination of a team, involving livestock agents, specialists, researchers and industry advisors, that will fill informational gaps to enhance the sustainability of the Hawai'i Beef Cattle Industry. Project focal areas include: Cost of production and economic analyses marketing options, biotechnology and its application to beef genetic improvement, pastoral system investigations, outreach and meat science. Significant progress has been made to improve the working partnership with CTAHR and the beef cattle industry in Hawai'i. Cost of production cow-calf calculator has been completed with publication and software. The program also successfully conducted the annual Mealani Forage Field Day and A Taste of the Hawaiian Range under its outreach segment. A Sono Vet 2000 ultrasound machine has been purchased to used as an evaluation tool for determining carcass quality without having to sacrifice the animal to speed up the breeding program. Research using DNA-based testing tools for selection of desired traits in breeding programs is progressing well.

IMPACT

Greater numbers of ranchers have increased awareness of marketing models for Hawaiian cattle, best management practices and technologies for sustainable grazing production. Local beef slaughter numbers appear to have bottomed out in 2005 (9,200 heads) and showed signs of increasing in 2006 (estimated 10,000 heads). An inactive processing plant on Hawai'i island was

refurbished and opened for business to provide local grass fed beef for the local market.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - State, Smith-Lever, Hatch, County, Grants

KEY THEME: Aquaculture

ISSUE OR PROBLEM

Hawaii has the highest per capita consumption of seafood in the U.S. but imports more than 75 percent of its seafood. Successful aquaculture enterprises in Hawaii will not only reduce seafood imports but grow and diversify Hawaii's economy. This project provides new opportunities for diversification of Hawaii's aquaculture industry but also provides decision support tools for its aquaculture farmers. Grow-out facilities for two commercial fish farms in Hawaii (e.g., Cates International and Kona Blue Water Farms) were surveyed for the presence of the marine dinoflagellate, *Gambierdicus toxicus*. No signs of the dinoflagellate were detected in the land based grow-out facilities at Kona Blue Water Farms. In contrast, *G. toxicus* were found on all three submerged sea cages operated by Cates International and levels that ranged between 1 to 1,921 cells *G. toxicus*/gram algae. The major algal species that was growing on the cages and associated with *G. toxicus* was identified as *Tolypiocladia glomerulata*. The low levels of the dinoflagellate are consistent with number of cases (3.6 cases/100,000 population) reported for ciguatera poisonings in Hawaii. Fish specimens from these facilities were also tested using a membrane immunobead assay for detecting ciguatoxin and related polyethers directly from fish tissue. A total of 40 individual Pacific threadfin and 40 kahala intercepted through the normal marketing chain were examined and none were found to possess the ciguatoxin(s). These findings indicate that ciguatoxin(s) are prevented from entering the culture process for both *S. rivoliana* and *P. sexfilis* raised in aquaculture facilities even when *G. toxicus* is present. At the Windward Community College Aquaculture Facility, Sea Grant College Program staff continued the production of homozygous lyretail individuals using artificial insemination techniques. The homozygous individuals produced provided the raw material used in developing a gene marker. In addition, the lyretail trait was demonstrated to be a dominant genetic trait that is being inherited according to the Principle of Mendelian Segregation and confirmed via progeny testing in both males and females. No differences in clutch size, time between clutches could be found between heterozygous and homozygous genotypes and is consistent with the reproductive traits of the common swordtail. Initial attempts focused on the use of AP-PCR techniques and over 300 primers were investigated as to being able to distinguish between the three different genotypes. One potentially useful marker was identified (PCR product #34, 550 bp) and was cloned. That marker could be used to consistently distinguish between the homozygous recessive (common swordtail) and the other two lyretail genotypes.

IMPACT

This project has provided an increase in consumer confidence that the Hawaii farm-raised fishes are safe to consume. The swordtail has been acknowledged as being one of the Hawaii major

species being produced by freshwater ornamental fish growers. Production of a homozygous strain of lyretail swordtails will result in a dramatic rise in this particular product and impact the overall output of the Hawaii fledgling freshwater ornamental industry. Expansion and diversification of the industry could come about by the establishment of all female strains of homozygous lyretail females and provide an opportunity for expansion and diversification of the industry in the form of marketing the value added product of the female broodstock in addition to lyretail swordtails.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - State, Hatch, Smith-Lever, Grants

KEY THEME: Diversified/Alternative Agriculture

ISSUE OR PROBLEM

Hawai'i's farmers are continually looking for new and different crops for either the export or niche markets as part of diversifying their business. For several years now, CTAHR research and extension faculty have been working towards the identifying the best cultivars, planting and production methods, and processing protocols for tea. CTAHR has test plantings at three experiment stations and a tea nursery is being maintained at the Mealani Research Station. A plant material distribution program was developed in conjunction with the Hawai'i Tea Society (HTS) to distribute propagation materials. Eight tea cultivation/processing workshops and promotions were conducted (including two visiting tea experts from Japan and Taiwan). Three grower cooperators were set up for advanced observation at sites beyond the Mealani Research Station (Ka'u, Hilo, Maui). A Hawaii grown and processed semi-oxidized tea and a green tea prototype was developed and assessed at the Taste of the Hawaiian Range Food Show, a local tea merchant, and at the 1st Hawai'i Grown Tea Competition.

IMPACT

Many farmers have expressed interest in growing tea in Hawaii and many have already begun planting from planting materials provided by CTAHR. The Hawai'i Tea Society was established to coordinate and unify the efforts in establishing a tea industry. General feedback on our Hawai'i grown tea prototype from the general public and a tea merchant has been positive. The first Hawai'i Grown Tea Competition was held in Hilo and was cooperatively developed by CTAHR and the Hawai'i Tea Society. A total of 16 entries were submitted by growers from Volcano to Waimea. A green tea prototype developed at CTAHR won 1st Place in the Green Tea Category. Tea merchants were anxious to make contact with growers who had high quality products. Growers were highly interested in feedback comments/ratings in order to improve on their processing techniques. A new industry is on the verge of being established.

SCOPE OF IMPACT - State

SOURCE OF FUNDING – Hatch, State, Smith-Lever, Grants

KEY THEME: Invasive Species

ISSUE OR PROBLEM

Wood is the principle construction material in use in Hawaii, and termites are the most economically destructive insect pests in the State. Improved methods for protecting wood products and wood in service are needed by the general public, and by the construction, forestry, and forest products sectors. The purpose of this study is to determine the distribution of termites in Hawaii, identify and evaluate termite-resistant wood products for use or manufacture in Hawaii, and determine which soil insecticides are most effective for termite prevention under tropical environmental conditions. A collaborative project was initiated with USDA Forest Service researchers to describe the effects of disturbance on subterranean termite foraging in Hawaii and the continental USA. We determined that both the presence of dead termites and stress due to capture and return to foraging sites decreases termite feeding. In a laboratory foraging arena, it was observed that water (such as a heavy rain) stimulated increased foraging activity. Studies are in progress to examine the influence of caste proportions on termite sensitivity to disturbance. Field studies in Hawaii and Japan with borate and other wood treatments demonstrated at least 9 (Hawaii) to 10 (Japan) years of efficacy of borate treatments against the Formosan subterranean termite. Laboratory feeding studies revealed that boron ingestion rates differ depending upon the chemical nature of the boron compound used in wood treatment. The soil termiticide fipronil continued to perform well 10 years after application, although a small decline in activity was noted under the extreme rainfall conditions found in Hilo, Hawaii. A curriculum and public education project was conducted in 85 public school classrooms in Hawaii, increasing the termite prevention knowledge and awareness of residents on Oahu, Maui, and Island of Hawaii.

IMPACT

Each year of efficacy of the methods identified in this project equates to an annual savings of over \$27 million in termite control costs for Hawaii residents. Our emphasis on low-toxicity termite management methods, such as borate wood treatments, termite baits, and soil insecticides with long residual but low mammalian toxicity, will result not only in greater protection of buildings in the American Pacific, but also a safer and healthier urban environment. Surveys of termite distribution in Hawaii and studies of termite foraging behavior are necessary to improve bait application methods for subterranean termites. Our results are adopted quickly by local industry, the public, and the Department of Defense in the Pacific.

SCOPE OF IMPACT – State

SOURCE OF FUNDING – Smith-Lever, State funds, and Grants

KEY THEME: Ornamental/Green Agriculture

ISSUE OR PROBLEM

Aroids as foliage and blooming plants have high market demand. Growers continue to express the need for improved cut flower and potted cultivars. Germplasm needs preservation. The purpose is to help solve agricultural problems in tropical monocots, through discovery research and integrative breeding, to support the cut flower, potted plant, landscaping and interiorscaping industries in the USA. Fifteen new hybrids are being tested at grower-cooperator farms and at Waiakea. This includes 11 cut flower selections with five red, one green, two red obake, one orange obake, one pink obake, and one pink; 2 potted plant selections; and 2 novelty selections. Tests continue for UH1311 Waimea under protected cultivation. Thirteen new selections have been established in tissue culture, and several dozen are tagged for initiation of cultures for the coming cycle. Over 60 crosses were made in 2005. UH1554 Tropic Elf was withdrawn for consideration for early release as a compact potted variety due to uncertainty on floriferousness. UH1141 Maggie Inouye was multiplied for early release as a novelty cut flower. Plant selections UH1679, UH1211, and UH658 are being micropropagated for naming and early release. Species *A. ravenii* was propagated in vitro and planted out to test for nematode resistance. Cultures of eleven anthurium species were established in vitro and transferred to the US National Plant Germplasm System for maintenance and further distribution to qualified organizations, institutions, and stakeholders.

IMPACT

An anthurium species, *A. ravenii*, with potential resistance to anthurium burrowing nematode that is cross-compatible with commercial hybrids, was propagated for field testing and hybridization. Eleven anthurium species were established in vitro and transferred to the US National Plant Germplasm System for start of the first anthurium in vitro germplasm bank.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, State, Grants

KEY THEME: Plant Health

ISSUE OR PROBLEM

Various economically important plant diseases occurring in Hawaii are transmitted by insect vectors. This project studies the transmission biology of different pathogens, so that management strategies can be developed to control these diseases. Watercress yellows phytoplasma (WYP) represents a threat to most of Hawaii's vegetable industry, and banana bunchy top virus (BBTV) is widespread in the State and represents the major production limiting factor for banana growers. Our work with WYP has resulted in the identification and characterization of the etiological agent of the disease. We also showed that WYP is a threat to other crops in Hawaii, such as lettuce. In addition, we showed that WYP is spread by an invasive leafhopper vector of

the genus *Macrosteles* (Hemiptera, Cicadellidae). We have conducted extensive oviposition and adult survival host range studies with the leafhopper and showed that many plants, including crops and native species, are hosts for this insect. We also determined the WYP is pathogenic to its vector, further characterization of this pathogenicity and its impact on transmission of WYP to plants is underway. We also performed several experiments to better understand the biology, ecology and epidemiology of BBTV and its aphid vector, *Pentalonia nigronervosa* (Hemiptera, Aphididae - banana aphid). We conducted life table studies with the banana aphid and showed 25C is optimum for population growth of this species. We also showed that, contrary to predictions, the banana aphid prefers to feed on the base of plants rather than new unfurled leaves. This is significant for the development of insect survey practices, as growers can now look for aphids at the right section of banana plants. We also developed a binomial sampling plan for this insect. In addition, we conducted field experiments linking detection of BBTV in plants to plant morphology. We found that PCR assays allowed detection of the virus in infected plants only 5 days prior to symptoms. We also determined that under field conditions BBTV infections take 1-2 months to develop symptoms. A study on the molecular epidemiology of BBTV in Hawaii showed that the virus spread to all other islands from Oahu, suggesting that inter-island transportation of contaminated plant material was an important component of disease spread throughout Hawaii.

IMPACT

Our work with WYP has resulted in better understanding of this disease and immediate change of cropping practices by watercress growers in Hawaii. Growers are now able to understand the epidemiology of this disease, and have been able to recover to pre-aster yellows production levels. Research on BBTV is following a similar path, with results being made immediately available to growers and incorporated into management practices. Two examples will be briefly discussed. Result from our work on spatial disease epidemiology is being used by the Maui Invasive Species Committee and the Hawaii Department of Agriculture to survey for BBTV infected plants in Maui. The results are being incorporated into survey approaches hoping to increase their efficiency. Our data show that aphids prefer to feed on the base, not top, of banana plants. These results allow growers to search for aphids at their preferred feeding site. That can also be linked now to a simple sampling plan we devised for management of this vector species with data collected in Hawaii.

SCOPE OF IMPACT – State

SOURCE OF FUNDING – Hatch, State, Grants

KEY THEME: Rangeland/Pasture Management

ISSUE OR PROBLEM

A significant amount of agricultural acreage is being removed from sugar and pineapple production in Hawaii. Without proper understanding about the conversion of these lands from intense cropping operations to forage production systems the condition of these lands will continue to decline in quality threatening their potential to produce agricultural products in the future. The purpose of this project is to develop a suite of recommendations for the efficient and effective management of these lands that fit Hawaii's unique production requirements. These

recommendations or Best Management Practices (BMPs) will provide stakeholders with efficient, economical, and ecologically sound alternatives when considering range and pasture improvements, converting former sugarcane and pineapple lands into sustainable forage production systems, controlling noxious weeds and invasive grasses, increasing the nutritional quality of forages for animal production, and developing grazing management practices that improve animal distribution, grazing efficiency, and protects native ecosystems. Data continue to be collected on previous trials implemented on Kauai investigating the efficiency of different management practices in controlling the noxious grass, tufted beardgrass. It has been noted that combination of mowing, grazing and applications of N fertilizer and lime can be effective in controlling this grass in former sugarcane lands. New trials underway on Kauai have included implementing inter-seeding of desirable grasses and legumes into existing stands of bushy beardgrass. Initial seeding efforts were not successful and subsequent trials are planned. The pasture improvement trials on Hawaii continue to be monitored. Results show that seeding green panic, signal grass, and perennial peanut can greatly improve pasture quality. Moreover, forage production in the trial areas has allowed for dramatic increases in the stocking rate. Further investigations into the ecology and toxicology of fireweed in Hawaii are being developed with three areas of focus: 1) distribution and rate of spread of fireweed on Hawaii and Maui; 2) Physiologic and morphologic characteristics of individual plants within and between populations across elevation, climate, and soil gradients; 3) exploring possible linkages between soil types and factors contributing to objectives 1 and 2; and 4) development of fireweed management strategies for land owners. In order to identify the most economical means to remediate former sugarcane and pineapple lands research sites on Kauai, Maui, and Hawaii were selected for a series of trials. Treatment applications were completed at these sites by May of 2006. Initial, six month post-treatment samples of soil and vegetation quantity and quality measures have been completed. For the remainder of the project, vegetation samples will be collected at three month intervals. This will provide information on the residual effects of the different treatment levels on forage quality and quantity. Subsequent soil samples will be collected at 18 and 24 months post treatment and will provide information on the residual effects of the different treatments on soil quality parameters. Forage production over the initial 3 month period following the treatment applications at the Kauai and Hawaii sites was more rapid than expected. For example, average production in the high and low N plots was higher (12.7 and 9.6 tons/acre, respectively) than in the no N treatments (5.9 tons/acre). While it was not surprising that production increased with increasing N, it was surprising that the differences were so great in such a short period. These early results suggest that applications of N in former sugarcane lands can increase their productivity. A doubling of the amount of production per acre would offset the cost of application. There was a dramatic shift in soil pH in the limed plots relative to the no lime plots. How long this affect lasts will depend on the initial liming rate and soil weathering factors. Knowing the length of the residual effects will be valuable to producers who are trying to minimize their costs over the long-term.

IMPACT

Livestock producers who are utilizing former sugarcane and pineapple lands have successfully implemented several management practices outlined above. For example, ranchers on Kauai are using mowing, N fertilization to control bushy beardgrass while other ranchers on Maui are using low application rates of N and lime to improve forage production and quality. Many ranchers on Maui and Hawaii are now more aware of the potential effects of fireweed on their

animal health. Moreover, they are more aware of means to control the spread of fireweed on their lands. Over all the results of this project have helped producers in Hawaii become better managers by giving them economical and sustainable solutions that they have utilized to improve their pastures.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, State, Smith-Lever, Grants

National Goal #2:

A safe and secure food and fiber system. To ensure an adequate food and fiber supply and food safety through improved science-based detection, surveillance, prevention, and education.

A report for Goal 2 will not be provided. The Hawaii POW for Goal 2 contains the following statement: "Hawaii's program under Goal 2 will be the Smith-Lever 3d Targeted program in Food Quality and Safety."

National Goal #3:

A healthy, well-nourished population. Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices.

OVERVIEW

The 2005 Hawai'i Health Survey found that more than half of our state's adults are obese or overweight. This population is at elevated risk for many health conditions, including type II diabetes, high blood pressure, heart disease, stroke, and some cancers. Obesity-related medical expenses in Hawai'i are estimated to cost more than \$290 million per year. The rate of obesity in children ages 6 to 11 is twice the national average. About three-quarters of Hawai'i residents don't eat enough fruits and vegetables, and many suffer from diabetes, heart disease, high blood pressure, or diet-related cancers.

To combine their strengths and enhance their effectiveness, CTAHR extension faculty in all four counties and two college departments continued the NEW (Nutrition Education for Wellness) group for the second year. Their first year was very productive with well executed educational programs for a large and varied audience throughout the State. The second year was even more successful. NEW's team approach has been spearheaded by extension faculty, but the program's project roster includes research and instruction components as well, such as materials developed for young athletes by food science and human nutrition students. The collaborative projects

developed under the NEW umbrella reflect partnerships not only within CTAHR but also with colleagues at mainland universities and local, state, and federal agencies. By linking projects and pooling resources, NEW enables more efficient outreach to improve the health and well-being of Hawai'i's people.

An estimated 60,000 people in Hawai'i rely on rainwater catchment systems for their sole source of drinking water. CTAHR initiated a project to address the needs of these people on rainwater catchment systems to provide information and support on maintenance, decontamination, testing, and improvements. Because no other agency provides educational and information support to this group of residents, demand for their literature, educational sessions, and other services have been very large. Hawai'i will be hosting a combined 2007 American and International Rainwater Catchment Systems Association Conference. Assistance and educational activities, including workshops, have expanded beyond Hawai'i, to our several of our partners in the Pacific Islands territories.

The College's extension workers held 122 workshops, conferences, and educational sessions with 6,587 people attending in this Goal area. Five hundred seventy nine volunteers provided 20,814 hours of volunteer time worth (at \$17/hour) \$353,838 towards accomplishing Goal 3.

CTAHR has 18 projects under the National Goal #3 in the CRIS database. We selected 4 projects from 2 key themes to highlight in this year's report. The major selection criteria are the quantifiable outcome and impact. We provide only the summary output data in this section, and will present outcome and impact information under individual key themes below.

Research results have been shared through refereed journal articles, abstracts, books and book chapters; theses, local, regional, national and international meetings, symposia and workshops; and an array of web pages. CTAHR faculty published 115 various publications last year under goal 3.

Allocated Resources -- Goal 3:

Fiscal Year	Research Hatch Funds (\$)	Research State Funds (\$)	Research Other Fed & Non Fed Funds (\$)	Research Total Funds (\$)	Research Scientist Years (SY)
2006	127,977	396,454	30,605	555,410	2.13

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2006	63,358	104,766	157,809	325,932	2.13

ASSESSMENT:

All units in the College of Tropical Agriculture and Human Resources are required to conduct regular performance evaluation of their faculty members. These reviews are conducted based on goals established during previous year's reviews. Since all faculty members with CTAHR research FTE are required to establish their Hatch projects, regular performance evaluation serves a good vehicle to assess our progress toward the goals in our plan of work. CTAHR has made good progress in meeting these goals.

KEY THEME: Human Health

ISSUE OR PROBLEM

An estimated 60,000 people in Hawai'i rely on catchment systems for their sole source of water. No government agencies regulate the safety of these systems. Without proper maintenance, the water may be contaminated, unfit for human consumption or even skin contact. Until CTAHR became involved, homeowners had to design and build their own systems and operate and maintain them in a safe manner. This project has been researching, talking to experts, and creating guidelines that were recently published by CTAHR as a booklet that will help homeowners maintain a system that is as safe as possible from the time the raindrop is caught until it leaves the faucet. Because there are no testing facilities on the east side of Hawai'i, an easy-to-use water testing kits were assembled and made available for sale at low cost so homeowners can monitor their water and be assured it is not contaminated with fecal coliform bacteria. Frequent workshops are held to teach people how to manage their systems. The project focuses on servicing Hawai'i residents but because it is an issue that spreads throughout the Pacific islands, the project also reaches out to Federated States of Micronesia and other areas. Through CTAHR's efforts, residents are getting the information and tools they need to reduce the risks of unsafe water. Over a 2 year period, over 9,000 pieces of literature (mostly the CTAHR publication *Rainwater Catchment Guidelines*) were requested and provided. Hawai'i will be hosting the 2007 American Rainwater Catchment Systems Association Conference.

IMPACT

Residents who depend on rainwater catchment systems for their drinking water are much more knowledgeable about how to maintain and service their systems to insure safe drinking water. The Hawai'i Rainwater Catchment System (HRCS) Association was formed thus enabling community ownership and self direction. The HRCS is a key partner now in the educational and outreach activities with CTAHR. Post workshop/seminars showed that 100% of respondents found the seminars useful and that they will change the way they care for their water system as a result of what they learned from the seminar. Ninety six percent of survey respondents who used the test kit indicated they will use it again. There was a 25% drop in the number of positive (contaminated) water samples since the test kits were made available. Although it is difficult to link this reduction to the any one factor, the results of people having cleaner water is very encouraging.

SCOPE OF IMPACT - State, and Federated States of Micronesia.

SOURCE OF FUNDING - State, Smith Lever, County, Private

KEY THEME: Human Health

ISSUE OR PROBLEM

The NEW (Nutrition Education for Wellness) project continues to be active in coordinating several projects involving health and nutrition and is expanding its partnership with other groups such as the Hawai'i Department of Health, USDA Food and Nutrition Service, American Heart Association, Hawaii Farm Bureau, Produce for Better Health Foundation, and private industry to promote healthy food and lifestyle. The project provides lecturers for classroom teaching in nutrition, food safety, food security, and health. The Team works with agricultural partners to promote the consumption of locally produced fruits and vegetables. Developed an educational food guide concept that includes materials and training curriculum and presented to about 100 agencies and 300 consumers where 55% agree that it simplifies the *Dietary Guidelines 2005* and *My Pyramid 2005* into a practical and do-able mode. This program continues to provide educational opportunities to seniors, recipients of food stamps, sight-impaired, youth, and others. The *Healthy Meetings for Wellness* Web site has been updated with eight new features that focused on Hawai'i's efforts in the areas of obesity, diabetes, nutrition, and physical activity for young children. An overview of the NEW website was presented at a *Keiki Caucus* at the State Legislature. NEW education materials posted on the website have been included in the 2006 Iowa State Nutrition calendar, and by extension workers at Southeast Louisiana University.

IMPACT

Preschools utilizing program services reported between 73 and 95% satisfaction of program educational services and improved skills in meeting licensing requirements for healthy menus. The food stamp training reported 52% reported improvement in eating 5 fruits and vegetables per day and 62% reported improvement in food safety practices. Sixty percent of kindergarteners' parents that participated in the K.A.M.P. program committed to volunteer at their children's schools. Two schools that previously participated in K.A.M.P. expanded the concept to all grades in the school and using the students in the highest grade (5th) as group leaders, tour guides, and helpers. Fruit and vegetable consumption and physical activity among adults doubled upon completion of the Kauai Great Weigh Out program. A letter writing campaign by participants of TRY WALK convinced public officials who repaired unsafe sidewalks and traffic lights almost immediately.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, Smith-Lever, State funds, and Grants

KEY THEME: Human Health

ISSUE OR PROBLEM

This statewide hand washing education program reached over 6000 children and adults. Presentations to pre-school, elementary and intermediate school reached over 3300 students, parents and staff. Approximately 3000 additional adults and youth were reached through community fairs and festivals. Proper hand washing instructions have been distributed and posted in many bathrooms at many University and school sites where individuals can read while they wash. Individuals served included at-risk and underserved groups such as young children, older adults, limited resource families and Native Hawaiians.

IMPACT

Germ City has increased awareness of good hand washing hygiene and its connection to good health. During the presentations, over half of the participants indicated spending more time washing their hands. All participants were challenged to share information on the importance of hand washing with at least 3 other people which extends the outreach to an additional 9000 individuals. Some of the impacts in schools were: modified policies to keep bathrooms open throughout the school day, increased availability of soap and paper towels in bathrooms, providing hand alcohol sanitizers as an alternative to hand washing prior to lunch, and overall greater awareness and increase in hand washing among students and staff. Feedback from participants in several community fairs indicate knowledge gains and planned behavior changes (i.e. hand washing before eating, after playing/working outside, after coughing and sneezing, after using the bathroom and after handling animals). Frequent hand washing is key to minimizing the spread of seasonal influenza, and other highly contagious diseases such as the Norwalk virus that is common on cruise ships and tourist destinations such as Las Vegas. The Germ City website provides accessibility to program information and resources and averages over 50-100 hits a week. Through the website, materials have been requested for use in health education programs in Guatemala & Kentucky and shared with evacuation centers following Hurricane Katrina and Rita.

SCOPE OF IMPACT - State, Kentucky, Guatemala

SOURCE OF FUNDING - Smith Lever, Grant, State

KEY THEME: Human Nutrition

ISSUE OR PROBLEM

The Pacific Islands are in nutrition transition, and are experiencing some of the highest rates of obesity in the world. The project will identify physical activity, dietary, educational, economic and food assistance and agricultural elements influencing body weight in the Pacific region. These will be used to develop nutritional intervention programs with Land Grant colleges, health departments, food stores, schools and community-based food and nutrition education programs throughout the Pacific region. The goal of the Healthy Living in the Pacific Islands Healthy Pacific Child Program (HLPI-HPCP) is to improve the nutritional status of children and to prevent overweight among children in the US-affiliated Pacific Islands. Healthy Foods Hawaii: The series of six target behaviors and foods that were originally identified for phases of the

intervention were modified during the testing period and reduced to four phases: snacks for children, beverages, condiments, and meal planning. Graphic materials for display in stores, health centers and community locations were developed and tested for each of the four phases. A pilot test of one phase of materials was conducted in Jan/Feb 2006, and resulted in some modifications to the materials and approach. The main intervention started on O'ahu in February 2006 and on the Big Island (Hawaii) in March 2006. To date, three phases have been implemented in both sites and the fourth and final phase is currently being implemented in both sites, with completion of all four phases of the intervention in December 2006. The O'ahu intervention has been implemented by project staff, the Big Island intervention by a community group that received training from project staff and who receive materials and detailed instructions by mail, in addition to phone support as needed. Sample materials may be viewed at www.healthystores.org. The baseline (pre-HFH intervention) data collection started in August 2005 was completed in July 2006. A total of 370 24-Hour Dietary recalls and Questionnaires were collected for 185 mother:child pairs in the selected communities. Data from Client Questionnaires has been inputted and 24 diet recall data is currently being analyzed. Two Pacific Island sites have collected information about the availability of healthier food choices in local stores and food outlets (Food Source Surveys). The Pacific Tracker (PacTrac) Dietary Assessment Tool: PacTrac was made available to the public online in December 2005 (<http://pacprac.crch.hawaii.edu>). Food and recipe information for possible inclusion in the PacTrac database has been collected from American Samoa, the Republic of the Marshall Islands, and Palau, and is underway in Federated States of Micronesia. Nutrition Survey: A series of presentations were made in Saipan in December 2005 ('Nutrition Survey CNMI June/July 2005') to local community leaders, educators and the public with preliminary survey results. These were later compiled into a more detailed 'Draft Preliminary Report on the Nutrition and Health Status of Children in the CNMI' which was presented to community leaders, educators and the public in Saipan in June 2006. The modified PacTrac (Version3) has been used to input the 420 24-hour dietary recalls collected during the survey in Commonwealth of the Northern Marianas and is currently being analyzed.

IMPACT

Healthy Foods Hawaii: The targeted food system intervention has provided the opportunity to educate, inform and interact with community members, particularly during taste tests and cooking demonstrations, and has resulted in opportunities to educate and inform the public about possible incremental dietary changes towards healthier lifestyles. Many participants have reported trying new foods as a result of these demonstrations. The project has further developed and maintained links between local health care centers, farmers, food distributors and community groups, who are involved in the recruitment, data collection activities and intervention implementation. *PacTrac:* Initial feedback on the online version of *PacTrac* indicated that the link was accessible in the remote island locations. With the modifications to the database and inclusion of additional island foods, the program has been used for dietary analysis in two Pacific Island sites (Guam and Commonwealth of the Northern Marianas), providing, for the first time, accurate nutritional information on local foods and local diets.

SCOPE OF IMPACT – State, Guam and Commonwealth of the Northern Marianas

SOURCE OF FUNDING - Hatch, State, Grants

National Goal #4:

Greater harmony between agriculture and the environment. Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources.

OVERVIEW

Invasive species has been identified as the single greatest threat to Hawaii's economy and natural environment and to the health and lifestyle of Hawaii's people. Introduced pests already cause millions of dollars in crop losses, loss of potential production because of farmers' reluctance to plant certain crops, the extinction of native species, and the spread of diseases. Unwanted alien pests are entering Hawaii at an alarming rate—about 2 million times more rapid than the natural rate. CTAHR researchers have recently begun to generate current and potential economic impact data by invasive species. Hawai'i is in the midst of a growing invasive species crisis affecting the Islands' endangered plants and animals, overall environmental and human health, and the viability of its tourism and agriculture-based economy. Examples of economic impacts to Hawai'i by invasive species currently in Hawaii have been estimated at \$300 million/year by fruit flies, \$150 million/year by subterranean termites, and \$5,028/acre/year losses for taro caused by the apple snail. The estimated economic impact if the red imported fire ant (RIFA) finds its way to Hawai'i is estimated to be between \$15.5 million and \$46.1 million/year. The estimated economic impact of the brown tree snake is between \$29 million and \$454 million/year, mostly as a result of damages caused by power outages.

Several of Hawai'i's agricultural crops have been severely affected by invasive diseases. Papaya production has been reduced from 2,400 acres harvested in 1990 to the current 1,480 acres primarily because of the papaya ringspot virus and the papaya black spot. Ginger went from 190 acres in 1990 to 40 acres in 2005, mostly because of bacterial wilt of ginger. Anthurium production went from 228 farms producing 2.5 million dozens in 1980 to 58 farms producing 0.6 million dozens in 2005 because of bacterial blight.

To meet the growing interest in sheep farming, the first Sheep Production Workshop and Demonstration was held in collaboration with the Sheep Producers Association of Hawai'i. This program provided participants with information on sustainable grazing management practices, sheep production and management, flock health and disease control, and marketing opportunities.

Livestock production is an efficient, low intensity production system suited to utilizing the former sugarcane and pineapple lands in Hawai'i. The standard practice for converting these lands to livestock production has been to fence it up and graze the animals on whatever grows. However, to be competitive, efficient conversion of these lands into sustainable grazing systems requires development of a series of Best Management Practices. A combination of mowing, grazing and applications of N fertilizer and lime was shown to be effective in controlling this grass in former sugarcane lands. Research and demonstration efforts were initiated on sites on Maui, Kaua'i, and Hawai'i islands to determine the most efficient practices for converting

former sugarcane and pineapple lands into sustainable grazing systems.

The nettle caterpillar, coqui frog, erythrina gall wasp, little fire ant, and guava rust continue to be addressed through research and extension activities. CTAHR is cooperating with many agencies to deal with these species. One of the most obvious species is the Puerto Rican native, coqui tree frog. Though their impact on native insect species is still being debated, its greatest impact is its annoying night time mating call by the males. Because of the lack of natural enemies, and perhaps other reasons that are still being investigated, coqui frog populations in the dense subtropical forests are the highest found anywhere. CTAHR scientists developed a hot water spray (115°F for 5 min) system last year for both cut foliage, cut flowers and potted plants that might be harboring the frogs or their eggs. Two functioning units have been built for use by commercial nurseries and several more are being built. The system has been improved by re-circulating the hot water to make it more energy efficient. This allows potted plants to be shipped inter-island without having to individually inspecting each potted plant.

Research and extension efforts to promote harmony between agriculture and the environment continue to be a priority for CTAHR. Areas addressed by research and extension projects include: biological control of pests, integrated pest management, agricultural waste management, forest natural resource management, nutrient management, soil erosion, soil quality, handling hazardous materials, pesticide application, sustainable agriculture, and water quality.

As pesticides become more costly, increased concern for non-target impacts of pesticides, availability of better lures, traps and environmentally friendly pesticides, efforts to recycle, and other factors have created greater interest in IPM programs. The Hawai'i Area-Wide Fruit Fly IPM program is beginning to wind down, however, the program expanded to Molokai where the effort is being collaborated with organic papaya farms. The USDA, has terminated sterile fruit fly male production in Hawaii and relocated the production facilities to U.S. mainland. Innovative techniques, such as use of vermiculture as a means of disposing of dairy and cafeteria food wastes is being tested in Hawai'i with excellent results.

Research and extension efforts into preserving, protecting, and renewing Hawai'i's natural resources continue to be an area of focus. Research into koa decline is being conducted to determine whether or not *Fusarium oxysporum* f.sp. *koae* is the fungus responsible for koa wilt which is a major component of this complex. Outreach efforts were made through an annual conference, demonstration sites, field days, printed materials, individual consultations, and a website (www.ctahr.hawaii.edu/forestry).

Extension workers held 58 workshops, conferences, and educational sessions with 1170 people attending, towards accomplishing Goal 4. Extension workers also had 1293 direct contacts and 1898 indirect contacts with various stakeholders in their outreach programs. There were 54 volunteers contributing 308 hours of volunteer time and in kind donations worth \$40,706. CTAHR has 85 projects under the National Goal #4 in the CRIS database. We selected 6 projects from 6 key themes to highlight in this year's report. The major selection criteria are the quantifiable outcome and impact. We provide only the summary output data in this section, and will present outcome and impact information under individual key themes below.

Research results have been shared through refereed journal articles, abstracts, books and book chapters; theses, local, regional, national and international meetings, symposia and workshops; and an array of web pages. CTAHR faculty published 209 various publications last year under goal 4.

Allocated Resources -- Goal 4:

Fiscal Year	Research Hatch Funds (\$)	Research State Funds (\$)	Research Other Fed & Non Fed Funds (\$)	Research Total Funds (\$)	Research Scientist Years (SY)
2006	122,095	914,137	308,430	1,400,910	4.58

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2006	126,788	475,031	586,308	1,188,127	6.96

ASSESSMENT:

All units in the College of Tropical Agriculture and Human Resources are required to conduct regular performance evaluation of their faculty members. These reviews are conducted based on goals established during previous year’s reviews. Since all faculty members with CTAHR research FTE are required to establish their Hatch projects, regular performance evaluation serves a good vehicle to assess our progress toward the goals in our plan of work. CTAHR has made good progress in meeting these goals.

KEY THEME– Agricultural Waste Management

ISSUE OR PROBLEM

Animal waste management from confinement operations is a major concern to livestock producers. Due to new federal laws, odor and fly complaints, Salmonella spp. outbreaks and bovine spongiform encephalopathy (BSE) disease in the cattle populations, the search continues for environmentally sound technologies that are economically feasible. Vermicompost, or the use of non-thermophilic worms to break down organic waste such as rotten vegetation, compost and manure piles, shows promise. With the loss of many registered chemical nematicides, vermicomposting can be a useful alternative, although large amounts (tons/acre) are required. Outreach activities include printed literature, workshops (35 statewide), demonstration sites on a dairy, and a hog farm. Work is continuing with the Department of Health to establish pathogenic

microbial standards. All samples have thus far have been free of any pathogenic organisms. An innovative “bio-nest” bioreactor that was developed and reported last year for treating dairy wastewater is being demonstrated to students, farmers, and others through demonstration/field days. A DVD and a website: <http://www.ctahr.hawaii.edu/wwm/education.asp> has also been developed.

IMPACT

Interest in vermicomposting is increasing as a result of the workshop and demonstrations. This project has spawned two new worm businesses in Hawaii who are working with homeowners and are adapting the system for large-scale agricultural applications. Six schools on the Big Island initiated vermiculture projects on their facilities (two for lunch waste management and 4 for recycling). The use of vermiculture was accepted by the Hawai‘i State Department of Health, Vector Control Division, as a best management practice for fly prevention in island dairies. Most workshop participants go away impressed with the system, especially because they solve their waste problem and have a valuable product as a result. The Bio-nest bioreactor was chosen as a “Success Story” at the national Non-Point Source Coordinator’s meeting in June 2006.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Smith Lever, Private grant

KEY THEME– Forest Resource Management

ISSUE OR PROBLEM

Forest and rangelands in Hawai‘i are home to unique and diverse flora and fauna. Today, nearly half the land area of the state remains in forest cover with about equal amounts in public and private ownerships. Hawai‘i’s forests are especially vulnerable to invasive species of all kinds. As a result, Hawai‘i leads the world in the number of endangered species. Other challenges to Hawai‘i forestry today include how to integrate koa silviculture with ranching in silvi-pastoral systems, and how to manage native forest to meet both conservation and production objectives. The limited and declining supply of old growth koa and the extremely high value of koa have resulted in a major effort to reforest lands with koa. Numerous pests affect koa such as the koa wilt (*Fusarium oxysporum* f.sp. *koae*), black twig borer, root knot nematodes, and other pest species. Outreach programs for forestry include direct and indirect contacts, workshops, conferences, websites, field consultations, publication of five native tree profiles in the book “*Traditional Trees of Pacific Islands*” (over 50,000 downloads during the reporting period).

IMPACT

Many of the large land owners attending workshops and other educational efforts are implementing recommended management practices on their land. Kamehameha Schools has received FSC “green” certification for their 4,000 acre Honaunau forest, a first for Hawaii, and is

conducting larger scale thinning operations on previously harvested lands. The Nature Conservancy is thinning koa stands across its 8,000 acre Kona Hema preserve lands and working to develop economic models for other local landowners. These forests represent a significant portion of the forests in the 100,000 acre Kona region koa belt, the most important koa forest in the state. While only 23 land managers attended our koa field day, they represented most of the major owners of koa forest in the state. Three quarters of those who responded to the post-workshop survey said that they would apply techniques they learned to their own land. Native hardwood trees were harvested from demonstration sites on Moloka'i and sent to local wood turners to make into added value products. At least five additional landowners have planted native and exotic trees as a long term crop for future harvest.

SCOPE OF IMPACT - Hawai'i, Guam, Palau

SOURCE OF FUNDING - Smith Lever, State, grants

KEY THEME: Hazardous Materials

ISSUE OR PROBLEM

Security of people's safety and health and rapid responses to terrorists' threats are very important. The purpose of this integrated project is to develop new analytical methods for emergency responses, understand biodegradation mechanisms to advance bioremediation technology for cleanup of chemically contaminated sites, and to offer a bioremediation demonstration and biotechnology workshop to build community support. Novel analytical methods and remediation technologies are two important tools for effective responses to emergency involving hazardous substances. A suite of extraction, separation and detection methods have been developed for explosives, pesticides, flame retardants, common pollutants, animal growth regulators, antibiotics, biotoxins and proteins. Those analytical methods include supercritical fluid extraction, pressurized fluid extraction, gas chromatography-mass spectrometry (GC-MS), liquid chromatography-MS (GC-MS), and DNA probes. We have studied phytoremediation, microbial degradation, zero-valent iron reduction and photolysis for pesticides, polycyclic aromatic hydrocarbons, the flame retardant polybrominated diphenyl ethers, and polychlorinated biphenyls. Organophosphate insecticides are used as model chemicals for nerve agents. The zero-valent iron destruction technology has shown high commercialization potential for water treatment. We have built more 17 detailed catabolism maps of those chemicals in bacteria isolated from contaminated sites. Differential protein profiling has shown transporter proteins, oxidative enzymes, DNA and RNA repair enzymes and molecular mechanisms to protect the bacterial cells from damages by the toxic chemicals. More than 70 plant species have been studied for their potential of environmental cleanup. The general trend leads one to consider that salt and/or drought tolerant plants can bear other potential stress-inducing conditions. On average, 150-200 unknown samples are analyzed per year to aid the State of Hawaii on emergency responses. After the events of September 11, 2001, the State of Hawaii was inundated with alleged biological threat response calls to the local fire hazardous materials teams. During that time, a need arose for fast field testing and triage of the samples as either potential biological or chemical agents. To meet the needs, we have worked the Department of Health (DOH) and have had an "All Hazards Field Sampling and Categorization"

training program. A manual and a set of DVD videos are designed and produced for live training of the Hawaii Hazmat teams and evolved to include tools, supplies, testing demonstrations, chain of custody and transportation guidelines for either chemical substances or biological organisms. It is also designed for refresher training sessions. This training manual and DVDs will be available for distribution early next year. In collaboration with DOH, we have had the live training to more than 135 Hazmat members from the City and County of Honolulu on Oahu, and the Kauai and Hawaii Counties from 2002 to 2005.

IMPACT

A suite of new methods have been developed for rapid extraction and analysis of toxic chemicals in various matrices, and are used in emergency responses, hazard evaluation and mitigation, and risk assessment. In addition to further understanding of mechanisms of microbial catabolism, new abiotic and biotic mitigation technologies have been developed for cleanup of contaminated sites. A series of workshop has been conducted to train more than 135 Fire Hazardous Materials Team members in response to chemical and biological threats in Hawaii. A manual and DVDs of this program are in production for future refresher training sessions for experienced teams.

SCOPE OF IMPACT – State

SOURCE OF FUNDING – Hatch, Smith-Lever, State, Grants

KEY THEME– Integrated Pest Management

ISSUE OR PROBLEM

The value of the crucifer industry (primarily head and Chinese cabbage) is approximately \$4.3 million on 800 total acres planted annually (2005 Statistics of Hawai‘i Agriculture). Damage by a major pest, diamondback moth (DBM), *Plutella xylostella* (Linnaeus), surpasses economic damage thresholds throughout most of the year. By 1990, DBM developed resistance to 5 pesticide classes. Head cabbage growers experienced yield losses of 20 to 100%. DBM readily migrated between farms within regions, which made it clear that growers within a region had to make a concerted effort and adhere to the same rotation to prevent or delay development of insecticide resistance. This project’s objectives were to provide a statewide outreach program on DBM resistance management and effective use of insecticides along with periodic monitoring of populations and determining their pesticide resistance levels to Success® (spinosad), Avaunt® (indoxacarb) and Proclaim® (emamectin benzoate), and to evaluate DBM bioassays for resistance. Educational workshops, meetings and field days were held in major cabbage production areas in the state. Bioassays of DBM populations are conducted twice a year from each major production area. If resistance to any of the recommended insecticides is identified, growers are notified to remove those insecticides from their spray schedules until bioassays indicated that the population is sensitive.

IMPACT

Crucifer farmers participate in these regional DBM management programs and by doing so

minimize the use of ineffective insecticides that the DBM are resistant to. Growers have thus been able to effectively manage populations of and damage caused by the DBM.

SCOPE OF IMPACT - Hawai'i crucifer growers.

SOURCE OF FUNDING - Smith Lever, State, Private

KEY THEME – Natural Resources Management

ISSUE OR PROBLEM

The main goal of this work is to use Makaha Valley to develop an integrated decision support system at the watershed continuum by combining multi-scale field experiments with a strong numerical modeling and geospatial component to help understand hydrological processes and their variability under different controlling parameters, i.e., land use extreme weather conditions. This project has hydrological and remote sensing components. 1) Hydrological component of the project -) Physical characterization of the Watershed, 6 field meteorological-hydrological monitoring station instrumentations were installed in the watershed. Data have been collected from these sites since August 2005. Data includes rainfall, soil water content, and other meteorological parameters, as well as soil sampling and testing at multiple locations. Soil volumetric water content is being monitored with capacitance sensors at depths of 20 and 80 cm. A laboratory calibration was conducted for the soil moisture sensor to calculate site specific soil water content. -) Data analysis, Field data have been downloaded every month. These data have been analyzed, summarized and some of them were used to calculate potential evapotranspiration. Soil moisture data summarized the rainfall data and soil moisture data collected over the same period to qualitatively assess the spatial and temporal variability of rainfall. The results of these analyses were presented in class presentations. 2) Vegetation characterization with remote sensing/GIS techniques. During last year, we focused our activities on two major topics: -Classification and validation of the QuickBird and Ikonos images, - Theoretical determination of spectral separability among native and nonnative plants. Both the QuickBird and Ikonos images have successfully been classified to their respective limits based solely on spectral signatures. The work resulted in six separable classes, two of which have been identified through intensive field assessments: 1) Ohia-dominated vegetation formation and 2) Kukui vegetation community. Identifications of the other four classes are in progress. Our remote sensing field team located eight field plots and collected the following vegetation characterization data at each site as part of class identification and validation activities: DBH, canopy cover, and species compositions. Spectral separability among six native and nonnative species at leaf scale has been determined successfully. The species studied were: Koa, Ohia, and Lama as native species, and Strawberry guava, Christmas berry, and Coffee. We have also been working to "scale-up" the spectral separability work to a canopy level. A series of intensive field work were conducted to collect biogeophysical parameters of the six plants, including tissue optical properties, soil reflectance, LAI, NPVAI, LAD, and NPVAD. Measuring LAI and NPVAI were found to be very difficult and thus we are continuing refining the measurement protocol for these two parameters.

IMPACT

1. This project has a positive impact on NREM's watershed hydrology and spatial analysis teaching program of the Natural Resources and Environmental Management Department. 2. The research site has been used as a laboratory for many of our graduate and undergraduate students to demonstrate several watershed hydrology processes. 3. Data from this site have been used to calibrate watershed hydrologic model with water quality prediction capabilities that will allow us to test different management scenarios related to different water-resources issues, including the effects of land-use changes and the implementation of best-management practices. 4. Other models have been also used to study surface and near-surface hydrologic processes in the watershed. The availability of these functional models have been important to the teaching and extension programs at Natural Resources and Environmental Management Department. 5. Specific teaching and research benefits of this project are: i) Advancing knowledge of the regional hydrologic system; ii) advancing understanding of hydrologic processes; and iii) Providing water-resources information that will be used by multiple parties for planning and operational purposes.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, State, Grants

KEY THEME – Sustainable Agriculture

ISSUE OR PROBLEM

The uncontrolled development of algae, cyanobacteria and aquatic plants due to non-point source pollution of P from agriculture is of particular concern to coastal states like Hawaii. The purpose of this study is to better understand the interaction of arbuscular mycorrhizal fungi with vegetable crops in order to provide the crops with adequate P while minimizing the adverse effects of P on the environment. One of the variables that is critical in determining whether or not to apply the arbuscular mycorrhizal technology in vegetable crop production is the degree to which vegetable crops of interest rely on the mycorrhizal condition for nutrient uptake and growth. During the life of the project, we have determined the AM dependency of a number of vegetable crops. These include asparagus, bell pepper, egg plant, onion, tomato, and sunflower. Asparagus and onion were classified as highly dependent species while egg plant, sunflower, and tomato were classified as marginally dependent. The study on bell pepper was aborted because of disease infestation. We observed that crops that are different in their dependence on the mycorrhizal condition required different mycorrhization media in the nursery. Mycorrhization of onion seedlings in the nursery led to a three-fold increase in onion bulb and foliage yield after transplanting in the field. Research we undertook also showed that vegetable crop species like ginger that cannot be inoculated at the time of planting could be inoculated through a companion crop like onion after the former plants were established in the field. In another study, in which we evaluated the influence of cropping sequence on the effectiveness of AM fungal effectiveness in onion, we found out that growth and P status of onion was stimulated by a previous crop of sun hemp to a greater extent than by a previous crop of mustard. However, the effect of AM fungal inoculation was initially negative although the effect disappeared as time progressed. This was explainable by the fact that initially onion was allowing its roots to be colonized by AM fungi at soil solution P concentrations which were near-sufficient for mycorrhiza-free growth.

Arbuscular mycorrhizal colonization of onion roots was somewhat higher if onion was preceded by sun hemp than by mustard, but the values were not statistically significant. Leaf P content monitored as a function of time also indicated that there was no mycorrhizal inoculation effect. However, P content of onion was significantly higher if sun hemp was the previous crop than if mustard was the previous crop. In either case, the level of AM fungal colonization of roots declined with time irrespective of the mycorrhizal status of onion at the time of transplanting. As a result, final bulb and leaf yield of onion was not affected by mycorrhizal inoculation. These observations suggest that the ephemeral nature of the parasitic effect of AM fungi observed was due to the fact that onion was subsequently suppressing the development of the fungi in its roots under the prevailing circumstances.

IMPACT

As a result of our study, we have made available a method for raising robust mycorrhizal seedlings of vegetable crops in the nursery and has further demonstrated that a judicious application of the AM technology in vegetable crop production can nearly triple yield as illustrated in onion while reducing the amount of P added to soil by as much as 20-fold. Our work also demonstrated for the first time under field condition that while AM fungi can act as parasites on associated plants, this effect is short-lived and may not influence final yield significantly. Our results point to the importance of considering previous cropping history, soil solution P status, and mycorrhizal dependence of host species when growers are contemplating the application of arbuscular mycorrhizal technology in their cropping systems.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, State, Grants

Goal 5:

Enhanced economic opportunity and quality of life for Americans. Empower people and communities, through research-based information and education, to address economic and social challenges facing our youth, families, and communities.

OVERVIEW

About one in five Hawai'i farmers was born outside the United States. Many have limited English skills that make their challenging occupation even harder, with potential harmful consequences.

To flourish, young *keiki* need caring adults and stimulating experiences. The *Learning to Grow* project, support the efforts of parents, caregivers, and family service professionals to promote children's health, safety, and school readiness.

Hawai‘i is one of the most cosmopolitan states in the country with no single ethnic or national group making up a majority of the State’s population. Although the largest groups have been traditionally Asian, Pacific Islanders, and Caucasians, there has been a recent influx of Latin Americans. Uniformed military personnel and their families make up about 10.6% of Hawai‘i’s population. Their children have the similar, but also, special needs which our 4-H Youth Development Program is providing opportunities for them that didn’t exist before.

Hawaii’s urban population, based on the 2000 Census, makes up 91.6% of the population as compared to the 79% for the United States. Research and extension efforts continued to provide economic, quality of life opportunities for the unique population characterized above. Programs targeted youth development, youth and families at-risk, family resource management, urban communities, and rural community sustainment.

CTAHR for many years has had a strong leadership development program for development of leadership capability in communities, governmental and non-governmental agencies, and industry organizations. Impact for these efforts takes time to develop. The activities and impacts of one of CTAHR’s leadership development programs are reported here. Leadership development can build the capacity of individuals, groups and organizations to identify and resolve community issues. To enhance and strengthen the abilities of clientele organizations they are provided opportunities for members to work together in learning leadership skills, opportunities for them to conduct their own educational programs, and projects and activities to improve their communities. Statewide training for Youth-Adult Partnership teams to strengthen their working relationship as partners in community building and enhance their ability to implement community service learning projects throughout the state to improve the lives of Hawai‘i’s people.

Extension workers held 392 workshops, conferences, and educational sessions with 9,736 people attending. Three thousand and sixty volunteers provided 71,212 hours of volunteer time worth (at \$17/hour) \$292,604 towards accomplishing Goal 5. CTAHR has 21 projects under the National Goal #5 in the CRIS database. We selected 4 projects from 4 key themes to highlight in this year’s report. The major selection criteria are the quantifiable outcome and impact. We provide only the summary output data in this section, and will present outcome and impact information under individual key themes below.

Research results have been shared through refereed journal articles, abstracts, books and book chapters; theses, local, regional, national and international meetings, symposia and workshops; and an array of web pages. CTAHR faculty published 35 various publications last year under goal 5.

Allocated Resources -- Goal 5:

Fiscal Year	Research Hatch Funds (\$)	Research State Funds (\$)	Research Other Fed & Non Fed Funds (\$)	Research Total Funds (\$)	Research Scientist Years (SY)
2006	147,506	228,025	370,103	761,453	3.28

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2006	189,741	1,146,662	869,676	2,206,079	14.50

ASSESSMENT:

All units in the College of Tropical Agriculture and Human Resources are required to conduct regular performance evaluation of their faculty members. These reviews are conducted based on goals established during previous year's reviews. Since all faculty members with CTAHR research FTE are required to establish their Hatch projects, regular performance evaluation serves a good vehicle to assess our progress toward the goals in our plan of work. CTAHR has made good progress in meeting these goals.

KEY THEME: Children, Youth, and Families at Risk

ISSUE OR PROBLEM

Difficulties faced by custodial grandparents in Hawaii are compounded by cultural differences in both their perceptions of grandparenting and their support needs. This project addresses the needs of grandparents raising grandchildren in Hawaii by conducting research on the cultural context of care-giving and providing specific and applicable assistance to these caregivers. Over the past year we conducted two focus sessions with support groups for grandparents raising grandchildren to get their input on developing a series of culturally sensitive brochures. We used the findings from the support groups to design four brochures in the Ohana Caregiver Series addressing the following topics: community resources, addiction, managing grandchildren's problem behavior, and stress management. We re-visited both support groups to present our findings and deliver copies of the completed brochures. The brochures were then distributed through support groups, the legal aid society, and two community fairs. A talk on the process of brochure development was also presented at a national conference.

IMPACT

The brochures have been received favorably by many local grandparents. Grandparents have mentioned that the information contained in them is relevant and useful. The brochures have also helped to raise awareness of the needs of grandparents raising grandchildren in the community at large. There were over 3,000 visitors to the senior expo at which the brochures were distributed and over 10,000 visitors at the youth fair at which the brochures were distributed. In addition to these expected impacts, the brochures had the unexpected impact of serving as a focus for the organization of grandparents raising grandchildren as a political group. One of the support

groups that we visited used the brochures as a way to help them locate and organize other grandparents in the community. Data collected from the grandparent focus groups has also been used in reports to the Hawai'i State Legislature.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Hatch, State, Grants

KEY THEME – Leadership Training and Development

ISSUE OR PROBLEM

Leadership development is an investment for the future. Leadership development is carried out in a number of ways to include formal, two-year leadership development classes, short-term workshops that cover individual leadership topics, development of leadership training courses and materials, and other means. The Agricultural Leadership Program of Hawai'i (ALPH) provides training and practical experience in leadership, collaboration, strategic planning and facilitation to individuals engaged in agricultural enterprises, community or organizational development. ALPH started in 1982 and has graduated over 100 individuals in ten 2-year classes who today are key players in agriculture, government, community organizations, and in private industry. The program partners with other agencies to host a biennial Agricultural Conference that provides a platform for discussion for key issues facing the industry and which brings together leaders from throughout the agriculture industry. The program also conducts workshops for an inner city school complex in Honolulu on Collaborative leadership for student leaders, new faculty, and new administrators.

IMPACT

In a survey of graduates, 56.8% indicated that the program helped them build their businesses or helped them get promotions. Between 87% and 95.6% of the respondents thought the program: (1) broadened their perspective of statewide agriculture, (2) built their self confidence, (3) enhanced their ability to lead groups, (4) improved their communication skills, (5) enabled them to build a personal network, (6) enhanced their ability to work with others and (7) increased their understanding of state government. Over 90% thought they were either “greatly helped” or “helped” in that area. These were: (1) facilitating others to come up with the best strategy for solving a problem, (2) ability to motivate others and involve them in group efforts, (3) seeking the views of others as you make up your mind, (4) use of group process skills in your community work, (5) confidence in establishing and achieving personal long range goals for yourself and (6) confidence in establishing and achieving long range goals. It significantly helped their involvement in improving their local community (76.1%), improving their business organization (73.9%) and improving their industry/commodity organization (71.7%). It also helped their involvement in projects to improve the environment (69.6%) and their involvement in conservation programs (67.4%). They have gained a broader perspective and enhanced their skills and abilities in areas that make them more successful in their work and community organizations. Also, as a result of their participation in the Program, these participants make

more significant contributions to their professional, industry commodity and community organizations. Hence, the impact of the Program is both personal and societal.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - Smith Lever, Private, State Funds

KEY THEME – Community Development

ISSUE OR PROBLEM

Many of Hawai‘i’s families are faced with a series of frequent changes due to social, economic and demographic changes. Individuals and families must strengthen their personal skills through educational programs focusing on social competencies, decision making, communication skills, and interpersonal relationships. To enhance and strengthen the abilities of clientele organizations (FCE, 4-H Youth Development, and FCL), members are provided opportunities for them to conduct their own educational programs, and projects and activities to improve their communities. A major effort focused on how citizens can protect themselves from becoming a target for criminals. Family and Community Education (FCE) members adopted “Street Safe” as their state service project. FCE throughout the State collaborated with Cooperative Extension Service, government agencies, community organizations, and businesses in delivering community education workshops on Personal Safety, where participants are taught to protect themselves from becoming a target for criminals and Home Safety, in which participants are taught effective common sense strategies to protect their home. A 4 part 30 minute series of "Street Safe: Life in the Real World" was produced for showing on public access television. Community Learning Centers have been established in three targeted underserved communities: Oahu - Kūhiō Park Terrace in collaboration with Parents and Children Together (PACT) program; East Hawaii - Keaukaha Hawaiian Homes with Queen Lili‘uokalani Children’s Center (QLCC); and West Hawai‘i – Hōnaunau Elementary School and Kealakehe Intermediate School with West Hawai‘i Department of Education. Youth receive homework assistance, stimulate their academic learning, enhance their work preparation skills, gain leadership skills and develop life skills. Adults, through workshops, have strengthened their parenting skills, developed employability skills, improved their literacy level, and expanded their computer skills.

IMPACT

Nearly 80% of the program participants indicated that they would take measures to protect themselves and secure their homes by following the recommended practices. These proactive measures will significantly reduce their chances of becoming victims. FCE members contributed more than 12,000 hours of service to improve the lives of the people of the Big Island. Big Island FCE members, according to the Independent Sector (the value of volunteer time for 2005 is \$18.04) have contributed at least \$216,480.00 to UH Mānoa CTAHR Cooperative Extension Service! Twenty two of 45 volunteer leaders that attended leadership workshops took on leadership roles in their local and State organizations. Many FCE volunteers organized a statewide support system working with other large groups to lobby legislators on legislation relating to issues such as grandparents that live in public senior facilities who have to raise their

grandchildren but then face eviction.

SCOPE OF IMPACT - State

SOURCE OF FUNDING - State, Smith-Lever, Grants

KEY THEME – Youth Development/4-H

ISSUE OR PROBLEM

Youth Development continues to be a priority effort for the College. County 4-H Livestock Shows/Auctions were successfully held on each island, culminating in the State 4-H Livestock in July, 2006. Outreach efforts have been conducted to involve youth and volunteers in our 4-H Youth Development Program through the three basic delivery modes: Traditional 4-H club program; 4-H Special Interest programs; and 4-H School Enrichment programs. Operation Military Kids (OMK) partnered with military staff to develop youth development programs for military youth in Hawaii, Kwajalein, and Japan. Youth gained knowledge and skills in the following program areas: leadership and personal development; community service; citizenship; foods and nutrition; livestock; small animals; consumer and family science; environment and earth sciences; technology; engineering; math; science; healthy lifestyles; ATV safety; computer technology; record keeping; youth and adult partnerships; communication; public speaking; judging; demonstrating; etc. The 4-H Juried Curricula were used to strengthen the capacity of volunteer 4-H leaders in all counties/communities. Program expansion efforts have included 3 new Cloverbud 4-H clubs; a community 4-H club; a club at the NCP Community Site at Honaunau School; and other 4-H clubs. A beach cleanup project by a group of 4-H'ers taught skills such as teamwork, communication, community involvement, critical thinking, and citizenship.

IMPACT

There appears to be more long term involvement in the traditional 4-H club program with youth joining 4-H as kindergartners and continuing in the program till their senior year. With this "longevity" more teens are volunteering to serve as "junior leaders" for 4-H Cloverbud 4-H clubs. There appears to be a correlation between 4-H members involved in the program over a long period of time and their academic achievements in the school and their involvement in community programs. A very high percentage of youth in our 4-H programs continue to further their education beyond high school. The use of an online 4-H monthly newsletter has resulted in a cost reduction of \$200 in postage and paper per month and a reduction in the number of manpower hours to produce the monthly newsletter. The Hawai'i OMK, in just 18 months, established a solid and long lasting working partnership between the 4-H program and the military community to collaboratively provide youth development programs to youth that don't remain in a place very long.

SCOPE OF IMPACT - State, Kwajalein, Camp Zama Japan

B. Stakeholder Input Process

CTAHR did not make any major changes to its method of seeking stakeholder input since 2002. Stakeholder input is vital to enable CTAHR to meet its land grant mission.

Actions Taken to Seek Stakeholder Input and Encourage Their Participation. Research, extension and education faculty within the College of Tropical Agriculture and Human Resources (CTAHR) represent a wide array of disciplines at University of Hawaii at Manoa (UHM). Their scope of impact reaches stakeholders at the local, state and national levels. In an effort to solicit input from these stakeholders, there are several levels of participation which directly result in opportunities for discussion necessary for continual advancement toward recommended program goals. CTAHR has a Board of Advisors, chosen from various stakeholder groups and appointed by Dean for five-year term, which provides inputs on strategic issues facing our college. Each department, and county has its own advisory board to address local issues. To establish Hatch or extension projects, our faculty member must identify stakeholders their projects are serving, and how inputs are solicited from these stakeholders. Inputs from stakeholders were used to formulate and implement research and extension projects.

Process Used for Identifying Stakeholders and Approach Used to Collect Input from These Groups: Hawaii has approximately 30 statutorily appointed commodity commissions and grower organizations. Most of these have research committees. The membership of these groups provides a rich source of engaged individuals from the natural resources community. Hawaii has active environmental, consumer, and community organizations. These organizations provide a broad perspective for input to the management of the college.

How Input Was Considered: Pertinent feedback is received from various stakeholders on a wide range of research and extension program initiatives which are currently in progress. As a result of the input received, CTAHR faculty modify work plans to improve the design of research projects and provide specific opportunities for continued feedback. Information is disseminated to communities through newsletters, local newspaper coverage, and radio programs. Administrators and faculty use input to prioritize resource allocations, inform other researchers and policy makers of trends and concerns. Recommendations from various advisory boards represent key constituent views, and are useful in the developing research and extension programs which reach the communities we serve. Input from the CTAHR Board of Advisors is considered at the strategic level. In 2006, the Board's input helped shape the development of legislative request package for CTAHR.

Examples of research and extension projects that were recently initiated are provided below.

- The Hawaii Caregiver Coalition, a cooperative agreement between AARP Hawaii Chapter and the U.S. Administration on Aging, and the Cooperative Extension System have identified the needs of grandparents caregivers a priority. As a result, the Integrated Project HAW00359-H entitled "Examination of Cultural Contexts of Grandparents Raising

Grandchildren” was developed.

- Surveys of high school and college students indicated that only 10% received any formal financial education and that a significant percentage reported significant financial problems related to education-related debt. As a result, the Integrated Project HAW00362-H (Peer-Education Financial Literacy Project) was initiated to identify more in-depth financial education needs of college students to develop a follow-on financial education program for college students.
- A group of parent educators, counselors and family therapists from Kaiser Permanente, The Family Education Centers of Hawaii, psychology private practices and the University of Hawaii met to discuss the needs of the large numbers of dual worker, time-pressed, multi-ethnic and military families in Hawaii, who are dealing with these stresses. This resulted in the Integrated Project HAW00377H (Development and Evaluation of a Family Education and Conflict Resolution Program Target at Deployed Military and Other At-Risk Families).
- A sector of diversified agriculture that is growing very rapidly is the Sapindaceae (lychee, longan, rambutan) crops. Planting of orchards have been very active and many are now beginning to produce crops. The industry began to see several problems in the orchard with diseases, insects, low fruit set, post-harvest handling and other issues related to this issue. As a consequence an extension POW (20-066 Culture and Management of Nuts and Sapindaceae Tropical Fruits in Hawai‘i) was developed to integrate with existing Hatch Project HAW00828H (Flowering, Fruit Set, and Production of rambutan, lychee and Longan in Hawai‘i).
- At the request of the Hawai‘i Farm Bureau Federation, and the Hawai‘i Department of Agriculture a series of introductory 2-day organic farming classes (Extension project 18-822 Organic Farming Academy) was begun in September 2006. The classes will eventually be held on five islands. Instructors for the classes consisted of researchers and extension workers from CTAHR, local established organic farmers and representatives from two organic farming associations. Classes also included a half day field trip to a working organic farm to see first hand the organic farming methods used. Input from attendees will be used for follow-on specific organic farming classes.

C. Program Review Process

There have been no significant changes in our program review processes since our 2004 Plan of Work Annual Report was submitted.

D. Evaluation of the Success of Multi and Joint Activities

The UHM currently has 32 scientists who contribute to 32 multistate projects under the five National Goals. Each multistate project submits an annual report on the group’s activities, accomplishments and plans for the future. CTAHR makes no attempt to evaluate any of the multistate research activities as that is accomplished through the efforts of the scientists and administrative advisors in each of those programs. The Western Research Coordination and Implementation Committee is responsible for evaluating each new or revised proposal for projects, and the AES directors approve or disapprove of them based on recommendations from

the RCIC.

The College of Tropical Agriculture and Human Resources contributes to 32 multistate projects:

- National Goal #1 (NC-1311, NE-1008, NRSP-8, S-9, SCC-80, W-6, W-112, W-1173, W-1004, W-1185, W-1186, WERS-20, WERA-110, WERA-1004, WERA-1008)
- National Goal #2 (S-1007, W-1045)
- National Goal #3 (NC-1033, NCDC-211, S-294, W-1003, W-1122, W_TEMP1981)
- National Goal #4 (S-1000, SDC-326, W-1082, W-1128, W-1170, W-1190, WERA-103, W_TEMP1881)
- National Goal #5 (NC-1030)

CTAHR is actively encouraging our scientists to participate in multistate activities. We continue to monitor our progress.

Strategic Issues Addressed:

The multi and joint activities have successfully addressed CTAHR's strategic goals of promoting diversified agriculture, sustaining Hawaii's natural resources and environment, and strengthening communities. CTAHR's strategic goals are directly related to National Goals 1, 2, 3, 4, and 5. We have initiated several new projects, including blueberry production, tea production, and biomass energy program. The first two projects are aiming to develop new industry to boost local agricultural industry, and the biomass energy program intends to utilize under-utilized farm land to solve local energy need.

Underserved and Underrepresented Populations Served:

CTAHR's integrated projects have made significant progress in serving ethnic groups and cultures that often are not sufficiently served by most federal programs. One example is highlighted below:

A farm safety program specifically targeting underserved farmers (immigrant farmers from countries such as the Philippines, Laos, Cambodia, Korea, and Tonga) is being conducted statewide. It was recognized that many immigrant farmers speak varying amounts of English as their second language and are at risk, especially in the area of pesticide safety. Outreach is conducted through a variety of methods such as small group meetings, individual on-farm consultations and assistance, bilingual training materials in their native language, and workshops on IPM, pesticide use, handling and storage, how to recognize common pests of the crops they grow.

Program Outcomes and Impacts Achieved:

Overall, our programs are producing valuable outcomes and impacts for our stakeholders and represent sound investments of federal appropriation. We were able to obtain additional funding from non-federal sources to support our programs. This is a reflection of the credibility and

productivity of our programs.

Improvements in Program Effectiveness and Efficiency:

The brief descriptions of the integrated projects above highlight how our programs address our strategic issues, serve underserved and underrepresented populations, and impact our stakeholders. We have added more integrated projects in 2006, and reduced the number of research only projects. We have also begun to track faculty productivity by proposal submission and grant obtained in our database. Our programs have increased their efficiency and effectiveness, which ultimately results in profitable and sustainable agriculture and strengthened rural communities.

E. Multistate Extension Activities

Form CSREES-REPT (09/04) – See Below

The College of Tropical Agriculture and Human Resources (CTAHR) received an exemption from meeting mandated multistate extension requirements provided under Section 105 of the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA) for FY2002 through 2004 on November 15, 2005. CTAHR was encouraged to show “good faith” efforts to comply with the law in the future. Although the exemption was received after the close of FY2005, the College has several examples of multistate extension activities to report for this period. The administration is taking this matter seriously and working towards involving more extension specialists in multistate research projects with the objective of expanding the extension component to these research efforts.

The College is also involved in many other “unofficial” multistate extension activities. These include exchange of faculty, resources, informal meetings, attendance of workshop and other activities where a formal agreement is not in place. We are working towards formalizing some of these activities. We are also expanding our efforts to collaborate with our Pacific island partners and share our expertise in many areas. Much of this already is taking place.

F. Integrated Research and Extension Activities

Form CSREES-REPT (09/04) – See Below

University of Hawai‘i at Mānoa has a unique organizational approach that integrates research, extension and credit education programs. All faculty in the statewide branch stations and extension offices have an academic home in a campus department. They are full members of the department faculty and are fully enfranchised in the departments, colleges and university. For example, extension faculty who are stationed in a county hold an academic appointment in a department and fully participate in promotion and tenure activities of the department. They hold tenure track and professorial positions. They are fully represented in the Faculty Senate of the university. They plan and implement education (both academic and extension) and research programs in a fully integrated fashion. We continue to encourage our faculty to submit

integrated project proposals when their existing Hatch project or Extension project terminates, and we are getting good results of adding more integrated projects in 2006.

U.S. Department of Agriculture
 Cooperative State Research, Education, and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
 (Attach Brief Summaries)
 Fiscal Year: 2006

Select One: Interim Final
 Institution: University of Hawai'i
 State: Hawai'i

		Integrated Activities (Hatch)	%	Multistate Extension Activities (Smith-Lever)	%	Integrated Activities (Smith-Lever)	%
<i>Established Target %</i>		18	%	4	%	8	%
<i>This FY Allocation (from 1088)</i>		1,212,864		1,197,432		1,197,432	
<i>This FY Target Amount</i>		\$218,316		\$47,897		\$95,795	
Title of Planned Program Activity							
111H	Community Business Matching	\$3,800				\$1,970	
266H	Best Management Practices for the Sustainable Productivity of Hawaii's Range & Pasture Lands	36,916				1,964	
353H	Curriculum Innovations for At-Risk Preschoolers	22,345				\$5,492	
356H	Nutrition Education for Wellness (N.E.W.): Models for Promoting Healthy Behaviors	138				3,700	
359H	Examination of Cultural Contexts of Grandparents Raising Grandchildren	9,338					
362H	Peer-Education Financial Literacy Project	4,304				14,743	
372H	Incarcerated Parents: Adjustment of Their Children & Families	38,356				993	
373H	Understanding the Well-Being of Hawai'i's Families	25,685				1,992	
513R	Animal Manure & Waste Utilization, Treatment and Nuisance avoidance for a Sustainable Agriculture	25,462				853	
522H	Identification & Remediation of Hazardous Substances to Safeguard Human & Environmental Health	7,234				3,035	
822H	Weed Management in Sustainable Tropical Cropping Systems	62,231				28,057	
833H	Optimizing the Soil Environment for Diversified Crops in Hawai'i	\$20,113				\$3,990	

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Fiscal Year: 2006

Select One: Interim Final

Institution: University of Hawai'i

State: Hawai'i

Title of Planned Program Activity	Integrated Activities (Hatch)	%	Multistate Extension Activities (Smith-Lever)	%	Integrated Activities (Smith-Lever)	%
<i>Established Target %</i>						
<i>This FY Allocation (from 1088)</i>						
<i>This FY Target Amount</i>						
845H Utilization of Arbuscular Mycorrhizal Fungi for Environmentally Sound Production of Vegetable Crops	2,150				1,678	
863H Optimizing Nutrition from Animal Manures for Hawai'i Vegetable Farms	6,141				5,096	
872H Cultural Studies of Intensive Vegetable Production	1,984					
874H Developing Taro as an Alternative Food & Ornamental Crop	36,954				2,560	
886H Light Manipulation for Flowering of Orchids	3,362					
926H Development of Multiple Disease Resistant Commercial Tomatoes	2,000				2,000	
935H Biology & Management of Invasive Ants in Hawai'i	18,166				6,826	
943H Pineapple Cultivation & Production in Hawai'i	38,902				2,657	
948H Preservation of Hawaiian Taro Cultivars & the Development of Pest Resistant Commercial Taro Hybrids	4,180				2,000	
969H Determining the Technical & Economic Feasibility of Incorporating Microbial Treatments into Current Anthurium Production Systems	21,038				885	
971H Molecular Identification, Genetic Variation & Host Susceptibility of a New Invasive Rust Pathogen Attacking Ohia (Metrosideros Polymorpha) in Hawai'i	54,795				1,983	

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Fiscal Year: 2006

Select One: Interim Final
Institution: University of Hawai'i
State: Hawai'i

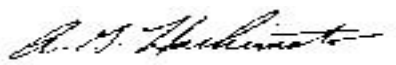
		Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)
<i>Established Target %</i>		%	%	%
<i>This FY Allocation (from 1088)</i>				
<i>This FY Target Amount</i>				
Title of Planned Program Activity				
977H	Control of Papaya Fungal Diseases	\$999		\$399
12-503	Polluted Runoff Control for Waialeale Livestock Farm			6,108
14-202	Enhancing Conception Rates in Dairy Cows Under Heat Stress Conditions by Determining the Chemical Constituents of Cervical Mucus at Estrus		30,679	30,679
14-204	Best Management Practices for the Sustainable Productivity of Hawaii's Range and Pasture Lands			25,500
14-225	Development & Testing of Nutrition Messages to Increase Calcium Intake Among Preadolescents		4,277	
16-902	Developing Insect Identification Guides & On-Farm IPM Training for Banana & Papaya Growers			13,200
16-916	Etiology & Control of Fungal Diseases & Education Program for Local Growers			13,583
18-803	Controlling Plant Growth with Photosensitive Plastic Film & Photosensitive Shadecloth			1,311
18-805	Extension Strategies for Improved Soil Nutrient Management in Hawaii			7,000

U.S. Department of Agriculture
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 Fiscal Year: 2006

Select One: Interim Final
 Institution: University of Hawai'i
 State: Hawai'i

	Integrated Activities (Hatch)	%	Multistate Extension Activities (Smith-Lever)	%	Integrated Activities (Smith-Lever)	%
<i>Established Target %</i>						
<i>This FY Allocation (from 1088)</i>						
<i>This FY Target Amount</i>						
Title of Planned Program Activity						
20-025	Foliage Production & Nursery Management Program for Hawai'i County				5,762	
20-072	Diabetes Awareness, Education & Screening Project		36,699			
21-080	Grandparents Raising Grandchildren				8,049	
22-034	Aster Yellows Disease: A New Threat to Many Crops in Hawai'i				36,000	
22-070	Nutrition Education for Wellness (N.E.W.)		13,990			
23-040	Development & Enhancement of Ornamental Crops/Commodities				\$26,200	
	Total		\$450,659		\$85,645	\$266,265
	Carryover		0		0	0

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.



 Director

April 1, 2007

 Date

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and
Multistate Extension and Integrated Activities
Brief Summaries
Fiscal Year: 2006

Institution: College of Tropical Agriculture and Human Resources
State: Hawaii

111H Community Business Matching (Goal 5).

Progress/Accomplishments: A database of business profiles has been constructed. A journal article has been submitted, which was also accepted for presentation at the 2007 Western Regional Science Association meeting in 2007. The article outlines what factors contribute to a business' decision to relocate. The Community Business Matching model has been re-programmed. The pilot project in Anaconda, Montana has been completed and a case study was accepted for presentation at the 2007 National Association for Community Development Extension Professionals. Cooperators have been located across the West and more funding has been secured from Montana State University. More communities in Montana and Nevada are now implementing the CBM model and draft documentation for the model is complete. Work has begun on a large grant in order to enlarge the business database.

266H Best Management Practices for the Sustainable Productivity of Hawaii's Range & Pasture Lands (Goal 4)

Progress/Accomplishments: Data continue to be collected on previous trials implemented on Kauai investigating the efficiency of different management practices in controlling the noxious grass, tufted beardgrass. It has been noted that combination of mowing, grazing and applications of N fertilizer and lime can be effective in controlling this grass in former sugarcane lands. New trials underway on Kauai have included implementing inter-seeding of desirable grasses and legumes into existing stands of bushy beardgrass. Initial seeding efforts were not successful and subsequent trials are planned. The pasture improvement trials on Hawaii continue to be monitored. Results show that seeding green panic, signal grass, and perennial peanut can greatly improve pasture quality. Moreover, forage production in the trial areas has allowed for dramatic increases in the stocking rate. Further investigations into the ecology and toxicology of fireweed in Hawaii are being developed with three areas of focus: 1) distribution and rate of spread of fireweed on Hawaii and Maui; 2) Physiologic and morphologic characteristics of individual plants within and between populations across elevation, climate, and soil gradients; 3) exploring possible linkages between soil types and factors contributing to objectives 1 and 2; and 4) development of fireweed management strategies for land owners. In order to identify the most economical means to remediate former sugarcane and pineapple lands research sites on Kauai, Maui, and Hawaii were selected for a series of trials. Treatment applications were completed at these sites by May of 2006. Initial, six month post-treatment samples of soil and vegetation quantity and quality measures have been completed. For the remainder of the project, vegetation samples will be collected at three month intervals. This will provide information on the residual effects of the different treatment levels on forage quality and quantity. Subsequent soil samples

will be collected at 18 and 24 months post treatment and will provide information on the residual effects of the different treatments on soil quality parameters. Forage production over the initial 3 month period following the treatment applications at the Kauai and Hawaii sites was more rapid than expected. For example, average production in the high and low N plots was higher (12.7 and 9.6 tons/acre, respectively) than in the no N treatments (5.9 tons/acre). While it was not surprising that production increased with increasing N, it was surprising that the differences were so great in such a short period. These early results suggest that applications of N in former sugarcane lands can increase their productivity. A doubling of the amount of production per acre would offset the cost of application. There was a dramatic shift in soil pH in the limed plots relative to the no lime plots. How long this affect lasts will depend on the initial liming rate and soil weathering factors. Knowing the length of the residual effects will be valuable to producers who are trying to minimize their costs over the long-term.

353H Curriculum Innovations for At-Risk Preschoolers (Goal 5).

Progress/Accomplishments: The main goal of the third year of this integrated project was to support Head Start classrooms in implementing the Learning Connections curriculum and to provide intensive coaching and professional development for teachers. Learning Connections (LC) is a preschool enrichment curriculum designed to meet the needs of Hawaii's multicultural Asian American/Pacific Islander population. LC includes daily small-group activities that support children's language, literacy, and math development as well as weekly home activities that children complete with their parents. Using this Hatch project as a foundation, we received a three-year Early Reading First award from the U.S. Department of Education for over \$1.7 million. Between January and June, we worked with 14 teachers and 95 children and their families in 5 Head Start classrooms. Teachers received (a) over \$5,000 in classroom materials including the LC curriculum, (b) weekly LC lesson plans, (c) 20 hours of workshops training on the LC curriculum and developmental issues, (d) nine hours per month of in-class coaching and technical assistance, and (e) free tuition to enroll in a specially-designed course on preschool literacy development and instruction. Families received weekly home activities and bi-monthly coaching on working with their preschool child. Evaluation results indicate that teachers implemented the LC curriculum with reasonable fidelity, scoring an average of 3.98 out of 5.00 on a structured observation of implementation quality. Scores for teachers in the first cohort also improved significantly on the ELLCO, a measure of the quality of the classroom literacy environment and on the CLASS, an observational measure that assesses both the emotional climate and instructional quality of the classroom. These changes in classroom quality translated into positive educational outcomes for the Head Start children. Children gained an average of 5.7 standard score points on the PPVT, a test of vocabulary size. This represents an improvement of over one-third of a standard deviation for age-adjusted scores. Children also showed significant gains on tests of phonological awareness (a 40% increase in mean raw scores) and early math (an increase of 54% in mean raw scores). All of the five original classrooms continued with our project in the current school year. In July we added five new classrooms, raising the total number of participating teachers to 24 and the number of participating children to 204. Sixteen hours of workshop training was provided in July, and teachers and parents continue to receive ongoing in-class coaching and assistance. A second goal for this project year was to develop new measures for conducting evaluation and research on classroom processes. We drafted and collected pilot data on three new measures: (a) an observational rating of teaching quality, (b) a teacher-report measure of knowledge about preschool literacy development and teaching practices and (c) a

parallel self-report measure of teachers' knowledge of preschool math. We also applied for a Teach Quality Research grant in reading from the Institute for Education Sciences. This proposal was not funded.

356H Nutrition Education for Wellness (N.E.W.): Models for Promoting Healthy Behaviors (Goal 3)

Year 1 of this project focused on developing the pilot phase using a quasi-experimental, pre- and post-test group comparison. 18% of the target group participated in the pilot phase, and promotion-recruitment efforts were re-designed based on a follow-up survey to determine reasons for non-participation. The Healthy Meetings for Wellness Web site was updated to include: 1) project video, 2) Healthy Meetings Checklist, 3) walking maps, 4) 8 factoids, 5) Produce a Plate leaflet used in the nutrition education workshop, 6) the pre- and post-checklist for participants, 7) 2006 workshop schedule, 8) the Web resources handout, and link to pertinent Websites. The on-line instructional video was taped and is ready for editing. Marketing materials were developed and include NEW labels for water bottles, NEW labels for produce, NEW door hangers, NEW magnets and folders and a tabletop NEW program display. Year 2 of this project focused on the intervention program for all CTAHR departments, and was conducted from October 21, 2005 to November 16, 2005. The enhanced condition included (a) web-based instructional materials on healthful meetings, (b) a meeting well workshop, (c) email reminders about recordkeeping and tips for implementing healthful nutrition behaviors in the workplace, and (d) procedures for requesting on-line advice and assistance from team members with qualifications in dietetics. The web condition included only the web-based instructional materials. Between February and April 2006, thirty-eight CTAHR faculty and staff participated in orientation sessions, completed the pre-assessment, and participated in a nutrition workshop. A total of 68 people attended health screenings held on the islands of Oahu, Maui, Hawaii (Hilo and Kona sites) and Kauai. Eleven participants completed post-assessments and received incentives for their participation. Due to inadequate funding, this project terminated on September 30, 2006.

359H Examination of Cultural Contexts of Grandparents Raising Grandchildren and 21-080 Grandparents Raising Grandchildren (Goal 5)

Progress/Accomplishments: Over the past year two focus sessions were conducted with support groups for grandparents raising grandchildren to get their input on developing a series of culturally sensitive brochures. The findings were used to design four brochures in the *Ohana Caregiver* Series addressing the following topics: community resources, addiction, managing grandchildren's problem behavior, and stress management. Feedback was solicited from two support groups prior to publication. The brochures were then distributed through support groups, the legal aid society, and community fairs. A talk on the process of brochure development was also presented at a national conference. The brochures have been received favorably by many local grandparents. Grandparents have mentioned that the information contained in them is relevant and useful. The brochures have also helped to raise awareness of the needs of grandparents raising grandchildren in the community at large. There were over 3,000 visitors to the senior expo and over 10,000 visitors at the youth fair at which the brochures were distributed. The brochures had the unexpected impact of serving as a focus for the organization of grandparents raising grandchildren as a political group. One of the support groups that we visited used the brochures as a way to help them locate and organize other grandparents in the

community. Data collected from the grandparent focus groups has also been used in reports to the Hawai'i State Legislature.

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362H Peer-Education Financial Literacy Project (Goal 5)

Progress/Accomplishments: Upon the conclusion of the student and faculty/staff needs assessments, the data were analyzed utilizing SPSS. There were 411 University of Hawaii @ Manoa (UHM) students and 21 faculty/staff who participated. The students seemed to be interested in learning about a variety of money management topics primarily investing, credit, and budgeting. They preferred learning this information through sessions with a financial aid counselor or special events with free food. The faculty/staff in a similar study responded likewise, that students should be concerned about budgeting, credit, and loans. They also suggested that events with free food would attract a student audience. A manuscript summarizing the results has been submitted to a referred journal and is currently under review. Drawing upon the information from the needs assessment, a review of existing financial education programs for college students, a site review, and assessment of the current department situation, a curriculum from USA Funds, called Life Skills was selected. Pilot sessions were conducted at a UHM dormitory for 20 student residents and 53 College Opportunities Program students to verify suitability of the curriculum and evaluation tools. To conduct the project as a peer delivery mode, interested students were recruited to work in pairs as facilitators of these financial literacy modules. In the summer, four peer leaders who were trained in group process and leadership by the UHM New Student Orientation program were instructed in financial management concepts and the USA Funds curriculum. These peer leaders conducted five sessions focusing on the topics of goal setting, budgeting, and credit. They reached 109 entering freshmen and transfer students prior to the fall term as part of UHM student services orientation. Additionally, ninety-five students were recruited to provide information for control group samples. During fall semester, arrangements were made so that four students needing practicum experience for an educational administration course in leadership were enlisted to become peer leaders. Their training in financial literacy with the USA Funds Life Skills curriculum was supplemented by The ABCs of Credit Card Finance booklet provided by the Hawaii Credit Union League, and other materials from the University of Hawaii Cooperative Extension Service. USA Funds has been a supportive partner with not only no-cost workbooks, but biannual visitations by the regional representative. Her interest in our project has led to the inclusion of new evaluation questions for the USA Funds curriculum. Subsequently, she requested our assistance in testing the new tools as well as a brand new website to supplement existing materials. This UHM project was recently featured in a USA Funds national newsletter.

372H Incarcerated Parents: Adjustment of Their Children and Families (Goal 5).

Progress/Accomplishments: Data gathered previously via interviews of incarcerated mothers

were analyzed to identify academic/school and behavioral/psychological problems experienced or exhibited by a sample (N = 45) of their children. The more common problems reported for the children of incarcerated mothers were: (53%) argues a lot, (49%) unhappy, sad or depressed, (47%) temper tantrums, (44%) prefers being with older kids, (42%) swearing or obscene language. Higher percentages of boys than girls were reported to have academic/school related problems, such as: (29% vs 6%) placement in class for learning problems, (25% vs 0%) being suspended or expelled, (18% vs 12%) truancy or skipping school, (18% vs 6%) repeating a grade, (14% vs 12%) being tardy to school or class, and (11% vs 6%) placement in class for behavioral problems. Similarly, higher percentages of boys than girls were reported to have/exhibit behavioral/psychological problems, such as (57% vs 47%) argues a lot, (50% vs 47%) unhappy, sad or depressed, (46% vs 41%) prefers being with older kids, (43% vs 41%) swearing or obscene language, (43% vs 29%) feels he/she has to be perfect, (43% vs 18%) lying or cheating, (36% vs 35%) sudden changes in mood or feelings, (36% vs 6%) gets in many fights, (36% vs 6%) destroys things belonging to family, (29% vs 24%) hangs around with others who get in trouble, (21% vs 18%) is cruel, bullying or mean to others, (21% vs 6%) feels worthless or inferior, (21% vs 6%) withdrawn, doesn't get involved with others, (11% vs 6%) deliberately harms self or attempts suicide, and (11% vs 6%) is cruel to animals. Higher percentages of girls than boys were reported to have/exhibit problems in only two areas: (47% vs 46%) temper tantrums or hot temper and (18% vs 11%) uses alcohol or drugs for nonmedical purposes. Data were analyzed to determine whether frequency of contacts between incarcerated mothers and their children mediated reported children's school and behavioral problems. In seven of eight items pertaining to academic/school related concerns and problems, and in 19 of 21 items pertaining to behavioral, emotional or social problems, differences were found that are consistent with the hypothesis that children who visit their incarcerated mothers more have or exhibit less academic, school, behavioral, emotional and social problems. Project staff provided consultation to the Girl Scout Council of Hawaii in support of their efforts to design and organize a Girl Scout Beyond Bars Program for the State of Hawaii. Once the program was funded and workers recruited/hired, project staff provided inservice training for Beyond Bar workers. Subsequently, project staff are providing consultation on research to measure program effectiveness. Project staff continued to provide information and consultation to Hawaii State Senator Brian Kanno, related to legislative concerns regarding incarcerated parents and their children in Hawaii.

373H Understanding the Well-Being of Hawaii's Families (Goal 5)

Progress/Accomplishments: This integrated project includes research on risk and resiliency in Hawaii's multicultural population. The research provides a basis for extension and outreach activities that support the wellbeing of children, families, and older adults in our state. DATA COLLECTION & DISSEMINATION: We conducted two large-scale studies using representative samples of households across the state. Data on intergenerational solidarity and conflict were collected from 2,675 adults and data on family characteristics that promote resilience were collected from over 6,000 households. These data will be the basis of research and outreach publications. In collaboration with public and private agencies, we enhanced the Homeless Management Information System (HMIS), a state-wide database on the homeless population. All state-funded shelter and outreach programs that serve the homeless enter data into the HMIS. We launched the web-based Data Center on Hawaii's Aging, which includes state and national data on over 180 indicators and a resource bank of over 600 publications on the

aging in Hawaii. We also disseminated data on the wellbeing of Hawaii's children through the on-line Hawaii Kids Count Virtual Databook and a monthly e-mail newsletter that reaches over 1,000 service agencies, community advocates, and legislators. CONFERENCES: A research conference on multi-ethnic families was attended by 30 academics from eight states and Canada. The public keynote address attracted over 250 attendees. The conference resulted in an edited book now under contract negotiations. We also co-sponsored the first annual Hawaii Fatherhood Conference, an extension event attended by over 200 people. CAPACITY BUILDING FOR AGENCIES & FAMILIES: Our Learning to Grow initiative helps parents and caregivers ensure that children under age five are healthy, safe, and ready for school. Over 3,000 parents and caregivers received monthly mailings with resource information and ideas for early learning activities, while over 2,200 children received free age-appropriate books. Over 2,000 parents who applied for state childcare subsidies saw a video and received information about selecting quality childcare; 97% of consumers rated these materials as good or excellent. We also collaborated with the state Department of Education and 23 agencies to open 15 Family Resource Network Centers in selected public schools and community sites. These centers provide parents and school staff with resources on family and parenting issues. Learning to Grow publications included a set of developmental guidelines and a book of learning activities for infants and toddlers. These materials have been distributed to almost 2,000 families and agencies. Over 300 professionals attended training sessions on the developmental guidelines; 98% rated the training as good or excellent. In the Compassion Capital initiative, we provided workshops for over 600 representatives of faith-based and community organizations. We worked more intensively with 17 organizations, training 34 fellows in organizational capacity building, providing over 500 hours in customized technical assistance, and awarding over \$256,000 in small grants.

513R Animal Manure and Waste Utilization, Treatment and Nuisance Avoidance for a Sustainable Agriculture (Goal 4).

Progress/Accomplishments: A project entitled "Polluted runoff control for Waialeale livestock Farm" was funded through US EPA Clean Water Act Section 319(h) Grants and Department of Health, State of Hawaii. This project involves both point source and non-point source pollution control. The point source pollution includes mainly the milk parlor wastewater and some domestic sewage. The non-point source pollution includes the run off from beef/ dairy feedlots. The treatment system includes two of anaerobic Bio-nest (10 m³ each), one aerobic biopottery (5m³) and a windmill for aeration. After half year of the operation of this integrated treatment system, removal efficiency of TCOD (Total Chemical Oxygen Demand), TSS (Total Suspended Solids) and ammonia nitrogen are 93%, 92% and 60%, respectively. This integrated treatment system makes both point source and non-point sources pollution controllable. It is simple, reliable and low cost. This project has been progressed as proposed. A CD entitled "Animal Waste Management and Pollutant Runoff Control" has been prepared for the distribution of the interested persons and agencies.

522H Identification & Remediation of Hazardous Substances to Safeguard Human & Environmental Health. (Goal 4)

Progress/Accomplishments: Novel analytical methods and remediation technologies are two important tools for effective responses to emergency involving hazardous substances. A suite of extraction, separation and detection methods have been developed for explosives, pesticides,

flame retardants, common pollutants, animal growth regulators, antibiotics, biotoxins and proteins. Those analytical methods include supercritical fluid extraction, pressurized fluid extraction, gas chromatography-mass spectrometry (GC-MS), liquid chromatography-MS (GC-MS), and DNA probes. We have studied phytoremediation, microbial degradation, zero-valent iron reduction and photolysis for pesticides, polycyclic aromatic hydrocarbons, the flame retardant polybrominated diphenyl ethers, and polychlorinated biphenyls. Organophosphate insecticides are used as model chemicals for nerve agents. The zero-valent iron destruction technology has shown high commercialization potential for water treatment. We have built more than 17 detailed catabolism maps of those chemicals in bacteria isolated from contaminated sites. Differential protein profiling has shown transporter proteins, oxidative enzymes, DNA and RNA repair enzymes and molecular mechanisms to protect the bacterial cells from damages by the toxic chemicals. More than 70 plant species have been studied for their potential of environmental cleanup. The general trend leads one to consider that salt and/or drought tolerant plants can bear other potential stress-inducing conditions. On average, we analyze 150-200 unknown samples per year to aid the State of Hawaii on emergency responses. After the events of September 11, 2001, the State of Hawaii was inundated with alleged biological threat response calls to the local fire hazardous materials teams. During that time, a need arose for fast field testing and triage of the samples as either potential biological or chemical agents. To meet the needs, we have worked with the Department of Health (DOH) and have had an "All Hazards Field Sampling and Categorization" training program. A manual and a set of DVD videos are designed and produced for live training of the Hawaii Hazmat teams and evolved to include tools, supplies, testing demonstrations, chain of custody and transportation guidelines for either chemical substances or biological organisms. It is also designed for refresher training sessions. This training manual and DVDs will be available for distribution early next year. In collaboration with DOH, we have had the live training to more than 135 Hazmat members from the City and County of Honolulu on Oahu, and the Kauai and Hawaii Counties from 2002 to 2005.

822H Weed Management in sustainable Tropical Cropping Systems. (Goal 1)

Progress/Accomplishments: Five potted landscape ornamentals were exposed to either 2 sequential (80 days apart) applications of spray herbicide treatments or granular forms of herbicide to determine crop and weed response. Spray applications were dithiopyr (.22 kg ai/ha) and dithiopyr (.22 kg ai/ha) + isoxaben (1.1 kg ai/ha). Granular formulations applied were Snapshot (a mixture of 2% trifluralin (3.7 kg ai/ha) and .5% isoxaben (1.1 kg ai/ha)) and Showcase (a mixture of 2% trifluralin (3.7 kg ai/ha), .25% isoxaben (.55 kg ai/ha) and .25% oxyfluorfen (.55 kg ai/ha)). The potted ornamentals screened for safety were: Manila Palm (*Veitchia merrillii*), Triangle Palm (*Dypsis decaryi*), Foxtail palm (*Wodyetia bifurcata*), Sago Palm (*Cycas revoluta*) and Cook Pine (*Araucari* Family). No herbicide applications resulted in a detrimental crop response. Snapshot provided the widest spectrum and longest lasting weed control. Native Hawaii sedge (*Fimbristylus cymosa*) is a candidate species for roadside ground cover use in Hawaii. Transplants were exposed to two preemergence herbicides: oxadiazon (2.2 and 4.4 kg ai/a) and oryzalin (2.2 and 4.4 kg ai/ha) and mixture of the two. Herbicides were applied at planting and 43 days later. The higher rate of oxadiazon resulted in stunting of sedge growth. Both rates of oryzalin provided for normal growth and good weed control. Transplants of 3 native Hawaiian grass species used for conservation plantings in Hawaii were treated with 5 selective postemergence grass herbicides to determine crop tolerance. The grass species included

Pili grass (*Heteropogon contortus*), Emoloa (*Eragrostis variabilis*) and Akiaki (*Sporobolus virginicus*). Herbicides screen for tolerance to these grasses were quizalofop-p (.07 and .09 kg ai/ha), fluazifop-p (.21 and .28 kg ai/ha), sethoxydim (.38 and .52 kg ai/ha), clethodim (.20 kg ai/ha and .27 kg ai/ha) and imazapic (.14 and .28 kg ai/ha). Pili grass dry weight was significantly reduced by all herbicides except imazapic. Emoloa and Akiaki dry weight was significantly reduced by all herbicide treatments by 50 to 75%. These data indicate that imazapic would be useful for selective grass and broadleaf weed control in Pili grass. Experiments on common Bermuda grass maintained at soccer field height and Tifway 328 maintained as a putting green were initiated to identify improvement in goosgrass (*Eeleusine indica*) using foramsulfuron at various reapplication intervals and in mixture with other postemergence herbicides. Goosgrass control was improved when the reapplication interval increase from 14 to 28 days. Foramsulfuron mixed with metribuzin and MSMA reduced longer term control of goosgrass.

833H Optimizing the Soil Environment for Diversified Crops in Hawaii (Goal 4).

Progress/Accomplishments: Organic amendments are often enhancing soil quality and crop productivity. To understand such effects, we assessed the changes in chemical properties of three agronomically important soils (Andisol, Oxisol, and Ultisol) of Hawaii, which were amended with chicken manure and green manure (*Leuceana leucocephala*) at 5.0 g/kg. The amended soils were incubated at 23 +/- 2 oC and under field-moist conditions for 8 weeks. Sub-samples were chemically analyzed at 2, 14, 28, 42, and 56 days after the organic additions. The data showed that organic amendments raised soil pH and EC, and reduced KCl-extractable Al. Soluble C concentrations were decreased exponentially with incubation time. Initial soluble C levels were highest in the Oxisol (60 umole/g) and lowest in the Andisol (20 umole/g). Of the 8 low-molecular-weight organic molecules monitored, 3 (acetic acid, catechol, and oxalic acid) were found at biologically significant levels in all the manure-amended treatments. Since these molecules are known to complex soluble Al, thereby reducing its toxicity, the additions of organic manures to nutrient-poor, acid tropical soils could effectively alleviate soil acidity problems.

845H Utilization of Arbuscular Mycorrhizal Fungi for Environmentally Sound Production of Vegetable Crops (Goal 4)

Progress/Accomplishments: One of the variables that is critical in determining whether or not to apply the arbuscular mycorrhizal technology in vegetable crop production is the degree to which vegetable crops of interest rely on the mycorrhizal condition for nutrient uptake and growth. During the life of the project, we have determined the AM dependency of a number of vegetable crops. These include asparagus, bell pepper, egg plant, onion, tomato, and sunflower. Asparagus and onion were classified as highly dependent species while egg plant, sunflower, and tomato were classified as marginally dependent. The study on bell pepper was aborted because of disease infestation. We observed that crops that are different in their dependence on the mycorrhizal condition required different mycorrhization media in the nursery. Mycorrhization of onion seedlings in the nursery led to a three-fold increase in onion bulb and foliage yield after transplanting in the field. Research we undertook also showed that vegetable crop species like ginger that cannot be inoculated at the time of planting could be inoculated through a companion crop like onion after the former plants were established in the field. In another study, in which we evaluated the influence of cropping sequence on the effectiveness of AM fungal effectiveness

in onion, we found out that growth and P status of onion was stimulated by a previous crop of sun hemp to a greater extent than by a previous crop of mustard. However, the effect of AM fungal inoculation was initially negative although the effect disappeared as time progressed. This was explainable by the fact that initially onion was allowing its roots to be colonized by AM fungi at soil solution P concentrations which were near-sufficient for mycorrhiza-free growth. Arbuscular mycorrhizal colonization of onion roots was somewhat higher if onion was preceded by sun hemp than by mustard, but the values were not statistically significant. Leaf P content monitored as a function of time also indicated that there was no mycorrhizal inoculation effect. However, P content of onion was significantly higher if sun hemp was the previous crop than if mustard was the previous crop. In either case, the level of AM fungal colonization of roots declined with time irrespective of the mycorrhizal status of onion at the time of transplanting. As a result, final bulb and leaf yield of onion was not affected by mycorrhizal inoculation. These observations suggest that the ephemeral nature of the parasitic effect of AM fungi observed was due to the fact that onion was subsequently suppressing the development of the fungi in its roots under the prevailing circumstances.

863H Optimizing Nutrition from Animal Manures for Hawaii Vegetable Farms (Goal 1)

Progress/Accomplishments: Field experiments characterizing plant available N (PAN) from three animal manures (swine, dairy and poultry) have been conducted during the past year. The experiments consisted three manures applied at 4 rates to achieve the equivalent of 0, 150, 300 and 600 lb N per acre and a chemical treatment as the control. Each treatment was replicated three times. The experiments have been conducted at two sites, on an Oxisol at the Poamoho research station and on a Mollisol at the Waimanalo research station. The objective of the field experiments is to quantify PAN from added manures. At the Poamoho site two cropping cycles have been completed. Nitrogen balance calculations for the first cropping cycle show that on average 50% of the N added in the poultry manure was mineralized and 48% and 11% was mineralized from the dairy and swine manures respectively. At the Waimanalo station, N balance calculations showed less PAN from the same manures: poultry manure 39.1%, dairy manure 16.3%, and swine manure, 2.35%. Nitrogen balance calculations are being conducted on the second harvest date for the Poamoho station. We are also installing the third and last cropping cycle at Poamoho and the second cropping cycle at Waimanalo.

872H Cultural Studies of Intensive Vegetable Production (Goal1)

Progress/Accomplishments: Edible ginger was planted in non-perforated 11.4-liter pots containing perforated upside-down 3-liter pots to conserve growing medium and these pots were sub-irrigated with 5 cm of 1.5 mS nutrient solution. Yields of 767 and 1509 grams/pot were gathered from pots planted with 1 and 2 ginger rhizomes per pot, respectively. Baby ginger (immature soft rhizomes) was harvested from bottom-perforated, 11.4-liter pots containing similar upside-down 3-liter pots and these pots were sub-irrigated with 5 cm of 1.5 mS nutrient solution from a tank. Yields of 463, 838 and 1238 grams/pot were harvested from pots planted with 1, 2 and 3 rhizomes, respectively. Potatoes were grown in 36 x 36 x 12.7 cm perforated trays resting on a 5 cm plastic support and sub-irrigated with nutrient solution (EC = 1.5 mS). Similar total salable yields (1.5 to 1.7 kg/linear m of tank) were harvested from semi-decayed wood chip medium treatments ranging from 1 liter per tuber (3 liters per tray) to half-full trays of medium (8 liters per tray). Plots were hilled with dry grass. Yukon Gold out yielded (2.0 kg/linear m of tank) All Blue and Red Salad potatoes (1.7 and 1.1 kg/m of tank, respectively).

Red Sails leaf lettuce growing in a topcover-supported, suspended pot, non-circulating hydroponic method yielded 336 g/head which was 6 per cent more than lettuce growing in a float-support system in a raceway of non-circulated nutrient solution. Heads in the outer rows of the raceway yielded 17 per cent greater than those in the inner 4 rows when spaced at a density of 16 plants/m². Raceways were rehydrated prior to harvest such that the expanded polystyrene boards were free-floating. The pulling force required to move 2 boards (1.2 x 1.2m) containing 14.3 kg of lettuce down the raceway to the harvest location did not exceed 1.4 kg. Watercress was grown in open tanks of a complete nutrient solution (EC=1.5mS) which either was completely changed or where about 1/3 (which was lost by evaporation and transpiration) was replenished and the remaining solution was allowed to carryover after each monthly harvest. After 13 consecutive harvests, the carryover treatments had 61 per cent lower yields and 52 per cent lower tissue N content as compared to the treatment which was completely changed after every harvest. Adding 122 ppm N and 0.61 ppm Mn to the following 2 crops of the carryover treatment resulted in yields which were only 33 and 21 per cent lower, respectively, than the treatment completely changed after every harvest. Tissue Cu in the completely changed treatment was 34 pm vs. 25 ppm for the carryover treatment with a corresponding decrease in nutrient solution concentration from 0.32 ppm to 0.02 ppm Cu and this may have contributed to lower yields from the carryover treatment.

874H Developing Taro as an Alternative Food and Ornamental Crop. (Goal 1)

Progress/Accomplishments: Taro Variety Trials: In a field study conducted during 2005-06, eight new hybrids developed by either Dr. John Cho or Dr. Ramon de la Pena were compared with the commercial cultivar, Maui Lehua. The best-yielding taro cultivar was Maui Lehua; it also had the highest poi rating. Two hybrids developed by Dr. John Cho (1999-6 and 1999-9) had yields that did not differ significantly from the best. Their poi ratings were acceptable and just slightly below acceptable. The corms of 1999-6 had much greater acidity that required a longer cooking time. Training of students: During Spring 2006, the Food Service program students at Hawaii Community College included taro in their recipe preparation. The students were a mixed group of males and females with ages ranging from 18 to 49 years old, and about half were already working in food service. A survey at the end of the semester was conducted, and 21 students responded and the following is a summary of their responses. About two-thirds of the students thought taro was very easy or easy to use in recipes, with the rest responding that taro was not very easy or difficult to use. Their most successful recipes prepared in class were Rumakay, Taro Haupia Pie, Poi, Steamed Taro, Taro Wrapped in Bacon, and Taro Muffin. Only 3 students felt that taro was very versatile as an ingredient, and 11 thought that taro was only somewhat versatile. Most enjoy eating taro, and about half had tasted taro that was not adequately cooked and experienced a reaction (itchiness) to the undercooked taro. Their responses to how long taro should be cooked ranged from 20 minutes to 75 minutes. Whether they plan to prepare taro again at a job or at work received mixed responses with maybe being the more common reply. Their reasons for cooking taro again were for cultural significance, taste, versatility, and good nutrition. Irrigation of taro for luau leaf: Increasing irrigation levels of taro cultivar Bun long (commercially grown for luau leaf) resulted in significantly increasing leaf areas, fresh weights, and dry weights of first fully matured leaf blades. Percent dry matter tended to decrease significantly with increasing irrigation levels, although this effect depended on the harvest date. Taro leaves from Harvest 4 (6-10 layers from one leaf blade) were cooked in a steamer for 90 minutes, and then the pressure needed to penetrate these leaf layers was measured

using a fruit penetrometer. In Harvest 4, the lowest irrigation level resulted in leaves that required the highest pressure to penetrate six cooked layers, e.g. the toughest leaves. However, different treatment effects were found for cooked leaves from Harvest 5. It is possible that environmental factors influence the toughness of taro leaves. Further research needs to be conducted on factors involved in toughness of cooked leaves.

886H Light Manipulation for Flowering of Orchids. (Goal 1)

Progress/Accomplishments: With potted M-10973 Rhv. Herbert Kurihara Flori orchid plants, under the 30% black and red shade cloths, flowering ended earlier (10/27/05). When flower production resumed, new spikes were produced earliest under the red shade cloth (12/1/05). No new spikes were produced under the black shade cloth. With potted M-10878 Colmanara Sphacetante Evelyn AM/AOS orchid plants, spike formation occurred later than with the M-10973 plants. Spike formation occurred on the same date for all shade cloth treatments (2/10/06) with similar numbers of spikes. With potted M-11066 Den. Vimalamitra Kiilani Sunshine orchid plants, when floral buds were starting to form, the 30% black and gray shade cloths resulted in a higher number of total buds per plant and open buds per plant than the 30% red and blue shade cloths. As flowering tapered off, the black and gray shade cloths also resulted in a higher number of buds and open buds per plant than the red and blue shade cloths.

926H Development of Multiple Disease Resistant Commercial Tomatoes (Goal 1)

Progress/Accomplishments: Marker assisted selection (MAS) was successfully employed to select the progeny from genetic crosses containing 3 disease resistance genes and to develop inbred tomato varieties that could be commercially grown in Hawaii. A genetic backcrossing strategy was employed for the development of different horticultural tomato types. Two donor beef steak type tomato parents, G8-5 was homozygous for Sw-5 that confers resistance to the tomato spotted wilt tospovirus (TSWV), Mi that confers resistance to the root knot nematode, and Tm2a that confers resistance to the tomato mosaic tobamovirus. The other parent (3-4#5) was homozygous for Sw-5 and the ripening-inhibitor (rin) mutation that yield fruits that fail to ripen. Markers employed included 3 co-dominant SCAR markers, UBC421 for Sw-5, Rex-1 for Mi, and Tm2 for Tm2a. A beefsteak-type F1 hybrid tomato suitable for commercial production in Hawaii was generated by crossing G8-5 and 3-4#5. A plum-type tomato inbred tomato suitable for production in Hawaii was also developed in this program. In the development of this inbred line, a plum-type breeding line with homozygous resistance to TSWV and the root knot nematode was generated by a cross between G8-5 and an inbred plum variety derived from a F1 commercial hybrid, Supra. The resultant F1 hybrid was self-pollinated and progeny homozygous for both Sw-5 and Mi was selected after 2 self-pollinations. Cross pollinations were then made with the F3 generation materials and plum-type parental lines derived by self-pollinating and selecting desirable F5 plants from two commercial F1 hybrids, Classica VFFNA hybrid and Spectrum hybrid. Selection for horticultural type was made from field evaluations on the island of Maui and disease resistance selections were based upon marker assisted selection using molecular markers. A green zebra type tomato was also developed in this program. In the development of this inbred, a genetic cross between the variety Green Zebra and 3-4#5 was generated and the progeny self-pollinated for 5 generations. During the selection process, MAS was used to select progeny homozygous for the Sw-5 gene and inbred line selected for commercial production selected based upon yield, fruit size and taste. A red grape tomato was developed in this program. In the development of this inbred a genetic cross between G8-5 and

an inbred grape variety, derived from F1 Bright Pearl, was generated and self pollinated for two generations then backcrossed prior to self pollinating and selecting a commercial grape type tomato line resistant to Sw-5, Mi and Tm2a. The three tomato types are currently being distributed to growers in Hawaii. During the selection process, MAS was used to select progeny homozygous for the Sw-5, Mi and Tm2a genes and inbred line selected for commercial production selected based upon yield, fruit size and taste. The tomatoes developed are being distributed to Hawaii tomato growers.

935H Biology & Management of Invasive Ants in Hawaii (Goal 3)

Progress/Accomplishments: Published a guide for monitoring the little fire ant on the Island of Hawaii. This guide is a multi-agency effort to aid in management efforts, and to help prevent the further spread of this serious pest in Hawaii. In laboratory evaluations of the aggressive interactions among invasive ant species in Hawaii, the big-headed ant and the yellow crazy ant were found to be the most aggressive ants in a variety of locations on the Island of Oahu. These three pest ants are among the world's worst invasive species listed by the World Conservation Union. Our results are intended to identify the key ant species that must be targeted by control efforts.

943H Pineapple Cultivation & Production in Hawaii (Goal 1)

Progress/Accomplishments: The fungicides Vanguard and Switch are very effective in preventing *Penicillium* growth on stored fruit. Vanguard and Scala did not prevent *Cladosporium* growth on stored fruit, although both were effective in laboratory studies. A soil survey found *Pythium splendence*, *P. arrenomonis*, and *P. graminicola* to be most prevalent in Oahu pineapple fields. *Phytophthora nicotiana* and *P. cinnamomi* were also found occasionally. In pineapple plots treated with Melocon the incidence of *Pythium* infect and subsequent plant loss was greater than in those plots treated with LCF or nothing. Surviving plant growth was similar in all treatments, however Melocon treated pineapple had a higher percentage of precocious fruit compared to the LCF and untreated plots. Whereas plant-parasitic nematodes are quite damaging to pineapple, molecular analysis of the nematode soil community has a tremendous potential to serve as a biomarker indicative of soil health. DNA from various nematode trophic groups was extracted and the 18S ribosomal DNA gene amplified. *Pratylenchus penetrans* DNA was often below the threshold level to be visualized on an agarose gel. Only those soil samples containing 1000 *Steinernema glaseri* nematodes delivered sufficient quantities of DNA to amplify the 18S ribosomal DNA gene.

948H Preservation of Hawaiian Taro Cultivars and the Development of Pest Resistant Commercial Taro Hybrids (Goal 1)

Progress/Accomplishments: Two farm trials were conducted at a cooperator wetland farm in Keanae, Hawaii to evaluate the potential of several elite taro hybrids previously selected based upon earlier performance trials in Hanalei, Hawaii. Three cycle 1 hybrids developed in 1999 were compared to the industry standard variety (Maui Lehua) and harvested on December 28, 2005 at 13 months after planting. All three hybrids (99-6, 99-7, and 99-9) were siblings from a genetic cross between an F1 hybrid [generated from a cross between Bangkok (a Thailand taro leaf blight resistant variety) and Niuw Waula (a Samoan variety)] and Maui Lehua. All three hybrids out produced Maui Lehua with average yields of 2.67 kg, 1.86 kg, and 2.18 kg, respectively, compared to Maui Lehua at 1.27 kg. Hybrid 99-6 was more tolerant to pocket rots

compare with the other hybrids and Maui Lehua and was preferred for processing by Haleiwa Poi, Inc. In the second trial, nine other cycle 1 hybrids developed in 1999 and 2000 were evaluated in May 2006. On the island of Kauai 12 growers and one grower on Maui have incorporated hybrids 99-6, 99-7, and 99-9 in their plantings, replacing a portion of Maui Lehua. Cumulatively about 3 acres of 99-6, 2.5 acres of 99-9 and 1 acre of 99-7 are in production. In July and September 2007 sixty-nine hybrids selected from the progenies of 17 different genetic crosses were evaluated in preliminary wetland trials in Hanalei on the island of Kauai. All (21) the hybrids from a cross between Maui Lehua and P5 (Palauan taro leaf blight resistant donor variety) appeared to be larger, matured earlier than the standard variety but were more susceptible to corm rots probably caused by a *Pythium* sp. Seven of the 69 hybrids appeared to be more leaf blight tolerant and higher yielding as compared with Maui Lehua. Six of 7 were derived from crosses between two cycle 1 hybrids with different leaf blight backgrounds. Three of the hybrids were from a cross between F1 [Maui Lehua x Thailand] and F1 [[Bangkok x Sol] x Lehua Maoli]. Thailand in the former hybrid is a leaf blight resistant variety. A second trial was initiated to compare the 7 hybrids for performance.

969H Determining the Technical and Economic Feasibility of Incorporating Microbial Treatments into Current Anthurium Production Systems (Goal 1 & Goal 5)

Progress/Accomplishments: The present field studies are a continuation of laboratory and greenhouse trials in which foliar treatments of anthurium plants with four species of beneficial bacteria stimulated growth of stage-four microplants and reduced incidence and severity of anthurium blight disease caused by *Xanthomonas axonopodis* pv. *dieffenbachiae*. The current focus is on optimization of bacterial formulations for large scale field application and an analysis of cost of production. Field plots were established in Hilo, Hawaii, to quantify the effectiveness of biological control agents (BCAs). Disease incidence in treated plots was reduced by 45 percent in comparison to nontreated plots in the first two experiments. To increase the rate of disease progression in the field, the inoculum level of the pathogen was increased 10-fold and inoculated leaves were bagged overnight to increase humidity. The conditions needed to achieve 100 percent disease incidence on highly susceptible Ozaki and Marian Seefurth cultivars under field conditions was established in two field experiments (three replications per experiment). In subsequent field experiments with Ozaki and Marian Seefurth, the BCA treatments reduced disease incidence and severity by 43 - 25 percent, respectively, which is similar to the first field experiments. Significant differences were observed 120 days after pathogen inoculation (dai) and continued to increase up to 220 days (present). In subsequent field experiments, the formulation of the BCA mixture was modified to improve survival of BCAs on plant leaves. BCA-treated plants again showed a significant reduction in disease incidence in comparison to nontreated plants and also showed approximately 8 percent lower disease incidence at 180 dai than plants receiving weekly chemical sprays with Xerotol. In laboratory studies, valine and isoleucine (but no other amino acids), inhibited growth of Xad when glucose was the principle carbon source in liquid culture. Thus, supplements with amino acids were compared in greenhouse studies in an effort to enhance effectiveness of the BCAs. Optimal treatments with organic nutrients were applied in field plots in Hilo and disease incidence and severity in three replications per treatment are now being evaluated. Use of selected amino acids to enhance survival of BCAs on leaves shows promise. Each experiment is left in the field for 180 to 270 days to permit growers to view the field plots. The cost of producing inoculum and applying beneficial bacteria to plant leaves was calculated at 55.00 dollars per acre, a cost which is close to the cost of a fungicide

application. The final cost analysis will depend on the optimal formulation for rapid growth of BCAs in liquid or solid culture. Production technology is being transferred to a local laboratory in Hilo. Culture purity is monitored in Hilo and replacement cultures are mailed to our cooperators at regular intervals. A field day has been set for November 21, 2007, at which time results of the first five replicated field experiments will be demonstrated to local growers.

971H Molecular Identification, Genetic Variation and Host Susceptibility of a New Invasive Rust Pathogen Attacking Ohia (*Metrosideros Polymorpha*) in H (Goal 1)

Progress/Accomplishments: 1. We have developed a microsatellite-enriched DNA library and 192 positive clones (containing single sequence repeats) were identified. Sequencing of 14 clones showed that four clones have a repeat number >10 (12-40) and 7 have a repeat number <10 (6-9). 2. We have collected 8 rust samples from Oahu Island of Hawaii. PCR amplification has confirmed that they are *P. psidii*. Primers have been designed based on the specific sequences of the ribosomal DNA (rDNA) and used to amplify the rust DNA samples for identification. 3. In terms of extension activities, we have created a website to inform the forestry and conservation communities about the rust and what it looks like. The website also serves as a clearinghouse for information for the various groups engaged in research on the rust. The URL is: http://www.ctahr.hawaii.edu/forestry/Data/Pests_Diseases/ohia_rust.asp. This website has been updated 9 times since its inception in April 2005 with new photographs and information. 4. We have sent out three general updates to clientele on the rust and have answered 123 individual questions on the rust by e-mail. We also answered many phone calls about the ohia rust.

977H Control of Papaya Fungal Disease (Goal 1)

Progress/Achievements: A new papaya disease caused by the fungus *Asperisporium caricae* was found first on the island of Maui in February 2001, then on the island of Hawaii and Oahu, and by September on Kauai. The fungus causes extensive leaf spots and fruit spots and can render the fruit unsellable. Fruit and leaf lesions often are invaded by what appears to be a hyperparasitic fungus, tentatively identified as a *Scopulariopsis* sp. A field fungicide test for the control of *Asperisporium* black spot demonstrated that azoxystrobin (with either "Tactic" or "Latron B-1956") at 0.28 kg/ha applied at 2-week intervals for four sprays followed by mancozeb + copper hydroxide (2.8 kg/ha and 4.5 kg/ha) for three sprays at 2-week intervals resulted in 0% and 3.1% of fruit with new infections 1 and 3 weeks after the last spray with "Tactic"; 2.9% and 8.3% of fruit with "Latron B-1956"; 4.5% and 5.1% of fruit with new infections for mancozeb + copper hydroxide controls, and 49.2% and 63% for unsprayed controls. Wettable sulfur applied at 4.47 kg/ha at 14 day interval was shown to be a commercially acceptable field control of this disease and is now standard practice by most papaya growers. *A. caricae* was successfully isolated and maintained on PDA and V-8 juice agar but growth was slow and sporulation limited. An inoculation technique using 2 to 3-month old papaya seedlings and utilizing fresh *A. caricae* conidia from naturally infected papaya leaves. Tiny yellow spots appeared in about 35 days and developed into typical lesions over the next 60 days. A 5 minute video was produced describing the cause and effects of the *Asperisporium* black spot disease on papayas for farmers. Several workshops on how to identify and manage the disease have been held.

12-503 Polluted Runoff control for Waialeale Livestock Farm. (Goal 4)

Progress/Accomplishments: A two stage wastewater treatment system that was completed last year has demonstrated to be energy efficient and four times faster than conventional treatment

and removes 90 percent of dairy wastewater contaminants. The system was recognized by the U.S. EPA as a “success story” at the National Non-point Source Coordinator’s Meeting in June 2006. It won the 2005 Social and Environmental Technology Inventors Challenge and the Hawaii Department of Health is developing waste water discharge standards based on this system. Information on the technology is being disseminated through a workshop (1), video presentations, demonstration/field days (4), publication, and a website. Two patents have been applied for and are pending. Further modifications are being planned which will capture methane produced by the system and used as a source of energy to power the system.

14-202 Enhancing Conception Rates in Dairy Cows Under Heat Stress Conditions by Determining the Chemical Constituents of Cervical Mucus at Estrus (Goal 1).

Progress/Accomplishments: Research found that there were no differences observed in pH, Cu, Fe, Mn, and Zn concentrations for lyophilized mucus samples at the time of breeding. However, Ca⁺⁺ concentration was significantly higher for cows that subsequently did not become pregnant. Litmus paper evaluation for calcium showed that given the current technology, litmus paper evaluation of Ca concentration by color change is 75% accurate in predicting failure to conceive at the time of breeding. The reason for this low accuracy is the wide range of Ca for the litmus test. Further studies that would require larger numbers of samples and the use of a color change dip stick that is more sensitive to Ca concentration would provide more definitive application. The outcome of this work is to develop rapid, field tests (litmus tests) to aid a technician in artificial insemination to decide: a) whether or not to breed a cow, or b) the quality and cost of semen to use, based on potential conception rates. (Also reported as Integrated Project.)

14-204 Best Management Practices for the Sustainable Productivity of Hawaii’s Range and Pasture Lands. (Goal 4)

Progress/Accomplishments: Over 15 educational workshops, field days, and other outreach sessions were conducted in areas such as: National Animal Identification Systems; the use of ultrasound technology for genetic selection; animal production and health issues; grazing management strategies; and provided public land managers and agency personnel with information on the identification and management of invasive weeds affecting Hawaii range and pasture lands. A field day was organized for the Hawaii Sheep Producers Association with a keynote presenter from the Cooperative Extension Service, University of the Virgin Islands with extensive experience and knowledge in warm weather sheep production. This program provided participants with information on sustainable grazing management practices, sheep production and management, flock health and disease control, and marketing opportunities through workshops, field days, publication and other venues. Support, presentations, technical advice, and recommendations were provided to individuals, producer organizations, state and federal land management agencies, and private organizations with interest in sustainable land management. Most workshop participants indicated that they had a better awareness of issues affecting Hawaii’s range and pasture lands and also indicated that they had gained new knowledge on integrated weed management strategies; methods to improve the productivity of range and pasture lands; better grazing. Many clientele indicated that they have adopted particular management practices for their operations as a result of specific recommendations that were provided or as a result of information presented at a workshop or in one of the publications. For example, several producers are using information provided in an extension publication on

calculating the cost of production to make better decisions for their operations. Producers on Hawaii, Kauai and Maui have all adopted recommendations on fertilization practices to improve forage production in their pastures.

14-225 Development & Testing of Nutrition Messages to Increase Calcium Intake Among Preadolescents (Goal 3). This project is the extension component of regional research project 228R that involves Colorado State University, Michigan State University, New Mexico State University, Purdue University, University of Arizona, University of California at Davis, University of Minnesota, University of Wyoming, Washington State University and the University of Hawaii.

Progress/Accomplishments: Data collection for the main study started during the summer and fall where 105 parent/child interviews per state were collected. In Hawaii 95 parent/child interviews were completed. Also further analysis of the qualitative data collected last year was conducted. Results showed that parents served as monitors of calcium intake (gatekeepers through food purchase and preparation), mentors offering encouragement and support and as role models of intake for young adolescents. Counseling to change physical and social food environment will focus on the types of foods made available for the children, age -appropriate encouragement and advice to consume calcium rich foods and ways to model intake. Counseling could make suggestions for easy to prepare breakfast and snack foods and beverages rich in calcium that parents could make available. The development of a parent motivator-barrier questionnaire would impact and enhance research from other institutions. To our knowledge this is the first questionnaire developed and validated to address this issue. The project also will increase our knowledge about factors that influence the calcium consumption of early adolescents. The information can be used to design effective, tailored nutrition intervention for early adolescents and their parents. The improvement in calcium intake among early adolescents may reduce the burden of osteoporosis in the future. The information on parental factors influencing food intakes of their children is likely applicable to other health-related behaviors such as the development of obesity. With the progress in data analysis we will focus on differences among race/ethnic groups and better understand sub-populations at risk base race/ethnicity groups and critical transition period (acculturation).

16-902 Developing Insect Identification Guides and On-Farm IPM Training for Banana and Papaya Growers (Goal 1).

Progress/Accomplishments: A multi-agency team, named the Banana Action Group (BAG), was created to coordinate statewide research and extension activities for BBTV in Hawaii. BAG members provided information for a series of local newspaper and magazine articles about BBTV. A number of BBTV extension type publications were produced including articles, brochures, flyers, a scouting guide and posters. A slide presentation about BBTV for use by agents and clients was created and posted on the World Wide Web. Two complete websites devoted to BBTV were created and placed on the UH-CTAHR server and the University of Hawaii ITS server. These websites are the most comprehensive sites about BBTV that are available on the worldwide web, and include detailed information on disease symptoms, occurrence, and management. The Maui Invasive Species Committee was provided photographs, information and dollars to support their BBTV publications for Maui. A complete set of BBTV photographs was assembled and copied onto CDs for distribution to interested persons or agencies. Farmer education and training activities are ongoing; field visits were made to train

farmers and to scout for diseased plants. A number of phone calls from clients were received and advice and diagnosis given as needed. As new information is gleaned from research, application will be transferred to banana growers through websites; articles, and presentations at grower meetings.

16-916 Etiology & Control of Fungal Diseases and Education Program for Local Growers (Goal 4).

Progress/Accomplishments: Fungicide tests identified Heritage® as being an effective control for *Coleosporium* rust of plumeria, a popular potted flowering plant, landscape plant, and flower for making leis. Orchid growers continue to be impacted by diseases caused by the fungus *Fusarium*. Four species (*F. culmorum*, *F. sporotricheoides*, *F. avenaceum*, and *F. sambucium*) have been collected from 35 orchid genera and intergeneric hybrids. In vivo fungicide screening tests have tentatively identified Pristine® as being effective but further tests are required to confirm. A potentially devastating disease, guava rust/ohia rust (*Puccinia psidii*) was first found in Hawaii in April 2005. Within a year, it was found on Hawaii, Kauai, and Maui islands on a wide range of hosts. As it happened in Brazil; and Florida, it is expected to eventually evolve into a serious pathogen of Eucalyptus. Australian researchers are concerned that the pathogen will make the jump from Hawaii to Australia. Surveys to identify the local host range are being conducted and nursery and industry personnel are being educated on its recognition and identification.

16-920 Supporting Pesticide Registration for Use in Hawai'i's Crops (Goal 4).

Progress/Accomplishments: Field pesticide residue trials were completed for imidacloprid in papaya (3 field sites), fenpropathrin in tropical fruits (lychee (1), guava (1), atemoya (1)), triflumizole in papaya (3), dinotefuran in watercress (2), and mancozeb in guava (1). Ongoing residue trials include NAA in rambutan (2), metaldehyde in taro (3) and boscalid+pyraclostrobin in persimmon (1). In addition, field pesticide efficacy trials were conducted on papaya for fungal disease and white peach scale control. The following studies are being conducted by the CTAHR Pesticide analytical laboratory: oxyfluorfen in ti, spinosad in almonds, buprofezin in coffee, triflumizole in pineapple, imidacloprid in papaya, and triflumizole in papaya. The lab completed and submitted 3 reports for spinosad in pineapple. IR-4-prioritized projects for Hawaii in 2007 include 1,3-dichloropropene for in-crop use and oxyfluorfen in coffee (over-the-top) for vine control, spiroadiclofen in lychee for mite control. Papaya growers on Hawaii Island are aware that they can suppress or control the white peach scale with chemicals already registered for use in papaya, through presentations made of field insecticide efficacy trials. Actual pesticide use information is difficult to obtain because growers do not like to disclose that information, so just hearing that some growers are using products which we were able to clear suggests that we've made impact. Furthermore, the fact that those growers are still in business is another factor. At least one persimmon grower has adopted the use of azoxystrobin to control *Cercospora* leaf spot. And, combined with the success of the Area Wide Fruit Fly Suppression Program Maui persimmon growers have experienced high yields in recent years. Some papaya growers on Hawaii Island now use insecticides previously thought not to be efficacious against the white peach scale with some success (i.e., suppression or control).

18-803 Controlling Plant Growth with Photo-selective Plastic Film and Photo-Selective Shade Cloth (Goal 1)

Progress/Accomplishments: A study with potted 'Freedom Red' poinsettia in a shade house compared a photo-selective plastic film (Solatrol®) and a blue photo-selective shade cloth on growth and flowering. Solatrol® resulted in less height increase than the blue shade cloth. Both treatments had less height increase than the black shade cloth (control). There was no difference in the starting of flowering among the three treatments. Flowering was reduced with the blue shade cloth compared to the Solatrol® and control treatments. Another study with potted 'Freedom Red' poinsettia was started in a glasshouse comparing 30% and 50% blue photo-selective shade cloths. A third study with potted 'Shasta' and 'Chesapeake' mums was started in a shade house comparing 30% black, gray, red, and blue photo-selective shade cloths. The use of photo-selective plastic films and photo-selective shade cloths may offer an alternative or supplement to the use of chemical growth regulators to control the height and growth of ornamentals. Their manipulation of light quality could help reduce the use of chemicals, thus reducing their impact on the environment.

18-805 Extension Strategies for Improved Soil Nutrient Management in Hawaii. (Goal 1)
Progress/Accomplishments Five on-farm trials clearly showed farmers that when their soil tested high in phosphorus prior to planting, adding P fertilizers did not increase yields compared to control plots that did not receive phosphorus fertilizers. Omitting phosphorus from the fertilizer program significantly reduces costs to the farmer. Prior to these experiments, many farmers were reluctant to trust a soil test result and follow fertilizer recommendations. A 2 day soil fertility workshop was conducted for county agents. Other extension activities include field visits and assistance to county extension agents on all islands; farmer meetings to communicate the results of the field trials. Agents are developing a much clearer understanding of soils and their behavior. Armed with a better understanding of soils and soil processes, our extension agents are more effective in communicating science-based information to their clientele. This change in the agents is evident during field visits with agents in various farms around the state. I have witnessed agents who are now able to answer farmer questions regarding soil fertility. The on-farm field trials have had a strong impact on farmer practice. Having seen firsthand that adding P fertilizers to soils already high in P does not increase yields, these farmers have now changed their fertilization practices by not applying P fertilizers and thus save money, are more profitable. Reduced P inputs also decreases the potential for off-site P pollution.

20-025 Foliage Production and Nursery Management Program for Hawaii County. (Goal 1)

Progress/Accomplishments:

A survey indicated that 75% of nursery growers are experiencing plant nutrition problems resulting in poor growth and unmarketable and lost plants. Educational workshops were conducted by CTAHR researchers on nutrient management in soilless media, systems and fertigation. As a result of this workshop, 80% of those responding indicated they have a better understanding of the interactions of pH and nutrient management. Growers are able to accurately calculate fertilizer quantities when mixing stock solutions for injector systems. Many growers did not know their actual cost per unit and used industry comparative pricing to set their product's price scale, not fully realizing their profitability. Researchers at University of Arizona and the University of Hawaii have collaborated to develop a cost of production spreadsheet that accommodated parameters that addressed needs from these two states. A nursery cost estimator spreadsheet was developed that addresses production systems in both states. Workshops were held in Hawaii and Arizona to introduce the new economic spreadsheet and collect input on its

applicability. Sixteen beta-testers were identified in Hawaii, and an updated version was distributed for commercial testing. A follow-up refresher workshop was held to answer questions on usability and input requirements. This improved cost of production spreadsheet was demonstrated as an essential tool for business decision making. Extension is working with eight floral and nursery organizations to conduct strategic planning and to develop a mechanism for the dozen or so organizations in this industry to coordinate their efforts in promotion, marketing, research and educational programs, and government relations to minimize duplication and dilution of efforts. This has led to the development of industry directed research projects that address their needs. Industry leaders have agreed that the formation of a formal industry-wide organization will assist industry expansion through a unified voice that promotes and protects the entire industry.

20-072 Diabetes Awareness, Education and Screening (Goal 3).

Progress/Accomplishments: Project partners include CES at Washington State University, New Mexico State University, West Virginia State University and Pennsylvania State University and the Joslin Diabetes Center in Boston..

This past year efforts continued to increase awareness and prevention of diabetes and related complications through screening and outreach. Twenty-one (21) screening events were held for the public, college students, and employee groups at health fairs, department stores, parks, and worksites including resorts and CTAHR offices (on 4 islands). We screened 1,084 adults for hemoglobin A1c, an indicator of one's blood glucose level and risk for diabetes, using fingerstick blood samples. In addition to receiving their A1c result, participants were offered printed materials on diabetes as well as information by trained staff. Project staff also provided information on diabetes to the public at two health fairs and through presentations at senior nutrition sites, an area health education center, and for various community groups. This project encompasses a multi-state collaboration on project outcomes and planning. Together with our USDA CSREES national program leader and researchers from the multistate collaborators met via teleconference calls and face-to-face in Washington, D.C. to discuss state project plans and outcomes. Plans for the upcoming year include tracking of screening participants with regard to follow-up medical screening and intervention. Follow-up fasting blood glucose screenings were held for participants with an A1c at or above 6.0 at four of the screening events. Of the 460 people screened, there were 79 (17%) who were asked to return for the follow-up screening; 18 returned and 4 had an elevated fasting blood sugar, which gave another indication of diabetes. Screening participants were strongly encouraged to seek further testing for diabetes through their health care provider. All screening participants became more aware of diabetes and related complications. Project staff provided information and guidance on nutrition and healthful eating (i.e., portion sizes, food choices) through outreach to the public.

21-080 (Extension companion to 359H) Grandparents Raising Grandchildren. (Goal 5)

Progress/Accomplishments: (Narrative is included with Integrated Hatch Project 359H Examination of Cultural Contexts of Grandparents Raising Grandchildren.)

22-034 Aster Yellow Disease (AYD): A New Threat to Many Crops in Hawaii (Goal 1)

Progress/Accomplishments:

In 1999-2000 watercress producers began complaining about chlorotic watercress dying and not

recovering. In 2000-01 we discovered a new disease and a new vector involved in the cause of the chlorotic watercress. A team consisting of CTAHR, Hawaii Department of Agriculture personnel and watercress farmers identified the cause as aster yellows phytoplasma, the first record of the disease affecting edible crops in Hawaii. This phytoplasma has been shown to closely resemble the aster yellows phytoplasma on the mainland. The leafhopper has not yet been identified (as of 11/06). After being in Hawaii for at least 7 years, it has not appeared in any other locations on Oahu or the neighbor islands. This project developed a seven-step Best Management Practice for watercress production which was adopted industry wide on Oahu island. The watercress industry on Oahu has fully recovered from the production decline experienced in 2001 and 2002. Yield of watercress has been fully restored to pre-aster yellows years. (The annual yield during the crisis dropped about 50%). This project is fully responsible for the successful recovery of the watercress production decline. This past year confirms the adoption of all the Best Management Practices by all of the watercress farmers. The "new" leafhopper vector and the phytoplasma are here to stay and the watercress industry has proven it can adopt new and different management practices and thrive. Watercress industry members all know and understand the scope, parameters and limitations of watercress production in dealing with this new disease and vector.

22-070 Nutrition Education for Wellness (N.E.W.) (Goal 3)

Progress/Accomplishments. Also, please see Goal 3. Key Theme: Human Health for progress and impact and progress report above for project 20-072 (Diabetes Education, Awareness, and Screening). Workshops were held for high school students to teach students on how to grow their own foods in their garden and the nutritional benefits of fresh fruits and vegetables. Seventy-seven preschool lunch programs are provided assistance to meet licensing requirements. Ninety-five percent of preschools receiving this assistance were satisfied and improved their ability to plan and develop quality and healthy menus. Educational sessions with food stamp recipients resulted in 52% of participants improving in eating five fruits and vegetables a day and a 62 % improvement in food safety practices. The NEW team is partnering with nine Kauai agencies to help the community to increase consumption of fruits and vegetables and increase daily physical activity through group exercise classes and weekly educational workshops. Over 500 Kauai residents participated in one or more activities that averaged a 100% increase in fruit and vegetable consumption and physical activity. 4-H teen leaders were trained to use 4-H juried curriculum to teach younger youth to eat healthier foods and engage in physical activity.

23-040 Improved Cultural Management of Ornamental, Nursery, Landscape and Turf (Goal 1).

Progress/Accomplishments: Twenty-two ornamental growers/shippers adopted six new clones of Darwin (Alpinia hybrid) gingers for commercial production and sales. Most of the ornamental flower growers are using monitoring and scouting techniques instead of routine/calendar spraying. Growers are using more organic matter to improve their soil. Growers are also selectively using of fertilizers and amendments, based on soil sample test results. Growers have adopted soil conservation practices such as green manures and contour planting. Many growers have reduced water waste and increased efficiency of water usage through drip irrigation technology.