

Annual Report of Accomplishments and Results
Fiscal Year 2001

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

Research and Extension Programs

GOAL 1: AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY

Overview:

A considerable amount of work was done relevant to Goal 1 at the University of Hawaii's College of Tropical Agriculture and Human Resources (CTAHR) during the past year.

Books and book chapters: 9
Edited volumes: 4
Refereed articles: 55
Published articles: 65
Conference presentations: 93
Conference papers/proceedings: 8
Workshops: 16
Abstracts: 13
Patents: 1
Miscellaneous: 4

Under the key theme of biotechnology, work was done on improving several commodities. Color options and disease resistance were improved in two types of tropical ornamentals, dendrobium orchids and anthuriums. Progress was made in transforming both pineapple and papaya for disease resistance, and efforts began to transform watercress for insect resistance. Recombinant myostatin has been produced to provide a tool to investigate the biochemistry and physiological function of myostatin in skeletal muscles. In more general research, probing cellular processes important to agriculture should be made easier with bioreactor-culture plants. Work to evaluate the biochemical mechanisms underlying plant productivity in response to light has yielded the first example of redox regulation of an RNA-binding protein in vascular plants. Progress was made in studies of Rhizobium-legume symbiosis. In other studies, a patent was filed for a platform on which plants can be grown in seawater. The plants will be selected for their ability to take up contaminants through their root systems.

In aquaculture, marine microalgae hold promise as lucrative sources of antibiotics. Improvements in fractionation equipment design will have an important effect on the economics of producing marine diatoms and other microalgae. Economic analyses are helping fish farmers determine the most profitable ways to raise Pacific threadfin fish.

Beef producers are investigating adding value to meat through such processes as drying, vacuum sealing, microwaving, and freezing.

In the area of animal production efficiency, much has been learned about the hormones that control pregnancy in ruminants and how they might be managed to avoid expensive terminations. Progesterone is necessary throughout gestation to maintain a pregnancy. Regulation of progesterone switches in pregnancy from luteinizing hormone to prostaglandin E2. This may explain why 10 percent of pregnancies are lost in midpregnancy.

CTAHR scientists are addressing agricultural competitiveness in several lines of research.

Macadamia varieties that minimize kernel shrinkage have been identified. Progress has been made in controlling the time of flowering of tropical ornamentals to meet market demand. New eggplant varieties give growers higher quality and improved disease resistance over varieties now being grown. Recombinant inbred lines of corn have been developed for resistance to tropical pests, diseases, and stresses. Locally grown corn is also being successfully used as cattle silage to replace expensive imported feed, a critical factor is saving the dairy industry in Hawaii. Irradiation has been shown to be a cost-effective, safe way to treat foods for quarantine. Cows can sustain milk production at 100 lb/day when they are cooled with high-speed fans and misters, thus enabling the farmers to make further investments in facilities.

CTAHR is the only college of tropical agriculture in the United States. Certain agricultural problems are unique to Hawaii because of its subtropical location. Work is being done to increase the production of native Hawaiian plants in the hope of increasing their use by landscape architects. In the area of insect control, progress has been made on identifying ant baits that will be effective in Hawaii.

As a way of improving agricultural profitability, an effective solar dryer has been designed that provides users with an opportunity to develop a cost-effective dried food industry. The dryer also has great potential in developing countries. On Maui, workshops were conducted to instruct growers on ways to improve farm management and marketing their products. As a result of the workshops, 88 percent of the growers were planning to make changes in their production practices.

Studies are underway to improve plant production efficiency in several different commodities: sweet corn continues to dominate and provide growers throughout the United States with a genetic base; currently registered fungicides can control a newly identified papaya fungus; new American Pacific taro cultivars improve yields and produce good quality poi; heretofore unidentified *Phytophthora* species have been isolated from the heart rots of maturing taro; taro and tomatoes varieties with disease resistance are being bred; new cupping techniques in coffee promise more uniform results; also in coffee, additional sources of host rootknot nematode resistance are being provided to local coffee growers; and increased understanding of the physiology of macadamia fruit growth will aid in predicting how cultural practices and weather affect growth and yield. Progress continues in the development of effective postharvest treatments in tropical fruit and ornamentals. Mechanized pruning technology in coffee reduced the cost of pruning from \$1,000 per acre to \$70 to \$120 per acre per year.

Hydroponics is an innovative farming technique. A new hydroponic method in watercress requires 1/1000 as much water as the usual constant-flow method, making it possible to produce watercress at high elevations. A different method of growing tomatoes in perlite or waste coal ash rather than standing water avoids providing a breeding ground for disease-bearing mosquitoes.

The health of coffee plants is being assured by a program to graft desirable coffee varieties to nematode-resistant rootstock. An extension agent is effectively reaching coffee growers through a program of regularly scheduled "coffee talks."

Urban gardening was aided by expansion of the Master Gardener programs on both Maui (15 volunteers) and Oahu (28 volunteers). "Transgenic Papaya Educational Sessions" were conducted on Oahu to teach people how to manage their transgenic papaya before they are permitted to buy seed.

Awareness has been raised among pig producers of the dangers of porcine reproductive and

respiratory syndrome (PRRS). Screening of herds found that 34 percent of them had animals infected with PRRS.

In the management of rangeland and pasture, weed populations can be kept under control by a very low-volume drizzle of herbicide. The method allows three acres to be treated in an hour, as opposed to 0.5 acre using conventional application methods. Herbicides have been tested that give options to ranchers fighting fireweed, the most serious pasture and range weed in Hawaii. Several legumes—Leucaena, peanuts, and new trefoil legumes—for use as animal forage are being tested under Hawaii's conditions.

Goals were met in outreach to ornamental growers: rejection of cut flower exports was reduced to under 0.1 percent and the wholesale value of the cut flower industry was increased by 2 percent. A retreat was organized and facilitated to help ornamental growers develop a marketing plan. This proved to be especially valuable in the financial crisis that resulted from the September 11 attacks.

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)
2001	915,176	8,231,503	1,103,123	10,249,802	46.9

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2001	500,332	1,079,562	0	1,579,894	23.6

Key Theme – Biotechnology

- a. Description of activity. The focus of this activity is to develop dendrobium orchid cutflower cultivars with modified seasonality, improved colored and white flowers, and improved cultivars for marketing flowering potted plants. (842H)
- b. Impact/Accomplishment. Genes that regulate flower color: The enzyme dihydroflavanol 4-reductase (DFR) is necessary for the biosynthesis of anthocyanin, an important component of flower pigmentation. The activity produced the first complete cDNA clone encoding dendrobium DFR, isolated from floral buds of lavender *Dendrobium* UH503. The nucleic acid sequence of the cDNA was determined and shown to be 87% similar to DFR of cymbidium orchid and 84% similar to bromheadia orchid. The expression of the gene as characterized by Northern blot analysis of developmentally staged dendrobium flowers showed high activity throughout flower bud development but lower activity in fully open flowers; it is absent in leaves. The cDNA was cloned into a vector to facilitate bacterial expression of the gene, allowing purification of the enzyme for use in biochemical studies of substrate preference. The activity produced dendrobium plants transgenic for snapdragon DFR to help elucidate the biochemical and genetic basis for differences in dendrobium flower color, and to produce novel orange/red dendrobium flowers. Other accomplishments include putting several compact orchid plants into tissue culture for producing new potted plants. Seed parents for industry standards were put into tissue culture for rejuvenation. Over 300 seed pods of 19 University of Hawaii *Dendrobium* varieties were provided to industry in 2000

c. Source of Federal Fund. Hatch and Grants.

d. Scope of Impact. State Specific.

Key Theme – Biotechnology

a. Description of Activity. The focus of this activity is to: (1) develop and disseminate red, orange, pink, coral, and white *Anthurium* cultivars with disease resistance, high yield, and other important horticultural traits and assemble and evaluate germplasm; (2) develop cultivars with new shapes and colors, and new flowering potted plants; (3) use biotechnology to develop gene transfer methods for *Spathiphyllum*, with an emphasis on flower color engineering; and (4) use tissue culture to develop nematode resistance and tolerance. (841H)

b. Impact/Accomplishment. Two new anthurium varieties were released to industry: 'Tropic Sunrise', an orange Obake, and 'White Lady', an elegant white flower. The activity engineered pink-flowered anthurium plants to produce the cecropin-like Shiva 1 lytic peptide for enhanced resistance to anthurium blight caused by *Xanthomonas campestris* pv. *dieffenbachiae* (Xcd). These plants were examined for population changes amongst beneficial plant-associated bacteria. No significant difference in each of the four bacterial strains was observed between transgenic and control plants. Beneficial bacteria are indigenous to leaves of anthurium plants and are integral to suppressing bacterial blight and stimulating growth. Results indicate the potential for a two-pronged approach, using transgenic plants primed with the beneficial bacteria, to provide enhanced and durable protection against anthurium blight disease. This work directly benefits anthurium researchers and consumers.

c. Source of Federal Fund. Hatch and Grants.

d. Scope of Impact. State Specific.

Key Theme – Biotechnology

a. Description of activity. The focus of this activity is mass production of tropical plants in bioreactors. Specifically, various cellular processes in bioreactor-culture plants were investigated. The activity also examined propagation of plant somatic embryos in bioreactors and metabolic sensing of the embryogenesis process. (510H)

b. Impact/Accomplishment. The activity was successful in developing a somatic embryo system for *Azadirachta indica* (neem). Subsequently, the work focused on detecting changes in intracellular pH of the cultured embryogenic cells during the transition from the callus to somatic embryo states. The result was, however, inconclusive due to the highly fluctuating nature of the dye-based intracellular pH measurements. This led to the use of green fluorescent protein (GFP) as an in-vitro physiological reporter for probing cellular processes in cultured plant cells. The activity was successful in developing transgenic plant cell lines expressing high levels of GFP and was able to detect GFP fluorescence in situ in real time using an optical sensor. The fluorescence signal could correlate with the amount of GFP or GFP-fusion protein produced. Results of this activity have laid

the groundwork to continue to find novel ways of probing significant cellular processes, including somatic embryogenesis, in cultured plant cells using GFP. Bioreactor-based plant cell and tissue cultures in combination with the fluorescent reporter technology offer a powerful technology platform to better understand a wide range of cellular and physiological processes important to agriculture.

- c. Source of Federal Fund. Hatch and Grants.
- d. Scope of Impact. State Specific.

Key Theme – Biotechnology

- a. Description of activity. The focus of this activity is to suppress myostatin activity to improve skeletal muscle growth. Myostatin, a recently identified protein, is a negative regulator for skeletal muscle growth. The study's initial step is to produce recombinant myostatin in an *E. coli* system. The recombinant myostatin will be used in the future to produce anti-myostatin antibody. The study is at the stage of protein purification and anti-myostatin antibody production. (264H)
- b. Impact/Accomplishment. Recombinant myostatin is produced in an *E. coli* system. With the purification and anti-myostatin antibody production completed, researchers will have invaluable tools to investigate the biochemistry and physiological function of myostatin in skeletal muscles. If the anti-myostatin antibody is proved to act as an effective inhibitor of myostatin, the anti-myostatin antibody has the potential to improve the efficiency of meat production by increasing the lean mass in animal carcasses, thus generating a great economic benefit to and reducing waste in the livestock industry.
- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Biotechnology

- a. Description of activity. This focus of this activity is to identify the biochemical processes and factors underlying plant productivity and adaptation in high-light environments. Photosynthesis is a central process controlling plant productivity in all plants. The photosynthetic apparatus harvests and converts light energy into the chemical energy of carbohydrate, protein, and lipids (oils). However, the high-intensity light of the tropics is rich in ultraviolet radiation, which damages key protein subunits (D1 and D2) and pigments (chlorophyll) that comprise the photosynthetic apparatus. This high-light-induced photodamage and resulting photoinhibition decrease plant productivity. Determining how plants overcome photodamage and adapt to light stress is an important prerequisite for engineering plants to better tolerate the high light conditions of tropical environments. Plants can replace the photodamaged D1 and D2 proteins with newly synthesized D1 and D2, which repairs the photosynthetic apparatus. To replace these proteins, the plant activates the expression of the *psbA* and *psbD* genes that encode D1 and D2, respectively. (670H).
- b. Impact/Accomplishment. Two mechanisms have been identified by which plants activate *psbA* and

psbD expression. The first involves blue-light-induced transcription, in which blue light, but not red light, activates the synthesis of mRNA from each gene. The project is now identifying the photoreceptors and factors in the plant cell that perceive and transmit the blue light signal, which leads to activated gene expression. These results were published in the journal *Plant Physiology* (2001, vol. 125, pp. 1957–1966).

The second mechanism involves the light-mediated activation of translation of *psbA* and *psbD* mRNAs, leading to the greatly enhanced synthesis of the D1 and D2 proteins. The project has identified two key proteins, protein disulfide isomerase (PDI) and poly (A)-binding protein (PAB) that increase the synthesis of D1 in response to light. In a recent paper in *Plant & Cell Physiology*, the researchers have described a biochemical mechanism by which these proteins operate (2001, vol 42: pp. 1071–1078). In addition, the researchers have cloned the genes for PDI and PAB from the *Arabidopsis* plant, which is the first cloning of these genes from any plant. The researchers are studying the genes for PDI and PAB to determine how these proteins activate protein synthesis in response to light.

Information created from this activity will increase our basic understanding and knowledge of how plants respond to light and how photosynthesis is controlled. This will lead to enhance plant resistance to high-light stress and lessening the impact of photoinhibition on crop yield.

- c. Source of Federal Fund. Hatch and Grant.
- d. Scope of Impact. State Specific.

Key Theme – Biotechnology

- a. Description of Activity. The focus of this activity is two-fold: (1) transforming papaya to produce the natural fungicide stilbene and (2) developing an “on-site” bioremediation method using salt-resisting plants. (616H)
- b. Impact/Accomplishment. Transformation of the stilbene synthase gene for increased fungal resistance in papaya is progressing well. This work attempts to introduce a powerful natural antifungal product, stilbene, into a papaya plant through gene transformation. Researchers have transformed ‘Kapoho’ and papaya ringspot virus (PRV)–resistant transgenic ‘SunUp’ papaya plants. The results from greenhouse and limited field studies showed that transgenic papaya plants with stilbene synthase gene have increased fungal resistance against powdery mildew and *Phytophthora*.

A provisional patent was filed on "Marine agriculture: growing terrestrial plants in seawater on floating cultivation platforms for multiple purposes." Cultivation of selected terrestrial plants in seawater was achieved using this invention. A lightweight, floating growth medium package (FGMP) made of a sealed nylon screen bag containing a mixture of hydrophobic polymer foam particles and natural soil amendments has been developed. The FGMP units are tied together in a floating, rigid framework to form a floating seawater cultivation platform. Selected salt-resistant terrestrial plants have been cultivated on the platforms floating on 100% seawater. This method enables us to practice marine agriculture or agriculture on the sea.

Copper removal from seawater using two Hawaiian native plants akulili (*Sesuvium portulacastrum*) and naio (*Myoporum sandwicense*) were conducted. They were used in an experiment to determine their ability to accumulate copper from seawater (32 parts per thousand salinity). The overall amount of copper in each bucket of 15 liters was sampled by testing for copper in solution and copper in precipitate. This was carried out at timed intervals, and the overall amount of copper in

the buckets with copper and plants was found to have decreased over time. Both species grew normally under the treatment conditions.

Agriculture-based remediation of hydrocarbon-contaminated soil with Hawaiian coastal plants was conducted. Three Hawaiian coastal tree species were selected and a tri-sector pot was designed to evaluate their growth potential and effectiveness on TPH and PAH degradation in soils ca. 3 ft below. Results showed that naio (*Myoporum sandwicense*), milo (*Thespesia populnea*), and kou (*Cordia subcordata*) could grow well under greenhouse conditions and with different effects on the rhizospheric degradation of spiked TPH and PAH. In the presence of kou or milo trees, soil pollutants were significantly reduced. These data are supportive of the concept of using deep-rooting Hawaiian trees for the bioremediation of coastal petroleum contamination.

c. Source of Federal Funds. Hatch

d. Scope of Impact. State Specific.

Key Theme – Biotechnology

a. Description of Activity. The focus of this activity is to transform watercress for insect resistant using Bt toxin genes. In order to do so the following objectives are needed: (1) transform watercress with synthetic cryIAb3 toxin genes from *B. thuringiensis*; (2) analyze transformed plants for insertion and expression of cryIAb3 toxin genes; and (3) evaluate responses to transformed plants for their effect on diamondback moth. (541H)

b. Impact/Accomplishment. The tissue culture and transformation protocol for watercress have been developed. The *cryIAb3* gene encoding a Bt toxin behind the cauliflower mosaic virus promoter (CaMV 35S) in a binary vector pBI121 for *Agrobacterium*-mediated plant transformation has been cloned. Sections of one-month old calluses were infected with *Agrobacterium* containing the cloned *cryIAb3* gene. Some kanamycin resistant calli have been obtained.

This project will help to improve the tissue culture and genetic transformation protocol for watercress with the long-term goal of developing insect resistant watercress varieties. Watercress production is among the more profitable industry in Hawaii, and the current production is meeting the demand for watercress in Hawaii.

c. Source of Federal Funds. Hatch.

d. Scope of Impact. State Specific.

Key Theme – Biotechnology

a. Description of activity. The focus of this study is to identify and develop control of an important virus of pineapple in Hawaii. Mealybug wilt of pineapple (MWP) is a devastating disease found in all the pineapple-growing regions of the world. The etiology of MWP has long been in question. (775H)

b. Impact/Accomplishments. The activity has recently determined that both pineapple mealybug wilt associated virus 2 (PMWaV-2) and mealybug feeding are necessary factors for the induction of

MWP in both containerized pineapple plants and in a large field study. Mealybug feeding in the absence of PMWaV-2 or PMWaV-2 infection did not result in MWP. Nor did the presence of mealybug feeding and PMWaV-1 without PMWaV-2 result in MWP. In a large field study, the average fresh fruit weight from plants that developed MWP symptoms was 35% lower than yields from PMWaV-free plants exposed to mealybugs. The new control approach is to develop PMWaV-resistant pineapple plants for control of MWP. Various gene constructs have been developed using gene-silencing technology to transform pineapple plants. Some of the putatively transformed pineapple plants are being tested in bioassays in the greenhouse for virus resistance.

Pineapple is the largest agricultural commodity in Hawaii. The farmgate value in 2000 was \$101.5 million. Currently, the Hawaii pineapple industry utilizes 20,700 acres and produces 354,000 tons of fruit. Although MWP has been studied for more than 90 years, the etiology of this disorder has been in question. This activity is the first to characterize the clostoviruses, to develop reliable assays to detect the viruses, and to identify factors involved in disease development.

- d. Source of Federal Funds. Hatch.
- e. Scope of Impact. State Specific.

Key Theme – Biotechnology

- a. Description of activity. The focus of this activity is to (1) understand how rhizobia in the soils interact with tree legumes to develop an effective nitrogen-fixing symbiosis and; (2) enhance biological nitrogen fixation for sustainable agriculture and agroforestry through establishment of effective *Rhizobium*-tree legume symbiosis. The results will help in selecting superior strains for tree legumes. (671H)
- b. Impact/Accomplishment. The research has isolated a novel alternate sigma factor encoded by the *sigX* gene in the tree-legume-nodulating *Rhizobium* sp. strain TAL1145. Mutants of TAL1145 containing transposon insertions on *sigX* are exopolysaccharide-defective (EPS⁻). Several *sigX* mutants have been characterized for EPS synthesis in the yeast extract-mannitol medium. The amount of EPS produced by these mutants was less than 50% of that produced by TAL1145. These mutants formed only small ineffective nodules on *Leucaena leucocephala*. Since the *sigX* mutants are EPS⁻, we hypothesized that *sigX* regulates some exo genes for EPS synthesis. Previously, we isolated a cosmid clone, pUHR123, containing a cluster of exo genes from TAL1145. A large number of GUS fusions on the exo genes in pUHR123 using the transposon Tn3Hogus was made. The pUHR123::gus derivatives were transferred to TAL1145 as well as the *sigX* mutant RUH102. These transconjugants were assayed for GUS activities. Those that showed enhanced GUS activities in the TAL1145 background but not in RUH102 were selected as having a gus insertion on a gene that requires alternate sigma factor SigX for transcription. A few of these genes have been sequenced and the position of the gus fusions determined. These results will help us to understand the role of the newly identified alternate sigma factor in the *Rhizobium*-legume symbiosis.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Aquaculture

- a. Description of activity. This focus of this activity is to develop new and novel antibiotics and products from marine microalgae. To achieve the objective, a foam fractionation device was developed to concentrate marine diatoms and to determine the minimum revolution per minute (RPM) required to further remove the ocean water from the condensed algae foam. (543H)
- b. Impact/Accomplishment. Foam fractionation efficiencies greater than 90% were achieved. The variable levels used are bubble size 100–500 um in diameter, air flow rate 2.25 liters per minute, overflow height 3.8 cm, and pH 7.5, with a cell density of 6 million cells per milliliter and a fractionation time of 30 minutes. Existing literature indicates that a fractionation efficiency of 50% is normally expected and, therefore, expensive centrifugation must be used to remove the excess moisture from the microalgae. The ability to increase the fractionation efficiency to 90% represents a major breakthrough in fractionation equipment design and will have an important effect on the economics of producing marine diatoms and other microalgae.

With the increase in bacteria resistant to available antibiotics, the impact of novel antibiotics development from marine microalgae can be substantial. The economic impact of such a discovery should also be self-evident as the world market for antibiotics exceed \$1 billion annually. For aquaculture, the ability to produce diatoms inexpensively can be exceedingly useful because it will allow us to use marine diatoms to produce *Artemia* and other zooplankton, such as rotifers and copepods, to supply live feed for ornamental fish. This will greatly enhance the Hawaii aquaculture base. The ability to produce live feed commercially can also be expected to lead to the development of a frozen live-feed industry, which may well produce frozen or freeze-dried mature *Artemia* to meet market demands.

- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Aquaculture

- a. Description of activity. The focus of this activity is to determine the profitability of culturing Pacific threadfin (*Polydactylus sexfilis*). Land-based tank systems and a Hawaiian fishpond were evaluated. Three land-based tank systems were evaluated: monoculture of threadfin using water purchased from an aquaculture park and from private wells, and joint culture of threadfin with flat fish using water purchased from an aquaculture park. The fishpond was evaluated under monoculture conditions. (540H)
- b. Impact/Accomplishment. Results show the intensive, land-based tank systems were the most profitable option when operated under monoculture conditions. The operations yielded internal rates of return (IRRs) of 64% for a system using purchased water and 56% for a system from private wells. The joint culture land-based tank yielded an IRR of 49%. The Hawaiian fishpond yielded an IRR of 37%.

For a hatchery enterprise producing 1.2 million fry per year, the cost associated with raising a day-40 fry (at 1 g) is estimated at 22.01 cents. The largest variable costs are in labor and supplies, which comprised 49% and 9% of the total production cost, respectively. The fixed cost of development and equipment is approximately 12% of total production cost. At a sale price of 25 cents per fry and cost of 22.01 cents unit cost, the 20-year IRR is 30.63%. In comparison to the 22.01 cents unit cost for 1.2 million fry production, analyses of smaller enterprises producing 900,000 and 600,000 fry per year reflected significant size economies with unit costs of 27.41 and 38.82 cents respectively.

In 1999, the farm-gate sales revenue of Pacific threadfin was \$459,150 from 13 farms. It was expected that farm-gate values could reach \$1 million in 2000. Results of the study provide vital information for potential investors as well as scientists to identify potential areas to improve production efficiencies.

c. Source of Federal Funds. Hatch and Grant.

d. Scope of Impact. State Specific.

Key Theme – Adding Value to New and Old Agriculture Products

- a. Description of activity. Provide best management practices in livestock production and marketing. Provide training in the identification of added value and niche marketing opportunities. Incorporate research based technology that reduces the risks of waste management contamination of water resources, addresses food safety issues in the local marketplace and inefficient use of resources into production systems. (20-048)
- b. Impact/Accomplishment. Promoted Added Value Beef Program to develop added value products using the lower priced or other non-traditional beef cuts to the local market. Currently 4 producers, with two different processors, are investigating means to add value through drying, vacuum sealing, microwaving and freezing. The Rural Economic Development Program and KTA supermarket have approved a grant for \$10,000 to help processors with new processing technology, plant assessments, and record keeping and marketing for new products (e.g., jerky, hash, hotdogs, sausages an laulau).

Six ranchers have requested stolons for pasture development, in response to a joint project with the USDA Plant Material Center in Molokai, NRCS in Hilo and CTAHR to help produce forage stolons for pasture development. The project provides ranchers with educational material on identification, establishment, and propagation assistance on various pasture forages.

Ninety-eight producers attended one of three livestock nutrient management workshops held on three different islands. Five demonstration projects are being examined to determine best management practices that meet State requirements. Baseline data have been collected on nutrient values of wet and dry manure. A federal grant was obtained to conduct research on nutrient utilization and uptake. American Samoa has requested help to implement a similar program. A joint program with Colorado State University was initiated to help producers develop their own nutrient management programs using recordkeeping. Pocket workbook and producer soil kits have been developed and is being field-tested.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Animal Health

- a. Description of activity. Implement proper herd health maintenance programs. Survey swine for porcine reproductive and respiratory syndrome (PRRS). Promote locally produced pork products. Promote the PigChamp record-keeping and analysis program producers in Hawaii and Guam. Develop a business plan, budgets and cash flow projections for the Hawaii Livestock Cooperative slaughterhouse to be built at Campbell Industrial Park. (14-211)
- b. Impact/Accomplishment. The Salmonella Safety Audit was made available to Hawaii slaughterhouses. Fifty-eight of 172 farms (34% of those surveyed and tested) were found to have animals that tested positive for PRRS. It was determined that Kauai is the only island that remains free of this disease; and that the incidence on Molokai and the Big Island is low. Awareness of PRRS has been increased such that several requests have been received from individual producers wanting to make sure their swine purchases are from PRRS-free sources. New "Hawaii Pork Island Fresh" labels were designed and produced, and made available to retailers selling local pork. Several farms are utilizing the PigChamp program. The Hawaii Livestock Cooperative has secured financing and permits required to build the slaughterhouse.
- c. Source of Federal Fund. Smith Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Animal Production Efficiency

- a. Description of activity. The focus of this activity is to improve the reproductive performance in domestic ruminants. Specifically, the activity examines basic concepts in regulating gonadal and uterine physiological mechanisms limiting and influencing pregnancy in domestic animals and improving reproductive efficiency through development of technologies and systems to control estrous activities, conception and fetal/neonatal survival. (259R)
- b. Impact/Accomplishment. The activity has identified what is regulating progesterone secretion by the corpus luteum during pregnancy in ruminants, which is prostaglandin E2 (PGE2), not luteinizing hormone (LH) which is required in non-bred animals. Thus, regulation of progesterone switches from LH to PGE2 during pregnancy. Progesterone is necessary throughout gestation to maintain a pregnancy. This may help explain why 10 percent of pregnancies are lost at midpregnancy.
- c. Source of Federal Funds. Hatch
- d. Scope of Impact. Multistate Research. AZ, CA, CO, HI, ID, KS, MN, MO, MT, NV, NM, OH, OR, TX, WA, WY

Key Theme – Rangeland/pasture Management

- a. Description of activity. Train ranchers, conservationists to manage pasture weeds efficiently, effectively and safely using very low volume herbicide application techniques. (13-120)
- b. Impact/Accomplishment. Workshops on weed management emphasizing very low volume drizzle herbicide application methods were conducted on Maui and Kauai. Workshops were supplemented by on-site consultations. State foresters, extension agents and private landowners are conducting follow-up projects. Early increase in labor efficiency amounts to 3 acres treated per hour versus a probable 0.5 acres per hour by conventional means. Very high efficiency is expected in remote areas without water sources.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Rangeland/Pasture Management

- a. Description of activity. Plan, coordinate and implement educational workshops on waste management and pasture productivity/management issues. Participate in on-farm demonstration-research models in the area of waste management; pasture productivity and management for improved production and profitability. Plan, coordinate and implement promotional activities with established industry associations and related interagency departments. (20-049)
- b. Impact/Accomplishment. “Composting Scenarios” described composting scenarios as a guidance document for the Department of Health, Wastewater Branch and Office of Solid Waste Management. The document was used by the DOH as their template for regulating livestock operations, resulting in less time and cost by the producer in preparing regulatory permits and allowing "common-sense" approaches to nutrient management. This will allow all livestock producers in the State of Hawaii to produce a safer, more stable and higher valued product without onerous regulatory oversight and conditions.

Trials in use of herbicides to control fireweed (*Scenecio madagascariensis*), one of the most serious pasture and range weeds in Hawaii. These trials have resulted in herbicide management options for these ranchers.

Identification of grasses resistant to the yellow sugarcane aphid have positively impacted the forage-based industries in Hawaii and increased beef productivity.

CTAHR researchers have developed lines of high-elevation and psyllid-tolerant *Leucaena leucocephala*, also known as haole koa. Cooperative work with other land grant institutions and federal agencies has led to the introduction of new pasture legumes, such as the perennial peanut and clover collection, for evaluation under our local environmental conditions. Distribution is ongoing of propagation materials from Forage Demonstration Gardens at Mealani Research Station in Kamuela, Hawaii. A collection of eight perennial peanut varieties from the USDA ARS Southern

Regional Plant Introduction Station in Griffin, Georgia was acquired and established, as well as two new trefoil legumes from the USDA National Forage Seed Production Research Center in Corvallis, OR was added in the past year.

"A Taste of the Hawaiian Range" Food Show highlighted the best of local agriculture, as a forum to bring together and educate the culinary industry, food service buyers, and the general public about the diversity of quality products produced in Hawaii. According to local media who attended the event, this food show is rated as one of the best food shows in the State of Hawaii. Participants included chefs, food service vendors, vegetable and ranch industry entrepreneurs.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this activity is to evaluate the technical feasibility and efficacy of using irradiation to treat fresh Hawaii grown produce, edible herbs, and ornamentals as a potential quarantine treatment to meet USDA requirement for export. Specific objectives are: (1) to determine the tolerance dose of selected, export commodities such as tropical fruits (e.g., carambola, lychee), fresh herbs (e.g., basil, parsley), and ornamentals (dendrobium, red ginger); (2) to determine if it is technically feasible to use irradiation to control *Thrips palmi* on various plant materials with export potential by studying the minimum dose necessary to "inactivate" the pest (sterility and non-emergence) and the maximum doses tolerable by the host plants; (3) to obtain data on irradiation of the Malaysian fruit fly (*Bactrocera latifron* Hendel) in terms of dose requirements to cause sterility, mortality, and to meet probit-9 criterion of various life stages of this fruit fly; and (4) to conduct shipping studies and market tests to demonstrate how the irradiation process can be used. (337H)
- b. Impact/Accomplishment. Results showed that gamma source has emerged as another commercial radiation source for treating fruits in addition to X-rays converted from e-beam. Vapor heat or hot air is another option of quarantine treatment since the 1990s. Tests have consistently shown that irradiated fruits ripen normally with excellent flavor and aroma retention, while a small percentage of heat-treated fruits has been found to have a hardened texture due possibly to some ripening enzymes being inactivated by heat. At the dose level needed for disinfecting fruits, the enzymes in fruits are not affected by irradiation at all. Irradiation is also cost-effective. It takes less than 10 minutes for a carton of fruits to be irradiated at 25 cents per pound as compared to 4.5 hours for vapor heat treatment at the same cost or higher because the heat treatment uses a lot more energy. The tropical fruit industry now can have several alternative quarantine treatments: heat, gamma-radiation, and X-radiation.
- c. Source of Federal Funds. Hatch
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this activity is to determine relationships between cultivars and development of shriveled kernels. Quality data from four macadamia cultivars, Kau (HAES 344), Purvis (HAES 294), Keaau (HAES 660), and Kakea (HAES 508), were obtained and analyzed over the 2000 harvest season. (831H)

- b. Impact/Accomplishment. The Kakea and Purvis cultivars were identified as having the least variation in shrivel kernel percentage over the entire harvest season and appear to be cultivars that will produce higher quality kernels in the environmental conditions of the research area (a major macadamia producing area). Kernel quality is critical in determining returns to producers and in maintaining market competitiveness.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this activity is to manipulate flowering based on market demand of tropical ornamentals. Specifically, this activity is: (1) to determine the relationships between environmental factors and yield and rates of development of flowers of tropical ornamentals such as heliconias; (2) to develop information on control of flowering and cultural practices in the production of new potted flowering plants; and (3) to develop information on control of flowering in lei flower crops in Hawaii. (856H)
- b. Impact/Accomplishment. The heliconia productivity experiment offers an indication of the potential flower yields of a number of commercially marketable varieties, as well as a means to anticipate flowering times. The growth rate data also enable advisers to recommend suitable plant spacings. Both of the growers who supplied rhizomes for this experiment viewed the results as very helpful but have not yet implemented changes to their cultural operations.

Rhododendron christiana is an attractive pink-flowered species with potted plant potential. This information adds to that previously developed for the vireya rhododendron species and is additional evidence that programmed flowering is possible. Different species will, however, require different time periods following treatment with retardants for initiation and development of the flowers, so one recipe will not necessarily fit all species/cultivars. Richard Marques and Roy Shigenaga of the Big Island have both asked for advice on using the retardants program for potted rhododendron plants, with Mr. Marques saying this is the kind of research they need to develop these plants as a crop beyond the hobby grower.

The heliconia retardant work offers potential for some of the more than 40 colorful *Heliconia psittacorum* cultivars to be grown as potted plants. It is apparent that rhizomes from retarded plants contain enough of the retardant that they can be used as propagules to start pots that will finish shorter and in better proportion than untreated rhizomes. Eric Tanouye of the Big Island expressed interest in this research during a recent visit.

The fragrance of *Hedychium coronarium* has been a chief attractant in the floricultural use of this plant in lei and as a cut flower, but its size has previously been a factor against growing it in pots. Using long days and a growth retardant drench it is possible to produce well proportioned flowering plants. Growers who have seen the flowering, retarded plants feel there is potential, although they suggest the production protocol may need some refining to standardize the results. Especially exciting is the possibility to extend this work to some of the pastel hybrid hedychiums developed at

Lyon Arboretum.

- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this activity is weed control for ginger and potted ornamentals for export, primarily anthuriums and orchids. (873H)
- b. Impact/Accomplishment. For orchid seedlings, diuron appeared safe and tolerated the application rates and schedule. For anthurium the preemergence herbicides diuron, isoxaben and oxyzalin appear to be safe with the application schedule. For edible ginger, clethodim appears safe for post emergence grassy weed control. In demonstration plots, thiazopyr demonstrated comparable safety with oxyfluorfen; sulfentrazone at the higher rate killed the ginger. Orchid and anthurium growers can use the herbicide efficacy work reported to expand production of high-value exported plants that are free of weeds. Pest-free plants are an absolute necessity for plants exported from Hawaii. The data generated on edible ginger will allow for the composition of a use pattern for oxyfluorfen. The use pattern will be used to obtain an approved protocol for a residue study with resulting data used to request a food use tolerance. A food use tolerance is required of all pesticides labeled for use in the U.S. by the EPA. With oxyfluorfen approved for use, ginger growers can expand production and reduce harvest costs associated with weed removal.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. Integrated Research and Extension.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this activity is on breeding eggplant, combining the required horticultural characters with disease resistance (spotted wilt, root-knot nematode, tobacco mosaic virus, and others) and high yield. (867H)
- b. Impact/Accomplishment. The Nitta eggplant backcross program is in its final stages of selection, and a purple and green variety should be released soon. Varieties developed will provide growers with improvements in quality and disease resistance that are lacking in the varieties presently grown.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Competitiveness

- a. Description of activity. The focus of this research is to establish and evaluate recombinant inbred lines (RILs) of corn for resistance to tropical pests, diseases, and stresses. Specifically, the activity

will identify quantitative trait loci (QTLs) governing segregations for significant resistances and selected agronomic traits and apply molecular probes (SSR, RFLP) for the chromosomal mapping of QTLs and/or genes of high commercial value. Genetically improved tropical and temperate corn inbreds by conversion to selected QTLs using marker-assisted selection where warranted will be released for grower evaluation. Yield trials on silage with 3-way hybrids were produced for grower evaluation. A field day display included 10 SX and 5 3X, all permitting pesticide-free production in Hawaii. Research on inheritance and identification of useful genes and QTLs continued, with publication on pericarp thickness. (866H)

- b. Impact/Accomplishment. Approximately 1,000 acres of hybrids from the program were grown in 2001 as silage for dairies. Response from the dairies was positive, with improved milk yields.
- c. Source of Federal Funds. Hatch.
- d. Source of Impact. State Specific.

Key Theme – Agriculture Competitiveness

- a. Description of activity. Conduct on site research with cooperating farms to evaluate the efficacy of current practices in reproductive management. Evaluate the new micro-environment modifiers (fans and misters) to cool cows and promote adoption of such technology on farm. Plan and develop a new system of nutrient management on farm to ensure all nutrients are contained within the operation. Plan and participate in workshops on nutrient management for livestock industry. (14-208)
- b. Impact/Accomplishment. There was increased awareness of the economic impact of heat stress on milk production and reproduction. All dairies on Oahu installed environmental modifiers (different types of fans and some added sprinklers and misters). Fans purchased by the farms varied with the ability of the producer to pay for installation. Initial studies on a large commercial farms found that there were tremendous differences in the efficacy of fans (with or without misters) to cool cows. Wind speed and the amount of water applied on the animal also proved to be important. Cows in high-speed fan environment did not have milk depression in the summer. The animals were able to sustain 100 lbs. (45.5kg) of milk production in summer months. The use of misters to cool cows resulted in higher milk production. In both cases, farmers had higher milk production in the summer months. This increased their profitability allowing them to further invest in facilities.

Education programs in nutrient management (conducted by a team) increased the awareness of the importance of keeping records of nutrient load and rejuvenation of old lagoons by dredging. Three farms are currently dredging their lagoons to increase holding capacity. They have also instituted composting activities. Two farms are composting manure solids from the wash-pens and milk-parlors. This compost is being used in pineapple operations and orchards.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Tropical Agriculture

- a. Description of activity. The focus of this study is to increase production of native Hawaiian plants. This is accomplished by utilizing conventional systems and technologies of seed and vegetative propagation and to determine, in conjunction with applied propagation approaches, the physiological basis for success in propagation of native Hawaiian plants. (825H)

- b. Impact/Accomplishment. The principal work was an attempt to root softwood and greenwood cuttings of the Hawaiian ho'awa, *Pittosporum confertiflorum*. The fact that some cuttings rooted well offers the promise that this plant material can be propagated vegetatively and faster than by seed. It is also clear that source of the cutting material can make a difference, as nearly all cuttings from one source failed to root and died during propagation.

A second accomplishment was the completion of a data-based web site on Propagation of Native Hawaiian Ornamental Plants. The site draws together information from literature sources generally unavailable to the general public as well as more generally available publications, from botanical garden records, and from anecdotal accounts.

There are a number of attractive ho'awa species in Hawaii for which a good seed source is generally unavailable. As small ornamental trees or shrubs, the ho'awa are not widely used because of a lack of plant material. The results of this research point the way for commercial nurseries to propagate desirable clones for use in landscapes.

The Web site on the propagation of native Hawaiian ornamental plants is linked to several other propagation Web sites, to the Botanical Gardens URL at Hamilton Library, and carries a PDCS identification code that enables Web search engines to find it. The site was user-tested and has received several hundred visits from persons seeking information on native plant propagation. We intend to maintain the site for a period of time and update it as new information becomes available. The URL for the site is <http://pdc.ctahr.hawaii.edu:591/hawnprop/>

- c. Source of Federal Funds. Hatch and Grant
- d. Scope of Impact. State Specific.

Key Theme – Tropical Agriculture

- a. Description of activity. The focus of this activity is to evaluate the efficacy of commercially available ant baits and baits with sugar and oil additives against urban ant species in laboratory and field studies. (925H)
- b. Impact/Accomplishment. In cooperation with the manufacturer, local pest control firms, and the State of Hawaii, field studies were completed in golf course and residential areas with a novel ant bait product containing imidacloprid. Ant species evaluated were *Technomymex albipes* (white-footed ant), *Tetramorium guineense*, *Pheidole megacephala* (big-headed ant), and *Solenopsis geminata* (tropical fire ant). The activity determined that this bait treatment was not effective in suppressing these four species, possibly due to limited feeding.

Actual impact is to prevent marketing of an ineffective material in Hawaii for ant control and to direct the manufacturer into developing a more acceptable bait matrix. Potential impact of this study will ultimately be the development of effective ant control products for use in Hawaii by continued cooperation with manufacturers, State agencies, and the pest control industry.

- c. Source of Federal Funds. Hatch and Grant.
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Profitability

- a. Description of activity. The focus of this activity is to develop a continuous solar dryer for the food industry to promote increased use of this renewable source of energy and help develop a dried food industry in Hawaii. Specifically, this activity will: (1) design and build a commercial-size, prototype solar dryer that can operate continuously and dry 900-1,000 pounds of fruit within a 24-hour period and (2) to analyze the drying operations of the prototype dryer. (340H)
- b. Impact/Accomplishment. A solar dryer was built on Kauai that is continuous (one batch per day), sanitary and clean, avoiding all contamination by insects and dust. Practically all solar dryers worldwide are batch-type, requiring three days or more to finish drying a batch of foods. This “continuous solar dryer” is quite possibly the first of its kind to be built to make efficient use of solar energy for drying. The drying process is non-stop, using three sources of non-fossil energy sequentially. The process dries food down to about 8–10% moisture within 24 hours. Another drying run can start the following day, thus making use of the equipment more efficient and productive. This prototype demonstration facility provides the users with an opportunity to develop a cost-effective dried food industry in both developed and developing countries. The potential use of this dryer in developing countries is great because of lower labor and materials costs.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Agriculture Profitability

- a. Description of activity. Improve the viability of Maui County's diversified agricultural industry by increasing efficiency and productivity of the farming system. Develop and maintain an integrated approach for the management of diseases and insect pests affecting edible crops. Increase growers' involvement in resolving problems facing industry (e.g. marketing, water, transportation, etc.). Increase efficiency in the delivery and dissemination of research-based information. (21-030)
- b. Impact/Accomplishment. A marketing committee was organized to help educate growers in the area of marketing and farm management. Committee members consisted of agricultural producer organizations, county government, CTAHR economics and marketing faculty, and County-based CTAHR extension agents. A Maui County agricultural marketing conference was organized.

Grower education workshops and on-farm demonstrations have been held to help growers understand how to control fruit flies using male attractant lures. Growers were asked to evaluate the workshops. Thirty-five percent of the growers indicated the workshops greatly improved their knowledge, while thirty-two percent indicated their knowledge change significantly. Forty-five percent indicated their confidence in utilizing workshop information greatly improved, while forty-five percent of the growers indicated it changed significantly. Eighty-eight percent of the growers

were planning to make changes in their production practices.

Based on a survey conducted in 1997, the Maui Onion Growers Association identified pink root and fusarium basal plate rot as the major bottlenecks facing their industry. Ten to 40% of crop losses are due to these diseases; occasionally 100% of the crop is lost. Field experiments indicated that 2- and 3-way interactions involving solarization, Vapam fumigation, and cover crop (rape) treatments provided significant control. Experiments are on-going. The success of this project will provide growers with alternative methods for the control of pink root and fusarium basal plate rot. The present recommendations of 3 to 5 year rotations and soil fumigation are not viable options for Maui's onion industry.

The development of Tomato Spotted Wilt Virus Resistant tomato varieties by a CTAHR researcher will allow growers to plant one additional crop per year, significantly increasing their annual farm revenues, considering tomato yields are approximately 40,000 lbs/acre.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to improve sweet corn production. Specific activities include germplasm acquisition and identification of new genes or novel allelic combinations useful to enhance sweet corn productivity. (864R)
- b. Impact/Accomplishment. Three composites created for “exotic disease resistance” were completed: NE-EDRbt1, NE-EDRsu1 and NE-EDRsh2. These are supersweet and sweet corns whose broad genetic base can aid U.S. breeders to expand the genetic base of sweet corn.

The sweet corn hybrids generated by this research continue to dominate Hawaii's sweet corn production. Producers in Australia and Thailand also use hybrids derived from this activity.

- c. Source of Federal Funds. Hatch and MRF.
- d. Scope of Impact. Multistate Research. FL, HI, ID, IL, IN, MA, MN, NYC, NYG, OH, OR, PA, WI

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to identify field and postharvest diseases of papayas and develop management programs and evaluate and register effective chemicals and biocontrol agents for papaya disease management programs.

A video was produced describing symptoms and control of a newly found fungal disease of papaya caused by *Asperisporium caricae*. A field fungicide test was initiated in August 2001 to determine the efficacy of azoxystrobin at 15.4 oz/acre for four sprays/crop cycle (unregistered) and a combination spray of mancozeb (2.5 lbs/acre, registered) and copper hydroxide (4 lbs/acre,

registered) sprayed on a 2 week interval. The mancozeb and copper hydroxide spray on a 2-week schedule and unsprayed treatments serve as controls.

Additional activity includes the monitoring of papaya ringspot virus (PRSV) project. This project was transferred from the State Department of Agriculture as part of the Puna PRSV Quarantine Zone. (735H)

b. Impact/Accomplishment. Early results suggest that currently registered fungicides when applied on a 2-week schedule will control the new black spot disease caused by *Asperisporium caricae*. Registration of other fungicides for control may not be necessary.

The PRSV Quarantine Zone project is expected to allow the growing of non-GMO cultivars of papaya in an isolated zone protected by a buffer of GMO orchards, allowing growers to export to Japan and receive prices that are 3 to 5 times more than what is being paid for GMO fruits.

- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. Integrated Research and Extension.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to identify, evaluate and distribute to taro farmers in Hawaii and American Pacific new taro cultivars resistant to taro leaf blight and pocket rot. Three test plantings of ‘Pa’lehua’ were planted and harvested. (711H)
- b. Impact/Accomplishment. In Hanalei, Kauai, the ‘Pa’lehua’ planted in the summer was harvested 9.5 and 10.5 months after planting. The average mean yield per plant was 2.76 and 2.96 lb, respectively, while the cultivar ‘Maui Lehua’ used as control was not ready to harvest. ‘Maui Lehua’ harvested after 14 month was used as comparison. It had a much lower yield of 1.95 lb/plant. ‘Palehua’ planted at the end of winter at Haleiwa, Oahu, matured in 8.5 months after planting and the mean average yield was 2.92 lb/plant, while the cultivar ‘Maui Lehua’ used as comparison had not reached maturity. The mean average yield per plant of the control ‘Maui Lehua’ was 1.63 lb at harvest. Poi made with ‘Pa’lehua’ was of good quality. This cultivar has the potential to increase poi taro yield by 50%.
- d. Source of Federal Funds. Hatch.
- e. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to examine the requirement of light and the effect of seed age on the fluctuating temperature and light stimulation of goosegrass (*Eleusine indica* (L.) Gaertn.) seed germination. (802H)
- b. Impact/Accomplishment. Dense, tight turfgrass dampens diurnally alternating temperature and reduces goosegrass germination and invasion. On the other hand, scalped or diseased turfgrass increases the diurnal temperature fluctuation and goosegrass seed germination; the application of a preemergence herbicide at that time would be most cost-effective. These findings provide turfgrass

managers with an increase understanding of the factors that trigger goosegrass seed germination.

- d. Source of Federal Funds. Hatch.
- e. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to quantify biophysical constraints to taro production and to validate the subsector-aroid model. Specific objectives are to quantify the effect of drought and temperature stress. (112H)
- b. Impact/Accomplishment. Plants grown at 100% evapotranspiration (ET) had significantly greater fresh and dry weights of corms compared to all other irrigation treatments. The optimal irrigation level for taro to produce maximum corm weight appears to be 100% ET.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to determine causal agents for diseases of taro and ornamentals and to determine whether taro diseases increase with increasing nitrogen and other elements applied. (726)
- b. Impact/Accomplishment. For the first time, pocket rot was reproduced by the inoculation of disease-free taro plants. Pocket rot was caused by a new homothallic *Phytophthora*, in three tests. Floraculture nurseries are using less toxic fungicides by switching to nonpersistent and low-risk fungicides such as Kaligree, a potassium bicarbonate. Cost of Kaligree is very low compared to the hundreds of dollars for Heritage. Increasing nitrogen levels to over 600 lb/acre in wetland taro caused higher levels of disease (severe leaf rots caused by *Phytophthora colocasiae*). In several tests, nitrogen levels of between 300 and 350 lb have been adequate for good crop production. Growers are saving 300 to 500 lb of nitrogen per acre per crop. This is a significant saving for growers and less nitrogen is being released into the environment.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to determine the postharvest handling and processing effects on the quality of coffee. (806H)
- b. Impact/Accomplishment. Sensory evaluation methodology was modified for cupping of coffee to obtain more uniform results. New varieties will be developed that will have improved quality characteristics, positioning Hawaii to continue to succeed in the specialty coffee market.
- c. Source of Federal Funds. Hatch.

d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. A conceptual model of macadamia fruit growth was developed. Macadamia fruit (nut) growth was described by different kinds of growth curves. (819H)
- b. Impact/Accomplishment. Final fruit size does not appear to depend upon the number of fruits in a cluster, indicating an importation of carbohydrates into the stem. During the initial phase of fruit growth, carbohydrates from the leaves on the stem are sufficient to support fruit growth, especially when there is a single fruit or few fruits in the cluster. As the sink strength of the developing fruit increases, carbohydrates move into the stem. This knowledge of fruit growth and the effect of carbohydrate partitioning on fruit growth assists with a better understanding of the physiology of fruit growth and yield of macadamia. Increased understanding of fruit growth physiology will aid in predicting how cultural practices and weather affect growth and yield.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to develop postharvest treatments and handling technologies to avoid disorders, maintain quality, and extend shelf life of tropical fruits and flowers and foliage. (660H)
- b. Impact/Accomplishment. Over 1,500 ACC antisense putative pineapple transformants have been produced. These have survived another round of more intense selection and are undergoing screening. Agrobacterium transformation efficiency is being improved through determination of optimal conditions for source plant material and agro infection conditions.

Potential approaches to minimizing fruit translucency that is caused by at least three preharvest factors were identified. Translucency can cause losses of up to 30%.

A biocontrol agent to control postharvest black rot of pineapple was isolated. In conjunction with a minimal fungicide dose, this gives control as good as the recommended fungicide dose. The biocontrol agent by itself gives about 80% of the control obtained with commercial fungicide treatment.

Developed the use of benzyladenine to extend the postharvest life of tropical flowers and foliage such as anthuriums, ginger, and ti leaves. All major anthurium shippers use this treatment on their flowers.

The papaya industry was provided with data on the relationship between leaf area and fruit load. This can be used to determine when canopy loss will influence fruit yield and quality.

- c. Source of Federal Funds. Hatch.

d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of the activity is to evaluate products and techniques that can be used as replacements to lost nematicides. The activity is essential since the enactment of the Food Quality Protection Act of 1996, which limits the availability of nematicides for all crops. Many products marketed as environmentally friendly nematicides are not effective. (732H)
- b. Impact/Accomplishment. The activity has demonstrated that artificial induction systemic acquired resistance in pineapple and cowpea with Actigard® can reduce reniform and root-knot nematode reproduction by 50%. Hot water drenches are also proving effective in eliminating burrowing nematodes from anthuriums and palms. The activity offers effective alternatives to the loss of nematode control products like methyl bromide and organophosphate pesticides.
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to evaluate multiple coffee cultivars and species for resistance and tolerance to the Kona coffee root-knot nematode. Genetic variation within nematode populations can thwart many control efforts that are undertaken. It is found that nematodes can respond to selection pressure from host plants, as well as to their physical environment. (707R)
- b. Impact/Accomplishment. This activity has discovered that allowing the Kona coffee root-knot nematode to reproduce on tomato can result in the loss of the ability to reproduce on coffee. Multiple lines have been shown with this asexually reproducing nematode, and those lines can go extinct easily. The work is producing additional sources of host root-knot nematode resistance to local coffee growers. This work also is contributing to the better understanding of genetic variation in root-knot nematodes and how this can be exploited for nematode control.
- c. Source of Federal Funds. Hatch and MRF
- d. Scope of Impact. Multistate Research. AR, CA, HI, ID, MI, NE, NM, NC, OR, WA, WY

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of the activity is to identify important tropical pathogens on crops such as papaya, taro, and palms and, ultimately, to develop effective control measures. Separate problematic species within *Phytophthora*, *Calonectria*, *Colletotrichum* and other genera are to be identified by using morphological, physiological, and isozyme comparisons. (726H)
- b. Impact/Accomplishment. Black spot of papaya caused by *Asperisporium caricae* was identified, the

first report of this fungus in Hawaii. Two new *Phytophthora* species have been isolated from heart rots of maturing taro plants. One of the *Phytophthora* species has been reproduced in isolation so that efforts to control it can be initiated. A fungus isolated from large spots of *Pritchardia* palms is a probable ascomycete. Efforts to produce spores are continuing. Limited research has been done on the pathology of palms, and this project is developing a database on this important tropical crop.

- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Plant Production Efficiency

- a. Description of activity. The focus of this activity is to identify and develop disease resistant taro and tomato. (798H)
- b. Impact/Accomplishment. Several genetic crosses have been generated between taro leaf blight resistant hybrids and susceptible commercial taro cultivars. These are being tested on-farm for commercial potential. Two tomato hybrids with multiple disease resistance were selected from 67 experimental lines. UH Hybrid #5 was selected from on-farm trials as being tomato spotted wilt virus (TSWV) resistant, high yielding, and producing large, firm, vine-ripened fruits of good quality. Sufficient UH Hybrid #5 seed is being generated to evaluate this hybrid in statewide uniform on-farm grower trials. This hybrid may be a possible replacement for production in TSWV-prone areas and should decrease Hawaii's reliance on imported tomatoes
- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. Integrated Research and Extension.

Key Theme – Plant Production Efficiency

- a. Description of activity. Develop and apply sustainable production technology to farm conditions. (18-816)
- b. Impact/Accomplishment. Concluded four year on-farm project to mechanize pruning for sustainable mechanized coffee production. The mechanized pruning technology developed and demonstrated by growers reduced cost of pruning from \$1,000 per acre per year to \$70 to \$120 per acre per year. Technology is being used by three mechanized coffee farms representing over 60% of state acreage.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Plant Health

- a. Description of activity. Provide educational programs on sustainable production for coffee,

avocado, tropical specialty fruits, citrus, landscape maintenance personnel and contractors, cut flower growers and home gardeners. Communicate technologies or methods such as grafting of coffee seedlings for nematode resistance. Support the Certified Landscape Technician training and certification program by teaching classes. Expand the “Gardening Helpline.” (20-065)

- b. Impact/Accomplishment. Coffee growers are now grafting Guatemalan coffee onto nematode resistance rootstock, due in part to several workshops and newspaper articles on the topic and on the reasons for grafting. At least four nurseries are selling grafted coffee plants. The 2000 Kona Coffee Cultural Festival Cupping Competition first place winner was a farmer who grafted and planted on his own farm, thousands of these grafted plants. A monthly, regularly scheduled meeting called “Coffee Talk” was conducted as an open discussion on any aspect of coffee production, processing or marketing. This meeting provided a forum for growers to ask question while interacting with other farmers. “Coffee Talk” is a very successful program that has provided an efficient way to furnish information to a group of growers in an interactive and informal setting. In addition, it provided an opportunity for new farmers to meet other farmers and exchange information.

Classes for the Certified Landscape Technician (CLT) training and certification program were conducted. Input was provided to the CLT Training program via their Advisory committee.

A regular newspaper column, published in both the Hilo and Kona newspapers every other week, has proven to be an efficient and economical way of reaching diverse audiences including commercial growers, home gardeners and the general public. The column has resulted in a great deal of positive feedback on the relevance and usefulness of the information provided, and a subsequent change of the practices of numerous growers. A “Gardening Helpline” (staffed with a volunteer who answered questions relating to gardening and landscaping, supplemented the newspaper columns. The “Gardening Hotline” reduced (but did not eliminate) the number of home gardening calls received.

- c. Source of Federal Fund. Smith Lever (b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Ornamentals

- a. Description of activity. Under the California/Hawaii Origin Inspection Program (OIP) maintain Hawaii County cut flower export shipment rejections due to insects to less than 0.1 percent. Increase the overall wholesale value of cut flowers from Hawaii County by 2 percent in the next three years. Conduct educational workshops and meetings to disseminate production, postharvest, and marketing information to flower growers and shippers. Develop publications to provide information to industry. Provide floriculture industry organizations leadership and guidance in developing industry priorities for potential research and industry projects. (20-024)
- b. Impact/Accomplishment. The percentage of export shipments of cut flowers that were rejected was less than 0.1 percent under the California/Hawaii OIP. During the reporting period, 14 Hawaii County flower shippers exported 10,122 lots containing 14,174 parcels with no rejections. The continued success of the OIP allows shipments to be exported with minimal inspection under the

program, providing expeditious movements of products to consumers, and maintains a high standard of cleanliness of products by Hawaii's shippers. This created a win-win situation for everyone involved while providing national security for the possible introduction of unwanted quarantine action pests.

The wholesale value of the cut flower industry increased by 2% to \$16.8 million. Educational workshops and meetings were conducted to disseminate production, post-harvest, and marketing information to flower growers and shippers. Technical assistance was provided to 942 individuals. Publications were developed which provided information about thrips. Floriculture industry organizations were provided with continuous leadership and guidance in developing industry priorities for potential research and industry projects. A retreat was organized and facilitated for the Hawaii Tropical Flower Council to set directions and goals for development of a marketing plan. This was critical because of the enormous global competition and slumping economy experienced in the past year.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Innovative Farming Technique

- a. Description of activity. The focus of this activity is to adapt and improve passive non-circulating hydroponic methodologies for cucumber, tomatoes and watercress. Cucumbers were grown in a 200-liter barrel of nutrient solution in Gatton, Australia, and Volcano, Hawaii. Tomatoes were grown in 10-liter plastic buckets filled with perlite or waste coal ash. The buckets were sub-irrigated with a constant depth of 7 cm of nutrient solution which was supplied from a 1,000-liter tank and flowed by gravity pressure to a sump which established the liquid depth. Nutrient solution outflowed from the sump through 0.6-cm microtubes into a 1.4-cm plastic manifold tube which distributed the liquid to individual pots by 0.6-cm plastic microtubes. Watercress was grown in uncovered tanks (30 cm deep) of noncirculating nutrient solution with an EC of 1.0 to 1.8 mS in a polyethylene-covered rainshelter at the Volcano Experiment Station. Additional nutrient solution was added to replace evaporation and transpiration. (872H)
- b. Impact/Accomplishment. A simple hydroponic method has been developed to produce watercress at high elevations. This method only requires 1/1000 as much water to produce a kilogram of watercress as the existing methods where watercress is grown in continuously flowing water. A major vegetable grower is trying this system in the Volcano area. The method of growing tomatoes in 10-liter plastic buckets filled with perlite or waste coal ash does not involve standing water, such that a crop will not become a mosquito breeding ground. Given the potential for mosquito-transmitted diseases (e.g., Dengue fever, malaria), this methodology has substantial impact potential. Non-circulating hydroponic methods developed by this program are now part of some elementary and high school science programs. No weekend watering is required. Hydroponics helps to teach chemistry, botany, volumes, math concepts, etc. At least one men's and one women's State of Hawaii Correctional Institutes are using non-circulating hydroponics as part of their educational and rehabilitation programs. Commercial lettuce growers ranging in size from a small greenhouse with family labor to a six figure gross income with hired employees are utilizing non-circulating hydroponic methodology. Hydroponic growers utilizing circulating, run-to-waste and other active

systems also find our research programs to be useful. Three graduate students at The U. of Queensland-Gatton are starting an enterprise featuring the Hi-Lo method of plant production. Their marketing plan targets schools.

- c. Source of Federal Funds. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Urban Gardening

- a. Description of activity. Increase the knowledge of the volunteers that participate in the Master Gardener training program and enable volunteers to enhance their networking opportunities. Increase the opportunities for access to gardening knowledge and to improve the opportunities for the public to receive answers to their gardening questions. Increase recruitment for Master Gardener training and increase awareness of the public of the Master Gardener program by developing a publicity program. (22-036)
- b. Impact/Accomplishment. Another 25% of the Maui Educational Garden was developed during this period; 75% of the garden is now operational. Maui Community College requested that an adjacent ½-acre area be developed into the Educational Garden and provided \$5,000 for this work.

Another 25% of the Maui Educational Garden was developed during this period; 75% of the garden that is now operational. Maui Community College requested that an adjacent ½-acre area be developed into the Educational Garden and provided \$5,000 for this work.

Field trips and additional training was provided to help retain volunteers in the Master Gardener program. Seventeen people finished the 2001 Master Gardener program; two more volunteers finished the course as "Garden Consultants." Four Master Gardeners accompanied by CTAHR staff to the International Master Gardener Conference in Orlando, Florida.

Six classes for the Gardening Public were conducted during this time period. Participants donated with 865 pounds of surplus produce being donated to the Salvation Army with some going to the Food Bank.

Twenty-three people attended a field day to showcase a head lettuce variety trial for the general public. Evaluation responses to this field day were: (a) 57% expressed interest in growing some of these lettuce varieties if seeds were available; (b) 61% expressed a desired for this type of program to continue; and (c) 70% indicated that this garden is a value to the community.

Fifteen volunteers assisted Maui CES by contributing more than 2,100 hours of service. The 28 Oahu Master Gardeners helped 2,180 people from September 2000 to October 2001, contributing over 700 hours to do so. They also contributed nearly 3,000 additional hours at the Urban Garden Center.

Attendance at "Transgenic Papaya Educational Sessions" is required in order to purchase transgenic papaya seed from the College's Agriculture Diagnostic Services Center Seed Lab. Sessions were held at the Urban Garden Center. Twenty-nine people completed the sessions and paperwork to purchase the seeds (more people attended, but not all wished to file the paperwork).

- c. Source of Federal Fund. Smith-Lever (b) and (c).
- d. Scope of Impact. State Specific.

GOAL 2: A SAFE AND SECURE FOOD AND FIBER SYSTEM

Overview:

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."

GOAL 3: A HEALTHY, WELL-NOURISHED POPULATION

Overview:

Hawaii has one of the highest rates of diabetes in the United States. Following a project to educate people about diabetes, 89 percent of participants had initiated contact with health providers to learn about further diabetes testing. Also observed were improvements in health beliefs and self-care behavior such as eating healthier foods (participants were using healthy recipes in their home cooking) and exercising.

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)
2001	56,720	31,208	0	87,928	0.3

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2001	11,571	129,164	0	140,735	2.5

Key Theme – Human Nutrition

- a. Description of activity. Introduce and help people understand five medical tests that measure indicators of diabetes health. Provide educational opportunities for people to learn to manage diabetes. (20-072)
- b. Impact/Accomplishment. Initially, under 1% of the participants enrolled in this project knew about all five tests and what the results mean. Over 88% had at least one elevated test result. At the 3 month follow-up, significant improvements in diabetes health beliefs and self-care behavior (eating and exercising better) were observed among the participants in East Hawaii as compared to their West Hawaii counterparts. Eighty-nine percent of the subjects had initiated contact with health providers about further diabetes testing.

A survey of the participants in food demonstrations on two different occasions showed a gain in knowledge in ways to make recipes healthier (practical skills) and that participants were using the

recipes at home with their families.

- c. Source of Federal Fund. Smith-Lever 3 (b) and (c).
- d. Scope of Impact. State Specific.

GOAL 4: GREATER HARMONY BETWEEN AGRICULTURE AND THE ENVIRONMENT

Overview:

Following are the college's accomplishments in Goal 4.

Books: 3
Refereed articles: 3
Journal articles: 3
Published articles: 1
Reviewed publications: 7
Conference presentations: 49
Conference paper/proceedings: 6
Workshops: 3
Research and extension reports: 4

Pesticide clearances and registrations are obtained and maintained on an ongoing basis because all Hawaii crops are considered minor crops. Effective alternatives to methyl bromide and organophosphate pesticides for nematode control have been identified. Progress was made in identifying antibodies effective in trace residue analysis.

One of Oahu's prime urban resources is Hanauma Bay. Protection of the bay is a high priority. Agricultural economists estimated the carrying capacity of the park at 1,363 visitors per day, whereas at current use levels visitors average more than 6,808 per day. This is a clear overuse of this resource. These data will help the park's managers justify plans to limit the number of visitors so as to preserve the bay's ecosystem.

In the areas of agricultural waste management and water quality, an on-farm swine waste management system was developed that integrated an intermittent aerator and entrapped mixed microbial cell (EMMC) technology. EMMC offers an opportunity to reuse treated wastewater for golf courses and in agriculture. Four swine farms participated in the On Farm Assessment and Environmental Review program and have implemented most of the recommendations. Two other farms have submitted forms to participate, and three others have indicated their intention to participate.

To improve water resource management in the agroecosystem of Central Oahu, various conflict resolution techniques were evaluated for their potential to bring together contending parties and their impact on the state's economy and environment.

Soil erosion is a concern in Hawaii's post-plantation agriculture because sugarcane and pineapple are both crops that protect against erosion. The revised universal soil loss equation (RUSLE)

was used to evaluate various cropping systems for their ability to protect soil from runoff. As Hawaii moves into diversified agriculture, growers need to be aware that conventional tillage practices offer less protection and look to alternative tillage systems and biological soil conservation. Well-managed pastures offer the best protection for both land and water.

Integrated pest management principles were employed when the diamondback both began to show resistance to the insecticide spinosad. Growers, researchers, and chemical companies cooperated to reverse resistance. It appears that in some regions growers may soon be able to use the insecticide again on schedules to which all agree. This cooperative program is being used by chemical companies as a model throughout the world. A pesticide safety education course was developed for new and immigrant farmers with limited English proficiency. Oral training evaluations indicate that all participants have adopted several pesticide safety practices, e.g., use of safety equipment, proper storage, and disposal.

In the area of sustainable agriculture, tests to find alternatives to methyl bromide to control ginger wilt suggest that the best means of protection is strict on-farm sanitation practices. Additional diversified crops, including tea, wasabi, and soba, are being investigated.

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)
2001	190,689	823,084	442,049	1,455,822	7.7

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2001	109,077	480,778	0	589,855	7.5

Key Theme – Natural Resources Management

- a. Description of activity. The focus of this activity is to estimate the relation between use level and carrying capacity of the Hanauma Bay, an important urban natural resource for Oahu. User fees have been suggested as a means of reducing the use level. Analysis of the magnitude of user fee necessary to reduce use to carrying capacity was conducted. (488H)
- b. Impact/Accomplishment. Hanauma Bay carrying capacity, or number of people that can use the resource without degradation, is estimated to be 1,363 users per day. By 1999 users per day had increased to 6,808. There is clearly an over use of this important open-access resource. Users include both Hawaii residents and non-residents. The political climate makes it impractical to charge Hawaii residents a fee to use Hanauma Bay. Resident use has remained relatively constant at about 1,000 users per day. This means that to reduce the number of users per day to carrying capacity the number of non-residents using Hanauma Bay must be reduced to about 363. Based on a

survey of current users' willingness to pay for admission, it was found that an admission fee of \$25.00 per day would be necessary to reduce total use to carrying capacity. The revenues that would be generated from this user fee structure, zero for residents and \$25.00 per day for non-residents, were estimated to be \$9,075 per day. Assuming that Hanauma Bay is closed to users one day per week, this would amount to \$2,840,475.00 per year, more than enough to cover the upkeep and maintenance of \$1,200,000.00 per year. These research results have been shared with the Hanauma Bay manager and presented for general audiences in the form of a CTAHR publication. The results are potentially crucial in the formulation of future Hanauma Bay management strategies. This information is particularly important for the ongoing debate about the advantages and disadvantages of physical restrictions versus economic disincentives to reduce the use rate of Hanauma Bay to carrying capacity.

- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Agricultural Waste Management

- a. Description of activity. The focus of this activity is to develop a more effective waste treatment system. Specifically, this study attempts to develop and refine physical, chemical, and biological treatment processes and engineering systems for management of manures and other wastes and to develop and refine methodology, technology and management practices to reduce odors, gases, airborne microflora, particulate matter and other airborne emissions in animal production systems. (518R)
- b. Impact/Accomplishment. Three major findings for this project have been achieved. They are (1) developed an on-farm swine waste management system in Hawaii, (2) integrated an intermittent aerator for an on-farm pig waste treatment, and (3) integrated EMMC (entrapped mixed microbial cell) technology for biological removal of carbon and nitrogen from diluted swine waste water.

This activity shows that the integration of intermittent aeration unit or EMMC process for the swine waste treatment systems provides reduction of energy consumption cost and possible reuse/disposal of treated wastewater without causing deterioration of environmental quality. Also, it provides possibility of developing a fabricated-package treatment plant or a central swine waste processing plant to be applied for the land-limited tropical/subtropical area.

- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. Multistate Integrated Research and Extension. AL, CA, FL, GA, HI, IL, IN, IA, KY, LA, MN, MI, NC, OR, SC, TN, TX, VA, WI, USDA-ARS

Key Theme – Agriculture Waste Management

- a. Description of activity. Develop and demonstrate livestock waste management practices and disseminate information on these practices. (14-210)

- b. Impact/Accomplishment. Four swine farms have participated in the On Farm Assessment and Environmental Review program and have implemented most of the recommendations. Two other farms (one swine and one mixed livestock) have submitted the forms required to participate in the program and will be assessed in November 2002. Three farms have indicated their intention to participate in the program.

Revision of Environmental Protection Agency rules affecting swine farms have reflected comments submitted to EPA on the potential impact of new rules for Animal Feeding Operations and NPDES permits on small farms in Hawaii.

Likewise, information provided to the Hawaii Department of Health was used to help assess the Total Maximum Daily Load (TMDL) as it relates to animal numbers and animal units and their potential impacts on stream quality.

As a demonstration, the oxidation pond for waste treatment at the Waialeale Livestock Research Farm has been cleared of 60% of the sludge. Top water and sludge were applied at agronomic rates to fertilize the pasture.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Water Quality

- a. Description of activity. The focus of this activity is to develop a more effective biological waste treatment using a modified EMMC (entrapped microbial cell process). Specifically, a component of the EMMC using modified cellulose triacetate is tested on xenobiotic compounds. The economics of using the modified process is also being evaluated. (511H)
- b. Impact/Accomplishment. Using a pilot scale (1,000 L reactor) of the modified EMMC to treat domestic sewage was shown to be comparable to conventional wastewater treatment. The highest removal of SCOD (soluble chemical oxygen demand) is about 76%, which is close to the maximum of batch biodegradability activity. Cost analysis was conducted and it was found that \$1.75 is required to treat 1,000 gallons (3.785 cubic meters) of wastewater per day. Application of EMMC technology for domestic sewage treatment provides better opportunity for potential reuse of treated wastewater for golf course and agricultural production system. The modified EMMC technology provides effective, low operation and maintenance and low energy cost in removing carbon, nitrogen and color simultaneously.
- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Hazardous Materials

- a. Description of activity. The focus of this activity is to develop analytical methods for environmental analysis. Specifically, to develop low-cost analytical methods, which minimize organic solvent use, and to study the environmental fate and monitoring of toxicants in Hawaii. (617H)
- b. Impact/Accomplishment. New procedures were developed for extraction of pollutants and pesticides in environmental and biological samples. Antibodies-based assays were also developed for measurement of pollutants and pesticides. These new methods require small amounts of organic solvents and are fast and efficient. These methods proved to be rapid and efficient for identification of chemicals for emergency responses. The work revealed the fate of pesticides in groundwater and agricultural fields in Hawaii. Field tests showed that a photoactive dye, phloxine B, was effective for the control of fruit fly. The fate studies have also provided data being used to make decisions on pesticide uses in Hawaii and assist the best management of pesticides.
- c. Source of Federal Fund. Hatch.

- d. Scope of Impact. State Specific.

Key Theme – Improving Water Resources Management in an Agroecosystem

- a. Description of activity. The focus of this activity is to evaluate alternative institutions and policies for resolving competing agricultural and environmental water demands. A case study of the Waiahole Ditch water allocation was conducted to explore this theme. In order to examine the institutional context of the allocation of Waiahole Ditch water, special emphasis on the conflicts and strategies for conflict resolution among multiple stakeholders was undertaken. A variety of conflict resolution techniques such as negotiation, arbitration, legal processes, water pricing, quotas and conditional permits were evaluated in terms of their potential impacts on the state's economy and environment. (425R)
- b. Impact/Accomplishment. The principal conclusion emerging from the study was that the decision on the reallocation of Waiahole water by the State Commission on Water Resource Management (CWRM) has failed to adequately address the concerns of the contending parties. The study findings should assist CWRM in deciding on future water allocations in Hawaii among competing water uses and users, taking fully into account environmental and economic impacts and also applying appropriate water laws.

Findings from the study will have a significant potential impact on approximately 250,000 residents of the study area in central Oahu, extending north from Pearl Harbor to Schofield Barracks and to Haleiwa. The target audience includes agricultural producers and members of the central Oahu Wellhead Protection program. This program consists of local residents representing a variety of community skills, plantation owners, and representatives from the state Departments of Agriculture and Health. Results from the study would also benefit state, county and federal water planning, development and monitoring agencies. These include the state Departments of Agriculture (Pesticides Branch) and Health (Safe Drinking Water Branch), Land and Natural Resources, USGS, NRCS, and the Farm Bureau. Findings could also be of special value to residents and monitoring agencies from other islands in the Pacific Basin such as Guam, Saipan and Fiji, where the public health impacts of groundwater contamination are beginning to cause increasing concern.

- c. Source of Federal Fund. Hatch and MRF.
- d. Scope of Impact. Multistate Research. AZ, CA, CO, HI, ID, IN, NE, NV, NM, OK, OR, TX, WA, WY, ARS, ERS

Key Theme – Soil Erosion

- a. Description of activity. The focus of this activity is to develop erosion prediction and control technology for application in Hawaii utilizing the revised universal soil loss equation (RUSLE) and the water erosion prediction project (WEPP). Assessment was made of the extent to which applied agrichemicals are subjected to transport with runoff and sediment, particularly under diversified agriculture versus plantation agriculture. Quantification was also made of the benefits of live cover and residue management for controlling nonpoint-source pollution. (135H)

- b. Impact/Accomplishment. Systematic evaluation and use of RULSE parameters shows that the extent to which a given land use imparts protection against soil erosion varies not only among crop species and applied management but also among varieties or cultivars with varying growth habits. The work with the RUSLE model has direct bearing on the potential environmental impacts of ongoing diversification of agricultural lands to replace Hawaii's large plantation industries, especially sugarcane and pineapple. The model and available small watershed data for these two crops show them both to be quite protective against erosion. It is also predicted that "diversified" crops will have "diverse" environmental impacts compared to plantation cropping systems, depending on whether they are annuals, orchards/forests, or pastures. Quantitative predictions showed that annual crops grown with "conventional" tillage practices would be considerably less protective against sediment losses than either sugarcane or pineapple. Orchards and short-rotation forestry for bioenergy are also vulnerable, particularly during the highly exposed early stages of tree growth, after full canopy development shades out ground cover or "understory" vegetation, and during or following harvest operations. Well managed pastures generally represent the most "protective" alternative. Alternative tillage systems and biological soil conservation options offer substantial promise for controlling erosion and sediment-based nonpoint source pollution, thus protecting soil and water quality under vulnerable land uses.
- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. State Specific.

Key Theme – Other(Harmony Between Agriculture and the Environment)

- a. Description of activity. The focus of the study is to develop trace residue analytical methods that generate minimum amounts of solvent wastes. Studies were conducted to characterize a monoclonal antibody, S2B1, which is highly selective for coplanar (non-ortho-chlorinated) polychlorinated biphenyl (PCB) congeners. The dissociation constants and on-and off-rates for binding of various PCB congeners to affinity-purified S2B1 IgG and Fab fragments in solution were determined. (634R)
- b. Impact/Accomplishment. The study examined the intrinsic properties of a highly selective antibody, S2B1. The knowledge is useful for antibody engineering to derive new antibodies with desirable properties such as tolerance to high temperature for assay application.
- c. Source of Federal Fund. Hatch and MRF.
- d. Scope of Impact. Multistate Research. ARS, AZ, CA-D, FL, HI, NV, NM, NYC, OR, UT, WA

Key Theme – Other (Harmony Between Agriculture and the Environment)

- a. Description of activity. The focus of this activity is to obtain minor use and specialty use pesticide clearances and assist in the maintenance of current registrations. Specifically, there are six pesticide residue projects involving 16 field trials and one processing trial. The analytical laboratory has 11 pesticide residue projects. (615R)

- b. Impact/Accomplishment. Two diazinon 24C registrations were retained. This is significant because diazinon is the only effective insecticide that controls aphids, the vector of banana bunchy top virus. Roundup is labeled for use to control weeds for *Stevia* growers. This will reduce the cost of labor for weed control.
- c. Source of Federal Fund. Hatch, MRF and Grants.
- d. Scope of Impact. Multistate Integrated Research and Extension. AK, AZ, CA-D, CO, FL, GU, HI, ID, MT, NM, NV, OR, UT, WA, WY

Key Theme – Other (Harmony Between Agriculture and the Environment)

- a. Description of activity. The focus of this study is to obtain pesticide residue data for registration of pesticides used in the production of specialty food crops or for minor pesticide uses on major food crops. Seventy-five project trials were conducted and obtained residue data for 16 pesticides on 19 crops. These projects include residues of chlorothalonil in persimmon; chlorpyrifos in coffee; clofentezine in persimmon; diazinon in watercress; dimethoate in taro; diuron in banana and in currant; ethephon in coffee; fosetyl-Al in blueberry and macadamia; imidacloprid in peach, coffee, and plum; malathion in watercress; metalaxyl in basil; metalaxyl-Cu in papaya; oxyfluorfen in pejiabaye and banana; permethrin in papaya; propiconazole in pineapple; spinosad in artichoke, raspberry, grape, banana, mint, and coffee. (618H)
- b. Impact/Accomplishment. This study obtained residue data to support registration of 16 pesticides for use on 19 crops in Hawaii and other states. This activity is essential for Hawaii, as all crops are considered minor crops.
- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. Integrated Research and Extension.

Key Theme – Integrated Pest Management

- a. Description of activity. Provide rapid response to industry crises and associated client requests. Provide decision support on efficient, best management practices needed to grow and market existing and new crops while protecting the environment. Educate growers on use of research-based technology that reduces losses due to pests such as disease agents, arthropods, and weeds. Facilitate food quality and safety education to producers. (22-016)
- b. Impact/Accomplishment. Created multi-disciplinary team to investigate a severe decline in watercress production. Through a process of elimination, the cause of the decline was determined to be a phytoplasma (yellow asters). A grower education program was developed and possible pest management scenarios were developed. Early detection of this disease will help limit its distribution.

A team of research and extension personnel determined that low pH was responsible for tip burn in hydroponically grown lettuce. By adding granulated coral to the nutrient recycling system the pH was adjusted and the tip burn problem mitigated.

A resistance management program was developed to address the diminished effectiveness of the insecticide “spinosad” on Diamondback moth (DBM), a major caterpillar pest of cabbages, broccoli, and watercress. Provided leadership to develop DBM Resistance Management Protocol to stop any further selection of resistant DBM in the population by halting application of spinosad to DBM host crops within a designated area for a specified period. As a result of this action and grower compliance with the conditions of the protocol, the proportion of the susceptible population was restored to near normal levels and appears that some regions may soon be able to start using the insecticide again as part of a well planned, integrated pest management (IPM) program. This action has served to prolong the usefulness of spinosad as an important tool for controlling DBM.

In anticipation of implementation of new food safety standards, “self audit” classes were given to growers using a modified New Jersey Food Safety Audit Program. This exercise helped growers develop a better feel for compliance with Food Safe programs.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Integrated Pest Management

- a. Description of activity. Assist pesticide applicators in improving their knowledge and adoption of safe, environmentally sound pesticide practices. (10-600C)
- b. Impact/Accomplishment. A pesticide safety education course for new and immigrant farmers with limited English proficiency was developed. Master holders of land leases assisted in recruiting farmers. Twelve hours of training was conducted in the farmer’s fields using a bilingual trainer and/or a translator. The program emphasized the importance of understanding the principles of integrated pest management, pest identification, selection of pest management options, pesticide safety, (mixing, loading, application, storage, and disposal), use of personal protective equipment, pesticide calculations, equipment calibration and maintenance, and recognition and management of pesticide poisoning. Forty farmers were targeted for the first classes; 88 signed up. Forty-four growers have completed training. Basic training materials (very graphical) have been translated into Lao and Tagalog. Training evaluations (conducted orally) indicate that all participants have adopted several pesticide safety practices, e.g., use of safety equipment, proper storage and disposal.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c) and Grants.
- d. Scope of Impact. State Specific.

Key Theme – Sustainable Agriculture

- a. Description of activity. Conduct ginger wilt management trials to develop alternatives to methyl bromide. Transfer best management cultural practices for taro. Conduct and coordinate on-farm and experiment station demonstration plots. Provide leadership and technical support in the transfer of vegetable and herb information to industry groups and growers on the Big Island. (20-026)

- b. Impact/Accomplishment. An evaluation of four cover crops grown for 2 months prior to planting ginger were compared to methyl bromide and a fallow treatment. The highest total yield was harvested from the methyl bromide treatment (significant). Based on the average, the methyl bromide and Sunn Hemp treatments had the highest percent grade 1 yield and the lowest nematode damage to the ginger root. Tests with systemic activated response chemicals were tested and found to be ineffective. Telone may be a possible replacement if proper equipment is available and application method developed. Implementing strict on-farm sanitation practices still appears to be the best means of controlling ginger bacterial wilt.

An industry meeting was held to update growers on the status of the project in addition to addressing marketing issues. As a result, a core group of growers cooperatively assisted in submitting a Small Business Proposal for funding a ginger market project next year.

Alternative crops including tea, wasabi, soba, and cabbage varieties are being investigated in field plots. A salad dressing and a Japanese cabbage dish are now part of the Kamuela Grown promotional package.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

GOAL 5: ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

Overview:

Activity in Goal 5 is summarized below.

Book and book chapters: 6
Edited volumes: 2
Edited journal: 1
Refereed articles: 27
Published articles: 24
Reviewed publications: 7
Conference presentations: 47
Conference paper/proceedings: 2
Workshops: 18
Abstracts: 7
Research and extension reports: 2
Miscellaneous: 5

Aloha attire—muumuu, shirts, and other garments—is a part of Hawaii’s history and culture and ethnic mix. The Apparel Product Design and Merchandising program trains students in the cultural history of clothing and provides to public museums exhibitions that draw media coverage. The media exposure has brought \$125,000 worth of additions to the college’s unique Asian historic costume collection.

One of the college's chief contributions to the children, youth, and families at risk programs is its data collection of indicators of family well-being. The indicators are being reviewed and refined to better serve the state's social decision makers as they devise effective policies for the welfare of children, families, and youth.

There has been considerable activity in youth development and 4-H. An Impact Assessment Study effectively measured the benefit of 4-H programs for the participants. Follow up with staff showed that they have begun writing plans of work with impact statements. The Mini-Society program was presented to more than 330 youth on all islands; a workbook called Keiki Kuleana was developed. The Hawaii Island 4-H livestock program increased its exposure to the public nearly five-fold by being incorporated into the annual Mealani Forage Field Day and Taste of the Hawaiian Range food show. The behavior of troubled youth was improved by involvement in the 4-H livestock program. A special program to introduce kindergartners to school is rated by 95 percent of participants as being useful to the family; respondents would recommend the program to others. Attendance at a state 4-H teen conference was rated by youth as the highlight of their 4-H career. In furtherance of 4-H goals to build leaders, ninety youth participated on a regular basis for a year in an ongoing workshop to develop their leadership ability; 12 learned more advanced leadership skills.

Followup surveys of a Learning to Lead Collaboratively workshop show that more than 55 percent of participants became involved in community projects. Ninety-seven percent agreed with the statement, "The skills and tools have enabled me to become a more effective participant of a group." Ninety-seven percent also said they would recommend the workshop to others.

Eighty percent of 630 participants in financial education and counseling made at least one improved personal financial decision or took an action with respect to personal finances. The total impact of the family resource management program is estimated to have provided approximately \$193,000 in benefits to participants.

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)
2001	70,856	294,088	309,161	674,105	2.7

Fiscal Year	Extension Smith-Lever Funds (\$)	Extension State Funds (\$)	Extension Other Funds (\$)	Extension Total Funds (\$)	Extension Faculty Years (FY)
2001	129,728	753,357	0	883,085	14.9

Key Theme – Other (Fiber-Related Products and Businesses for Protection, Social, and Economic Enhancement)

- a. **Description of activity.** The focus of this activity is to study the history of Hawaii's garment industry. Specifically, the activity analyzes the material culture, including clothing, of immigrants and look at how ethnicity shows up in the designs. (367H)
- b. **Impact/Accomplishment.** The history of aloha attire was published and is readily available to the public at large. The Apparel Product Design and Merchandizing (APDM) program at the University of Hawaii now provides students with training in the cultural history of clothing and provides museum exhibitions for the community. These semi-annual exhibitions are mounted in various locations on campus and in the community. These exhibitions are a collaboration between the Curator of the Ethnic Costume Collection, the APDM program, the College (CTAHR) and the Retail Merchants' Association.

The Aloha Attire book has become widely used by apparel manufacturers in Hawaii. The two largest companies require their sales representatives to read the book. Costume exhibits bring information to the public as well. In the last year

alone, three exhibits drew 15,328 local, national and international visitors. These exhibits draw positive media attention with newspaper and TV coverage throughout the entire State. Donations of historic garments valued at \$125,000 came into the collection in large part as a result of the media exposure.

- c. Source of Federal Fund. Hatch and Grants.
- d. Scope of Impact. State Specific.

Key Theme – Children, Youth and Families at Risk

- a. Description of activity. The focus of this activity is to review and refine the initial set of indicators developed by the Hawaii family policy academy that are used to assess the well-being of Hawaii's families. Collection and analysis of data from both the new and existing sources will be monitored over time. Comparison of the well-being of families residing in Oahu, Hawaii, Maui, and Kauai counties will be conducted.

Updated data was collected on the selected indicators, reviewing the family science literature and other similar social indicator projects, and expanding the number of indicators to capture additional dimensions of family well-being. Updated departmental and archival data were collected at the national, state, and county levels for a core set of indicators, with 1999 and 2000 as the most current year available for the majority of the indicators. A follow-up survey was conducted on a representative sample of Hawaii's families. The survey captured data relating to the quality of family relationships and how families view themselves, their support systems, and their communities. It was expanded to include an additional 15 indicators of family-well being, an index of "strong families," and a large enough sample size for county and ethnic comparisons. (380H)

- b. Impact/Accomplishment. Foundational data from the project has been provided for the web-based Data Center on Children and Families. The data collected is important to gauge the well-being of families in Hawaii and effectiveness of policies.
- c. Source of Federal Fund. Hatch.
- d. Scope of Impact. Integrated Research and Extension.

Key Theme – Youth Development/4-H

- a. Description of activity. Measure the effectiveness of training CES staff and volunteers to use outcome measures. Apply outcomes measurements developed at the state and national levels. Establish a baseline measure of current 4-H program and outcomes and generate defensible data that can be shared with decision-makers at the local, state and national levels. Build an infrastructure that will make impact assessment an ongoing, continuous part of 4-H youth development. (06-354)
- b. Impact/Accomplishment. The Impact Assessment Study was effective in measuring outcome of the to Hawaii 4-H program in terms of the benefits derived by 4-H youth (e.g., leadership roles in their school and community; development of useful and practical skills that will help them develop into capable, competent and contributing adults; record keeping skills; public speaking; etc.).

Follow up on staff that participated in outcomes measurement training revealed that staff are now writing their plans of work with impact statements.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Incorporate Mini-Society on Maui, Molokai, Lanai and Oahu into existing 4-H programs. Extend Mini-Society curriculum to other communities after refinement for cultural appropriateness. (06-361)
- b. Impact/Accomplishment. 266 youth (103 males and 163 females) on Molokai, Lanai and Maui in eleven 4-H units each received 24 hours of entrepreneurship concepts. Kauai and Hilo repeated the training for 40 youth and Maui did a third class for 25 youth. Several Oahu youths were also trained.

A workbook called Keiki Kuleana was developed. (*keiki* : youth; *kuleana*: responsibility).

Students experienced the "real world" in the context of entrepreneurship; learned entrepreneurship uses for subjects such as language arts, math, science and social studies; discovered the importance of cooperation; built creativity and logic; learned about setting and achieving goals; enhanced their sense of empowerment and self sufficiency and had fun.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Provide subject matter support to 4-H leaders and youth livestock programs. Provide 4-H members the opportunity to develop their leadership skills by planning and implementing workshop activities as well as participating in county and state shows. (20-318)

- b. Impact/Accomplishment. The Hawaii Island 4-H Livestock program increased in size, with 26 projects completed in the year. Hawaii county 4-H annual Livestock Roundup and Sale was incorporated into the Mealani Forage Field Day and "A Taste of the Hawaiian Range" Food Show events. By combining the activity, the 4-H program increased its exposure to the public nearly five-fold, assisting the program in recruitment and educational efforts.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Provide technical support to 4-H and FFA youth livestock programs. Inform youth about the roles of science and agriculture and the opportunities available to them. (14-206)
- b. Impact/Accomplishment. Veterinarians were recruited and trained to work with 4-H youth creating a valuable new relationship. Workshops on livestock judging helped youth in livestock evaluation and understanding Estimated Progeny Differences. The winning team went on to win the Northern International Livestock Expo in Montana. The most important impacts were on youth behavior. Troubled youth demonstrated hard work and responsibility in completing their projects. Others credited the 4-H program with helping them avoid drugs and trouble, or running away from home.

Educational displays for the general public were developed for the State Farm Fair, the Kona Fair, and the Ultimate Farmers Market. A Girls Engaged in Science and Math Workshop (For the Love of Animals) was held for grade 5 and 6 girls.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Implement collaborative youth development (non-formal) education programs with other organizations that serve youth. Share curriculum as well as provide youth development training to youth workers. Strengthen the role of identifying, conducting and utilizing applied youth development research. (22-021)
- b. Impact/Accomplishment. Fifteen 4-H clubs involving 160 youth were organized at Army installations. Forty of the youth completed their record books. A club leader manual was compiled for Army staff. Implemented statewide marketing campaign in April to include development of a logo and other marketing tools (e.g., volunteer recruitment brochure, exhibit, banners and marketing manual). Marketing teams from each county were recruited and members participated in a one-day training session. Mini-grant opportunities were offered to county teams to obtain funding to recruit and train volunteers.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Provide kindergartners and their parents an opportunity to feel comfortable in a “new” school environment. Provide parents with knowledge on the development of their child. (20-040)
- b. Impact/Accomplishment. Kindergarten-age youth and their parents attended orientation programs designed to prepare the parents and children for a successful school year. Eight programs in seven schools were presented, utilizing 37 teen

and adult volunteers who contributed over 336 volunteer hours. Evaluation instruments were completed by 80% of participants. Over 95% responded that the programs were useful to the family, provided community/school information that families could use to assist their children, and that they would recommend the program for others.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. Provide youth with experiences to develop self-knowledge, explore different educational and career options. Provide youth with experiences to develop skills for life. Provide youth with opportunities to understand basic organizational concepts and incorporate degrees of management into the community. (22-023)
- b. Impact/Accomplishment. A new 4-H club was created to develop web pages. The computer specialist was unable to participate and had to be replaced by a teacher at the school. Opportunities to work with the business community also fizzled. However, the students were not discouraged and managed to participate in a school web page competition. The students won first place!

Twenty-two teens and several adults attended the State 4-H Teen Conference. The conference provided the teens leadership opportunities, community service projects and team building. The Ropes Course taught to teens how to build trust and work as a team. It challenged them to overcome obstacles with determination. Overall the teens thought the conference was the highlight of their 4-H career.

- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Youth Development/4-H

- a. Description of activity. 4-H club members will participate in workshop and training sessions to gain knowledge in subject matter, develop leadership ability, and engage in program expansion and delivery. Youth, families and other members of the community will gain new knowledge and become involved in youth related activities. (23-053)

- b. Impact/Accomplishment. Ninety youth participated on a regular basis for a year to develop their leadership ability. Twelve older and more mature youth completed at least two leadership training session to serve as junior leaders who work as mentors for younger youth. They learned and practiced teamwork, officer duties, parliamentary procedures, organizational skills. Forty-two 4-H members participated in public demonstrations to develop their public speaking skills. The Kindergarten Transition Program was conducted in partnership with four schools, and helped approximately 200 incoming kindergartners and 275 parents to ease the transition to school. To address healthy eating for better learning, a three part nutrition newsletter was distributed to 600 families form grades K-5.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Family Resource Management

- a. Description of activity. Increase capacity of communities, families and individuals to improve their own quality of life. Provide advisory and programmatic support to FCE members. Provide 4-H volunteers meaningful opportunities to increase their knowledge and experiences to serve as leaders. (20-071)
- b. Impact/Accomplishment. FCE members have partnered with schools and local businesses to help more than 1,000 children, youth and adults appreciate the joy of reading. FCL graduates used the knowledge and skills they learned from training sessions and applied it to improve functioning of organizations, committees, task forces and other community groups they are affiliated with. Twenty 4-Hers used organizational, leadership and life skills learned from the 4-H program to create and develop a family newsletter, “4-Happiness ...Be Healthy.” Twelve 4-Hers improved their communication skills as teen mentors to 150 youth participants in the 4-H Fun Days. Fifty 4-Hers improved their communication skills by speaking in front of a group and answering questions. Twenty-five percent of the Kona 4-H Federation program participants accepted a new leadership role.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Family Resource Management

- a. Description of activity. Increase accessibility and impact of consumer-oriented, high quality financial information, education and counseling through workshops, seminars, publications and other outreach efforts. (06-358)
- b. Impact/Accomplishment. Six hundred thirty clientele educated or trained in financial education and counseling with at least one decision improved and one action taken in 80% of cases with respect to Long Term Care (LTC) insurance, estate planning, investing and retirement planning, budgeting, financing issues, debt, elder care, or loss of income. Fourteen institutions participated in financial education training. Eight staff members from five institutions were also enabled to pass their AFC accreditation exam in Financial Counseling. Six institutions participated in financial program design, development and delivery. In addition to workshops, counseling, and direct training, one book, 8 articles, two TV broadcasts and seven radio programs were completed. The total impact of the program is estimated to have provided approximately \$193,000 in benefits to participants.
- c. Source of Federal Fund. Smith-Lever 3(b) and (c).
- d. Scope of Impact. State Specific.

Key Theme – Leadership Training and Development

- a. Description of activity. Coordinate the Agriculture Leadership Program (ALP) for Class VIII until its completion in January 2001. Begin the recruitment of Class IX in October 2000. Provide short-term community workshops throughout the State covering different leadership topics. Focus especially on topics that are in high demand (e.g. facilitation training and strategic planning). Provide strategic planning and meeting facilitation upon request. (06-356)

b. Impact/Accomplishment. Eight 2-day workshops on “Learning to Lead Collaboratively” were organized along with two 2-day workshops on Facilitating Strategic Thinking and Planning were completed. A total of 369 people attended the ten workshops. The “Learning to Lead Collaboratively” workshop was evaluated using a mailed questionnaire. Six hundred sixty-eight questionnaires were mailed to individuals who had completed the workshops within the past two years. One hundred sixty-six (25.38%) were returned. Agreement with statements on the questionnaire (see below) supports the conclusion that these workshops have a significant impact on participants. And because half of the respondents said they became actively involved in one or more community projects after completing the workshop, this impact extends beyond the individual to their communities. In order for citizens to become involved in their communities they must have confidence about their ability to work collaboratively with others. This workshop provides them with some of the skills to enhance their confidence.

“I became actively involved in one or more community projects after completing this workshop.”*	55.4%
“I continued to be actively involved in one or more community projects after completing the workshop.”	79.9%
“I am using the skills and tools learned in this workshop.”	95.2%
“The skills and tools have enabled me to be more successful in my efforts to work collaboratively with others.”	95.8%
“The skills and tools have enabled me to become a more effective participant of a group.”	97%
“The skills and tools have enabled me to become a more effective facilitator of a group.”	93.4%
“The skills and tools have enabled me to become a more effective ‘leader’ of a group.”	91.6%
“I would recommend this two-day workshop to others.” **	97%
“I would be interested in taking an advanced facilitation workshop.”	74.7%
“I would be interested in taking the ‘Facilitating Strategic Thinking and Planning’ workshop.”	63.8%
*The trend (for the years with a significant number of respondents) indicates that their involvement increases as they have more experience using the tools they learned (i.e. 72% in 1996, 60.9% in 1998, 57.89% in 1999 and 43.1% in 2000).	
**74.1% of the total number of respondents strongly agreed with this statement.	

c. Source of Federal Fund. Smith-Lever 3(b) and (c)..

d. Scope of Impact. State Specific.

STAKEHOLDER INPUT PROCESS

The College of Tropical Agriculture and Human Resources undertakes a wide range of activities to seek stakeholder input and encourage stakeholder participation.

At the Dean's level, he has a Board of Advisors that provides him with advice to ensure that the State is well served by the College. The purpose of the Board of Advisors is to guide the strategic directions of the College. This guidance involves providing general advice on the education, research and Extension programs, the administrative and fiscal functions, and the student services and promotional operations of the College. The Board also serves to ensure that the College leadership understands the current and future higher education needs of the College's stakeholders. The Dean serves as members or ex officio committee members for or regularly meet with the following organizations to solicit input. The organizations below have an opportunity to provide input to the College via the Dean:

Agricultural Leadership Foundation of Hawai'i Board, 2000-present.
Agricultural Coalition, 2001-present.
Commodity Advisory Group, 2000-present.
Engineering and Technology Accreditation Committee (P-204), 1988-present; Secretary, 1991; Vice-Chair, 1992; Chair, 1993; Past Chair, 1994.
Hawai'i Farm Bureau Federation, 2001-present.
Hawai'i 4-H Foundation Board, 2000-present.
Japan-America Society of Hawai'i Board of Trustees, 2001-present.
Kamehameha CEO Board of Advisors, 2002-present.
University of Hawaii Mānoa Budget Advisory Committee, 2001-present.
National Agricultural Biotechnology Council, 2000-present.
National Association of State Universities and Land-Grant Colleges, 2000-present.
State of Hawai'i Board of Agriculture, 2000-present.
University Connections Advisory Board, 2000-present.
Western Association of Agricultural Experiment Station Directors, 2000-present.
Western Interstate Commission for Higher Education, Veterinary Medicine Advisory Council, 2001-present.
Western Regional College Board Council, 1999-present

At the College level, a public opinion survey was conducted using a focus group and a telephone survey to gauge stakeholders' opinions and priority. The respondents were randomly selected from the major islands of Hawaii. The sample respondents were representative of the general population of Hawaii. Through this public opinion survey, the College can better understand stakeholders' concerns in the areas pertinent to the mission of the College and faculty can then apply the results in the prioritizing of research and extension activities. The report has been posted on the College website. The results have been presented to the College Advisory Board and will be presented to the College at large at the upcoming all College conference. The findings will be incorporated into Hatch and Smith-Lever request for proposals (RFP) as one of the criteria for funding projects.

The various departments and units in CTAHR are also actively seeking stakeholder input and participation. Selected faculty members and researchers serve as representatives on commodities association boards and research committees. They also meet with industry and commodity leaders and representatives to solicit inputs on a regular basis. The prioritized areas arrived at from those meetings are incorporated into CTAHR requests for proposals in programs for Hatch, Smith-Lever, Hawaii Department of Agriculture and other commodity specific grants programs.

The external and advisory councils advisory boards that the faculty interact with include:

Oahu Banana Growers Association
Kauai Cattlemen's Association
East Kauai Water Users Cooperative
Hawai'i Cattlemen's Association
Hawai'i Association of Conservation Districts
Hawai'i State Livestock Residual Management Education Advisory Committee
State and County Farm Bureau
Local Water Conservation Districts
Maui Onion Growers Association
Hawai'i Tropical Flower Council
Hawai'i 4-H Foundation
Hamakua FCE
Hilo FCE
Kona FCE
Hawai'i Coffee Growers Association
Hawai'i Coffee Association
Hawai'i 'Awa Council
Landscape Industry Council of Hawaii
Hawai'i Food Manufacturers Association
Kauai Anthurium Association
Kauai Bonsai Club
Garden Island Orchid Association
Hawai'i Tropical Foliage and Flowers Association
Dendrobium Orchid Growers Association

The College will continue to solicit input from stakeholders to prioritize research, extension, and instruction related projects. Stakeholder input from the public, leaders of commodity groups and associations, and faculty will be used on a regular basis to determine research and extension topics and set program priorities and funding.

PROGRAM REVIEW PROCESS

There are no significant changes in the gProgram Review Process h that is being used in Hawaii.

EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES

Existing multi and joint programs were continued in FY 2001. These programs include: (1) continuing research and extension integrated projects that are listed in the POW; (2) the Hatch Multistate Regional Projects that are listed in the POW; (3) ten new integrated projects with external peer reviews were approved last year; (4) received an IFAFS grant on nutrition; (5) submitted nine IFAFS grants; (6) the Agricultural Development in the American Pacific (ADAP) project that involves American Samoa Community College, The University of Guam, The College of Micronesia, Northern Marianas Community College and The University of Hawaii; and (7) the Tropical and Subtropical Agriculture Research program that involves University of Hawaii, University of Guam, University of Florida, University of Puerto Rico, and University of the Virgin Islands.

Examples of Extension work with multi and joint activities for 2001 are:

1. Measuring Success: Measuring effectiveness of FCE and 4-H Programs. (06-355) Data collection and analysis of 4-H data with the National Assessment Project conducted in collaboration with the University of Arizona.
2. Supporting Pesticide Registrations for Use in Hawaii's Crops. (16-920) Pesticide residue samples were collected from taro, papaya and ginger field plots. Samples were sent to the University of Florida and Cornell University Leader Labs for analyses as part of a national program to register pesticide products for minor uses. Conversely, the University of Hawaii provides residue analyses for other Land Grant programs as well as providing Quality Assurance for field and laboratory studies.
3. Diabetes Awareness, Education and Screening Project. (20-072) This is a collaborative project with the Joslin Diabetes Center (Boston) and Washington State University. The project focuses on the need for diabetes awareness, screening and follow-up education for learning how to manage diabetes.
4. East Hawaii Livestock Producers Education and Assistance Program. (20-048) One component of this project is to develop a "Do It Yourself Nutrient Management Plan" to help livestock producers develop plans based on record keeping. This is a joint effort with Colorado State University.

Examples of Projects for Under Represented and At Risk Populations.

1. Livestock, Pasture, and Forage Improvement on the Island of Molokai. (21-061) Funding for this project was used to leverage additional resources to stimulate agricultural enterprises for Native Hawaiians. These included funding for a new slaughterhouse, a community kitchen, and a vocational center with teleconferencing capabilities.
2. Hawaiian Home Educational Program. (22-094) The objective of this program is to increase the skills of Hawaiian Home Land farmers in agriculture production, farm management, and leadership. A recently produced video, Malama O Ka Aina, explains the types of assistance available to homesteaders.

3. Family Financial Wellness Mobilization Project. (06-358) Among other objectives this project provides information and counseling for financially stressed individuals and staff training for the financial institutions that service their needs. The importance of this project has increased since the events of 11 September.
4. Livestock, Pasture and Range Production Improvement. (21-060) The target audience of this project is the livestock producers including the residents of Maui Farm, Inc., a certified foster home for neglected and abused children. Four 4-Hers from the Farm, completed projects in the market barrow program. They went on to win trophies in record book, production efficiency, showmanship and herdsmanship. The impact of succeeding in this program and the concomitant increase in self esteem and pride cannot be overstated for these 4-Hers.
5. Child Care and After School Arrangements for Low-Income Families. (06-360) This project focuses on developing a research-based report for state policy makers and human service professions that assess the child care needs of low-income families. This is a collaborative project with the Hawaii Institute for Policy Analysis. When completed this report is expected to lead to changes in state policy concerning support for a variety of child care services.
6. Developing Competent Kids Utilizing Agricultural-Environmental Science Programs. (22-026) This program uses agricultural and environmental science programs to awaken a child's inquisitiveness, motivate them to want to learn more and/or teach others, and to entice youth to gain knowledge in order to plan, implement and evaluate a learning experience. The targeted population is from a low-income, culturally diverse neighborhood.

MULTISTATE EXTENSION ACTIVITIES

Form CSREES-REPT (2/00), Page 51.

INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

Form CSREES-REPT (2/00), Pages 52 to 68.

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 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)

College of Tropical Agriculture and Human Resources
Hawaii

X	Multistate Extension Activities
	Integrated Activities (Hatch Act Funds)
	Integrated Activities (Smith-Lever Act Funds)

Planned Program/Activity	Actual Expenditures FY 2000	Actual Expenditures FY 2001	Estimated Cost FY 2002	Estimated Cost FY 2003	E
DOES NOT HAVE MULTISTATE EXTENSION ACTIVITIES. THERE ARE NO EXPENDITURES. A PRE-WAIVER WAS OBTAINED.					
TOTAL					

Director		Date
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	College of Tropical Agriculture and Human Resources
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	Hawaii
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		Multistate Extension Activities
	X	Integrated Activities (Hatch Act Funds) [Page 1 of 2]
		Integrated Activities (Smith-Lever Act Funds)

Planned Program/Activity		Actual Expenditures FY 2000	Actual Expenditures FY 2001	Estimated Cost FY 2002	Estimated Cost FY 2003	
Relationship Between Oxidation-Reduction Potential of Flooded Soil and Taro Yield		250	5,344	5,344	5,344	
Effective and Labor-Efficient Management of Weeds in Pastures and Native Forests of Hawaii		6,747	15,736	15,736	15,736	
Designing & Implementing Improved Nutrient Management Decision-Making for Natural Resource Management		4,800	0	0	0	
Factors Influencing the Intake of Calcium-Rich Foods Among Adolescents (W191)			54,347	54,347	54,347	
Measuring Success		5,048	0	0	0	
Family Businesses in Economically Vulnerable Communities			25,206	25,206	25,206	
The State of Hawai'i's Families		335	20,018	20,018	20,018	
Animal Manure and Waste Utilization, Treatment, and Disinfection Avoidance for A Sustainable Agriculture		13,929	14,764	14,764	14,764	
Irrigation Technologies for Protection of Natural Resources and Optimum Production		18,879	0	0	0	
Hawaii Pesticide Impact Assessment Program		0	0	0	0	

National Agricultural Program to Clear Pest Control for Minor Crops	393	0	0	0	
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 (Attach Brief Summaries)

	College of Tropical Agriculture and Human Resources
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	Hawaii
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		Multistate Extension Activities
	X	Integrated Activities (Hatch Act Funds) [Page 2 of 2]
		Integrated Activities (Smith-Lever Act Funds)

Planned Program/Activity		Actual Expenditures FY 2000	Actual Expenditures FY 2001	Estimated Cost FY 2002	Estimated Cost FY 2003	
Acquisition of Pesticide Residue Data on Specialty (MINOR) Crops to Support Registration Requirement		1,200	2,700	2,700	2,700	
Biology and Control of Fungal Diseases of the Tropics		18,169	28,290	28,290	28,290	
Control of Papaya Diseases		40,538	43,589	43,589	43,589	
Disease Management Strategies for Vegetable Crops in the Tropics		30,110	32,104	32,104	32,104	
Optimizing Evaluation for Container Production in Hawaii		2,858	0	0	0	
Development of New Material for Amending Metal Toxicities in Acid Soils			15,626	15,626	15,626	
Developing Weed Control Components for Best Management Practices in Hawaii		26,419	36,475	36,475	36,475	
Flower and Nursery Crops: Pest Management & Quarantine Treatments		15,722	30,953	30,953	30,953	
TOTAL		185,397	325,152	325,152	325,152	

Director		Date
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Pre-Waiver was requested. The Target amount is \$221,000. The Reduced Target amount was \$144,591. However, since expenditures exceeded the Target of \$221,000, the Pre-Waiver is not needed.

REES-REPT (2/00)

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College of Tropical Agriculture and Human Resources
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		Multistate Extension Activities
		Integrated Activities (Hatch Act Funds)
	X	Integrated Activities (Smith-Lever Act Funds) [Page 1 of 2]

Planned Program/Activity	Actual Expenditures FY 2000	Actual Expenditures FY 2001	Estimated Cost FY 2002	Estimated Cost FY 2003	F
TAHR Video Production Facility	38,919	0	0	0	
One State of Hawaii's Families	7,056	17,043	17,043	17,043	
Measuring Success: Measuring Effectiveness of FCE and 4-H Programs	2,975	0	0	0	
Pesticide Impact Assessment Program		0	0	0	
Supporting Pesticide Registration for Use in Hawaii's Crops	12,740	0	0	0	
Evaluation of Animal Waste Management Alternatives for the State of Hawaii		0	0	0	
Improved Irrigation System and Scheduling in Hawaii		0	0	0	
Weed Control Workshop: Noxious Alien Plants	100	0	0	0	
Cooperative Vegetation Management Case Studies in Pastures and Forests	3,100	0	0	0	
Hot Water Treatment for Cut Flowers and Propagative Materials	250	0	0	0	
Educational Programs to Transfer Pest Management Technology To The Cut Flower Industry		0	0	0	
Supporting Pesticide Registration for Use in Hawaii's Crops		49,690	49,690	49,690	

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 (Attach Brief Summaries)

College of Tropical Agriculture and Human Resources
Hawaii

		Multistate Extension Activities
		Integrated Activities (Hatch Act Funds)
	X	Integrated Activities (Smith-Lever Act Funds) [Page 2 of 2]

Planned Program/Activity	Actual Expenditures FY 2000	Actual Expenditures FY 2001	Estimated Cost FY 2002	Estimated Cost FY 2003	F
Technology Transfer to Support Sustainable Farming Systems in Hawaii	671	6,388	6,388	6,388	
Development and Expansion of the Floriculture Industry in Hawaii	12,941	58,360	58,360	58,360	
Fungal Disease Control and Educational Program in Hawaii	237	0	0	0	
Feed Management in Hawaii Pastures	6,000	0	0	0	
Improved Cultural Management of Ornamental, Nursery, Landscape and Turf Commodities	4,500	18,800	18,800	18,800	
The Relationship Between Oxidation-Reduction Potential of Flooded Soil and Taro Yield	250	11,799	11,799	11,799	
TOTAL	89,489	162,080	162,080	162,080	

Director	Date
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Pre-Waiver was requested from the Target amount of \$85,000. However, since the actual expenditures exceeded the Target amount, the Pre-Waiver is not needed.

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		Multistate Extension Activities
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The Relationship Between Oxidation-Reduction Potential of Flooded Soil and Taro Yield (Goal 1).

Accomplishments: The team hypothesized that redox potential could account for poor taro growth. To confirm this hypothesis, a field experiment was begun on July 4, 2001, with the cooperation of HPC, Inc., in Haleiwa, Oahu. Treatments were devised to confirm that redox potential is the reason for reduced taro growth and to figure out how to get nitrogen to the plants. One treatment added calcium peroxide to the soil and nitrogen fertilizer urea to the paddy. Calcium peroxide essentially oxygenates the water and may keep the redox potential high, preventing denitrification. The second treatment was a slow-release nitrogen fertilizer. Making nitrogen available a little at a time may allow plants to take up some nitrogen before it is lost. The third treatment was a control that used the same nitrogen fertilizer as the farmer. Each treatment was applied at a high and low level to find an adequate level for plant consumption. In each treatment, the nitrogen concentration in soil water at 1 and 3 feet below the soil surface was monitored, and soil nutrients and plant dry weights were measured. Preliminary results from the first month showed that the treatments did not affect plant growth. The dry weight of taro plants at two months after planting ranged from 1.5 to 2.5 g/plant, but these differences cannot be confidently attributed to the treatments and may have occurred by chance. The nitrogen concentration in soil water measured at the two depths was highly variable. The variability in the soil water nitrogen may be contributing to differences in plant weight. If the hypothesis is confirmed, taro paddies with low redox potential can be better managed. Better management could result in greater yield, less cost for fertilizer, and reduced emission of the greenhouse gas NO. A Taro Industry Update Seminar was held in Honolulu in 2001, which was attended by 70 participants. The participants viewed the field experiment and learned how oxygen is related to redox reactions in flooded areas that affect the nitrogen they apply as fertilizer to the taro crop.

Effective and Labor-Efficient Management of Weeds in Pastures and Native Forests of Hawaii (Goal 1).

Accomplishments: Trials to control fireweed (*Senecio madagascariensis*) were conducted on Maui and Hawaii islands. Fireweed was controlled by triclopyr and dicamba. It was sensitive to 2 kg/ha of 2,4-D and MCPA. Clopyralid at 0.25 kg/ha was very effective but very expensive. Basal bark applications of triclopyr in water and in oil carriers on *Ardesia elliptica* were only moderately effective and poor on *Myrica fastigiatum*. *Myrica fastigiatum* proved susceptible to very-low volume basal bark applications of triclopyr in oil. *Emex spinosus* was susceptible to

applied by the very-low-volume drizzle. Maui cattlemen received a grant from the state to begin a fireweed control program
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Designing and Implementing Improved Nutrient Management Decision-Making for Natural Resource Management (Goal 1).
Accomplishments: This project provides support for the ADSC (Agricultural Diagnostic and Service Center) FACS sample receipt, and reporting system. This project also hosts the soils and plant analysis databases through the local area network within Sheraton. Several activities are underway that are anticipated to provide further improved service and access to information generated by soils and plant analysis laboratories. This includes web access to results of the ADSC, first by county agents and we expect subsequently by individual clients and growers. Prototype web access to client results is being tested and soon will be ready for county agent and testing from neighbor islands. This access method is expected to provide yet faster turnaround of sample results. The system design is to permit access of sample analytical results within 24 hours of completion of a sample analysis by the soils and plant laboratories. Access to fertilizer recommendations will be developed soon thereafter, permitting client access to recommendations within 24 hours of completion. This is expected to result in better nutrient management decisions by facilitating the use of ADSC information in those areas expected to improve the production and reduce excessive nutrient application that can detract from groundwater quality.

Factors Influencing the Intake of Calcium-Rich Foods Among Adolescents (W191). (Goal 3)

Accomplishments: In this period, the development of the calcium food frequency dietary tool and the motivator/barrier questionnaire is completed. Currently, efforts are made to complete data collection across 11 states of youth ages 11–12 and 16–17 and of Asian and White ethnic backgrounds. These data will allow us to identify age-, gender-, and ethnic-specific motivators and barriers to calcium-rich foods. This information will be used in a behavioral intervention to try to increase bone density in a new study, already funded. Preliminary data. Increasing calcium intake is necessary to avert the current decline in calcium intake among youth in the United States as a necessary substrate to build bone. If calcium intake is not increased, the levels of osteoporosis and fractures found currently among these children age. Currently, there are 1.3 fractures per year at a cost of \$7–10 billion/year.

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Measuring Success (Goal 5).

Accomplishments: We held two training sessions and the PIs went to the state leadership conference in Hilo. A final booklet was developed. Twenty CES staff and volunteers were trained to measure the outcomes of their work in FCE and 4-H. The research participants provided the following impact statements at our final training session in the Spring of 2001 on:
 WAS THE OUTCOME OF OUR 2-1/2 YEAR PROJECT? (1) "I am excited about what I have learned, and now want to do a lot more with 4-H. I now know 4-H impacts our children's lives. (2) "I actually created a program with other 4-H, FCE and CES faculty on leadership development. (3) "I now actually do measurement of outcomes, and even help others!" (4) "I co-designed and tested a baseline survey." (5) "We collaborated with colleagues and clientele." (6) "This improved my career development!" (7) "I want to continue in-service training on measurement, including the formation of a CTAHR Research/Evaluation Team."

Family Businesses in Economically Vulnerable Communities (Goal 5)

Accomplishments: The project has engaged 13 states and identified factors associated with profitability and factors with perceived business success and their interrelationship. Preliminary results show that operating a family business can be profitable and rewarding, but it can also be negatively on family members' time, energy, and financial resources, and family success directly influences business success but this information is crucial to about 28,000 Hawaii households that have family businesses.

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the State of Hawaii's Families (Goal 5).

Accomplishments: Updated data was collected on the selected indicators, reviewing the family science literature and other similar projects, and expanding the number of indicators to capture additional dimensions of family well-being. Updated departmental data were collected at the national, state, and county levels for a core set of indicators, with 1999 and 2000 as the most current year for the majority of the indicators. A follow-up survey was conducted on a representative sample of Hawaii's families. The survey data relating to the quality of family relationships and how families view themselves, their support systems, and their communities to include an additional 15 indicators of family-well being, an index of "strong families," and a large enough sample size for comparisons. Foundational data from the project has been provided for the web-based Data Center on Children and Families. This is important to gauge the well-being of families in Hawaii and effectiveness of policies.

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

Accomplishments: Three major findings for this project have been achieved. They are (1) developed an on-farm swine waste treatment system in Hawaii, (2) integrated an intermittent aerator for an on-farm pig waste treatment, (3) integrated EMMC (entrapped cell) technology for biological removal of carbon and nitrogen from diluted swine waste water. This activity shows that the intermittent aeration unit or EMMC process for the swine waste treatment systems provide reduction of energy consumption cost and possibility of disposal of treated wastewater without causing deterioration of environmental quality. Also, it provides possibility of developing a turn-key package treatment plant or a central swine waste processing plant to be used in land-limited tropical/subtropical areas.

Microirrigation Technologies for Protection of Natural Resources and Optimum Production (Goal 1).

Accomplishments: Terminated.

Hawaii Pesticide Impact Assessment Program (PIAP) (Goal 4).

Accomplishments: Terminated

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National Agricultural Program to Clear Pest Control Agents for Minor Crops (Goal 4).

Accomplishments: The activity retained two diazinon 24C registrations. This is significant because diazinon is the only effective insecticide that controls aphids, the vector of banana bunchy top virus. Roundup is labeled for use to control weeds for stevia growers. This activity reduced the cost of labor for weed control.

Acquisition of Pesticide Residue Data on Specialty (MINOR) Crops to Support Registration Requirement (Goal 4)

Accomplishments: Seventy-five project trials were conducted and obtained residue data for 16 pesticides on 19 crops. These pesticides include: residues of chlorothalonil in persimmon; chlorpyrifos in coffee; clofentezine in persimmon; diazinon in watercress; dimethoate in banana and in currant; ethephon in coffee; fosetyl-Al in blueberry and macadamia; imidacloprid in peach, coffee and plum; mancozeb in coffee; metalaxyl in basil; metalaxyl-Cu in papaya; oxyfluorfen in pejobaye and banana; permethrin in papaya; propiconazole in pineapple; and thiophanate-methyl in artichoke, raspberry, grape, banana, mint, and in coffee. This activity obtained residue data to support registration of 16 pesticides on 19 crops in Hawaii and other states. This activity is essential for Hawaii as all crops are considered minor crops.

Pathology and Control of Fungal Diseases of the Tropics (Goal 1).

Accomplishments: Black spot of papaya caused by *Asperisporium caricae* was identified, the first reporting of this fungus in Hawaii. Several *Phytophthora* species have been isolated from heart rots of maturing taro plants. One of the *Phytophthora* species has been reported so that efforts to control it can be initiated. A fungus isolated from large spots of *Pritchardia* palms is a probable ascomycete. Investigations are continuing. Limited research has been done on the pathology of palms, and this project is developing a database on the pathology of tropical crop.

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Control of Papaya Diseases (Goal 1).

Accomplishments: A video was produced describing symptoms and control of a newly found fungal disease of papaya caused by *Asperisporium caricae*. A field fungicide test was initiated in August 2001 to determine the efficacy of azoxystrobin at 15.4 oz/acre for the top cycle (unregistered) followed by, and a combination spray of mancozeb (2.5 lbs/acre, registered) and copper hydroxide (4 lbs/acre, registered) sprayed on a 2-week interval. The mancozeb and copper hydroxide spray on a 2-week schedule and unsprayed treatments were compared. Additional activity includes the monitoring of papaya ringspot virus (PRSV) project. This project was transferred from the Department of Agriculture as part of the Puna PRSV Quarantine Zone. Early results suggest that currently registered fungicides when applied on a 2-week schedule will control the new black spot disease caused by *Asperisporium caricae*. Registration of other fungicides for control of PRSV is being pursued. The PRSV Quarantine Zone project is expected to allow the growing of non-GMO cultivars of papaya in an isolated zone proximate to GMO orchards, allowing growers to export to Japan and receive prices that are 3 to 5 times more than what is being paid for GMO papaya.

Disease Management Strategies for Vegetable Crops in the Tropics (Goal 1)

Accomplishments: Several genetic crosses have been generated between taro leaf blight-resistant hybrids and susceptible commercial varieties. These are being tested on-farm for commercial potential. Two tomato hybrids with multiple disease resistance were selected from experimental lines. UH Hybrid #5 was selected from on-farm trials as being tomato spotted wilt virus (TSWV)-resistant, high yielding, and producing large, firm, vine-ripened fruits of good quality. Sufficient UH Hybrid #5 seed is being generated to evaluate this hybrid in state and on-farm grower trials. This hybrid may be a possible replacement for production in TSWV-prone areas and should decrease Hawaii's dependence on imported tomatoes.

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Multivar Evaluation for Container Production in Hawaii (Goal 1).

Accomplishments: Terminated.

New Material for Amending Metal Toxicities in Acid Soils

Background/Description: The discovery that calcium sulfate may reduce the phytotoxic effects of manganese in acidic soils has led to the possibility of a new solution to an old problem plaguing pineapple producers in Hawaii. Pineapple plants grown in high-manganese soils show a severe leaf yellowing that resembles an iron starvation symptom, even though the iron concentration in the tissue is high. The symptom seems to appear only in the presence of high manganese in the tissue. In the past, the iron with foliar application of iron has cured the problem. In 1999, CTAHR extension agents and researchers discovered that the poor performance of watermelon crops in acidic soils with high manganese levels can be reversed by amending the soil with calcium sulfate. This observation led to the hypothesis that the sulfate ion may detoxify manganese or that calcium may interfere with the uptake of manganese into the plant. If detoxifying manganese or increasing calcium in the pineapple plant prevents iron deficiency, iron application becomes unnecessary. A team of CTAHR extension agents and scientists and personnel from the University of Hawaii set out to show whether the need for foliar application of iron can be minimized or even eliminated. On September 15, 2000, experimental plots were amended with either calcium sulfate, a combination of calcium sulfate and lime, or basaltic dust.

dust, donated by Ameron Hawaii, is a by-product of crushing rock into gravel and is a cheap source of calcium. The
tation practice served as the control. The amended soil plots will be subdivided so that half will receive iron and the
be sprayed with solution free of iron. At maturity, fruit yield and fruit quality will be measured. The industry is also in
whether the treatments will result in lowering of fruit translucency, a serious problem facing the growers today. This
ble pineapple producers to produce good fruit with significant savings on fertilizer, equipment, and labor costs. This
ic dust would be a win/win situation for both agriculture and the rock-mining industry.

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Developing Weed Control Components for Best Management Practices in Hawaii (Goal 1).

Accomplishments: For orchid seedlings, diuron appeared safe and tolerated the application rates and schedule. For anthuriums, herbicides diuron, isoxaben, and oxyzalin appear to be safe with the application schedule. For edible ginger, clethodim and emergence grassy weed control. In demonstration plots, thiazopyr had safety comparable with oxyfluorfen; sulfentrazone at the high rate for ginger. Orchid and anthurium growers can use the herbicide efficacy work reported to expand production of high-value export crops free of weeds. Pest-free plants are an absolute necessity for plants exported from Hawaii. The data generated on edible ginger will allow the development of a use pattern for oxyfluorfen. The pattern will be used to obtain an approved protocol for a residue study with resulting data on food-use tolerance. A food-use tolerance is required by the EPA of all pesticides labeled for use in the U.S. With oxyfluorfen and diuron, ginger growers can expand production and reduce harvest costs associated with weed removal.

Flower and Nursery Crops: Pest Management and Quarantine Treatments (Goal 1)

Accomplishments: Dursban 50 WP, Duraguard ME, Precision, and acetamiprid were evaluated against pink hibiscus mealybug infesting red ginger flowers. Dursban 50 WP and Duraguard ME were the most effective against mealybugs and ants, although acetamiprid showed some activity 10 DAT. The micro-encapsulated formulation, Duraguard ME, still had reduced levels of mealybugs and ants. Dursban 50 WP, and Duraguard ME were effective against aphids. *Anagyrus kamali*, an encyrtid wasp, and several other parasitoids, Coccinellidae, were the principal biological control agents found. The tremendous reduction in the mealybug population and insects indicates the potential for their use in management strategies. Two biorational insecticides, Merit and Distance, were evaluated against the avocado scale infesting protea leaves. Merit showed significantly increased mortality. Distance began to show significant mortality. Distance, an insect growth regulator, was expected to be a slow-acting product, as insects are not killed rather the reproduction is broken by nondevelopment of nymphs and inability to reproduce. Tolerance of potted 'Puna Gold' Bromeliads to a disinfesting hot-water treatment was evaluated. The 'Puna Gold' plants were very tolerant of all the treatments. No differences in flower blooming or leaf quality were observed. Currently three commercial shippers have adopted hot-water treatment (two other shippers are in the process of installing the

benefiting from reduced rejections and pesticide use; their workers benefit from reduced exposure to toxic insecticidal dips. Another benefit of the system is that it allows disinfestation of propagative materials; certain plants respond to hot water with increased root and stem growth.

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CTAHR Video Production Facility (Goal 1).

Accomplishments: Terminated

The State of Hawaii's Families (Goal 5).

Accomplishments: Activities focused on the dissemination of reports on the well-being of Hawaii's families via printed materials, web databases, and professional presentations. Over 700 copies of the "Hawaii Family Touchstones" report were distributed to social scientists, funders, educators, legislators, and national organizations. In a survey of users, mean scores no lower than 6 were received on a scale from 1 (disagree) to 7 (agree), indicating users found the report valuable, interesting, organized, attractive, and easy to read and understand. Updated project indicators and trend data are also presented on two web databases found at the Data Center for Children and Families. The first database presents all project indicators, with data available at the county level in most cases; the second presents a subset of project indicators presented at the community level. The Data Centers the leading child and family data source in Hawaii and State agencies are providing data as requested.

Measuring Success: Measuring Effectiveness of FCE and 4-H Programs (Goal 5).

Accomplishments: Terminated

Pesticide Impact Assessment Program (Goal 4).

Accomplishments: Terminated

Supporting Pesticide Registration for Use in Hawaii's Crops (Goal 4).

Accomplishments: Terminated

Evaluation of Animal Waste Management Alternatives for the State of Hawaii (Goal 4).

Accomplishments: Terminated.

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Improved Irrigation System and Scheduling in Hawaii (Goal 1).

Accomplishments: Terminated

Weed Control Workshop: Noxious Alien Plants (Goal 1).

Accomplishments: Terminated

Cooperative Vegetation Management Case Studies in Pastures and Forests (Goal 1).

Accomplishments: Terminated

Hot Water Treatment for Cut Flowers and Propagative Materials (Goal 1).

Accomplishments: Terminated

Educational Programs to Transfer Pest Management Technology To The Cut Flower (Goal 1).

Accomplishments: Terminated

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Supporting Pesticide Registration for Use in Hawaii’s Crops (Goal 4).

Accomplishments: The following registrations and projects are in various stages of facilitation: A supplemental label for Roundup for control of a bunchy top virus was obtained (not only for Hawaii but also for American Samoa and Guam); Roundup was labeled for use in papaya. Supported an IR-4 proposal to EPA that it include kava in the root crop group classification. This will help facilitate labeled uses of insecticides (e.g., imidacloprid) and fungicides (azoxystrobin). Worked through IR-4 to get EPA to classify the use of hydramethylnon as a bait in bait stations as a nonfood use for in-field use, and worked toward obtaining a product label for the use. Worked with the banana industry on methidathion-impregnated bags for the banana industry. The residue laboratory (IR-4 Satellite Laboratory) submitted three completed residue analyses to EPA: imidacloprid in coffee, propiconazole in pineapple, and spinosad in mint. Two project reports were completed and are being reviewed by our quality assurance officer, spinosad in nectarine and spinosad in coffee, and 6 other residue analysis projects are ongoing. Roundup is now registered in Hawaii with significant potential, now has one important pesticide registered, glyphosate (Roundup), for general weed control. Growers of this new crop are now able to reduce mechanical and manual weed control costs. Papaya growers have been educated on effective methods to control mites and powdery mildew. This will help considerably until new registrations for powdery mildew and mite control are available. Sulfur can be effectively used in rotation to prevent pesticide resistance.

Technology Transfer to Support Sustainable Farming Systems in Hawaii (Goal 4).

Accomplishments: Field days and slide presentations were used to: demonstrate the use of living mulches for native grass establishment and rotational cover crops; the design of a comprehensive approach to forest weed management; and the use of chemical alternatives to control purple nutsedge in commercial landscapes. Activities and presentations help agriculture and landscape professionals understand the efficiency of herbicides thus reducing total usage while improving efficiency.

Development and Expansion of the Floriculture Industry in Hawaii (Goal 1).

Accomplishments: There is no progress to report at this time.

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Fungal Disease Control and Educational Program in Hawaii (Goal 1).

Accomplishments: The relationship between soil fertility, yield and disease control in taro was examined. Different sources of potassium resulted in differing results, thus the tests were tentative and will be repeated. Similar experiments with Potassium were flooded out. The effect of potassium was tested. EM (Effective Microorganisms) was tested for its effect on plant pathogens responsible for foliar blight, pocket rot and soft rot. Phosphorous acid (PA), shown to be effective in reducing other diseases, was also tested. After one year, neither EM nor PA alone reduced disease. At six months there was slightly less disease in the plot treated with EM and POA, but not at 13 months. In general, pocket rots were reduced and did not vary between treatments. Tests must be repeated.

Weed Management in Hawaii Pastures (Goal 1).

Accomplishments: Terminated

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

Accomplishments: County extension agents in their role as advisors to the Kauai Anthurium Association, Kauai Bonsai Club, Orchid Association, MOA Sangetsu (Ikebana), and the Hawaii Tropical Foliage and Flowers Association served as the communication link between government agencies and the college. Efforts focused on increasing national and international access to, and for, organizations to purchase clones. Twenty-six Heliconia hihai and H. caribaea accession clones were released to industry for propagation and sale.

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The Relationship Between Oxidation-Reduction Potential of Flooded Soil and Taro Yield (Goal 1).

Accomplishments: The activity of this project is to show that (1) rhizosphere redox potential and its consequences, i.e., Fe and Mn, are highly correlated to yield in taro paddies and (2) to demonstrate that pre- and post-planting draining is effective in raising redox potential and taro performance. The team hypothesized that redox potential could account for poor taro growth. To confirm this hypothesis, a field experiment was begun on July 4, 2001, with the cooperation of HPC, Inc., in Haleiwa, Oahu. Treatments were devised to confirm that redox potential is the reason for reduced taro growth and to figure out how to get nitrogen to the plants. One treatment added calcium peroxide to the soil and then fertilizer urea to the paddy. Calcium peroxide essentially oxygenates the water and may keep the redox potential high, preventing denitrification and nitrate production. The second treatment was a slow-release nitrogen fertilizer. Making nitrogen available a little at a time may allow plants to take up some nitrogen before it is lost. The third treatment was a control that used the same nitrogen fertilizer as the farmer. Each treatment was applied at a high and low level to find an adequate level for plant consumption. In each treatment, the nitrogen concentration in soil water at 0 and 3 feet below the soil surface was monitored, and soil nutrients and plant dry weights were measured. Preliminary results from the first month showed that the treatments did not affect plant growth. The dry weight of taro plants at two months after planting ranged from 1.5 to 2.5 g per plant, but these differences cannot be confidently attributed to the treatments and may have occurred by chance. The nitrogen concentration in soil water measured at the two depths was highly variable. The variability in the soil water nitrogen may be contributing to differences in plant weight. If the hypothesis is confirmed, taro paddies with low redox potential can be better managed. Better management could result in greater yield, less cost for fertilizer, and reduced emission of the greenhouse gas NO₂. A Taro Industry Update Seminar was held in 2001, which was attended by 70 participants. The participants viewed the field experiment and learned how oxygen is related to redox reactions in flooded areas that affect the nitrogen they apply as fertilizer to the taro crop.