FY 2020 Annual Report of Accomplishments and Results

HAWAII
College of Tropical Agriculture and Human Resources (CTAHR), University of Hawaii at Manoa

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your FY 2020 Plan of Work located in the Institutional Profile. Use this space to provide updates if needed.

1. Executive Summary (Optional)

Update to Executive Summary in the FY2020 Plan of Work: The coronavirus (COVID-19) pandemic and its associated impacts on human health and the economy resulted in necessary modifications in the plan of work. While many research and extension activities were necessarily either delayed or canceled, others were reoriented towards meeting specific needs of the Hawaii population due to the pandemic. Ways that CTAHR has been responding to the needs of the Hawaii population during the pandemic can be found at the following website:
https://cms.ctahr.hawaii.edu/ER/COVID-19

In addition, this report (section V) provides further documentation of at least two activities focused on assisting youth, families, and communities during the pandemic.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your 2020 Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates ONLY
1. The Merit Review Process	No update to FY2020 Plan of Work.
2. The Scientific Peer Review Process	No update to FY2020 Plan of Work.

III. Stakeholder Input

The NIFA reviewer will refer to your 2020 Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates ONLY
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	No update to FY2020 Plan of Work.
2. Methods to identify individuals and groups and brief explanation.	No update to FY2020 Plan of Work.
3. Methods for collecting stakeholder input and brief explanation.	No update to FY2020 Plan of Work.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	Update due to pandemic: College priorities and research and extension programs are in line with expressed stakeholder needs, although stakeholders from all industry groups would like to have increased support from CTAHR for their particular sector. Given the large number of upcoming retirements, past budget and staffing cuts, and the effect of the pandemic and restrictions on hiring, stakeholder requests will be a challenge to meet. Nevertheless, as CTAHR recovers from the pandemic, the University of Hawai'i System President has highlighted the college as representing an essential area that merits greater investment. Prior to the pandemic, priority positions were determined for a five-year hiring plan based on faculty, state, and industry input. Anticipating changes in a post pandemic world, CTAHR has begun a Strategic Positioning process that will inform a new staffing plan to address the future agriculture environment.

IV. Critical Issues Table of Contents

No.	Critical Issues in order of appearance in Table V. Activities and Accomplishments
1.	Protect and Manage Natural Resources and the Environment
2.	Diversified Tropical Agricultural Systems
3.	Biosecurity of Agriculture and Natural Resources
4.	Youth/Family/Community Development and Health
5.	Bioengineering for Agriculture/Natural Resources/Health
6.	
7.	

V. Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). In your outcome or impact statement, please include the following elements (in any order): 1) the issue and its significance (e.g. who cares and why); 2) a brief description of key activities undertaken to achieve the goals and objectives; 3) changes in knowledge, behavior, or condition resulting from the project or program's activities; 4) who benefited and how. Please weave supporting data into the narrative.

No.	Project or Program Title	Outcome/Impact Statement	Critical Issue Name or No.
1.	Rapid ʻŌhiʻa Death (ROD) and the Threat to Hawaiʻi's Most Important Tree	Hawaiʻi's most important native tree, ʻōhiʻa lehua (*Metrosideros polymorpha*), has been dying across large areas of Hawaiʻi Island mainly due to two fungal pathogens (*Ceratocystis lukuohia* and *Ceratocystis huliohia*) that cause a disease collectively known as Rapid ʻŌhiʻa Death (ROD). Working closely with state and federal entities, as well as private landowners, CTAHR researchers and extension specialists have focused on attaining a better understanding of the disease, how it is spread, and how it may be controlled. Presently, a major part of the CTAHR program is	Protect and Manage Natural Resources and the Environment

		facilitating research and extension to help forest landowners and forest managers stop the spread of the disease. In the past year, we have seen increasing evidence that high numbers of feral ungulates (cattle, pigs, goats, and sheep) in the forests correspond to high levels of disease. We hypothesize that the animals are injuring trees allowing the pathogenic fungi that cause Rapid Ohia Death to infect the trees. Our observations suggest that an effective management strategy would be to fence forests and remove feral ungulates. One outcome of the research is that the state forestry agency is applying for increased funding to protect watersheds by fencing off critical forests and protecting them from feral ungulates. We also assisted in writing a five-year strategic plan for managing Rapid Ohia Death, which provides the framework for a comprehensive and effective attack on the disease through: • Management actions - survey, response, and control. • Research on tools for improving detection and forest management. • Research on the pathogens and how they spread. • Development of disease resistance and restoration techniques. • Continual public engagement to build community awareness, support, and behavior change needed to reduce the spread of the disease and to protect and enhance the remaining healthy ʻōhiʻa forests.	
2.	Evolution of Screenhouses in Hawaiʻi Agriculture (Using EcoSystem enhancement to manage a broad spectrum of crop pests for sustainable farming operations)	Hawaiʻi agriculture must enlist technology to increase production levels of various crops and commodities and in turn, increase the profitability for producers. A CTAHR Research and Extension team has been designing and testing screenhouses best adapted for managing insect pests, especially those that develop resistance to common crop protection insecticides. Screenhouses serve as a non-chemical, physical barrier which puts the pest at a disadvantage. Growers can see a 50% reduction in insecticide use for management of small insect pests, such as fruit flies, caterpillar aphids,	Diversified Tropical Agricultural Systems

		whiteflies, and thrips. With the use of screenhouse systems, CTAHR research trials have documented up to a five-fold increase in marketable yields in the production of (non-pollinated) cucumber, kale, and zucchini. And the addition of the "Ecosystem Enhanced Screenhouse" method, which integrates insectary plants that attract beneficial insects inside the screenhouse, can generate even higher crop yields. In some trials, cucumber marketable yields increased seven-fold compared to cucumbers grown outside of the screenhouse. Since 2014, CTAHR has been evaluating different proto-types of screenhouses (DIY vs commercial systems), and has placed roughly 24 screenhouses on a wide range of farming systems in Hawai'i. Applied research findings have been shared statewide and in partnership with external agencies. CTAHR has also collaborated closely with the USDA and NRCS to showcase the advantages of integrating screen with high-tunnel systems for environmental conservation. To date, NRCS has contracted for the installation of 187 commercial high tunnels in Hawai'i through federal cost share programs. The adoption of this technology has increased food production across the state.	
3.	Surveying and Mitigating Red Ginger Decline	Red ginger (*Alpinia purpurata*) production in the state has been decreasing over the past five years. From 2014 to 2018, roughly one-third of the farms that reported income from red ginger no longer report that income, implying that these operations no longer grow red ginger substantially. One of the reasons for this decrease in ginger production could be the difficulty of producing ginger due to a severe disease in ginger stands. Growers in east Oahu began reporting severe dieback in their ginger fields around 2014. Since then, these reports have spread throughout the island. This decline symptom was linked to several viruses in early identification efforts, as well as the possibility ofother pathogens. The incidences of the decline symptoms have increased since 2019. This disease severely	Biosecurity of Agriculture and Natural Resources

		reduces crop vigor and makes the red ginger fields virtually unprofitable. In April 2019, a grant was awarded to the University of Hawai'i at Mānoa with the explicit purpose of identifying and characterizing the causal agents of the pathogen as well as surveying the state for the prevalence of these pathogens and developing mitigation strategies for the decline symptoms. Several collaborators have been working on statewide surveying for viral, fungal, and bacterial pathogens infecting Alpinia and related ginger species in symptomatic fields. Stakeholder education has also been occurring to inform growers of the disease characteristics and management practices to mitigate the issue. Seminars and grower consultations have occurred in order to disseminate this information. Six viruses have been identified in ginger fields that are showing decline symptoms. One virus has never been identified in ginger before. Two new viruses have been identified since April 2019. Viral pathogens have been detected on O'ahu, Kaua'i, and Hawai'i Island. Bacterial pathogens have not been identified in symptomatic plant material. Bacteria have been determined to not be a primary causal agent. Several fungal pathogens have been identified consistently in symptomatic plant material. Four of these fungi have failed Koch's postulates for pathogenicity and are not considered primary causal. Currently, plants are being grown for more pathogenicity testing. A total of 524 industry stakeholders have been educated on the disease identification, characteristics, and management based on the current knowledge at conferences and seminars. Many more of the general public have been informed of this disease during public outreach days, including CTAHR Day, Ag Day at the Capitol, and the Hawai'i Farm Bureau's Hawai'i State Farm Fair.	
4.	The Children's Healthy Living Network	The Children's Healthy Living Program for Remote Underserved Minority Populations in the Pacific Region (CHL) Network is a partnership among	Youth/Family/Community Development and Health

	(An integrated approach to building capacity and addressing community and child health in Hawai'i and the Pacific)	remote Pacific states and other U.S. jurisdictions: Alaska, American Samoa, Commonwealth of the Northern Mariana Islands, Guam, Federated States of Micronesia, Hawai'i, Republic of Palau, Republic of the Marshall Islands, West Virginia, and University of Arizona. The Pacific region has some of the highest rates of chronic disease in the world. Diabetes, heart diseases, strokes, cancer, and other conditions are affecting Pacific peoples at a disproportionate rate compared to other populations. This places a significant burden on individuals and communities in these island countries and territories. Childhood obesity is an important determinant of adult obesity, but child health surveillance systems are absent and training opportunities are limited in the region. The CHL Network is a partnership among Land Grant colleges to build capacity to address health issues through research, training, and extension. Since 2017, the CHL Network partners have actively engaged over monthly working group calls and annual meetings to achieve the following objectives: (1) Adapt and disseminate CHL child obesity policy, systems, and environmentally focused, multilevel prevention training and social marketing materials for the Pacific region, (2) Facilitate use of CHL data and findings related to child obesity and its multilevel (policy, system, and environmental) determinants, (3) Promote partnership and coalition building and strengthening in and among Pacific communities and the region around child health, and (4) Build and sustain a child health and nutrition monitoring system in the Pacific. As a result of the CHL Network: • There is an active national network of leaders seeking to expand monitoring, training, research, extension, and policy efforts in Pacific child health and nutrition. • An additional $2,325,903 in USDA funds has been awarded in the Pacific.	

		• More than 200 individuals have received formal education on Pacific child nutrition and health through the online Children's Healthy Living Program Summer Institute courses. • Standardized protocols for collecting anthropometric measures (weight, height, waist circumference) have been developed and adopted across the network partners. • Data on the nutritional status of individuals and communities in the region has been collected by measuring 1,753 individuals and assessing 548 community environments. • CHL data has yielded 12 peer-reviewed publications and been utilized by 30 students in their pursuit of higher education.	
5.	4-H Junior Master Gardener Program (Growing great kids in times of adversity)	With the COVID-19 pandemic stay-at-home orders, families needed ways to keep their children engaged during the day. Also, schools were looking to supplement their students with a "stay at home" project that was (1) educational, (2) connected to their class studies, and (3) could be completed from the safety of their home. Hawai'i County 4-H started a program in 2012 to grow giant pumpkins. Due to the popularity of this program, it has continued to be held annually. Over the years, the program was diversified to include many other giant fruits and vegetables. Typically, this program would start in June and conclude in September. However, when the COVID-19 pandemic hit and "stay at home" orders began, an effort was made to start the program earlier to give youth "something" to do, supplement school studies, and get our youths outdoors and away from their computers. Prior to plant distribution, a seminar was held to provide growing information and answer questions about growing giant produce. A Facebook Group page was set up so that participants could post their successes and receive assistance when challenges would arise. Monthly "Talk Story" sessions and an annual tour	Youth/Family/Community Development and Health

		(all held virtually) added to even more educational opportunities throughout the 2020 program. In an effort to have more accountability and give plants a good start, families/schools were expected to provide photos showing their garden area was ready to receive plants. This step not only helped ensure project success, but also provided an indication of families needing additional support. Impacts and outcomes included: • Because many youths were at home a greater portion of the day due to the pandemic, they were well-positioned to manage and take better care of their plants, which resulted in more contest entries at the conclusion of the program. In 2019, there were 22 entries for the contest. This year (2020), there were 76 entries — an increase of 245%! And seven state records were produced. • Survey results indicated: (1) 50% of the participants were first-time gardeners, (2) Highly significant positive changes in participant knowledge and ability to grow "Giant" vegetables and plants, and (3) 100% of the responses indicated that families/schools want to see the annual seminar and the monthly 'Talk Story' sessions continue so they can participate again in 2021.	
6.	Grow Eat Think (GET) Local Farm-to-School (Increasing the availability of 'aina-based distance learning)	Continued school closures in response to the COVID-19 pandemic have presented a challenge for educators who provide hands-on, 'aina-based (place-based) education for youth in Hawai'i. In many places, school gardens, cafeterias, and farms are not accessible to teachers and/or students. Therefore, there is a need for farm-to-school opportunities that take advantage of distance and hybrid learning models. Informal and formal needs assessments are integral to seeking community input for developing community-relevant, farm-to-school programming that is responsive to the current pandemic situation and builds a model to meet future needs. To meet the need for distance learning, new professional	Youth/Family/Community Development and Health

		development opportunities, curriculum, and digital content have been created. • A mushroom cultivation curriculum, as an indoor solution for distance learning, was piloted with educators during summer 2020. • To bring farm experiences to children in the absence of field trips, interactive virtual-reality farm fieldtrips are being developed in partnership with four community farms. • New online resources to promote consumption of locally grown foods have been developed and posted on the *CTAHR Grow Eat Think (GET) Local* website and social media. • *School Garden* talk story connects 116 Hawai'i school garden teachers with representation from every island to assess and meet teacher needs. • The *Garden To Cafeteria* (GTC) program teaches students how to grow and harvest food safely to be used in the school cafeteria's salad bars and in scratch-cooking recipes. *Growers Place-based* educational programs are expected to increase the currently low levels of student engagement in distance learning, thereby increasing youth knowledge about agriculture, food systems, and nutrition while fostering a sense of connection to local farms. Forty teachers participated in a *Ready to Fruit: Mushrooms in the Classroom* program, 60% of whom reported they are likely to integrate mushrooms into their program this year, where 100 students statewide are expected to cultivate mushrooms utilizing the curriculum in the second quarter with the guidance of their teacher. In the long-term, the program is expected to increase the students' willingness to consume mushrooms, which could support a stronger mushroom industry as well as add to a nutritious diet for youth in the future.	

7.	Growth Hormone Regulates Intestinal Gene Expression of Nutrient Transporters in Tilapia (*Oreochromis mossambicus*)	Tilapia, one of the main finfish cultured worldwide, exhibit excellent growth in captivity. In vertebrates, including fish, the endocrine system orchestrates the production and release of hormones by integrating sensory information with an array of physiological functions in nearly every organ. Growth is largely regulated by growth hormone (GH), which is secreted by the pituitary gland. Once in circulation, GH can bind to its receptor (GHR) in target tissues, such as muscle, liver and intestine, to initiate physiological responses that include cell proliferation and differentiation, nutrient uptake, and protein synthesis. The intestine is the primary site for the uptake of nutrients required for growth. Proteins that transport oligopeptides, amino acids, sugars, water, and ions facilitate the uptake of nutrients across the intestinal epithelium. Little is known, however, on how GH affects intestinal nutrient uptake. The CTAHR aquaculture laboratory has developed a model for investigating whole-organism effects of GH by employing the Mozambique tilapia (*Oreochromis mossambicus*). In this model, researchers surgically remove the pituitary gland (hypophysectomy; Hx) and replace GH via intraperitoneal injections. With this approach, the CTAHR researchers have shown that GHR expression in muscle, liver, and intestine of Hx fish was dramatically reduced following hypophysectomy; an effect that was recovered by replacement with GH. Next, they demonstrated that GH stimulates the expression of intestinal PEPT1, PEPT2, and GLUT2. These results indicate that GH is a key regulator of peptide and sugar transport in the intestine of tilapia. This study appears also to be the first to report links between GH and specific molecular targets in the intestine of Mozambique tilapia that underlie nutrient absorption. The identification of such GH targets may contribute to the development of strategies for enhancing the growth of domesticated fishes.	Bioengineering for Agriculture/Natural Resources/Health

OPTIONAL **Youth Development Expenditures (dollars)**	
State and/or Institution:	FY 2020 Expenditures ($)
1862 Smith-Lever	
1890 Extension	