

# Federated States of Micronesia (College of Micronesia) Annual Report - FY2021

## Report Status: Approved as of 07/08/2022

### Contributing Organizations

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College of Micronesia

### Executive Summary

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#### Overview

The geographic region served by the College of Micronesia land grant program (COM-LG) covers six sites across three island nations and over 2 million square miles. Four extension counties in the Federated States of Micronesia (FSM) are Yap, Chuuk, Pohnpei, and Kosrae. These counties include 607 islands and atolls, of which 65 are inhabited and spread across an ocean area of more than one million square miles. The Republic of the Marshall Islands (RMI) consists of two north-to-south chains of islands. Altogether it consists of 30 atolls, each of many islets and five coral islands. The Republic of Palau (ROP) consists of a cluster of more than 343 islands in the southwest corner of the region, roughly 500 miles southeast of the Philippines. In 2021, despite challenges induced by the COVID-19 pandemic, extension staff continued providing advisory and extension services as per the approved work plan. In addressing the wide range of issues identified by the stakeholders, our programs emphasized addressing national and local issues and priorities. In 2021, we reassessed our program areas, resulting in the consolidation of topics with regional significance and priorities.

This annual report highlights the 2021 accomplishments of research and extension activities carried out under six critical issues, namely 1) Lack of local food production and food insecurity, 2) Sustainable aquaculture development, 3) Youth and family issues in the communities, 4) Climate change challenges in Micronesia, 5) High incidence of food and waterborne illnesses, and 6) Childhood obesity. The overall goal is to increase knowledge, understanding, abilities, or behavior related to an issue and/or broader changes in economic, environmental, or social conditions that enable Micronesians to lead prosperous, healthy lives. The focus of work conducted across six critical issues is guided by inputs from a diverse range of stakeholders including the small scale, socially disadvantaged, limited resource farmers and underserved island communities, rural families, diverse and vulnerable youth, and individuals and agencies with an interest in our programs.

#### Critical Issue: Childhood Obesity

Childhood obesity continues to be a significant health problem across Micronesia. Modernization, dietary changes, and dependence on imported food products increase obesity. Presently Micronesians are among the top 10 obese countries in the world. Without substantial interventions to prevent or reduce obesity, the number of obese children and adolescents will continue to rise to severe conditions like heart disease, cancer, and stroke later in life. Presently, children and their families have limited knowledge and skills in healthy food choices and lifestyles. The target audience needs to be provided with information and training about nutrition, health, physical education, and healthy indigenous knowledge and practices. Addressing the causes of obesity through appropriate extension interventions and educational programs is central to reducing obesity prevalence. Training programs on parental attitudes and actions focused on children's eating and exercise behaviors and delivering culturally appropriate parental best practices. Extension conducted various activities through active collaboration with local government and non-governmental agencies. School administrators played a significant role in meeting the objectives of this program. Extension staff gave recommendations to increase local foods consumption, including school/home-grown vegetables and fruits, understanding BMI, cooking healthy recipes, the significance of MyPlate, the nutritional food guide, and incorporating other suggestions to reduce the fat and calorie content of meals. In FY 2021, the 'Childhood obesity' program reached 2,645 individuals, including 704 students. The post-program survey revealed that more students bring water to school instead of relying on sweetened drinks. There is an increased use of local foods in students' meals instead of high-sodium ramen noodles and take-outs. The program helped participants be aware of the complex set of factors in their environments that impact their success. The participants developed skills within school and community contexts through training activities and after-school programs.

### **Critical Issue: Climate change challenges in Micronesia**

Islands and atoll nations in the western Pacific are increasingly vulnerable to the acute effects of climatic changes. Many of them are barely a few meters above sea level. Climate change disproportionately affects the marginalized island and atoll communities, undermining sustainable development. Due to their socio-economic conditions and the broader development context, these communities with high levels of vulnerability and inequality are less resilient to diverse climate impacts. The Micronesian region is vulnerable where the communities have the most urgent adaptation needs. Building resilience of traditional agriculture systems is a priority given climate variability and change challenges.

The seed system is an important area for enhancing such resilience as seed security links to island communities' food security and resilient livelihoods in general. Resilient seed systems can absorb shocks and reorganize to maintain seed security with direct links to ensure food security over time. An ongoing research project in Yap County evaluates the potential of open-pollinated seeds to meet small-scale growers' needs for planting material and enhancing resiliency during times of stress. Seeds of open-pollinated crops identified through multilocation field trials are collected and distributed to communities. The extension efforts on climate-smart adaptation practices focused on hands-on training, in-house advice sessions, and technical assistance programs for the displaced and socially disadvantaged island communities. Climate-smart adaptation strategies are attractive to the island communities. Because it maintains or increases their production and food security, increases the soil's fertility and the long-term productivity of the land, and helps them adapt to climate change. The training sessions reinforced the importance of alternative crop production methods to bypass degraded and poor soil conditions and improve staple crop production in degraded lands. In Chuuk County, extension staff conducted 34 educational sessions to strengthen communities' perceptions of disaster preparedness, and coastal protection measures, identify emergency food sources, and reduce environmental pollution through proper solid waste management in households and communities. Skills building and educational sessions for students focused on climate change impacts and ways to mitigate and adapt. In Pohnpei County, program staff trained the communities in intercropping and agroforestry methods involving breadfruit trees, coconut, banana, yam, and taro. In Majuro, programs focused on restoration activities involving native sheltering trees, salt-tolerant plants, and mangroves in eroded coastal areas. Outreach programs aimed at developing leadership skills among students to prepare them as next-generation citizens to tackle the climate crisis and equip them with needed information on sustainable coastal zone management. Demonstration gardens are maintained to showcase climate-smart production systems. We shared the results of research and extension programs with stakeholders in meetings and through local outreach events. In FY 2021, this program reached 1,307 clients via direct contacts.

Upon request from the Satawan Atoll (Chuuk County) Mayor, the staff provided outreach and extension support to restore mangrove forests and secure food sources by establishing community and school-level nurseries for fruits and vegetable seedlings. This bottom-up approach helped promote food security requirements of atoll communities. Later, the local government introduced an ordinance targeting households to establish family vegetable gardens and adopt proper solid waste management strategies. This initiative prompted other atolls and islands to engage in similar activities to protect the fragile environment.

### **Critical Issue: High incidence of food and waterborne illnesses**

The burden of food and waterborne illnesses in the Micronesian region is significant. Urbanization increases the probability of food and waterborne diseases due to crowded conditions. Lack of proper knowledge of food safety, poor food-production processes and food handling, improper food storage, contaminated water sources, and poor hygiene contribute to a high-risk environment. Humid tropical conditions favor the spread of pests and the risk of contracting diseases. The extension has played a crucial role in providing families, communities, and businesses with best practices for managing food safety risks, especially during the pandemic times. This year the program offered a wide range of education for the target audience to increase their knowledge and awareness and subsequently adopt food safety guidelines. The topics include identifying potential contamination sources, improving personal hygiene while handling food, food inspections to avoid contamination, and food safety guidelines. Skill-building workshops, mentoring sessions, demonstrations, and hands-on exercises were tailored to meet specific audiences' needs, including students, food processors, chefs, food handlers, homemakers, and community members. The activities carried out under this program enabled the participants to learn and adopt best practices in their workplaces or communities. Proper compliance with safety hygiene measures leads to safe food products. Consumers feel more confident in the food system as it reduces food and waterborne illnesses outbreaks. Safely regulated and supported local food production and distribution systems allow consumers to access confidently. Extension efforts strengthened existing collaborations that provided information and skills to stakeholders on healthy lifestyles and the consumption of safe and healthy foods. A healthy population contributes more to the development of local economies and the welfare of island communities. In FY 2021, the program reached 1,478 participants in the Federated States of Micronesia counties and 480 participants in the Republic of Marshall Islands through direct contacts.

### **Critical Issue: Lack of local food production and food insecurity**

Micronesian islands have an economically detrimental reliance on imported foodstuffs, especially starchy foods, fruits, vegetables, and animal products. The steady increase in demand and consumption of imported foods has led to an overall decline in local food production and threatens food security. Strengthening traditional agricultural systems using science-based methods and focusing on local food production and processing methods is crucial to reducing poverty and meeting overall food security objectives. Our programs utilized research, extension, and education activities to provide knowledge, technical assistance, and methods to produce local foods and improve food products and processes for existing and expanded markets.

This year, the RMI extension staff trained the communities to launch the 10x10-w-5 'Community Demo Garden Initiative' to establish backyard gardens for growing various vegetables. Besides providing communities gain access to healthy, nutritious food, this initiative allows for creating social ties and greater feelings. Across the four counties in the Federated States of Micronesia, 1,187 hands-on training sessions benefited 1,166 clients to improve their homegardens and agroforestry systems to enhance local food production. Additionally, 119 households, including 12 black pepper producers, increased their engagement on a commercial scale. Hands-on training sessions on swine production and management resulted in an overall increase in local meat production. Research on agroforestry systems explored coconut and breadfruit-based practices. It looked at ways to improve the food security needs of the island communities. Another project demonstrated the possibility of producing seedlings from the leaves of pineapple crown using local resources. In the Republic of Palau, the production and distribution of disease-free, salt-tolerant, locally desired taro planting materials are sustained to support the traditional community-centered staple crop production in lowland and upland areas.

Overall, research and extension activities created interest and encouragement among island communities to tackle food insecurity issues. Collaborations with various stakeholders, including local agencies and international partners, increased public awareness of the USDA programs and services and the adoption of traditional agroforestry methods integrated with vegetable gardening activities among the communities. Outreach programs empowered communities to develop sustainable agriculture activities to enhance local crop production. A wide selection of local produce is becoming available in the local market. Outreach efforts also enabled more participants, households, and communities to engage in better adapted integrated crop and animal production systems and reduce household/community food security barriers. In 2021, there were 3,027 contacts among (adults and youth) under the 'Lack of local food production and food insecurity program.

### **Critical Issue: Sustainable aquaculture development**

Coastal fisheries and aquaculture are integral to the island communities in Micronesia. The subsistence fisheries offer tremendous opportunities and contribute to food security and household income. It also makes a significant socio-economic contribution to the island communities. However, the sustainability of this sector is at stake due to overfishing, climate change, and habitat degradation. With continued unsustainable harvests from the wild, aquaculture is seen as the only solution to meeting the rising demand of aquatic species for food and economic viability. Through research and extension efforts, the College of Micronesia land grant program prioritizes and promotes aquaculture and its economic potential for sustainable community development across Micronesia. Programs focused on developing and refining techniques in the seed production and grow-out culture of traditionally and economically important aquaculture species such as mangrove crab, rabbitfish, giant clam, small clam, and sea cucumber. Multispecies hatcheries served as locations for seed production activities, hands-on demonstrations, local and regional training, and capacity building.

A research project in the Republic of Marshall Islands aimed to standardize protocols for the hatchery, nursery, and grow-out culture of small clams and groupers. In contrast, extension focused on increasing knowledge and awareness of sustainable clam harvesting, sustainable and hybrid spawning practices, maintenance, conservation planning, and development. The extension and outreach efforts resulted in about 398 community members gaining new knowledge and acquired skills in sustainable aquaculture practices. Seed production operations involving mangrove crabs continue in the Republic of Palau to enhance the wild population. Since 2019, the staff in Yap Country has been engaged in the hatchery technology of giant clams and training communities in clam farming. In 2021, the staff conducted 38 demonstrations and hands-on training on hatchery and grow-out methods that engaged 124 new clients from different communities. These sessions empowered several new clients to adopt the practice of giant clam farming while also increasing skills and knowledge in the hatchery and nursery of giant clams. There has been a 109% increase in community members participating in giant clam aquaculture. Due to the pandemic and food shortages, communities are beginning to see the value of giant clam aquaculture as an additional source of protein and food. In 2021, staff collaborated with stakeholders and local government departments to draft a bill for the development, management, and regulation of commercial aquaculture activities within Yap County. A research project in Pohnpei County aims to develop technologies for site-specific nursery and grow-out technologies for sandfish sea cucumber for supplementary income. This is in addition to developing a complete technology package for the very highly sought-after sandfish sea cucumber aiming for foreign investors to invest in the local economy. Due to the past several years of sustained efforts, the program is receiving inquiries

from various public and private entities interested in sea cucumber farming as a viable income generation opportunity. The extension component of this program aims to stock conservation, restore depleted stocks, and sustainable harvesting. In 2021, 179 community members in Pohnpei and Yap counties received training in spawning and larval rearing, juvenile production, grow-out techniques, and hatchery and farm management. Four new community-based sandfish sea cucumber grow-out farms (three in Yap County and one in Pohnpei County) were established in 2021. Altogether, the aquaculture extension program served 1027 clients via direct contact.

**Critical Issue: Youth and family issues in the communities**

The traditional extended family system in Micronesia has changed significantly during the last few decades. Many of these changes are both profound and ominous. Today, Micronesian families face challenges maintaining smooth relationships due to outside influences and threats. Issues affecting youth and families include NEET (not in education, employment, and training) situation, domestic violence, physical and sexual abuse of children, drug and alcohol abuse, and school dropout. These must be addressed in the context of solid family and community support and reinforcement of healthy lifestyle choices.

Youth need a safe environment for optimal social, emotional, physical, and cognitive development – inclusive of the family and school settings. In 2021, extension staff enriched the lives of youth and families through a wide range of educational activities such as skills-building activities, healthy physical activities, vegetable gardening, counseling, cultural activities, after-school academic tutoring sessions, and leadership development sessions. These emphasis areas support healthy families, build positive youth skills, and strengthen intergenerational community relationships. Outreach sessions comprised workshops to enhance youth’s life skills in handicrafts making, sewing and weaving. Tutoring and counseling sessions are provided to school dropouts and vulnerable groups to avoid substance abuse, engage in sports and fitness programs, and complete academic sessions. Through parental guidance and counseling sessions, young couples and families with relationship challenges learned about the value of respect, proper communication, discernment of correct behavior, wise decision making in family resources management, solving conflicts, and experiencing a harmonious life.

Overall, outreach programs enabled youth to connect with diverse audiences in their communities and better understand communal life. Developing youth skills, building their confidence and competence, and better responsible behaviors positively contributed to society. Partnership with governmental and non-governmental agencies enabled us to extend our programs and services to a broader audience through various outreach activities. Youth gained confidence in their abilities and turned their ideas into plans to address problems in their communities. Overall, there is greater participation of youth in community services. In 2021, outreach and educational activities under this program reached 3,018 youth and adults.

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## **Merit and Scientific Peer Review Processes**

### **Updates**

No updates

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## **Stakeholder Input**

### **Actions to seek stakeholder input that encouraged their participation with a brief explanation**

No updates

### **Methods to identify individuals and groups and brief explanation**

No updates

### **Methods for collecting stakeholder input and brief explanation**

No updates

### **A statement of how the input will be considered and brief explanation of what you learned from your stakeholders**

No updates

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## **Highlighted Results by Project or Program**

Critical Issue

## Implementing climate-smart adaptation strategies in the Federated States of Micronesia

Project Director

Murukesan Krishnapillai

Organization

College of Micronesia

Accession Number

7000120



## Climate change adaptation strategies for displaced atoll communities in Yap

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### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

The Federated States of Micronesia (FSM) lies in the heart of the western Pacific, where impacts of weather extremes are mainly felt by low-lying atolls and narrow coastal plains of the high volcanic islands. Climate variability and change affect every aspect of FSM communities' lives due to islands and atolls' small size, low elevation, and extensive coastal areas. Many localized climate extreme features further amplify climate risks. Further changes are projected to be evident in the coming decades because of increased temperature, decreased rainfall, rising sea level, and ocean acidification. Recurrences of disasters and crises threaten food security through impacts on traditional agriculture, causing forced migration of coastal communities.

As many of the projected impacts are now unavoidable, implementing some degree of adaptation is essential to enhance food security, strengthen livelihoods, and increase the resilience of FSM communities to future climate risks. There needs a greater emphasis on various site-specific climate-smart adaptation strategies for the livelihood opportunities of the communities.

The overarching goal of the climate change extension program is to enhance the island communities' adaptive capacity and climate resilience. More specific objectives of the program include:

1. To increase the awareness, knowledge, and skills in climate-smart agriculture.
2. To present the importance of site-specific climate-adaptive practices.
3. To deliver science-based climate-smart information to strengthen livelihood opportunities.

The extension program to address the Climate Challenges in Micronesia is a valuable program developed to help increase access to nutritious vegetables for the island communities affected by climate variability and change. The extension team is positioned to lead the way to help build a more resilient food system for the displaced communities.

### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Through 2021, we continued engaging and educating island communities in climate-smart agriculture. The extension efforts on climate-smart adaptation practices focused on hands-on training, in-house advice sessions, and technical assistance programs to displaced and socially disadvantaged island communities. Over the years, our extension program standardized low-cost production methods of vegetables and staple crops. Our training sessions reinforced the importance of alternative crop production methods to bypass degraded and poor soil conditions and improved stapled crop production in degraded lands. This year, outreach efforts allowed extension staff to engage 54 households (on an average of 6 members per household) and over 400 indirect contacts. This year the program has been extended to three new atoll community settlements. Training session topics included volcanic soil management, compost preparation, seed germination, transplanting, nutrient management, and alternative crop production methods. The training enabled communities to grow their produce utilizing climate-friendly practices.

The program staff also engaged 58 Early Childhood Education (ECE) staff to adopt climate-smart vegetable production methods. The ECE staff participated in exploratory workshops and then created action plans for establishing vegetable gardens at school premises and homegardens. Extension personnel continued working with ECE staff to ensure the most significant educational impact and continued momentum on their vegetable gardening activities.

Our extension approach was:

- Needs-based: Respected the needs and aspirations of the target audience (displaced atoll communities).
- Best fit and innovative climate-smart practices: Alternative crop production methods are standardized for local situations (based on experience).
- Knowledge-intensive: Incorporating climate-smart agricultural practices while respecting the traditional knowledge of island communities.

**Briefly describe how your target audience benefited from your project's activities.**

The outreach efforts helped the target audience gain new knowledge, acquire core skills, and increase aspirations regarding climate-smart agriculture practices to adapt. Evaluation results indicate an 86% increase in knowledge, 72% of participants adopted various climate-smart vegetable production methods, and 73% of respondents increased economic quality of life due to outreach and extension interventions.

In written surveys, program participants responded the following:

- 74% (n=74) tried and utilized core skills in vegetable gardening to a great extent.
- 78% (n=74) extension program encouraged more involvement in vegetable gardening as an adaptation strategy.
- 38% (n=74) reported growing at least three types of vegetables.
- 76% (n=74) utilized home-grown vegetables for own consumption.
- 73% (n=74) reported that the vegetable gardening program helped to enhance their economic quality of life.

Additionally, over 94% of participants are primarily satisfied with the program. Monthly savings from having homegrown crops for consumption are estimated to be approx. \$100/per household. Few respondents requested to extend the program to remote islands and atolls.

**Briefly describe how the broader public benefited from your project's activities.**

Our research and extension divisions have been providing climate-smart research and extension activities for over a decade. The goal is to enhance the adaptive capacity of island communities to climate extremes through science-based information disseminated through outreach events and informal education. A critical need is to increase climate literacy to create more vibrant and resilient communities and traditional agriculture-dependent livelihood opportunities to adapt to climate risks. Program participants have become tutors among respective households within the target communities and disseminate knowledge to extended family members. The public, in general, and program participants in particular, gained a better appreciation of how a changing climate impacts their lives and how sustained crop production reduces vulnerability during extreme weather events. Older adults (generally age 65+) benefited from increased social interaction and mobility within the targeted community settlements. Communities benefit as older people remain engaged in vegetable gardening activities.

Our extension programs focus on outcomes and professional judgment and often reframes critical issues to suit the target audience. For example, instead of addressing climate change per se, extension education focuses on local impacts such as sea level rise, climate variability, and water security. Thus, our extension approach is repurposed to meet the target audience's needs (displaced island communities) by focusing on adaptation strategies incorporating several site-specific climate-smart agriculture practices. The fact that these adaptation methods could be easily replicated in other locations to benefit a vast audience increases the importance of our work. Traditional agriculture is the mainstay of the island communities. Therefore, our outreach and extension programs potentially benefit not only the target audience but also communities in other locations through knowledge transfer and have important implications for society as a whole. Youth engagement in extension programs strengthens knowledge sharing across generations and is vital in continued cultural resilience.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

**Publications:**

1. Murukesan Krishnapillai (December 2020). Understanding Climate Change. Module 11, AgKnowledge Learning Series Training Modules for Extension Training, Yap Cooperative Research and Extension; pp. 32.
2. Murukesan Krishnapillai (December 2020). Climate Change Impacts on Agriculture and Food Security. Module 12, AgKnowledge Learning Series Training Modules for Extension Training, Yap Cooperative Research and Extension; pp. 24.
3. Murukesan Krishnapillai (December 2020). Climate-Smart Agriculture. Module 13, AgKnowledge Learning Series Training Modules for Extension Training, Yap Cooperative Research and Extension; pp. 24.
4. Murukesan Krishnapillai (December 2020). Climate-Smart Agriculture Solutions for Your Area. Module 14, AgKnowledge Learning Series Training Modules for Extension Training, Yap Cooperative Research and Extension; pp. 24.

**What the program plans to do during the next reporting period to accomplish the goals?**

The outreach and extension efforts will continue incorporating a broader target audience from other locations to enhance island communities' adaptive capacity and climate resilience and achieve the intended outcomes within the stipulated timeframe.

**Impact Statement (Optional)**

Use this space to talk about the impact that this result had, in layman's terms. Adding comments here will **not** change the content in the highlighted result.

Climate change affects every aspect of the lives of atoll communities in Yap due to the islands' small size, low elevation, and extensive coastal areas. Recurrences of natural disasters threaten food and nutrition security through impacts on traditional agriculture, causing the forced migration of atoll communities to highlands in search of better living conditions. College of Micronesia extension program has provided outreach, technical assistance, and extension education to the displaced atoll communities since 2007 to enhance food and nutrition security, strengthen livelihoods, and increase their resilience to future climate risks. The extension program applied a three-pronged pro-poor, pro-woman, pro-nature model adaptation model to boost household and community resilience under harsh conditions on a degraded landscape. Displaced atoll communities now have access to nutritious and reliable food sources, and their resilience is more significant than before. This spells a healthier future for the settlers.

Critical Issue

**Lack of local food production and food insecurity**



## Enhancing local crop production in the Federated States of Micronesia

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### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Traditional agriculture is the mainstay for the livelihood and food security of the people of the Federated States of Micronesia (FSM). Homegardens and agroforestry systems are the primary source of food and sometimes income for the island communities. Mixed tree gardening, inclusive of diverse and intermittent starchy root crops and vegetables often integrated with animal production systems such as poultry and pigs, is a predominant food production system. Improving them is critical to attaining poverty reduction targets and food security objectives. Homegardens are integrated into family life. Studies indicate that homegardens significantly reduce food insecurity when nutrient-rich foods are readily available to families. The most fundamental social benefit of homegardens stems from their direct contributions to household food security by increasing availability, accessibility, and utilization of food products. Families who grow their food are more likely to eat fresh produce than families who do not.

However, food production has declined over the years as fewer families continue to maintain their traditional food production and agroforestry systems. This has resulted in more reliance on imported foods, which can be otherwise grown for the local market. It is crucial to maintain and enhance the agroforestry systems by combining sustainable indigenous techniques and new practices to improve food security, enhance livelihood opportunities, and increase income generation opportunities. Fully established agroforestry systems will reduce communities' dependence on purchased products and resources and reduce vulnerability to changing market conditions. This can be achieved through crop diversification and livestock (poultry and pigs) integration and adaptation of sustainable land-use practices to improve productivity.

There is renewed interest and emphasis at the government and community level to revive and improve crop production systems in the FSM to address food insecurity through food self-sufficiency and improve nutritional benefits. Traditional food production systems such as home gardening and agroforestry can be exploited to increase production for the local market, provide income for farming households, and increase the availability of nutritious food for island communities.

The goal of this extension program is to enhance local crop production to address food insecurity, with specific objectives, i) to increase the knowledge and skills of at least 400 participants each year in the sustainable production of local crops, ii) at least 60% of the participants who received training will have adopted appropriate production skills, and iii) to provide extension support to establish at least 60 households, commercial production operations each year. Through extension interventions, farmers and their families, households, and communities would have the capacity to improve their current production systems, adopt new technology and practices, and participate in commercial activities and income-generating opportunities.

### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

Extension interventions were provided to target audiences, including students, youths, individual farmers, women's groups, families, and communities. Hands-on training and demonstrations in various crop and vegetable production techniques were conducted at schools and communities to promote interest in agriculture science and the significance of local crop production to food security. In 2021, the program assisted a total of 1,494 participants to increase their understanding, knowledge, and skills in growing vegetables, crops, and fruit trees.

Training sessions hands-on activities focused on land preparation and soil management, seed germination and propagation, transplanting and plant care management, mulching, composting, fertilizer application, pest and disease management, and harvesting and post-harvest handling. A total of 3,765 one-on-one consultations, 1,187 hands-on training sessions, 738 hands-on demonstrations, and technical assistance sessions were conducted. The extension program enabled participants to grow various vegetable crops such as cabbages, lettuce, cucumber, eggplants, sweet peppers, tomato, and kangkong for home consumption and the local market. The program also focused on critical staple crops, including coconuts, taro, sweet potato, cassava, and fruit trees, including mango, citrus, papaya, and banana. Black pepper was the only cash crop that the program targeted.



The extension activities contributed significantly to promoting and enhancing local crop production to address food insecurity and meet the program's primary goal and objectives. About 1,166 participants (78%) have established and improved their homegardens and agroforestry systems to produce various food crops for their consumption. Many households have engaged in or increased their commercial activity by selling their produce to the local market. Extension support has resulted in 119 households, including 12 black pepper producers, increasing their engagement in commercial production.

**Briefly describe how your target audience benefited from your project's activities.**

The extension program resulted in increased knowledge and skills and awareness of the importance of local food production to food security. Extension support helped participants establish and improve their home gardens and increase the productivity of their agroforestry systems. A total of 710 homegardens provided respective households and families with a supply of fresh and nutritious vegetables valued at more than \$60,000. Farmers who ventured into the marketplace reported positive results and responses from customers and consumers. About 107 farming households reported extra income earnings from the sale of their products ranging from \$3,000 to \$10,000. About 45 families had incorporated new crops into their agroforestry production systems, such as cassava, taro, banana, and black pepper. A Survey of participants indicated that more than 60% had applied the knowledge and skills provided and successfully maintained their homegardens and crops. More than 60 households are engaged in commercial activities by selling their produce at the local market. At the local market, farmers and families have realized increased revenues from the sale of fresh produce. Demand from consumers is increasing. Two women who engaged in monthly market fairs reported an annual sale of more than \$8,000, and they are exploring ways to increase their product quantity and variety.

**Briefly describe how the broader public benefited from your project's activities.**

The extension program has created interest and encouragement among island communities to tackle food insecurity issues. More women and youth groups sought technical assistance from the extension program and other similar programs on the island to engage in gardening activities. Partnership with various stakeholders and local agencies increased public awareness of the USDA programs and services and the adoption of vegetable gardening activities among the communities. Outreach programs empowered communities to develop sustainable agriculture activities to enhance local crop production. A wide selection of local produce is becoming available in the local market. Outreach efforts also enabled more participants, households, and communities to engage in better adapted integrated crop and animal production systems and reduce household/community food security barriers. Participants ably demonstrated the commercial potential of agriculture products. About 18 crop brochures were published and distributed, enabling the larger audience to know more about local crops, production methods, and health benefits. Feedback from clients indicates that they gained new knowledge on the health benefits of these crops. The program staff received several requests for the planting materials, and clients reported establishing many crops in their homegardens.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

What the program plans to do during the next reporting period? The outreach and extension programs will be expanded to more atolls and low-lying areas. Communities from remote atolls residing on the main island will be recruited for training. These core trainers will later serve as echo trainers in their respective communities, including via social media.

**Impact Statement (Optional)**

Use this space to talk about the impact that this result had, in layman's terms. Adding comments here will **not** change the content in the highlighted result.

Increased food security can be achieved by involving more local food producers in growing staple crops, fruits, and vegetables. Extension and outreach support enabled participants to improve their homegardens and increase the productivity of agroforestry systems. In 2021, 710 homegardens supplied nutritious vegetables valued at more than \$60,000. About 45 households incorporated new crops in their agroforestry production systems to meet food security requirements. Additionally, 107 households reported extra income from their farms ranging from \$3,000 to \$10,000. About 45 families incorporated new crops into their agroforestry production systems, improving food security. Farmers realized increased revenues from the sale of fresh produce in the local market. Extension intervention and technical assistance activities empowered communities to enhance sustainable agriculture activities to improve local crop production.

## Sustainable aquaculture development

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### Enhanced sustainable production of valuable marine species for food security in Yap

Project Director

Murukesan Krishnapillai

Organization

College of Micronesia

Accession Number

7000121



### Sustainable production of valuable marine species for food security

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#### **In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

Coastal fisheries and the use of the reefs are integral to the people's livelihood in the Federated States of Micronesia. Fisheries is one of the main subsistence activities that play a substantial role in the lives of Micronesians in terms of consumption, sharing/gifting among households, and contributing to household income. Various factors such as overfishing, climatic changes, habitat degradation over time have led to a significant decline in wild fish stocks. Numerous reports have projected future changes that will continue to affect fish stocks and contribute to a further reduction that threatens the food security communities get from fisheries. In addition, the recent global pandemic has seen shortages of imported foods. To alleviate this pressure, more locals are raising poultry and pork and farming crops and vegetables. However, even this still falls short of supplying the demand of local consumers.

With all the negative pressures, strategies and implementation are needed to address the issue of fisheries increasing its contribution to food security and better the lives of communities to become sustainable and sufficient.

The aquaculture extension program seeks to engage communities in site-specific sustainable aquaculture practices that can improve people's socioeconomic conditions. The objectives of the program include:

1. To increase the awareness of 500 participants each year in giant clam farming and rabbitfish cage culture through education and outreach.
2. To provide technical assistance and hands-on training for grow-out farms to at least 100 individuals each year.
3. To provide outreach and technical assistance to establish at least three income-generating aquaculture operations each year.

The aquaculture extension program is in itself an opportunity to provide communities with site-specific technologies to enhance deteriorating marine natural resources, opportunities for employment, and food security.

#### **Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

In 2021, the aquaculture extension program continued to provide outreach and educational workshops, hands-on training and demonstrations, technical advice sessions, and field visits. In 2019, the program established the hatchery technology of giant clams and since then have engaged communities to participate in activities that led to the farming of giant clams.

This year, through educational and outreach efforts, staff extended the program to 384 new participants from various communities and schools on the mainland of Yap with over 300 indirect contacts. A total of 9 workshops and six hatchery tours covered topics on understanding aquaculture, giant clam aquaculture, and ocean grow-out of giant clams. The workshops enabled clients to understand the basis of aquaculture and gain an insight into giant clam technology. The staff

also conducted 38 demonstrations and hands-on training on hatchery and grow-out methods that engaged 124 new clients from different communities. These sessions empowered several new clients to adopt the practice of giant clam farming while also increasing skills and knowledge in the hatchery and nursery of giant clams.

**Briefly describe how your target audience benefited from your project's activities.**

The extension efforts of the program helped the target audience increase their awareness and knowledge and gain skills necessary for sustainable aquaculture practices. Evaluation results indicate a 91% increase in knowledge, and 62% of participants have adopted skills in giant clam technology.

From surveys, program participants responded the following:

- 98% (n=182) increased their awareness of aquaculture in general and giant clam technology to various extent.
- 95% (n=53) reported that the outreach efforts encouraged them to get involved in aquaculture.
- 98% (n=182) of clients reported sharing information from the outreach efforts to others.

From the respondents, 99% indicated that the program is practical and is an opportunity to establish a foundation for aquaculture for future generations.

**Briefly describe how the broader public benefited from your project's activities.**

There has been an increase in community members participating in aquaculture activities, especially giant clam aquaculture. When compared to last year, the number of participants increased this year by 109% (from 273 to 571), the adoption rate of aquaculture practices increased by 133% (from 33 to 77), and giant clam farms have increased by 79% (14-25). Established farms contain juvenile clams in cages placed in natural areas for best growth.

Adoption of giant clam farming is increasing among communities. Because of the pandemic and food shortages, communities are beginning to see the value of aquaculture as a means of supplying additional protein and alleviating the pressure on wild stocks. Four communities from the previous year have increased the number of clams in their farms, and 11 new communities and/or individuals have established their giant clam stocks.

Outcomes of the program:

- In collaboration with the Yap State Government Department of Resource & Development, a bill was drafted to allow for the development, management, and regulation of commercial aquaculture activities within the state.
- Juvenile clams were purchased under a disaster and risk funding for an outer island community to raise food security.
- In April, Yap Fishing Authority shipped juvenile clams to Chuuk, and two farms were established.
- The Marine Resources (state office) purchased juvenile clams and distributed them to communities with marine protected areas for conservation purposes.
- Two agencies (IOM and Ridge to Reef) inquired about providing seeding clams to food security and conservation grants to communities.
- Yap Fishing Authority has sold 1,830 pieces of seedling clams this year, worth a total of \$2,638.

- o Four communities from the previous year have increased the number of clams in their farms. Eleven new communities have adopted the practice of giant clam farming.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

**What the program plans to do during the next reporting period to accomplish goals?**

The program will continue to engage different communities and other locations to increase sustainable aquaculture practices and accomplish the desired outcomes.

### **Impact Statement (Optional)**

Use this space to talk about the impact that this result had, in layman's terms. Adding comments here will **not** change the content in the highlighted result.

The giant clam farming extension program in Yap County shows that participants significantly strengthened their knowledge of successfully carrying out farming activities. Compared to last year, there has been a 109% increase in the number of participants this year, a 133% increase in the adoption rate, and the number of giant clam farms has increased by 79%. Without timely extension and outreach training, these communities are at risk of not successfully operating the farming activities due to incorrect grow-out methods. More excellent efficiency rates and confidence have been observed for those actively engaged in training sessions. There has been renewed interest from the communities in aquaculture activities. This paved the way for the local government officials to draft a bill with inputs from extension staff for the development, management, and regulation of commercial aquaculture activities.

Critical Issue

## Youth and family issues in the communities

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### **Plant Spacing and Living Mulch Effects on Taro (*Colocasia esculenta* (L) Schott**

Project Director

Lolita Ragus

Organization

College of Micronesia

Accession Number

1021712



### **Plant Spacing and Living Mulch Effects on Taro**

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**In 2-3 sentences, briefly describe the issue or problem that your project addresses.**

FSM Research and Development identified taro as an import substitutable products for intermediate goods (flour, juice and oil) and sophisticated products including biscuits, cookies, chips, soap and jam. This potential of taro for import substitution redounds to improvement of its productivity despite of small land area and scarcity of planting materials in stolls and low-lying areas of the FSM.

Plant spacing affects corm yield and eventually the production and productivity of taro. Weeding is most important during the first 3-5 months after planting of taro, which is harvestable after 9 months of planting. Weeding consumes about 30% of labor cost. This project will incorporate living mulch (*kangkong* or *Ipomoea aquatica* L.) to suppress weed growth during taro growth and development.

The goal of this project is to increase local productivity with minimum weeding and reduced incidence of insect pests and diseases using local materials. Its objectives are:

1. To determine and quantify planting space, living mulch and their interaction effects on taro yield and its components

2. To identify and assess weeds, insect pests and diseases of the different treatments

3. To determine costs of production and returns of the different treatments.

Owing to the scarcity of information about the influence of plant spacing and living mulch in taro yields, its components and incidence of pests, this project focuses on this aspect.

**Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.**

This two-year ongoing project had three objectives and ultimate goal of increasing local taro productivity with minimum weeding and reduced incidence of insect pests and diseases using local materials. Aside from determining yields of taro and incidence of insect pests and diseases, costs of production and returns under two taro plant spacing (75 cm x 75 cm and 60 cm x 60 cm) and mulching practices with and without kangkong mulches will be determined.

Project activities involved determination of taro yield and yield components at two levels of plant spacing and two rates of the living mulch; recording incidence of insect pests and diseases and determination of farm inputs used and labor hours spent from land preparation to harvesting in various treatments.

**Objective 1 To determine and quantify planting space, living mulch and their interaction effects on taro yield and its components**

**Unmulched taro plots produced smaller corms averaging 32.2 cm and ranging from 12.7 to 21.8 cm) than mulched plots (20.1 cm and ranges of 17.5 to 22.7 cm).**

Taro plant heights, leaf sizes and number of suckers developed monthly in main plots with and without *kangkong* and sub-plots of two spacing levels (75 cm x 75 cm and 60 x 60 cm spacing between rows and between plants) were determined.

**Generally, various treatments showed differences but were non-significant. These treatments were mulching (main plots of unmulched and mulched), narrow (60 x 60 cm) and wide (7cmx 75 cm) spacing and their interaction treatments.**

**Mulching Effects on Taro**

**Taro Plant Height:** Taro plants were tallest in unmulched (97.63 cm) and wider planting space and shortest Non-mulched taro plants were taller (69.90 cm) than mulched with kangkong (61.37 cm) at mulched and wider spacing (56.97 cm).

**Number of Stems.** Highest number of stems was observed from unmulched taro at wider planting space (6.81) and lowest from plots mulched with kangkong at narrow planting distance (4.62). Unmulched taro plots had an average of 6.10 stems compared to 4.78 stems in mulched plots with kangkong.

**Leaf Width.** Wider leaves (20.57 cm) were observed from unmulched plots at wider spacing and narrower leaves from mulched plots (16.08 cm) at wider spacing. Unmulched taro plots had an average of 20.41 cm compared to mulched plots (17.60 cm).

**Leaf Length.** Unmulched taro plots grown at narrow spacing produced longest leaves (26.17 cm) and mulched taro spaced wider had short leaves (22.13 cm). Unmulched taro plots had longer leaves (25.92 cm) than mulched plots (24.75).

**Sucker Number.** Sucker number in all plots ranged from 0.53 to 0.78. Unmulched plots produced 0.67 suckers while mulched plots had 0.53 suckers.

**Corm Weights.** Corm weights recorded were: 770 g, 825 g, 700 g and 800 g per plant for unmulched plot of narrow distance planting, unmulched plot at wider planting spacing, mulched plots at narrow planting distance and mulched at wider planting space, respectively.

**Corm Length.** Corm lengths ranged from 6.75 cm to 7.67 cm. Longest corm (7.67 cm) were from unmulched plots at wider spacing and shortest corms (6.75 cm) from mulched plots at narrower planting distance.

**Corm Diameter.** Unmulched plots at narrow spacing produced biggest corm diameter (10.0 cm) and smallest at mulched plots with narrow planting space (6.42 cm).

**Marketable Corms.** Mulched taro plots at narrow planting distance produced the heaviest marketable corms (691.7 g/plant), followed by the mulched plots at narrow planting spacing 9666.67 g/plant) the the unmulched plot at narrow planting distance (570.0 g/plant). The lowest corm weights from mulched plot at wider spacing (466.67 g/plant) . Marketable corms from mulched weighed 616.7 g/plant while the unmulched plots produced 630.9 g/plant.

**Non-marketable Corm weights.** Mulched taro plots at wider planting distance produced heaviest non-marketable corm weights (233.3 g) and the unmulched plots at narrow spacing had the lowest non-marketable weights (133.3 g). Mulched and unmulched plots produced averages of 183.3 g and 166.7 g, respectively.

**Biomass Weights.** Mulched plots produced heavier biomass weights 91225.0 g/plant) than the unmulched plots (1116.7 g/plant). Unmulched plots recorded 1399.8 g and 1499.8 per plants for narrow and wider planting distances, respectively. The mulched plots produced 1466.6 g and 1299.8 g per, for narrow and wider plant spacing.

**Biomass to Corm Weight Ratios.** More foliage was observed among plants in mulched taro at narrow spacing 92.10. Taro plants without mulch at either plant spacing tested had 1.82 ratio. Taro plants mulched and planted in wider spacing had 1.7 ratio. The higher the ratio, the more leaves and stems produced and the lesser the ratio, the heavier is the corm weight.

### Effects of Planting Distances in Kangkong As Living Mulch

**Kangkong Stem Length.** Kangkong stems were longer (56.8 cm) at narrow planting space than at plots wider spacing (54.9 g)

**Kangkong harvest Weights.** Average kangkong harvests were 1264.6 g. Kangkong harvest was higher under narrow planting space (1422.2 g) than wide spacing (1088.9 g).

### b.2. To identify and assess weeds, insect pests and diseases of the different treatments

#### Weeds

Three predominant weeds among treatments were carabao grass (*Paspalum conjugatum* P.J. Bergius), crabgrass (*Digitalis sanguinalis* (L) Scop. and seed-under leaf (*Phyllanthus niruri* L). Five minor weeds identified were morning glory (*Ipomoea purpurea* (L) Roth., common verbain (*Vervena officinalis* L.), sensitive plant (*Mimosa pudica* L., wild daisy (*Leucanthemum vulgare* Lam) and purslane (*Portulaca oleraceae* L).

Monthly mean weed weights in unmulched and mulched plots were 37.0 g and 26.8 g, respectively. More monthly weed number (13.9) in unmulched plots than the mulched plots (11.1) in unmulched plots. A greater number and weights of weeds were observed in wider planting spacing (14.5 g and 46.6 g) than the narrow planting distance (13.3 and 27.4 g). For mulched plots, both planting distances had averages of 11.1 weeds growing. However, wider planting spacing produced heavier weed weights (31.5 g) than the narrower planting space (22.1 g).

#### Insect Pests

Common green grasshopper (*Omocestus viridulus*) common cutworm (*Agrotis ipsilon*), leafminer (*Liriomyza* spp) were the insect pests found in all the treatments. Their damages were minor in all the mulched, unmulched and mulching by spacing distances plots.

#### Diseases of Taro and Kangkong

Dasheen mosaic virus (DsMV) and taro leaf blight (*Phytophthora colocasiae* Racib) were observed damaged taro plants mildly. Kangkong did not show any disease problem among the mulched and unmulched plots.

### Objective 3. To compare costs of production and returns of the different treatments

Man-days spent from land preparation to harvesting differed only in preparing planting materials of taro and kangkong, weeding and harvesting the two crops. More man-days were spent in wider planting distances than the narrow planting space. Using partial budgeting, the cost of production in the different treatments and Returns on Investments (ROIs) reflected the profitability of each treatment. The respective expenses for all the treatments including labor, supplies and materials were \$18,555.57, \$11,599.99, \$25,388.91 and \$16,433.32 per hectare, for unmulched narrow distance planting, unmulched wider planting distance, mulched narrow planting distance and mulched wider planting distances. Minimal profits were obtained from unmulched at narrow planting space (\$277.78/ha) and maximum profit from mulched plots at narrow planting distance (\$17,755.57/ha). Profits from other treatments were \$420/ha and \$7,253.33/ha for unmulched plots at wider planting distance and mulched plots at wider planting spacing. Returns on Investments were 69.96%, 44.18%, 1.48% and 0.28% for mulching taro at narrow planting spacing, mulching at wider planting distance, unmulched at narrow planting distance and unmulched at wider planting space, respectively.

**Briefly describe how your target audience benefited from your project's activities.**

Target audience developed awareness about the feasibility of increasing their family incomes and improving nutrition for healthy living. Using *kangkong* as living mulch in taro patches will decrease weed population thereby lesser time consumed in weeding. Families adopting *kangkong* as living mulch of taro will benefit from nutrient contents of these crops and also earn extra incomes from selling the *kangkong* stems. Farmers, gardeners, homemakers, hobbyists, village leaders, schools, teachers, students, and extension agents benefit from monthly harvesting of *kangkong* for their healthy meals or selling for extra family cash.

**Briefly describe how the broader public benefited from your project's activities.**

Taro producers and communities would be aware of the potential of *kangkong* as a complementary crop in taro growing for weed growth suppression and earning extra income while waiting for taro harvest time nine months after planting. They would have a better understanding of the role of planting distance in taro corm yield and the dynamics of pest incidence and *kangkong* interaction. Using *kangkong* as living mulch in taro patches will decrease weed population thereby lesser time consumed in weeding. Families adopting *kangkong* as living mulch of taro will benefit from nutrient contents of these crops and also earn extra incomes from selling *the kangkong* stems. Owing to high incidence of non-communicable diseases in the FSM, taro and *kangkong* will be grown in their gardens and farms because of their high nutritive values and popular demands in the local markets. *Kangkong* is easy to grow and a compatible companion crop of taro, which is usually harvested 7-9 months after planting. Mulching *kangkong* will control weeds in taro patches thus minimize taro producers in laborious hand weeding of this crop. In addition, *kangkong* is a healthy vegetable especially rich in Vitamins A and K, phosphorus and potassium. Medical studies indicate *kangkong* as having anti-diabetic anti-oxidant and protective effects in liver damage.

This project would provide communities with new knowledge and skills in growing together two crops in one area. At present, taro is grown as a monocrop.

**Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.**

**What are program plans to do during the next reporting period to accomplish the goals?**

The project activities are completed. Results will be disseminated through distribution of brochures (Sweet Taro (Brochures No.65) and Water Spinach (Brochures No. 12 ) and partnership with the Department of Agriculture, women's groups, community leaders and churches during training, meetings and other community events.

Type  
**Projects / Programs without a Critical Issue**  
Not Provided

Projects / Programs  
**0**