



**PROJECT TITLE**

Making Global Solutions Local: Increasing Awareness and Consumption of Nutrient-Dense Moringa for All Californians

**PROJECT DURATION**

**Start Date:** November 1, 2020

**End Date:** March 2023

**SUMMARY**

Increasing consumption and production of climate-sensitive nutrient-dense specialty crops in California is imperative. Moringa oleifera (moringa) is an ideal crop in speed with California’s mission to have a healthier environment, healthier people, and prosperous farmers. While utilization of moringa at a global level is rapidly increasing, there is a vast knowledge gap in California and unmet potential for local market growth. Through presentations and intensive trainings, the project will sequentially increase awareness, knowledge, availability, and access of moringa to over 25,000 California residents, with a focus on underserved communities. Impact assessment of knowledge gained, taste preferences, adoption of cultivation, and consumption of moringa will be measured by quantitative and qualitative means. Results will be published as part of an online website and resource to disseminate information and connect producers with consumers, ultimately scaling the moringa industry in California.

**PROJECT PURPOSE**

**Issue, Problem or Need**

There is a need to develop more nutritious specialty crops in California that have less detrimental impact on the environment. Moringa sequesters twenty times the amount of carbon of most vegetation, addressing current climate issues. Simultaneously, children and adults need to increase consumption of healthier vegetables such as moringa to combat growing rates of obesity and chronic diseases.

Promotion and increasing awareness of the utility, benefits, and economic potential of moringa is crucial for Californians. Limited water supply and climate change highlight the need for drought-tolerant, fast-growing new crops to offset cost and loss of crops requiring more water, fertilizer, and time. Moringa is 27 percent protein by dry weight, contains high levels of nutrients, and has health-promoting properties.

This proposal addresses the priorities of increasing knowledge of how to produce, prepare or preserve specialty crops; increasing the awareness of and demand for locally sourced specialty crops; and increasing the availability of specialty crops in homes, schools, the workplace, hospitals, prisons, and in other underserved communities.

Awareness and training programs offered virtually and at schools, workplaces, and farming groups will provide education on the benefits of eating and growing moringa. Consumers will learn about moringa’s unique nutrients and health properties, how moringa is utilized in many cultures around the globe, and moringa’s suitability and potential as a crop in California. Production of moringa will provide farmers greater resilience to current agricultural challenges such as land, water, and time. The training programs will first target children, adults, and farmer to spread awareness; followed by intensive hands-on training for organizations with interest in production, processing, and preservation techniques with current and future moringa farmers. The program will measure participants' taste preferences for moringa in everyday foods and track consumption and production rates. The project will focus on underserved communities to promote moringa as a healthy, affordable, climate-sensitive crop for improved California food systems. It will also be flexible and adaptable to the current COVID-19 pandemic and social distancing recommendations. The platform will utilize virtual, hybrid, and in-person education and training formats in order to reach and impact all beneficial and meet up-to-date health guidance and regulations. It will also utilize the expertise from moringa famers in different parts of the state as they contribute as Project Coordinators. This will allow for virtual material to be developed from different geographic and cultural perspectives within CA.



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**Project Objectives and Work Plan**

**Objective 1: Outreach for planning trainings, logistics, and data collection design.**

Objective 1 Activities	Performed by	Timeline
Develop a list of schools, businesses, community programs, and farmer groups to contact to determine interest in virtual awareness training, with potential follow-up for cultivation training, consumption data collection, and processing and preservation.	Project Director (PD)	Nov 2020 – Jun 2021
Modify existing training modules to address virtual audiences and target specific beneficiaries.	PD	Nov 2020 – Jan 2021
Development, production, and printing/posting of age-appropriate moringa information rack cards, <del>and</del> pamphlets, and online materials and tutorials that adhere to the most-updated U.S. Food and Drug Administration and Federal Trade Commission regulations and policies regarding dietary guidelines. Develop at-home moringa gardening kits (if in-person cultivation demonstrations are not permitted) with materials (seeds) and information that can be mailed to schools, distribution centers, and/or individual residences.	PD	Nov 2020 – Jan 2021
Develop food frequency surveys modified and adapted from ones used in CalFresh projects that will include questions on overall fruit and vegetable consumption, and specific questions on moringa production and consumption including amount, form (dried, fresh, value-added), and frequency. Make surveys available online.	PD; Data Analyst (DA)	Nov 2020 – Jan 2021
Source contacts for local agencies, businesses, and farmers.	Project Coordinators (PCs)	Nov 2020 – Jan 2021
Source and receive matching funds and in-kind moringa supply contributions from Kuli Kuli Ltd. Connect with schools and universities to see if distribution sites would be available for beneficences to collect information, and moringa seeds and samples.	PD	Nov 2020
Submit Institutional Review Board (IRB) approval for food frequency surveys and veggie meter data collection. Ensure privacy for personal data using the Research Electronic Data Capture (REDCap) platform and compliance with the California Consumer Privacy Act.	PD; DA; Website Developer (WD)	Nov 2020

**Objective 2: Implementation of awareness trainings and presentations at 60 locations.**

Objective 2 Activities	Performed by	Timeline
Awareness presentations will be held virtually at regional schools, colleges, businesses, and farmer groups, and will include relevant material for the age group and interest level of beneficiaries. Information on moringa will include background, nutrition and health benefits, history of use, drought tolerance, and demonstrations with moringa for seeing, tasting, touching, and smelling fresh and dried moringa and food products. These will be made into interactive, online materials to reach all beneficences including through remote means and include input from project coordinators.	PD, WD, PCs	Dec 2020 - Sep 2021; Dec 2021 - Sep 2022



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Data input from attendance and participation in trainings. Tracking of current and prospective moringa farmers.	DA	Dec 2021 - Sep 2022
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**Objective 3:** Implementation of cultivation training at 30 locations.

Objective 3 Activities	Performed by	Timeline
Conduct a follow-up round of cultivation trainings in-person if possible (otherwise through virtual training and tutorials) at locations that expressed interest after initial awareness trainings. Workshops will provide information on best practices for cultivation of moringa, watering, fertilization, pest management, frost protection, and harvesting timeline. Moringa raised beds will be built and seeds planted with participant or will be done remotely if needed.	PD, WD	Apr 2021 – Sep 2021; Apr 2022 - Sep 2022
Project Coordinators will help in developing online learning materials and sharing their expertise as moringa farmers in California.	PCs	Apr 2021 – Sep 2021; Apr 2022 - Sep 2022

**Objective 4:** Track consumption data.

Objective 4 Activities	Performed by	Timeline
Receive IRB approval and establish REDCap platform for data entry.	PD; DA	Jan 2021 – Mar 2021
Procurement of veggie meter from Longevity Link Corporation.	PD	Jan 2021 – Mar 2021
Initial baseline food frequency surveys and veggie meter readings will be taken as a kick-off for the implementation of the “Moringa Challenge.” This will be conducted at the same time and location as the cultivation training for those sites interested and who have consented to personal data collection. Surveys and veggie meter reading will be taken at locations that allow for in-person meetings. Surveys only will be used for participants or regions where only remote interaction will take place.	PD	Apr 2021 – Sep 2021; April 2022 - Sept 2022
Six-week follow-up surveys and veggie meter readings to track consumption trends.	PD	May 2021 - Oct 2021; May 2022 - Oct 2022
Data and analysis entry from six-week surveys and veggie meter readings into REDCap platform and online database.	DA	May 2021 - Oct 2021; May 2022 - Oct 2022
Three-month follow-up surveys and veggie meter readings to track consumption trends.	PD	Jul 2021 – Dec 2021; July 2022 – Dec 2022
Data and analysis entry from three-month surveys and veggie meter readings into REDCap platform and online database.	DA	Jul 2021 – Dec 2021; Jul 2022 – Dec 2022



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Six-month follow-up surveys and veggie meter readings to track consumption trends.	PD	Sep 2021 – Feb 2022; Sep 2022 – Feb 2023
Data and analysis entry from six-month surveys and veggie meter readings into REDCap platform and online database.	DA	Sep 2021 – Feb 2022; Sep 2022 – Feb 2023

**Objective 5: Implementation of processing and preservation trainings at 20 locations.**

Objective 5 Activities	Performed by	Timeline
Implement the processing and preservation training will take place in person (with a virtual training platform developed as a backup incase in-person training is not possible) which will include detailed demonstration workshops and information sharing on proper hygiene, handling, drying, and packaging of moringa leaf powder and preparation of value-added moringa products. Construction of chimney solar dryers will be conducted in appropriate sites. Dehydrators will be distributed in sites where solar dryers are not appropriate.	PD	Sep 2021 – Feb 2022; Sep 2022 – Feb 2023
Project <del>manager</del> coordinators will assist in construction of dryers as needed and with information for packaging and processing of moringa specialty crop products. This information will be useful for the larger specialty crop industry as techniques for drying and processing moringa can be used, adapted, and applied to other fruits, vegetables and herbs grown in California. Preserving and storing nutrient-dense specialty foods can increase the market size by expanding the potential for sales throughout the year, rather than just when the specialty crop is in season.	PM PCs	Aug-2021- Oct 2022

**Objective 6: Development and maintenance of moringa website and online database.**

Objective 6 Activities	Performed by	Timeline
Develop web-based information on moringa uses and benefits, cultivation best practices, and processing and preservation. Information and lessons learned from previous research, input from farmers, and outcomes from previous California Department of Food and Agriculture, and National Institutes of Health funded projects on moringa will be incorporated. Video tutorials and online activities developed for all Awareness training (Objective 2). They will also be available for Cultivation/Consumption (Objective 3) and Processing/Preservation (Objective 5) as needed if in-person training is not possible.	PD, WD	Nov 2020- Jan 2021
Design and launch of moringa website with information sharing of training materials and data on moringa farmers and baseline cultivation information. Information for producers, retailers, and consumers will be made available to promote the growth of the moringa industry.	WD	Jan 2021



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Data entry for participation in all training stages, cultivation tracking, yield data, consumption data, and sales data will be entered as it is collected and analyzed.	DA	Nov 2020 - Feb 2023
Pictures, video, and participatory online forums will be added to the website as they are made available throughout the grant period and beyond.	PD; WD; Participants	Nov 2020 – Feb 2023

**Objective 7: Engagement with moringa markets.**

Objective 7 Activities	Performed by	Timeline
Farmers’ markets will be approached to educate current moringa distributors on how to market and package moringa for sale at existing farmers’ markets, and provide education on how to get the second certificate for bringing more moringa products and volume to farmers’ markets. “Second certification” allows for the producer to supply their products to another certified farmer to sell at farmers’ markets on their behalf. This will allow farmers of moringa, and other specialty crops, to promote their crop at multiple locations daily without having to be there in person. Giving farmers the ability to allow other farmers to assist in the distribution of their crops allows a higher level of visibility and exposure in the marketplace. Second certificates are also used by universities to promote the sale of crops through certified farmers’ markets by allowing a certified producer to sell crops produced by the universities.	PD; PMPCs	Apr 2021- Sep 2021; Apr 2022 – Sep 2022
Local grocery stores, restaurants, and retail stores will be contacted via phone and skype for interest in selling fresh and dried Californian grown moringa and moringa products. Interested parties will be linked with farmers and added to the online database.	PD; PCs	Jul 2021- Feb 2023

**Objective 8: Project impact assessment and outcome distribution.**

Objective 8 Activities	Performed by	Timeline
Online training materials will be modified and updated based on successes and lessons learned from the trainings on awareness, cultivation, processing, and preservation.	PD, WD	Feb 2023 – Mar 2023
Moringa cultivation, yield, sales, number of farmers, number of retailers and distribution data will be compiled, published, and made available on the moringa website.	DA	Feb 2023 – Mar 2023
Completion of consumption data analysis and manuscript submitted to open access scientific journal for publication.	PD; DA	Feb 2023 – Mar 2023
Completion of final report for CDFA.	PD	Mar 2023

**Project Beneficiaries**

Estimated number of project beneficiaries: 26,825

Does this project directly benefit socially disadvantaged farmers as defined in the RFA? Yes  No

Does this project directly benefit beginning farmers as defined in the RFA? Yes  No

Project beneficiaries include elementary, middle, high school, and university students; farmers, hospitals, and workplaces; organizations working with underserved populations; and exposition and virtual training attendees. Students will learn about the health benefits of moringa. Adults will learn about and incorporate moringa into their diets to increase nutrition, protein, and resilience to chronic diseases. Interested beneficiaries will further knowledge and skills during in-depth



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production and processing training, ultimately improving the health of Californians and spreading awareness to others about moringa.

This project aims to support increased awareness and consumption of moringa in California, benefiting the specialty crop industry on the producer and consumer level. California adults and children will learn more about food grown and eaten around the world for centuries that can readily be grown and eaten fresh or dried. The efforts are aimed to benefit current and future moringa farmers and businesses, as well as children and adults in California, by adding moringa to their diets. Information will focus on evidence-based science, and participants will learn best cultivation and drying practices to improve and increase moringa production based on information shared from moringa farmers that will serve as Project Coordinators. Benefits of the program will reach many people and not target individuals or specific businesses.

**Statement of Enhancing Specialty Crops**

By checking the box to the right, the recipient confirms that this project enhances the competitiveness of specialty crops in accordance with and defined by the Farm Bill.

**Continuation of Project Information**

***How this project will differ from and build on the previous efforts:***

This project builds upon 2016 Specialty Crop Block Grant Program (SCBGP) Project 32, which focused on production and developing best practices for processing with current moringa farmers in the Fresno Valley. The project also builds upon 2018 SCBGP Project 21, which is investigating different cultivation techniques and fertilizer treatments to understand the effects on nutritional and phytochemical content of dried moringa. The previous and ongoing projects have greatly improved the production of moringa in California and advised farmers on acquiring Cottage Food class status for sale at farmers' markets. The project aims to increase consumer demand for such farmers while increasing the number of farmers. The project will utilize and incorporate the materials and best practices developed in the previous and ongoing projects into the training at schools, workplaces, and with farmers. The Program Directors from both projects have agreed to collaborate and advise on this project.

***Summary of the outcomes of the previous efforts:***

2016 SCBGP Project 32 delivered training to small-scale moringa farmers in the Fresno area on drying moringa, developed relationships with buyers in the California region to increase sales, and gained information about value-added processing. The project increased market potential for these farmers and developed a manual for drying moringa. 2018 SCBGP Project 21 has completed one year of addressing production issues in California-grown moringa including evaluation of frost protection methods, irrigation scheduling, and fertilizer applications. This project continues to evaluate these production methods as well as quantifying the effect of production practices on nutrient and antioxidant content of moringa leaves and identifying pests present on moringa. These efforts will assist local moringa growers in improving moringa production in anticipation of increased market demand.

***Lessons learned on potential project improvements:***

2016 SCBGP Project 32 demonstrated drying methods that can preserve moringa and increase nutrients for moringa powder. Navigating and educating farmers on food safety regulations for organic certification and marketing was one of the main challenges. The project intends to further enhance market connections through the online database and promote moringa as a non-genetically modified organism (non-GMO) crop. Due to increasing environmental pressures from climate change, pesticide use, and decreased quality of soil and water, there has been a growing shift in consumer preference for non-GMO crops. Advantages of promoting moringa and other non-GMO specialty crops include an improved environmental impact profile regarding pesticides, soil health, antibiotics, and fertilizers. Some studies have also noted improved nutritional content in non-GMO crops compared with their GMO counterparts. Preliminary results of these studies should be available by the start of this project and will be incorporated into the training manuals on best practices of cultivation.

**Project Sustainability**



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Moringa can be easily grown in California once greater awareness is achieved. Through the virtual and in-person training programs, literature and resources will be developed and available for participants and the general public during and after the completion of the program. Once increased awareness and demand is established further outreach will happen through people to people connections and increased consumption, making the project self-sustaining. Recognition will also invoke more companies and universities to conduct research and develop further programs on moringa. Businesses will further develop and refine preservation and new ways to prepare moringa in food products. Current production of moringa in California is less than 10 acres, and this project looks to double production along with market demand, an increase with continued expected growth over the years to come.

**Support from Other Federal or State Grant Programs**

Was this project submitted to a Federal or State grant program other than the SCBGP for funding and/or is a Federal or State grant program other than the SCBGP funding the project currently?      Yes  No

**EXTERNAL PROJECT SUPPORT**

This project is supported by Con10u2FarmL3C, Davis Farmers Market, Moringafarms, and Shared Abundance Organic Farm. Davis Farmers Market supports this project because it aligns well with the local certified famers’ market mission to support healthy, active and nourished lifestyles by teaching Californians about nutrition, while also building partnerships in communities to make healthier choices and bring locally produced food to the general population reducing need for outsourced crops. In addition, the project will strengthen the marketplace and understanding of moringa through the proposed awareness training, cultivation, and consumption activities, and should have great health impact across communities state-wide.

**EXPECTED MEASURABLE OUTCOMES**

**Outcome 2:** Enhance the competitiveness of specialty crops through increased consumption.

- **Indicator 1:** Of the 16,225 children and youth reached,
  - a. 16,225 gained knowledge about eating more specialty crops.
  - b. 8,112 reported an intention to eat more specialty crops.
  - c. 4,056 reported eating more specialty crops.
- **Indicator 2:** Of the 10,600 adults reached,
  - a. 10,600 gained knowledge about eating more specialty crops.
  - b. 5,300 reported an intention to eat more specialty crops.
  - c. 2,650 reported eating more specialty crops.
- **Indicator 3:** 2 new and improved techniques and processes to enhance the nutritional value and consumer acceptance of specialty crops (including patents).
- **Indicator 4:** 1 new specialty crops and/or specialty crop products introduced to consumers.
- **Description of data collection methods:** Initial outreach efforts will identify, and document target populations interested in awareness trainings. During the trainings, attendance information retention surveys will be completed. Participants may sign-up on a list server to keep updated on moringa research and information. The project anticipates approximately 50 percent of awareness training participants will be interested in follow-up trainings on cultivation and have the intention to increase consumption of moringa. Cultivation training attendees will complete detailed retention surveys, and participate in focus groups where questions, comments, and concerns will be documented and shared with the groups and consolidated for the website. Participants who enroll in the “Moringa Challenge,” will take initial readings to determine baseline carotenoid levels, and indicator or fruit and veggie intake, followed by a six-week, 3-month, and 6-month follow-up survey and veggie meter reading. The project anticipates that 50 percent of those intending to increase moringa consumption will be consuming more after six months, which will be demonstrated by higher carotenoid levels and food frequency results. Since the veggie meter will measure overall fruit and veggie intake, the survey will help to indicate whether changes in vegetable intake are due to increased consumption of moringa. If in-person veggie meter reading are not possible then survey data will be used to monitor moringa and vegetable consumption.



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Two new technologies and processes, solar drying and food dehydration, will be introduced during the third phase of the training program which will be focused on processing and preservation. In the awareness training, taste testing of fresh moringa leaves, dried powder, and novel food combinations with moringa (hummus, pesto, smoothies, and popcorn) will be made available. Consumption data tracking will document and report on taste preference using the food frequency surveys. The number of solar-dryers and dehydrators will be documented and tracked. One new specialty crop, moringa, will be introduced to consumers. The number of participants in initial awareness trainings, talks, and presentations will be recorded. Participants will have the option to sign up for a list server, also documenting the number of consumers with an interest in moringa.

- **Description of activities to monitor and report on outcomes:** Documentation and records of participation and information retention surveys on awareness trainings will monitor impact. Results will be consolidated and analyzed to improve trainings and report outcomes online. Taste preferences and recommended recipes will be shared with participants and the public through the online website. The website will explain how to grow and process moringa, and the health and environmental benefits of moringa. The site will include up-to-date research. Moringa consumption data will be monitored over six months using surveys and scientific equipment. Results will be analyzed and published in an open-access peer-reviewed journal and on the website. Monitoring of the utility of processing and preservation techniques will be conducted by phone calls to individuals using the new technologies, and reports on success and challenges will be uploaded to the website.

**Outcome 3:** Enhance the competitiveness of specialty crops through increased access and awareness.

- **Indicator 1:** Of the 26,825 consumers or wholesale buyers reached,
  - a. 26,825 gained knowledge on how to access/produce/prepare/preserve specialty crops.
  - b. 6,706 reported an intention to access/produce/prepare/preserve specialty crops.
  - c. 3,353 reported supplementing their diets with specialty crops that they produced/preserved/obtained/prepared.
- **Indicator 3:** Number of existing delivery systems/access points reached that expanded and/or improved offerings of specialty crops.
  - a. 5 farmers markets.
  - d. 5 grocery stores.
- **Indicator 4:** Number of new delivery systems/access points offering specialty crops.
  - a. 10 farmers markets.
  - d. 2 grocery stores.
  - f. 1 food hubs that process, aggregate, distribute, or store specialty crops.
- **Description of data collection methods:** Data collection for Indicator 1 will coincide with data collection methods, documentation, and surveys for Outcome 2 with additional information included on where consumers can access moringa, and preferred methods for preservation and consumption. Farmers' markets will be approached to educate current moringa distributors on how to market and package moringa for sale at existing farmers' markets and provide education on how to get the second certificate for bringing more moringa products and volume to farmers' markets. Farmers selling moringa at markets will be listed on the website for ease in access by customers. Monthly tracking of participating growers selling at farmers' markets will be tracked over the program period. New moringa farmers selling at farmers' markets will be documented. Farmers will be introduced to existing and new grocery stores to distribute fresh leaf moringa. Annual sales records of moringa at farmers' markets and grocery stores will be tracked and recorded.
- **Description of activities to monitor and report on outcomes:** Taste preferences and recommended recipes will be shared with all participants and the public through the online website. The website will also explain uses, how to grow and process, and the health and environmental benefits of moringa. The site will include up-to-date research conveyed in understandable terms. Moringa consumption data will be analyzed and published in an open-access peer-reviewed journal and on the website. Growers and retailers will be listed and monitored and listed on the website to create a network for consumers and wholesale buyers to readily reach producers. Annual





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moringa sale records, number of sellers at farmers' markets and grocery stores, along with the types and number of moringa products sold will be tracked and published in annual reports for stakeholders.

- ☑ **Outcome 4:** Enhance the competitiveness of specialty crops through greater capacity of sustainable practices of specialty crop production resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
- **Indicator 2:** Adoption of best practices and technologies resulting in increased yields, reduced inputs, increased efficiency, increased economic return, and conservation of resources.
    - a. 5,030 growers/producers indicating adoption of recommended practices.
    - b. 5,030 growers/producers reporting reduction in pesticides, fertilizer, water used/acre.
    - c. 500 producers reporting increased dollar returns per acre or reduced costs per acre.
  - **Description of data collection methods:** Data will be tracked and collected at follow up visits to monitor the success of recommended practices for moringa as a specialty crop in groups that participated in planting. Record of seeds plants will be compared with sprouted and successful plants to determine germination rates. An estimated 75 percent of farmers who were involved in the cultivation training and continue to grow moringa will adopt recommended practices and reduce pesticide, fertilizer, and water use. Growing, harvesting, pruning techniques, mulching, organic methods, and composting will be shared with participants and available online. The project will only collect data on revenues from farmers. The project will be promoting micronutrient micro forestry, which will help in land and water conservation. “Microforests” are small (one meter by two-meter plots or garden beds) that are densely planted with moringa trees (10 centimeters by 15 centimeters apart), creating an edible “microforest” or hedge crop. Moringa is a particularly unique vegetable tree because of its nutrient density which is partly due to its low water content. While most vegetables are 90-95 percent water, moringa is only approximately 82 percent water; making its leaves packed with amino acids, minerals, and nutrients so that, in small plots that conserve space and water, a “micronutrient microforest” is created. Yield data for moringa production in California has not been documented previously and will be done so for the first time in this program. Previously reported values from other countries will be compared to yield outputs by growers in this program. Cultivation participants will document the need and rate use for organic pesticides. Farmers who have switched to moringa from other crops will report on any observed reduction in pesticide and/or water usage.
  - **Description of activities to monitor and report on outcomes:** Activities include scheduled visitations to schools and farms growing intensive beds of moringa. These will be “virtual” visits if in-person meeting is not possible. Best practices will be documented, adapted as needed, and shared with participants and on the website. Pictures and videos from schools, and interviews with participants will be collected and shared on the web to provide tutorials for interested parties. Yield averages before and after new practices, increased production size, sales, production and process into powder and sales will be analyzed and included in the annual reports and summarized on the website.