

## DEHYDRATED VEGETABLES

Strengthening the sustainability of smallholder supply chains

### USAID funds XUCA vegetable dehydration project

The United States Agency for International Development (USAID) through its Science, Technology, Research and Innovation for Development (STRIDE) program, funded the vegetable dehydration project of Xavier University College of Agriculture (XUCA) in May 2015.

This one-year project aimed to address postharvest losses and strengthen the sustainability of smallholder vegetable supply chains.

It focused on the dehydration of four economically important crops in Northern Mindanao (carrot, cabbage, squash and tomato) using a locally designed and fabricated heat-pump drying system. It also developed dehydrated vegetable-supplemented products and explored potential markets.

The Regional Agriculture and Fisheries Council of Northern Mindanao (RAFC-X), being the voice of the farmers in Northern Mindanao, served as the project's collaborating partner under the leadership of Chairman Edgardo D. Layug.

The project also involved the participation of several local government units in Misamis Oriental and Bukidnon and representatives from selected government agencies, Cagayan de Oro barangays and food manufacturing companies.



During the USAID scholarships and grants awarding ceremony last June 18, 2015, Dr. Maria Rosario P. Mosqueda, project principal investigator receives the certificate of recognition for Xavier University as research grant recipient.



Some of the grantees with representatives from USAID and the Research Triangle Institute (RTI).

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## XUCA strengthens research capability

Xavier University College of Agriculture strengthened its research capability through the USAID-funded vegetable dehydration project.

A faculty member and a laboratory technician of the College were trained at the Department of Science and Technology's Food and Nutrition Research Institute (DOST-FNRI) on food analysis.

Laboratory equipment, measuring instruments, computers, Arc GIS software and copies of the 2016 AOAC standards were also acquired. It has also strengthened its drying research capability through the acquisition of domestic food dehydrators, water activity meter, and fabrication of a lab-scale heat pump drying system.

XUCA has the capability to determine proximate composition and selected physical characteristics of food products.

For inquiries regarding laboratory service, contact XUCA through: [aggies@xu.edu.ph](mailto:aggies@xu.edu.ph)



Sylvia Aguhob, faculty member and project study leader, during her training at the DOST-FNRI, Taguig City.

## XUCA faculty members meet with vegetable supply chain players

Farmers, truckers, traders and vegetable retail vendors were interviewed by XUCA faculty members for the vegetable dehydration project. The activity aimed to provide a more holistic perspective of the vegetable supply chains in Northern Mindanao.

On-site farm interviews in key vegetable producing barangays of Claveria, Lantapan, Talakag, Impasug-ong and Malaybalay were conducted. This was done to assess the production capacity of the farmers as well as identify major issues in vegetable production.

A partial assessment of vegetable outflow via land transportation was also conducted at the Bulua Vegetable Landing Area (BVLA). The data gathered was used to determine the destinations of Northern Mindanao vegetables and estimate the demand volume at these markets.

In addition, major public markets in Mindanao were visited to gather information on vegetable sources and demand volume. These include Iligan City in Lanao del Norte, Ozamis City in Misamis Occidental, and Pagadian City in Zamboanga del Sur.



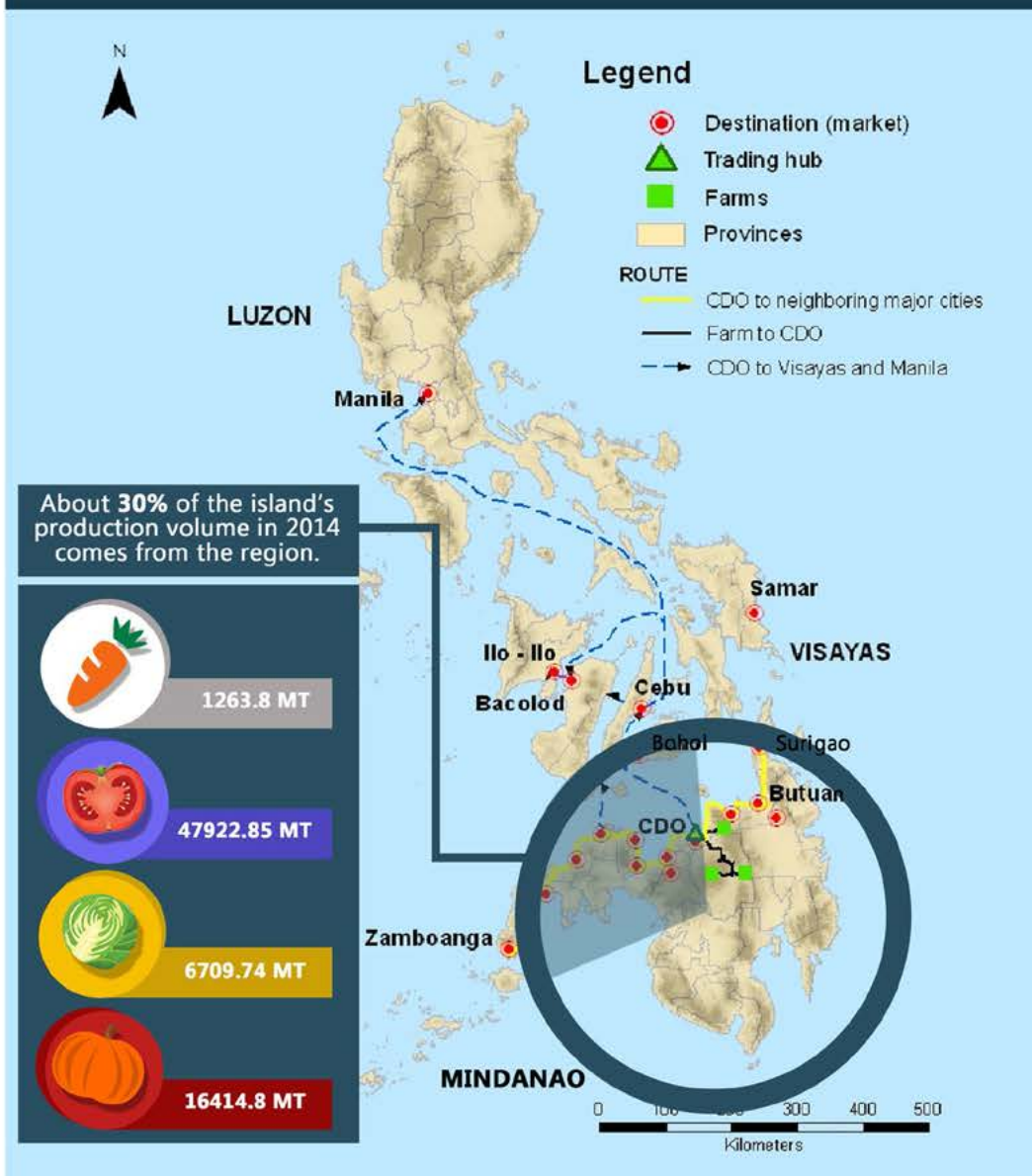
Engr. Mark Alexis Sabines interviewed Kagawad Roberto Sulatan, also a vegetable farmer in Miarayon, Talakag Bukidnon, September 2015.



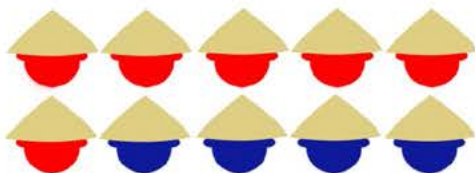
Trucker at the Bulua Vegetable Landing Area

**Northern Mindanao** is the leading vegetable producer in Mindanao and second in the Philippines.

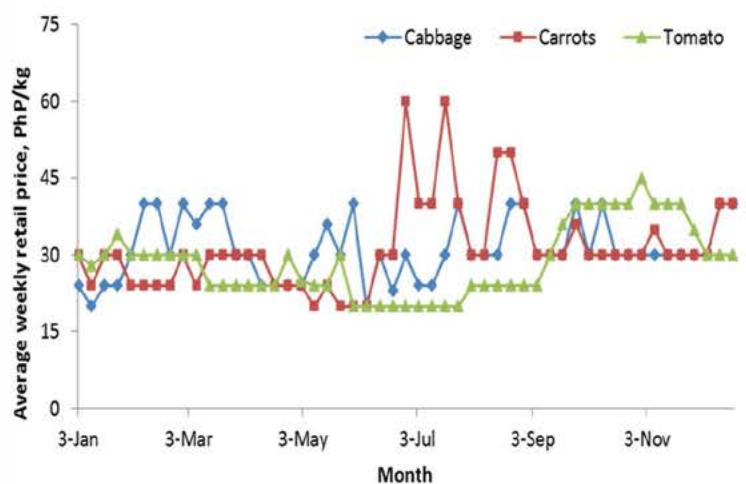
Aside from local markets, it also supplies other areas, such as **Metro Manila, Cebu, Bohol, Bacolod, Ilo-ilo, Dumaguete, Zamboanga Peninsula, Caraga Region, and the Lanao provinces**



However, **6 out of 10** farmers in Northern Mindanao remain poor.



**High post harvest losses** and **unpredictable market price fluctuations** of vegetables are among the major challenges that confront smallholder farmers.



Average weekly retail prices of selected vegetables in Cagayan de Oro City, January-December 2014 (Source: Philippine Statistics Authority, 2014)

## XUCA engineer develops a prototype heat pump drying system

Engr. Mark Alexis O. Sabines, an XUCA Agricultural Engineering faculty member, successfully designed and fabricated a heat pump drying system for the College's vegetable dehydration research project.

This prototype could be an alternative to the conventional hot air drying systems available in the market.

It has a maximum capacity of 10 kilograms. Its operating temperature ranges from 30°C to 100°C. Since it is locally fabricated, scaling up this prototype to pilot scale production would be easier as all components can easily be sourced. It has been tested on four vegetables (carrot, cabbage, squash and tomato) under 55°C, 65°C and 70°C drying conditions.



Prototype heat-pump drying system



Engr. Mark Alexis Sabines of XUCA checking the controls of the dryer.



## XUCA produces dehydrated vegetables

Dehydrated cabbage, carrot, squash and tomato were produced using the fabricated prototype heat pump drying system under XUCA's vegetable dehydration research project.

Samples of dehydrated carrots, squash and tomato were presented to Monde Nissin Corporation, a large scale instant noodle manufacturer. Dehydrated squash samples were shown to Santiago Fresh Miki Factory in Pagadian City. Both manufacturers gave positive feedback. Monde Nissin's materials department manager, Mr. Welly Toha, said that the products' color closely approximated that of the imported ones. He also indicated that the products will undergo further testing to meet their other quality specifications.

Mr. Eulie Teope, owner of Santiago Fresh Miki Factory, was pleased to learn about the dehydrated squash. He used to incorporate squash powder in his *miki* production but found it too laborious to produce.

Dehydrated carrot, squash and tomato powder were also used to enhance the quality of common food products such as cookies, soups, and instant noodles.

## Dehydrated vegetables drive food product enhancements

Sixteen dehydrated vegetable-supplemented products were developed by Xavier University College of Agriculture's vegetable dehydration project. Enhancements to existing products like bread (pandesal and meat bun), butter cookies, instant noodles, soup mixes and arroz caldo.



Participants during the consumer testing of dehydrated vegetable-supplemented products at Xavier Ecoville, Lumbia, Cagayan de Oro City.

The products were then subjected to a sensory evaluation by senior XUCA Food Technology students. Eight of sixteen products were shortlisted.

Representatives from the Department of Education-X and its Cagayan de Oro Division, Department of Social Welfare and Development-X, Office of Civil Defense-X, City Social Welfare and Development Office participated in focus group discussions and sensory evaluation to assess acceptability of the products for their programs.

These products could be alternative food sources during disaster relief operations and school feeding programs.

Evaluation was also done by potential household consumers in four barangays of Cagayan de Oro (Carmen, Consolacion, Kauswagan and Lumbia) and by the staff members of XUCA's Manresa Farm.

## Exploring potential market for dehydrated vegetables

There is a large market for dehydrated vegetables in the country. This was found by the XUCA project team during its market potential assessment.

About 2 metric tons of dehydrated carrot and cabbage are needed by Monde Nissin Corporation every month. These are used as condiments of instant noodles. At present, Monde Nissin sources all its dehydrated carrot and cabbage requirements from China.

About the same amount of squash powder is needed by Santiago Fresh Miki Factory in Pagadian City. Mr. Teope learned about the use of squash as food color in *miki* production from the Department of Science and Technology.

Limited supply of fresh squash and laborious drying constrained the fresh miki manufacturer from maximizing use of squash powder in his operation.



Mr. Welly Toha (right), Materials Department Manager of Monde Nissin Corporation, with Mr. Edgardo C. Layug during an interview in September 2015.



Mr. Eulie Teope (right), proprietor of Santiago Miki Factory with Engr. Mark Alexis Sabines during the interview in October 2015.

## XUCA GIS specialist develops protocol for vegetable supply estimation

Engr. Mark Alexis O. Sabines, dryer design engineer and GIS specialist of the vegetable dehydration project, was able to estimate vegetable supply at the parcel level in several barangays in Bukidnon and Misamis Oriental.

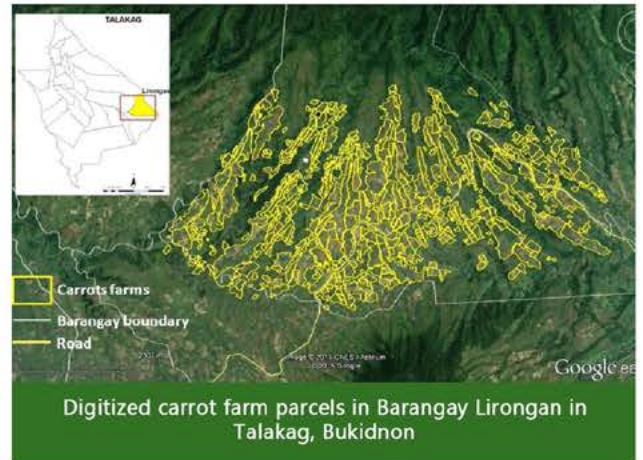
While province-level vegetable supply data are available from the Philippine Statistics Authority, spatial resolution of these data is coarse. For more effective planning, program and policy formulation at the municipal and barangay levels, higher spatial resolution would be necessary.

At higher spatial resolution, supply estimates become near-realistic as parcels of land across the landscape can be accounted. Location-specific factors affecting production and post-harvest activities can also be identified and analyzed.

Using GIS tools and assisted by community leaders and farmers, Engr. Sabines produced maps of vegetable production areas in twelve Bukidnon and Misamis Oriental barangays. These maps were used in estimating barangay production volume of selected vegetables.

Local government units can tap the XUCA Geoinformatics Laboratory for training and capacity building related to agri-land use mapping.

For inquiries, please contact [aggies@xu.edu.ph](mailto:aggies@xu.edu.ph).



Digitized carrot farm parcels in Barangay Lirongan in Talakag, Bukidnon



Farmers and community leaders with Engr. Sabines, in Barangay Miglamin, Malaybalay City, Bukidnon during a mapping validation workshop.

## The STRIDE Program

The Science, Technology, Research, and Innovation for Development (STRIDE) Program is a five-year PHP 1.3 billion initiative by the United States Agency for International Development (USAID) that will spur inclusive economic growth by boosting science and technology research.

USAID will work closely with Philippine academic institutions and industries to transform their capacity to produce research, graduates, and innovation partnerships to accelerate development in the country.

It is the flagship science, technology and innovation program of the U.S.-Philippines Partnership for Growth which promotes inclusive economic growth. STRIDE is managed by USAID/Philippines Office of Education (<http://stride.org.ph/about-us>).

### Scholarships:

- Professional Science Master's Scholarship
- PhD/Post-Doctoral Scholarship

### Grants:

- Philippine-U.S. Research and Exchange (PURE) Grants
- Collaborative Applied Research with Industry (CARWIN) Grants

For more information about the STRIDE program visit [www.stride.org.ph](http://www.stride.org.ph) or contact:

[helpdesk@stride.rti.org](mailto:helpdesk@stride.rti.org)  
 (02) 843.0787 - (02) 843.1081  
 0915.452.0390 (Globe)  
 0947.612.8835 (Smart)

## Photo Gallery of Project Activities



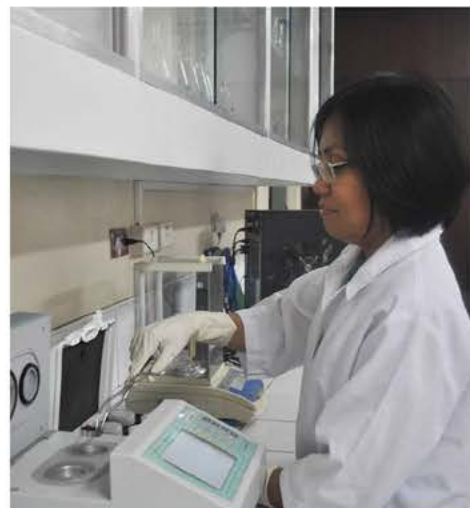
Engr. Mark Alexis O. Sabines, prototype heat pump dryer design engineer, with XU Agricultural Engineering laboratory technician, Guillmor Sumobay, conducting maintenance check up.



The participants of the mapping validation workshop in Barangay Kibangay, Lantapan, Bukidnon identifying parcels of cabbage farms in the Google Earth generated map.



Dr. Maria Rosario P. Mosqueda presented the project during the pitching activity and Careers in Science, Technology and Innovation Research Exhibit last March 10 at The Peninsula Manila.

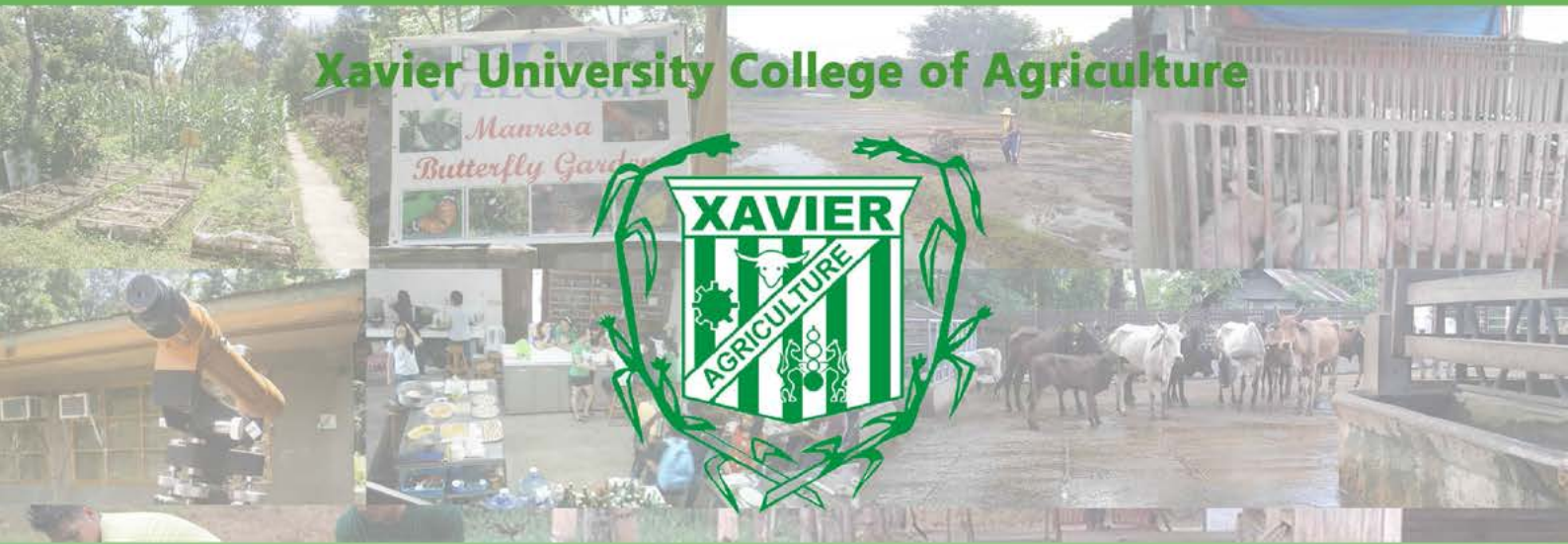


Dr. Mosqueda performing laboratory test for dehydrated vegetable products.



Sylvia T. Agujob, project study leader, with representatives from government agencies and local government units during an orientation session prior to a focus group discussion.

## Xavier University College of Agriculture



Established in **1953** by Fr. William Masterson, SJ

The only Ateneo university offering agriculture programs.

Recognized by the Commission on Higher Education Department (CHED) as a **Center of Excellence in Agriculture Education**

Reaccredited Level III by Philippine Accrediting Association of Schools, Colleges and Universities (PAASCU)

Declared as **Provincial Institute for Agriculture** (PIA) under the National Agriculture and Fisheries Education System

### Academic programs:

- Bachelor of Science in Agriculture
- Bachelor of Science in Agricultural Engineering
- Bachelor of Science in Development Communication
- Bachelor of Science in Food Technology
- Bachelor of Science in Agribusiness

### Key laboratories and facilities:

- Geoinformatics laboratory
- Proximate analysis laboratory
- Microbiology laboratory
- Tissue culture laboratory
- Soil laboratory
- Plant Pest Clinic
- General analytical laboratory
- Manresa Farm
- XU farms in Maramag and Sumilao

**“Potential of dehydrated vegetable production in strengthening the sustainability of smallholder vegetable supply chains in Northern Mindanao”**

### TEAM MEMBERS:



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