Science, Technology, Research and Innovation for Development (STRIDE)

Automation of the Coco Sugar Production

GRANTEE: De La Salle University (DLSU)

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US INDUSTRY PARTNER: The University of Arizona (UA)

COLLABORATING PARTNERS: Ragay Coconut Industry Development Council Philippine Coconut Authority Camarines Sur 1 Provincial Office Central Bicol State University of Agriculture (CBSUA)

GRANT PERIOD: December 16, 2015 to April 15, 2017

CONTRACT AMOUNT: Php 4,299,077 (approximately USD91,500)

Addressing the challenges in coconut sugar production

Foods high in the glycemic index (GI) cause blood sugar to spike, resulting in serious consequences for diabetics. According to the Philippines Department of Agriculture (DA), coconut sugar has a distinct property with a low GI of 35, lower than regular table sugar, which makes it beneficial even for diabetics. With coconut sugar's nutritional and health benefits, its demand has increased in both local and international markets. Nevertheless, coconut farmers still rely only on the conventional crude wood-fired cooking method, which results in varying quality of the sugar and longer cooking time.

Ribbon cutting during the project launch in Ragay, Bicol, Camarines Sur on February 5, 2016

DLSU recognized the challenges encountered by coconut farmers. To help increase their yield as well as improve the quality of their coconut sugar, and with support from USAID STRIDE in collaboration with the UA and the CBSUA, DLSU introduced the automated cooking system and technology for coconut sugar production. This innovation will directly impact coconut farmers, resulting in growth in the coconut industry, as coconut sugar is considered more profitable than copra based on market and economic analyses.

In the course of the research, a major challenge was addressed with regard to the collection of coconut sap, the raw material for coconut sugar. The project used a robotic system that ensures coconut tree tapping time does not exceed five hours, which means farmers avoid fermentation of the sap even without refrigeration or pasteurization. Collection of coco sap follows these processes: a) from the coco sap tank reservoir, the coco sap flows directly to the heat exchanger with initial temperature of 30 degrees Celsius; b) the coco sap flows to another chamber for additional heating until the temperature reaches 115°C, the optimal heat for caramelization; and c) once the coco sap is in its caramelized form and ready for drying, the output valve is opened so that the coco sap flows to the drying chamber, which is supplied with heated air to hasten the drying process.

Building of structure where the Automated Coconut Sugar Cooking System will be installed in Ragay, Bicol, Camarines Sur

Milestones

Significant activities undertaken by the project are as follows:

- Experiments to determine the porosity of coconut sap to determine whether a direct or convection heater is needed for the coco-sugar cooking system to ensure improvements in yield and quality.

  Result: Convection heating with 70°C air temperature resulted in the formation of a viscous substance, with only the surface dried up, while drying with continuous mixing produced sugar powder.
- Experiments to determine flowability of coconut sap to establish heating procedures such as when to initialize and stop heating and when to transfer the mixture to another container for cooling.

  Result: Flow rate decreases with corresponding increases in the concentration of the solution
- Final design of the automated coco-sugar cooking system is composed of: a) three cylinders (the boiler, heat exchanger, and rotary dryer); b) coco sap reservoir to be used as a bucket; and c) a combustion chamber that uses fireproof bricks.

The initial deployment of the prototype in Ragay, Camarines Sur, will serve as a working platform for continuous improvement in terms of technology transfer, the agribusiness model, and product commercialization. The agribusiness model that will be developed by CBSUA could be adopted by local farming communities in the Philippines.