



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



### Finding Solutions to Precocious Flowering of *Stevia rebaudiana* in the Philippines

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**INDUSTRY PARTNER:** Bicolandia Greenfields Development Organization, Inc (BIGFIS)

**GRANT PERIOD:** November 1, 2014 to November 30, 2016

**GRANT AMOUNT:** PHP3,439,920 (approximately USD73,190)

#### A healthy alternative to sugar

Stevia may refer both to the sweet compounds it contains, technically called *steviol* glycosides, which are found mainly in the leaves of the plant species *Stevia rebaudiana* (Bertoni), or to the plant itself, a bush belonging to the Asteraceae family, which grows to about 50 to 60 cm on average. *Steviol* glycosides are about 300 times sweeter than sugar, have zero calories, and do not register a glycemic index; thus, they are good sugar substitutes for patients with diabetes mellitus, metabolic syndrome, and obesity and for those who want to lose weight.

Stevia is best grown under sub-tropical conditions, when summer day length is 13 hours or longer, as the long day allows the leaves to accumulate the *steviol* glycosides. However, under such conditions, stevia production becomes seasonal because low winter temperatures prevent growth of leaves.



Prof. Cruz (2nd from left) and research team explain the *Stevia* post-harvest processes from storage to grinding

In countries near the equator, stevia is able to produce leaves all year long, but also tends to flower prematurely in the absence of the longer days during the summer. The *steviol* glycosides begin to decrease once 10% of the buds blossom into flowers. Thus, budding becomes the indicator for harvest.

Preventing flowering, which diverts nutrients toward the reproductive

stage of the plant, becomes the greatest challenge of the year-round production in the Philippines. The shorter days adversely affect the production of steviol glycosides and stevia's sweetness.

To maximize stevia production, CBSUA, with support from USAID STRIDE and in collaboration with BIGFIS, initiated a research to find ways to prevent precocious flowering of stevia to ensure high *steviol* glycoside content.

## Findings

The findings of the research are as follows:

1. Exposure to light-emitting diode (LED) light treatment delayed flowering on stevia plants.
  - First buds appeared in plants not exposed to light treatment in the fourth week, with the buds blossoming into flowers in five to seven days, and next buds appeared immediately after first flowering. Thus, the plants had to be harvested in about six weeks.
  - Plants exposed to light treatment performed better because only about 20% developed first buds in the fourth week and about 60% of the plants developed first buds in the sixth to the seventh weeks. Like the control plants, the buds bloomed into flowers in five to seven days.
  - For the control plants, buds appeared almost simultaneously throughout the plant.
  - For the plants exposed to light treatment, the appearance of buds on branches exposed to light treatment was slow, with about three to four weeks before harvest.
  - The average number of days for the appearance of first bud was a bit longer during summer months from April to July compared to the rainy months from October to January. This can be attributed to the difference in day length and light intensity of the summer and rainy months.
2. Plants exposed to LED lights showed better growth performance in terms of plant height, canopy, circumference, and dry weight.
  - Plant height and weight were significantly higher for plants exposed to light treatment.
  - In a majority of the samples analyzed, the weights recorded before and after freeze drying were taken and recorded illustrate that the dry weights of the treated plants were much higher than those of the control plants.
  - As the weight of the plant increases, the *steviol* glycosides content increases as well.
3. Plants exposed to LED lights showed increased *steviol* glycoside content in dried stevia leaves.
  - Analysis using a Reverse Phase High Performance Liquid Chromatography (HPLC) with an oven temperature of 25°C and a run time of about 30 minutes, and mobile phase of 75:25 water and acetonitrile under isocratic conditions, indicate that light treatment increases sweetness.
4. Planting distance should be investigated further due to differences in growth.
  - The planting distance used for the experiments was 22.5 cm; however, growth was not uniform with some plants producing more biomass and some producing less, which may be due to the shading effect of the bigger plants or congestion. In the entire duration of the experiment, outer plants seemed to perform better in terms of delay in flowering and growth parameters.

These findings imply that LED light treatment enables continuing vegetative growth and prevents precocious flowering, which also increases accumulation of more *steviol* glycosides; thereby, increasing sweetness.