



Stevia: Effect of cultivation methods on production and steviolglycosides content.

Sascha Weber & Nieves Garcia Victoria

Background

Consumers increasingly demand products from natural sources. This is the driving force for the demand of steviolglycosides by the food industry. Steviolglycosides are extracted from the leaves of the plant *Stevia rebaudiana*, and processed as low-caloric sugar substitutes in food and beverages.

S. rebaudiana is a short day plant cultivated seasonally in big outdoor plantations. Flowering is induced at photoperiods shorter than 12 hours where after the growth speed is reduced, leading to less leaf biomass production. Stevioside content in the leaves is reduced in flowering plants. Therefore leaves are harvested before flowering.

Objectives

Within the research topic by Wageningen UR Greenhouse Horticulture "Greenhouse Pharmacy" possibilities were investigated to increase plant biomass and steviolglycoside content in greenhouse cultivated Stevia, by means of specific cultivation methods.



The plants were cultivated in pots on ebb-flow tablets with or without red LED modules above.

Treatments

The effects of CO₂ supply (700 ppm), increased EC of the fertigation solution (2.3) and a night interruption of 2 hours with low intensity red (LED) light were investigated. The time to flowering, the biomass production and the steviolglycosides content by two *S. rebaudiana* genotypes (cv. Candy and cv. Sugar Love) were determined.

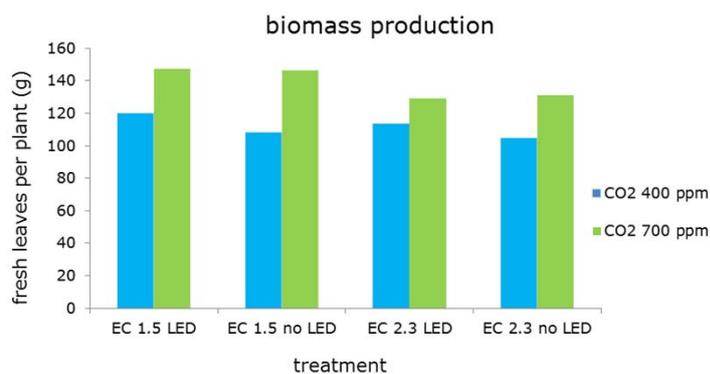


A food additive E-161 (Steviolglycoside, top-right picture) is extracted from the leaves of the Stevia plant (picture left), that is often used as low-caloric sugar substitute in beverages (down-right picture).

Trial Set-up

Both genotypes were cultivated from May till October from seed (cv. Candy) or from cuttings (cv. Sugar Love) in pots on ebb-flow tablets at a density of 23 plants/m² in two greenhouse compartments. In one compartment CO₂ was supplied to maintain a concentration of 700 ppm; in the other compartment no CO₂ was supplied, except by natural ventilation. Ambient concentration was around 400 ppm.

Each tablet was divided in two by a light-tight curtain: half of the plants were lighted during 2 hours each night with red LED's (Philips) at an intensity of 20 μmol·m⁻²·s⁻¹. Plants were fertigated with a solution of either EC 1.5 or EC 2.3.



Biomass production by Stevia (in gram of leaves per plant) depending on the EC of the solution, the use of red light, and the CO₂ supply.

Results

- Regardless of the treatment, both cultivars differed in the content of steviolglycosides (Candy 50% higher content than Sugar Love)
- CO₂ enrichment to 700 ppm increased leaf photosynthesis by 50% and biomass production by 25% compared to ambient (400 ppm).
- A 2 hour night interruption with low intensity red LED's prevented flowering in short days. These plants remained vegetative, and biomass production continued at pre-flowering rate.
- In the period prior to harvest, the red light treatment did not influence the steviolglycoside content in the leaves.
- A higher EC did not influence biomass production nor the steviolglycoside content.

Conclusions

- We estimate that by growing Stevia in greenhouses with CO₂ supply and red light LED night interruption, a year round production is feasible with a dry matter yield of about 2.5 times the outdoor yield.
- Greenhouse cultivation of Stevia offers added advantages in terms of lower need for crop protection agents and emission free cultivation.
- A further increase in steviolglycoside content can be obtained by the selection of the right genotypes, in combination with specific cultivation methods in greenhouses.