



AGRICULTURE

BIOFERTILIZER EFFECT ON GROWTH, PROTEIN AND CARBOHYDRATE CONTENT IN *STEVIA REBAUDIANA* VAR BERTONI

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Abstract

A comparative study on effect of chemical fertilizers and bio-fertilizers was done on growth and biochemical parameters in *Stevia rebaudiana* Var Bertoni. The results indicated that chemical treatment increased plant growth when compared to control. Vermicompost treatment increased growth compared to control but not as much as observed in combination of organic and inorganic treatment. However a combination treatment of biofertilizer and chemical fertilizer increased chlorophyll, growth, carbohydrates and proteins content compared to control. Therefore, it is necessary to evaluate and develop a balanced fertilization strategy that combines the use of chemical, organic or biofertilizer.

Keywords: Fertilizers, Biochemical contents, *Stevia rebaudiana* Var Bertoni

Introduction

Composts are prepared by biological degradation of plant and animal residues under controlled and aerobic conditions (Eghball et al., 1997). Vermicompost is described as biooxidation and stabilization of organic material involving the joint action of earthworms and mesophilic microorganisms (Aira et al., 2002). Fertilizers play an important role in increasing crop production. The main macronutrients present in inorganic fertilizers are nitrogen, phosphorus, and potassium which influence vegetative and reproductive phase of plant growth. Organic fertilizer nutrient content, solubility, and nutrient release rates are typically all lower than inorganic fertilizers and thus inorganic fertilizers are preferred over organic fertilizers. However, in the developing countries the increasing prices of fertilizers is affecting the poor farmers. The application of chemical fertilizers, pesticides, herbicides have improved the production but there is growing concern over the adverse effects of the use of chemicals on soil productivity and environment quality. Biofertilizer are useful substitutes to inorganic fertilizers which improves the soil quality. A good quality, high yielding planting stock material can be produced by applying fertilizers which can be greatly beneficial for farmer with small input of cost particularly in developing countries like India. Efficient 'Nitrogen' utilization is an essential goal in crop management. One of the recent achievements is the use of biofertilizer which retards nitrification for sufficiently longer time and increases the soil fertility (Jat and Pal, 2002). Integrated nutrient management by using chemical and biofertilizer is found to increase yield of *Stevia rebaudiana* Var Bertoni (Asteraceae) is a perennial herb that grows up to 1m tall and has 2-3 cm long leaves. It is indigenous

to the northern regions of South America. *Stevia* is still found growing wild in the highlands of Amambay and Iguacu districts (a border between Brazil and Paraguay). It is estimated that as many as 200 species of *Stevia* are native to South America; however, no other *Stevia* plants have exhibited the same intensity of sweetness as *Stevia rebaudiana*. It is grown commercially in many parts of Brazil, Paraguay, Uruguay, Central America, Israel, Thailand and China. *Stevia rebaudiana*, has been used for thousands of years as a source of intensively sweet – tasting compounds – the Steviol glycosides, eight types of steviol glycosides in leaves were identified, Stevioside, rebaudioside A, rebaudioside B, rebaudioside C, rebaudioside E, and dulcoside A. Stevioside has the largest share of all on dry weight, Stevioside has been used as intensive more energetic sweeteners in many countries of South America and Asia. It is a source of sweetener, stevioside which has non-caloric property. It is used as heart tonic to normalize blood pressure levels. *Stevia* is also known to have antimicrobial, antibacterial and antiviral and anti yeast activity. As *stevia* is a medicinally important plant and likely to become a major source of high potency sweetener in food market. Efforts are being taken to convert *Stevia* from a wild plant to a modern plant so it is necessary to understand the biology, chemistry and biochemistry of *Stevia* plant. Hence it was decided to study the effect of fertilizers (Chemical and Biofertilizer) on the growth, protein content and carbohydrate content of *Stevia rebaudiana*.

Materials and Methods

The seedlings of *Stevia rebaudiana* plantlets were purchased from local nursery and grown in an earthen pot of 30cm wide diameter on the terrace at Modern

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The plantation was done in winter season in the month of November 2009. The characteristics of soil were sand – 43.8 %, Silt – 38.2%, Clay – 17%, Organic Carbon – 0.34%, available Sulphur – 0.002%, Nitrogen – 0.007, Phosphorous – 4.2% and Potassium – 117.0 µg/g of soil, pH – 7.8%. The treatment of organic and inorganic fertilizer was given to the seedlings after 20 days of plantation. Initially optimum dose of treatment was standardized per plant. (i) NPK (Nitrogen: Phosphorus: Potassium, 18:18:10) 3g/Plants Treatment 1 (T1); (ii) Superphosphate + PSB(Phosphorous Solubilizing bacteria) (2:1) 4gm / Plants Treatment 2 (T2); (iii) NPK + Vermicompost (1:3) 5gm / Plants Treatment 3 (T3) and (iv) Vermicompost 7 gm/Plants Treatment 4(T4). All the treatments had control which was treated with equal quantity of water.

As the organic Nitrogen mineralizes slowly vermicompost was combined with NPK . Benzen hexachloride (BHC) was applied during the preparation of pots to protect the plants from termites. Weeding was done regularly. One uniform irrigation was provided after planting the plantlets and subsequent when required, the experiments were carried out with three replicates.

The sampling was done after 15 day interval followed by fertilizer treatment. Growth parameter like height, leaf area, chlorophyll a & b, protein content & carbohydrate were determined in third and fourth leaf from the top. Height was measured in centimeters, Leaf area was measured in sq/cm², chlorophyll a & b were estimated by using Arnon method (1949). The

total soluble protein content in leaf were estimated according by Bradford method (1976) and carbohydrates were estimated by using Anthrone reagent method.

Observations

Fig. 1: Effect of fertilizers on height of plants *Stevia rebaudiana*

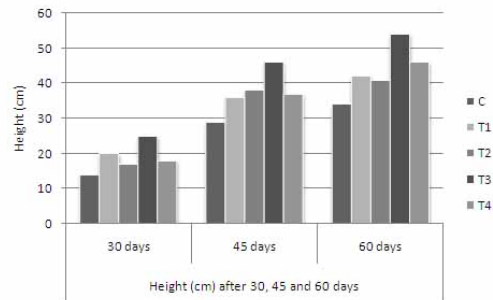


Fig. 2: Effect of fertilizers on leaf area of *Stevia rebaudiana*

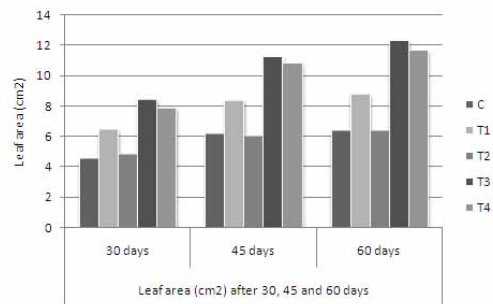


Fig. 3: Effect of fertilizers on chlorophyll concentrations in leaves of *Stevia rebaudiana*

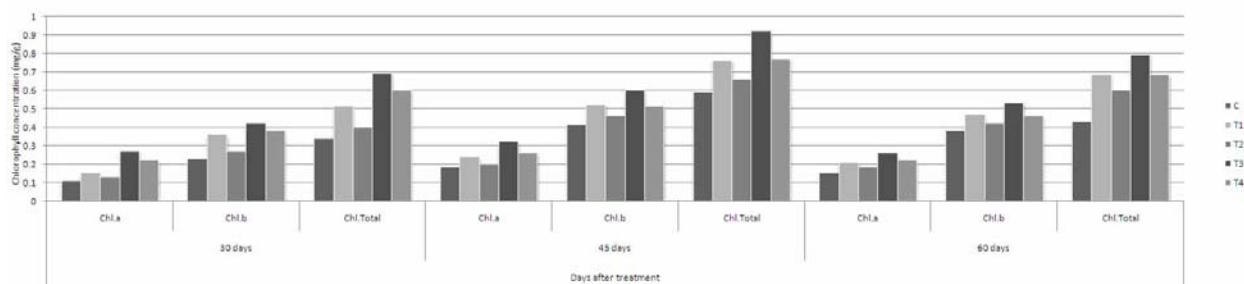


Fig. 4: Effect of fertilizers on protein content (mg/g) in leaves of *Stevia rebaudiana*

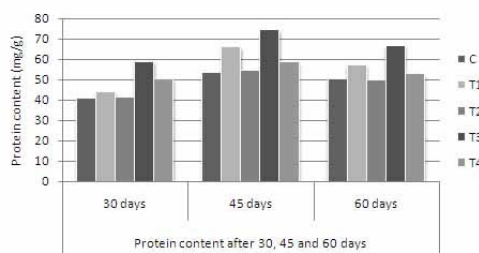
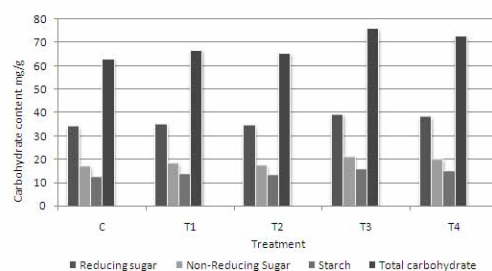


Fig 5: Effect of fertilizers on carbohydrate content (mg/g) in leaves of *Stevia rebaudiana*



Results and Discussions

Combined application of organic and inorganic fertilizers increases plant growth, yield, quality and soil fertility in plants (Mahmoud et al., 2009). In the present investigation the plant growth was measured in terms of height. The results indicated that growth and leaf area and chlorophyll a and b content at all intervals was increased more than control. (fig 1,2,3). However, a combination treatment of chemical and biofertilizer T3 increased height leaf area and Chlorophyll content to maximum when compared to control and T1, T2, T4 treatments.

Protein synthesis turnover in growing plants is a basic component of metabolic regulation which provides a way for varying the enzymatic complement during the response to environmental conditions (Huffaker and Peterson, 1974).

Protein and carbohydrate content increased at all treatment compared to the control. It showed maximum content at T3 treatment as compared to control and other T1, T2 and T4 treatment. (fig 4). Protein content increased after 45 days while at 30 and 60 days the content was least and in the middle phase of life cycle of plant protein content was highest.

According to (Das et al., 2007), the biomass increased progressively irrespective of treatments over control. However, the total fresh biomass production was recorded highest with combined application of biofertilizer when compared to sole application.

The present investigation indicated that stevia plants respond better with respect to height, leaf area, chlorophyll, protein and carbohydrate content with combination treatment of NPK and Vermicompost (2:1) T3 treatment compared to NPK or superphosphate with PSB or Vermicompost alone.

The type of nutrients released are different, whether chemical, organic or biofertilizers. Each type of fertilizer has its advantages and disadvantages over crop growth and soil fertility. Thus, a sound

management of fertilization ensures an enhanced and safeguarded environment.

Bibliography

- Aira M, Monroy F, Dominguez J, Mato S (2002). How earthworm density affects microbial biomass and activity in Pig manure. *European J Soil Biol.* 38: 7-10
- Arnon, D.I. (1949). Copper enzymes in isolated chloroplasts. 1. Polyphenol oxidase in *Beta vulgaris*. *Plant Physiol.*, 24: 1-15.
- Bradford method (1976) – A rapid and sensitive method for the quantification of microgram quantities of protein utilizing the principal of protein dyebinding. *Anal. Biochem.* 7:248-254
- Das Kuntal, Raman Dang, Thippenahalli Narayanappa Shivananda, Nazim Sekeroglu. (2007). Influence of bio-fertilizers on the biomass yield and nutrient content in *Stevia rebaudiana* Bert. grown in Indian subtropics. *Journal of Medicinal Plants Research* Vol. 1(1), pp. 005-008./
- Eghball B, Power JF, Gilley JE (1997). Nutrient, carbon and mass loss during composting of beef cattle feedlot manure. *J. Environ. Quality.* 26: 189-193.
- Huffaker, R. C., Peterson, L. W. (1974). Protein turnover in plants and possible means of its regulation. *Ann. Rev. P1. Physiol.* 25: 363-392
- Jat, M.L., Pal S.S. and Singh R. (2002). Crop residue treatment with mineral salts and its recycling under different tillage management practices and their impact on crop yields and soil health in a rice-wheat cropping system in Indo-Gangetic plains. In: *17th world Congress of Soil Science*, August 14-21 2002, Bangkok, Thailand.
- Mahmoud, E. K. (2009). Effects of Different Organic and Inorganic Fertilizers on Cucumber Yield and Some Soil Properties *World Journal of Agricultural Sciences*. 5(4):408-414.