ABSTRACT

Biochemical and Agronomical Studies on Bioganic: An Organic Fertilizer Produced by Rapid Composting of Animal and Plant Waste in Jamaica

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A locally produced organic fertilizer (by rapid composting in 4 -5 days), called bioganic, was biochemically and agronomically characterized. Its agronomic values as a fertilizer were examined in greenhouse and field studies. Bioganic contains all the macro- and most micro-nutrients in sufficient quantities to support plant growth. It also contains humic acids, auxins and gibberellic acids, which add to the growth-enhancing power of bioganic. Bioganic was enriched with the nitrogen-fixing bacteria, *Azotobacter chroococcum*, and phosphate solubilizing *Vesicular-arbuscular Mycorrhizal* fungi, to examine whether or not its efficacy as fertilizer could be further improved.

Bioganic showed significant positive growth response of vegetable like tomato (*Lycopersicon esculentum*) and hot pepper (*Capsicum annuum L.*). Bioganic induced more than 50% increase in plant size and stimulated early flowering and fruit production, compared to untreated plants. Bioganic was very

effective in producing high yields (> 50%) of vegetables like tomato, hot pepper and pumpkin (*Curcubita pepo*), compared to untreated, i.e, without bioganic, plants. It was also effective for tuber crop production like yam (*Dioscorea alata*).

Bioganic also improved the physical and chemical properties of soils. It increased the residual soil N & P and plant N & P at harvest. It altered the pH of soils thus favouring the growth of plants in acidic soil. Another significant contribution by bioganic was that the rhizobacterial population increased more than 1000-fold. Bioganic selectively increased the population of certain gram negative (gram -ve) bacteria that possess the ability to produce plant growth hormones. For the test tomato plants, the most highly promoted rhizobacteria were *Azotobacter* and *Pseudomonas* species which have the ability to produce the plant growth hormones, auxins and gibberellic acids. *Azotobacter* were the dominant bacteria in the rhizosphere of the bioganic-treated tomato plant, which was the major producer of plant growth hormone as well as being a known nitrogen fixer.

Azotobacter survived well in bioganic, which suggested a possible enrichment of bioganic with nitrogen-fixing bacteria. The enriched product was effective in improving the plant growth response compared with using bioganic alone. Due to the nitrogen-fixing abilities of *Azotobacter*, an enriched bioganic could supply nitrogen continuously for the enhancement of the plant growth

response.

A suitable vesicular-arbuscular mycorrhizal (VAM) fungus was selected to be used with bioganic in a combined treatment for tomato plants. Under greenhouse conditions, the combined treatment (bioganic + *Glomus aggregatum*) significantly ($p = 0.01$) improved the growth response of tomato plants.

In conclusion, bioganic is an extremely effective organic fertilizer, which acts as a soil conditioner and provides nutrients and growth promoters for plant development. The bioganic can improve dry matter content of plant tissues by as much as 25% and increase the yield of fruits up to 100%. Also, bioganic can be enriched with beneficial micro-organisms to produce a more effective and economical organic fertilizer.

The production of bioganic contributes significantly to the well-being of public health and the environment. This is due to the destruction of pathogenic organisms, the disposal of potentially harmful waste and the preparation of an environmentally-friendly fertilizer. Programmes such as land reclamation, soil preservation and conservation can be easily implemented by using bioganic. For small islands in the Caribbean and other parts of the world, poultry and cattle waste as well as agro-waste can be converted into useful and environmentally-friendly products.