



Short Communication

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From Green Biotechnology to Food Safety of Crop Production: All Cosmos Bio-Tech as a Model

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According to a combination of definition by Kafarski [1] and Merriam-Webster [2], 'Biotechnology is the manipulation of living organisms, systems and process for the benefit of society, the environment and industry in the forms of useful commercial products'. It also involves a multitude of applications of biological sciences and knowledge that is employed in such a manipulation [2]. According to Barcelos, et al. [3], 'Green biotechnology refers to biological techniques to plants with the aim of improving the nutritional quality, quantity and production economics'. In short, green biotechnology focuses on the application of environmentally-friendly tools as an alternative way to conventional mechanisms in the area of agriculture in particular. According to a review by Pessoa, et al. [4], food and pharmaceutical fields are looking for processes of substitute in order to acquire their major consumable products in a more maintainable and sustainable manner. Industrial biotechnology that depends on the availability of a suitable microorganism appears as a promising area for this purpose. This biotechnological approach using suitable microorganisms can provide a more adaptable strain which is able to reveal resistance to industrial conditions with high yields in biotechnological production of natural compounds [4].

Owing to the increasing demand for the use of agricultural products, along with new and more restrictive policies regarding the application of fertilizers, the search for alternative ways to increase crop production is necessary [5]. The ecosystem of the crops in a more sustainable is to be highly taken into consideration by this green biotechnology. One of the best alternatives is the employment of biofertilizers, which is an example of green biotechnology. Biofertilizers are fertilizers that contain living microorganisms (such as fungi and Rhizobacteria), which can increase microbial activity in the soil media of the crops [6]. They are becoming important because of low cost renewable source of nutrient that supplements the chemical fertilizers amongst small and marginal farmers [7].

One of the best reviews on the impact of human population growth is that by Hogan [8]. He summarized that the negative environmental impacts due to the uncontrolled human population growth are depletion of resources (such

as reduced bioavailability of minerals, and loss of biodiversities of flora and fauna) and the degradation of natural resources (such air, water and soil pollution). In order to have sustainable resources, the ever increasing human population must go in line with the increasing production of human food crops. However, the industrialization in developing countries has complicated the food safety of the crops. For example, soil heavy metal pollution in agricultural vegetables [9,10] is a growing environmental issue globally that is related to food safety [11].

Reduction of soil fertility and crop yields can be attributable to several reasons including Zn deficiency in the soils and environmental pollution. The Zn deficiency in the soils not only affects crop yield, but also human health and nutritional quality of crops [12]. The heavy metals that are discharged into the soils and waterways is caused by metal processing industries and the industrial operations such as mining, smelting, combustion of fossil fuels and sewage sludge application in agricultural practices. These metals released into the soils are known to have negative effects on microbial diversity, yields of various agronomic crops and soil fertility [13,14]. Therefore, soil pollution of the farming areas or crop plantations that use soils as media for the growth of the food crop is a serious problem nowadays [11]. This is of environmental and human health concerns because of the use of nitrogen-based fertilizers are both very costly and can pollute our ecosystem [5]. Consequently, the effective method to reduce the soil pollution is crucial and to increase the food crop production as well as the quality of the food crop is essential. The use of biofertilizers is highly recommended based on the many literature [7,15-18] found that are in great support of such farming practice to reduce the soil pollution.

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In this short communication paper, allow me to introduce one of the best companies in green biotechnology in Asia. It is All Cosmos Bio-Tech (ACBT) Holding Corporation which is located in Pasir Gudang, Johore, Peninsular Malaysia. ACBT focuses on using green biotechnology to maintain our ecosystem in a sustainable way encompassing plantations, research, development and management. This company's products include using Effective Microorganisms (EM) in the biofertilizers for sustainable crop production in order to cater for the increasing needs of food nutrition demands due to human population growth. Using conventional pesticides are undoubtedly both unsustainable and not environmental friendly whether in short or long terms. Biofertilizers enhance nutrients via the natural routes of nitrogen fixation, and accelerating plant growth through the creation of plant growth promoting rhizobacteria (PGPR). Hence, biofertilizers can diminish the use of synthetic pesticides and pesticides. This is due to the fact that biofertilizers do not enclose any toxic chemicals which are detrimental to the soil media [6].

ACBT has made a huge contribution to Asian's environment especially replacing the toxic conventional pesticides by EM in the biofertilizers in order to solve the toxic pest residual problems in the crop plantations in Malaysia and Southeast Asian countries. The use of excessive pesticides, by no means, creates a lot human health problems and our ecosystem health is greatly facing a warning red light that needs an immediate recovery. The ACBT's biofertilizers containing EM are capable to positively influence decomposing organic matter. The natural and effective cycles of nutrients need a healthy ecosystem. In brief, the biofertilizers can increase crop production by promoting plant roots, increase soil nutrient and fertility, and reduce leaching of some nutrients. The EM bacteria present in the biofertilizers are capable of nitrogen-fixing and phosphorus-acid producing.

There are four main components in a healthy ecosystem for an effective recycling of nutrients namely nutrient pool, producers, consumers and decomposers. If these decomposers are not properly doing their normal functions or not effectively decomposing the dead consumers and producers, our ecosystem would be under much stress or cycles of indispensable nutrients/elements for living organisms will be slowed down and cannot cater for the needs of food supply due to human population growth.

From biological point of view, there are three major Domains (Bacteria, Archaea and Eukarya) in the living classification. Bacteria are one the major Domains while Fungi are one of the five major Kingdoms under the Domain Eukarya. Therefore, the two decomposers (Bacteria and Fungi), consist of two major Domains in the living world. Undoubtedly, they the oldest life form on earth. They are considered microorganisms or microbes which play paramount function in decomposition. For example, PGPR fixes nitrogen from air and soil.

This green biotechnology using biofertilizers is clearly useful in maintaining sustainable practices in farming and ultimately to support human health. This results in minimizing soil pollution problems. Lastly, let me use ACBT as a model

to promote the knowledge application of biofertilizers into commercial products. Besides controlling soil pollution, this green biotechnology is definitely the best means to provide food safety of crop production to the ever increasing populations in Asian countries.

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