Chapter 64
Microbes as Sustainable Biofertilizers: Current Scenario and Challenges

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ABSTRACT

Across the globe, in both developed and developing countries, wheat provides the fundamental support for all other important foods. However, due to climate change, environmental stress, soil infertility, etc., the yield of wheat is affected. To overcome these issues, biofertilizers are recommended. They are eco-friendly, cost-efficient, and affordable by marginal farmers too when compared with chemical fertilizers. Biofertilizers are made up of living microorganisms that colonize the rhizosphere to promote plant yield and prevent plant disease. Pesticide degrading strains of bacteria are emerging as the best technique to overcome the negative effect of pesticides. Due to insufficient awareness among farmers, agricultural land and crops are cultivated through chemical fertilizers, which became a major threat to human health and agriculture. On the other hand, the government is implementing several measures in marketing bio-fertilizers for the betterment of agriculture and human health. In this chapter, the significance and future perspectives of biofertilizers have been covered.

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INTRODUCTION

The pivotal food consumed by millions of people in the world is wheat, which is one among the globally produced cereals. Wheat is cultivated all over the world but wheat origin was traced back to south- east Turkey (Morris et al., 2016). Archaeological research of wild emmer specifies that wheat was firstly grown in the Karacadag Mountains in southeastern Turkey. Through DNA analysis of wheat seeds, the oldest corroboration for hexaploidy wheat has been substantiated, dating around 6400-6200 BCE recovered by catalhoyuk. The Egyptians were the developers of bread and baking which made a huge revolution in the food production industries. Mean time wheat started to spread all over Europe to Asia. The northern region of India is traditionally dominated in wheat cultivation. The prolific producers are northern states of Punjab and Haryana plains in India. By today's date all types of extensive research efforts are been taken by India for improving the output in the years to come. It is said that wheat and wheat flour play the vital role in developing India's food economy (Michael et al., 2019; Bell, 1987).

In spite of hundreds of food group, the ultimate reason for choosing wheat for our study is that it is being grown in large scale over a huge range of soils and climatic conditions, along with a wide geographical distribution. Over 40 countries in the world, wheat has been declared as the national food over one third of the world's population. The annual production of wheat has been raised from 171 million metric tons to 308 million tons between the years 1948-1952 to 1966. During the same stretch the areas for cultivation were extended from 173 to 217 million hectors, and the world average yield became 900-1420 kg per hectare (Lupton, 1987). Factors such as decrease in crop yield; poor quality of land, loss of soil texture, animals and insects affects the crops which would simultaneously affect the growing population. To overcome this problem's fertilizer was introduced in markets. A fertilizer is a substance that is added to the soil to supply one or more plant nutrients needed for the growth of plant. It is of two types-inorganic fertilizer (made up of chemical products) and organic fertilizer (obtained from animal source) (International fertilizer development center 1980). Bio fertilizers are microbial inoculants consisting of living cells of microorganisms like bacteria, algae, fungi, or a combination which may help in increasing the crop productivity. Biofertilizers such as *Rhizobium, Azotobium, Azospirillium* and *Cyanobacterium* have been used for long time purposes. *Azolla* can be used for crops like wheat, maize, cotton and other vegetable crops. Phosphorous is the most important nutrient next to nitrogen for the growth of wheat. In case of inadequate phosphorous content, the crop resembles stunted growth, dark color over older leaves and inhibition of root and flowering system. To overcome this deficiency phosphorous rich bio fertilizers can be used. Generally, biofertilizers are suggested to be better than chemical fertilizers, as chemical fertilizers pollute ground water, affect soil health and soil fertility (Rai, 2006).

The growth of biofertilizer market is driven by growing organic food, initiative taken by government and organizing several awareness programs about the need for sustainability in modern agriculture (Ghosh, 2003). The foremost intention of the article is to describe the importance of wheat, concept of fertilizer, usage of bio-fertilizer on wheat, their benefits, limitation in modern agriculture and a portion of the contextual analyses applicable to the article are also discussed.