

Microbiome and Plant Health

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Recent researches have shown that plants are associated with plethora of microorganisms also called plant microbiome. Plant microbiome interactions primarily affect plant growth, development, plant-fitness and productivity. Depending upon the specific habitat of plant, microbial communities are mainly predominant in three different regions namely rhizosphere, phyllosphere and endosphere. The full range of microbes and their association with plants and hence maintenance of crop productivity has recently begun to be explored. In this article, we primarily focus on the interaction of plants and root associated bacteria enhancing plant mineral nutrition, summarizing the current knowledge in several research fields that can converge to improve our understanding of the molecular mechanisms underpinning this phenomenon.

Keywords: Inoculum, Microbiome, Plant health, Rhizosphere, Seed, Phyllosphere

Introduction

The plant microbiome also known as phytomicrobiome has recently become a very important aspect of research with plant scientist. This is mainly due to the strong evidences that have emerged that plant microbiome plays a very important role in maintaining plant health and crop production (Witton *et al.*, 2018). A better understanding of the plant microbe interactions and plant microbiome is expected to contribute significantly to the crop productivity in future. This article gives a glimpse of the recent developments in this area to indicate that this area is extremely important to explore in order to increase crop productivity in future.

The Plant Microbiome

The plant microbiome comprises of huge amounts of beneficial, commensal and pathogenic microorganisms that play critical essential roles in plant growth and maintaining plant health. (Naylor *et al.*, 2022). Recent studies have revealed that soil microorganism in association with plant microbiome especially in the rhizosphere are the facilitators of several plant processes. This they do by secreting hormones like auxins that help

in root growth changes. Some microbes take up iron from the soil and they solubilise phosphorus and make this nutrient available to the plants (Nelson, 2018). Plant microbiome provides protection against pathogens to the plants by indirectly activating the immune responses. The conversion of atmospheric nitrogen to ammonia is also taken by nitrogen fixers.

The plant microbiomes are very specific and their role to complex interconnected microbial networks that are important in plant health and ecosystem functioning has recently been explored (Babalola *et al.*, 2020). It will not be out of place to mention here that the plant microbiome is also specific to the genotype of plant, plant species, edaphic and other environmental factors, but the roles of this makeup are difficult to separate from each other in natural environments (Compant *et al.*, 2019). These microbial inhabitants in soil and around the plants are also responsible for production of antibiotics and fungal cell wall degrading enzymes. It has also been reported that by changing the genetic makeup of keystone microbial community, the overall performance of the plant can be enhanced. There are

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