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The role of soil microbiome in plant growth and development under stress conditions

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Abstract

Stress-related factors have a negative influence on plant growth and yield. Numerous approaches are used to alleviate these disadvantageous effects on the plant growth. Using soil microbiome and plant growth-promoting bacteria (PGPB) is another method for eradicating the adverse effects that stress-induced conditions have on plants. Numerous studies have shown that plant growth-promoting bacteria (PGPB) increase plant yield under a range of different stress conditions. In this proceeding review we will briefly discuss these issues.

Introduction

Plants, unlike other living things, do not have the option of relocating under stress environments. Numerous different changes happen in plants under stress conditions, including such membrane permeability degradation, increased ROS production, and decreased yield. As a result, they have different approaches for staying alive under stress [1]. Soil microbiome mutualistic relationships are one of these strategies. Soil microbiomes, regardless of whether they are dependent on stress conditions, take a significant part in plant growth and development [2]. Additionally, there are bacterial species called plant growth-promoting bacteria that positively influences plant growth in the soil microbiome. These bacteria play a significant role in improving plants' capability to withstand stress [3]. Plant growth-promoting bacteria can always be inserted into the soil to enhance plant growth, sustain nutrient status, and keep improving hormonal balance [4,5].

Results

Numerous studies have been published in the literature that demonstrate the beneficial impact of soil microbiomes on plant growth.

Bacillus safensis and *Ochrobactrum pseudogregnonens*, which are known to be osmotic stress tolerant bacteria, were used in the studies conducted by Chakraborty et al. on six different varieties of wheat [6]. In their research, they observed that in six wheat varieties exposed to water stress, both bacterial groups enhanced biomass, plant height, chlorophyll content, and indirectly increased yield [6]. Kohler et al. [7] studied the responses to drought stress by inoculating lettuce with different combinations of mycorrhiza and bacteria, alone or in combination. Phosphatase activity in lettuce roots and proline accumulation in leaves were seen after P.mendocina was inoculated on lettuce plants that had been exposed to severe drought. While superoxide dismutase (SOD) activity was reported to decrease in the literature, an increase in peroxidase (POX) and catalase (CAT) activities was seen

as a response to drought stress. This implies that bacteria that encourage plant growth are extremely important, particularly in the response to drought stress [7].

Marulanda et al. examined the effects of plant growth-promoting bacteria (PGPB) on the plasma membrane of the plant under unstressed and salt stress conditions by inoculating Bacillus megaterium strain on maize plant [8]. In their study, they discovered that Bacillus megaterium-inoculated plants exhibited enhanced root hydraulic conductance (L) values both under stress and not. Nevertheless, it has been noted that roots of plants with higher L values which have been exposed to salt stress and bacterial inoculation have high concentrations of plasma membrane type two (PIP2) aquaporin. All of this data demonstrates that bacteria are essential to the growth of stress tolerance and that the response of maize plants inoculated with the Bacillus megaterium strain to salt stress changes [8].

Conclusion

In conclusion, it has been found that soil microbiomes have an influence on how well plants grow under stress conditions [9,10]. Additionally, research has shown that soil microbiomes, such as PGPB, have a positive impact on plant growth and development while they are not under stress [3,4,5,9,10]. This research suggests that soil microbiomes or bacteria that stimulate plant growth stimulated plant growth and yield. More studies are required to determine the beneficial bacteria that support the plant growth under stress conditions to utilize them in the field with changing climate conditions.

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