**Mechanisms of plant-microbe symbiosis and applications**

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Nitrogen is the fundamental building block of key organic molecules in life processes, such as proteins, nucleic acids, and chlorophyll. It is essential for all living organisms. In the natural environment, nitrogen gas makes up 78% of the air. Plants, as primary producers in ecosystems, cannot directly utilize atmospheric nitrogen and rely on external nitrogen-containing compounds for their growth. To meet the demands of crop production, approximately 1-2% of global fossil energy is used for nitrogen fertilizer production. The excessive use of chemical fertilizers has led to severe environmental pollution.

In the symbiotic nitrogen fixation process, as seen in leguminous plants and rhizobia, nitrogen-fixing bacteria convert atmospheric nitrogen into forms of nitrogen compounds that are readily available for plant growth. This biological process reduces the dependence of leguminous plants on external nitrogen fertilizers. In my presentation, I will focus on mycorrhizal symbiosis and the nitrogen-fixing symbiosis between leguminous plants and microorganisms. I will discuss the nutrient exchange and signal recognition between plants and their symbiotic microorganisms, as well as the potential applications and challenges of plant-microbe symbioses in agricultural production.