Next-generation bioformulations for sustainability in agriculture

Shilpi Sharma
Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology Delhi, New Delhi, 110016, India

The bioinoculant technology suffers from various limitations, which has obstructed its application. The performance of these microbes in field where multiple stresses act simultaneously is often inconsistent, and also much reduced than that observed under lab conditions. One of the reasons for this is its competition with the native microbial communities, other reasons could be the requirement for specific ecological niches. Besides, it struggles with issues like shelf life, and slower action compared to chemicals. Another important aspect that is majorly ignored is the larger picture of mechanism of action of bioinoculants, which is yet to be elucidated. This includes gaining in depth understanding of how the native microbial community responds to such an amendment, which determines the latter's robustness and efficiency in real-life conditions. The group works on developing bioformulations that can overcome some of these challenges. This is done by employing state-of-art omics tools together with conventional techniques. By employing metagenomic and metabolomics studies, next generation bioformulations have been developed for plant growth promoting strains with enhanced survival and efficiency. This was initially tested in a series of plant growth experiments under controlled conditions with model crops pigeonpea (and tomato,) and then validated in farmer's field subjected to multiple stressors simultaneously. The bioformulations served tripartite functions of plant growth promotion, enhanced nodulation, and stress mitigation. Such a polyphasic approach to design bioformulations can be adopted on a large scale for ushering in sustainability in agriculture.