In recent years, metal nanoparticles (NPs) are reaching the plants directly as nano-fertilizers, pesticides, biostimulants, etc., and indirectly as byproducts of consumer products that accumulate in water and soil. Although the applications of nanotechnology in consumer products, medicine, engineering, agriculture, etc. are indispensable, the increasing presence of NPs in the environment is becoming one of the major problems of our time.

It is well-known that Metal NPs either promote or inhibit plant growth based on their concentration. However, the molecular mechanisms of how plants detect the presence of NPs and translate their concentration into various responses such as growth promotion or inhibition (hormetic dose response) are unknown. Elucidation of these mechanisms would enable us to develop new strategies for the use of NPs in the fast-growing smart agriculture with minimal damage to the envirnment. Moreover, our work will enable us to understand how increasing concentrations of nanomaterials in the environment might affect plant life.

Since the hormetic mechanism is the basis for metal NP based- fertilizers, pesticides, and biostimulants that are widely used in modern agriculture and because NPs are known to modulate every aspect of plant life, namely from seed germination to yield, understanding the underlying mechanisms is crucial. Our study is imperative in the context of agriculture, environment and human well-being as the results would help to strike a healthy balance between the use of NPs to increase yield at reduced cost of production and sustainable environment.