Recent trends in application of nanomaterials for management of bacterial and viral pathogens affecting vegetable crops

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Bacterial plant pathogens in the genus Xanthomonas, Pseudomonas and Ralstonia, and viral plant pathogens in the genus Begomovirus transmitted by whiteflies cause major yield loss to crops globally. While biological and chemical management options exist for managing some of these pathogens and whiteflies, many limitations exist including bacterial resistance to copper and antibiotics, and whitefly resistance to insecticides. Alternative approaches for disease and insect vector management includes development of engineered and naturally occuring nanomaterial formualtions that offers possibilities in improving plant disease management. Recent studies utilizing Mg-based nanomaterials (MgO, Mg double-coated, Mg-Cu), hybrid nanomaterials (Cu/Zn), and copper composites (Cu-CS, FQ-Cu) demonstrate the unique ways of designing and using engineered nanomaterials that have the potential to minimize impact of Xanthomonas and Pseudomonas strains in vitro and in planta. Similarly, nano-micron size emulsions of thyme and clove oil developed demonstrate possibilities in management of Ralstonia in vitro and in planta. Another key area of active research includes formulations of natural clay particles (nano and micron-sized) for minimizing whitefly attraction to plants and its impact on virus diseases. This presentation will cover the latest findings from our work on the above projects and also highlight some key trends in this area where research investment could lead to technologies that can be implemented in the future for plant disease management. A perspective on impact of some of these technologies on fate of particles and microbiome impacts will be also highlighted.