

Plant Pathology Seminar Series

"Nanoparticles and their use in plant disease management"

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Abstract:

The global increase in demand for food production with minimum ecological damage has been very challenging. Although it is possible to meet the global food demand through various approaches, the environmental cost that is incurred may be more than what can be achieved. However, the advent of nanotechnology may stand as a strong tool that can sustainably reduce the impact of many factors that hinder plant health. Nanoparticles are simply the particles of any matter that are in the size of 1-100 nanometers. With this small size, nanoparticles have larger surface area compared to materials of non-nano scale. Thus, one of the major advantages of using nanoparticles is the large reduction in the volume of active chemicals that enter the agroecosystem. A proportion of the chemicals we use conventionally to control a disease or pest does not reach the target, and rather contaminates the vulnerable ecosystem, which can be reduced using nanoparticles. Although many nanoparticles exist currently, most of them are yet to be studied for their agricultural use. Most nanoparticles that are currently in use in agricultural sector include nanoparticles of metalloids, metallic oxides, non-metals, carbon nanomaterials and nanotubes, graphene oxides and many more. Most of the research works have centered on the use of silver, copper, and zinc due to their peculiar properties such as antimicrobial activity and alteration of host defense. Silver was the first nanoparticle investigated for managing plant diseases. Lamsal et al. (2011) demonstrated at 100 µg/ml, silver nanoparticles suppressed powdery mildew comparable to conventional fungicide but also reported some curative responses.

Although the research has been showing exciting results for their potential use at a larger scale in controlling plant diseases, there are some challenges for using nanoparticles. One of the challenges is that the nanoparticles behave differently in different plant and disease system, requiring individual research works for each disease. Moreover, the long-term impact of nanoparticles in the environment is yet to be researched at a broader level. However, considering the huge challenge faced by the agriculture sector, nanomaterial-based disease suppression may play a key role in achieving sustainable global food security.

References:

Lamsal K, Kim SW, Jung JH, Kim YS, Kim KS, Lee YS (2011). Inhibition Effects of Silver Nanoparticles against Powdery Mildews on Cucumber and Pumpkin, Mycobiology, 39:1, 26-32, DOI: 10.4489/MYCO.2011.39.1.026

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