**Agricultural nanotechnology: Changing the future of crop protection**

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Can we really feed ten billion people as we head towards the next century? The current world population of 7.3 billion is expected to rise to 9.7 billion in 2050 and 11.2 billion in 2100. In this globalized world and interconnected economies, we need to address to ensure that our food crops are protected from pests and diseases as they account for 20-40% losses in productivity. The ongoing application of chemical pesticides suffers from issues such as residual toxicity, run off, specificity and resistance. Genetic modification (GM) is not available for all crops/pathogens, and it is not the preferred choice for all producers and consumers. The development of a new chemical crop protection product generally takes 10 years of R&D at a cost of $250 million. The emerging nanotechnology in agriculture has the potential to change the existing paradigm of genetic modification and has already started to challenge existing legislations.

The aim to deliver transformative green technologies is the key driver for agricultural nanotechnology innovations for crop protection. Nanoparticle based delivery of pesticides have the potential to provide site-specific and slow-release activity on pests and diseases of plants, with benefits in reduced input and less risk to the environment. Nanoparticles as carriers of innovative specific ‘bioactive ingredients’ rather than general chemicals could be a game changer for future crop protection strategies.

BioClay is one such non-toxic, non-GM, biodegradable crop protection platform that delivers pest targeting RNA interference (RNAi) as a topical application using anionic clay particles. At present the use of RNAi for disease resistance is limited to engineering genetically modified disease resistance plants. Topical application dsRNAs as the key trigger molecule of RNAi, as direct control agents, as resistance factor repressors, or as developmental disruptors, is gaining momentum. ‘RNAi in a drum’ as a spray-on technology is being actively pursued by many large, well established agrochemical companies as a replacement or alternative to chemicals with potential 'green' credentials. Many papers have shown that exogenous application of dsRNA can induce RNAi-mediated defence in viruses, fungi and insect pests. The major limitation however is the instability of topically applied naked dsRNA on the leaf surface leading to a very short period of protection. BioClay opens a window of opportunity to deliver the same as a sustainable spray application with an extended period of protection. Real world application of exogenous dsRNA for RNAi-mediated resistance will be governed by factors such as cost-effective production, design of regulation and public licensing.

Ag-nano innovations for sustainable crop protection needs amalgamation of science and market driven solutions with support from academia, philanthropy, industry , governments and community. A robust regulatory framework, based on global best practice, is critical to build confidence and certainty, which will underpin public investment and ensure collective efforts to address global challenges in agriculture.

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