WSU Plant Pathology Seminar Series

Utilization of CRISPR in Plant Pathology: Promises and Challenges

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Abstract

Genome editing is a powerful tool to change gene functions for improving plant traits. Recently, the CRISPR-CAS (clustered regularly interspaced short palindromic repeats associated proteins) system has emerged as a promising approach for editing genomes due to its robustness, high target specificity, and programmability (Wang et al. 2023). This system is originally derived from the adaptive immune strategies of prokaryotes (Barrangou et al. 2007) and has made significant progress as a biological tool of genetic engineering. In the context of plant pathology, the CRISPR-CAS system can not only modify plant genomes to improve resistance to a range of pathogens i.e. fungi, bacteria, and viruses, but also can target pathogen genomes directly to control diseases (Gosavi et al. 2021; Robertson et al. 2022). The effectiveness of CRISPR-CAS based nucleic acid detection in plant disease diagnosis has been demonstrated in apple, citrus, rice, tobacco, and tomato (Alon et al. 2021; Aman et al. 2020; Jiao et al. 2021; Wheatley 2021; Zhang et al. 2020). Despite all these advancements, there are still some challenges particularly related to the efficient delivery of CRISPR components and tissue regeneration (Afzal et al. 2021; Wheatley 2020). It is also less effective in polygenic traits like yield, quality, and some types of disease resistance unless there is a major gene contributing towards the phenotype (Peng et al. 2021). Some of the ongoing research is looking into nanoparticles and cell-penetrating peptides as potential vehicles to deliver CRISPR components in plants cells without causing tissue damage (Ronspies et al. 2023) thereby, helping CRISPR-CAS to reach its full potential in research and applications.

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