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Modified Geminiviral Vectors to Reduce Cell Death & Enhance Expression

Plants are a promising platform for rapid production of biologics as they offer many advantages over traditional systems, including safety, speed, versatility and cost. And the demonstration of plant-made pharmaceuticals that have been glycoengineered to have authentic human N-glycans further underscores their promising potential. However, high accumulation of certain foreign proteins, particularly when ER-targeted, can put too much stress on plant cells leading to tissue necrosis and reduced yields.

Researchers at the Biodesign Institute at Arizona State University previously created a replicating geminiviral expression system based on bean yellow dwarf virus (BeYDV) that enables very high-level production of recombinant proteins. They have subsequently created a new BeYDV expression system that also enables high production levels of recombinant proteins, but with reduced expression of Rep and RepA - proteins implicated in plant leaf cell death. Additional modifications to the system, including using lower concentrations of agrobacterium, have been made to further reduce cell death.

This new expression system not only reduces tissue necrosis, but also results in increased target protein accumulation to further the advancement of plant-based pharmaceutical production systems.

Potential Applications

- Plant-based production of biologics (proteins, vaccines, enzymes & other biomolecules)

Benefits and Advantages

- Transient expression or stable transgenic plants
- Enhanced expression of toxic proteins
- Can produce hetero-oligomeric proteins (e.g. fully assembled tetrameric functional IgG)
- Reduced plant leaf cell death

- Simple expression vector - eliminates the need to identify non-competing viruses and the need for co-infection of multiple expression modules
- Plant based systems do not require animal or human-derived nutrients, minimizing the risk of contamination with animal or human pathogens and toxins
- Appropriate post-translational modifications of recombinant proteins are enabled with this system

For more information about this opportunity, please see

Diamos et al - Front. Plant Sci - 2019

For more information about the inventor(s) and their research, please see

Dr. Mason's departmental webpage

Dr. Mason's Biodesign webpage