Multiple Non-transgenic CRISPR Gene Editing Tools are Joining the Force to Fight Huanglongbing

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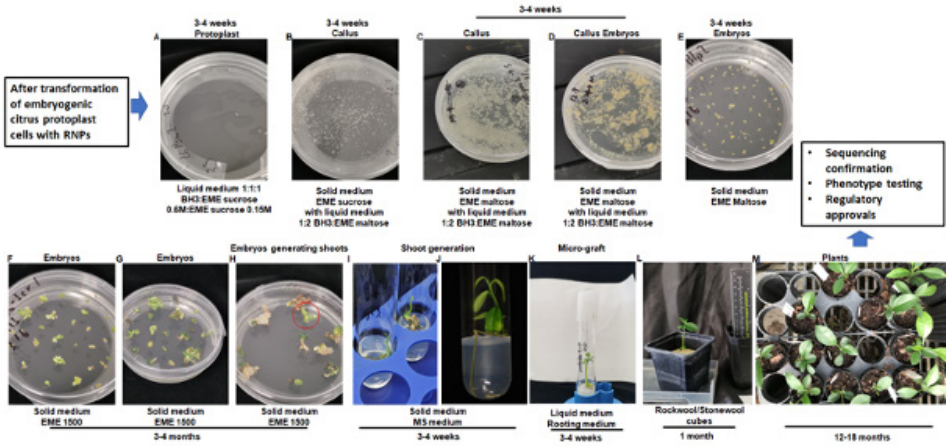

Take Home Message:

- The transgene-free canker resistant 'Hamlin' plants have been approved by USDA-APHIS and are in the process of further evaluation and commercialization.
- We have developed multiple transgene-free genome editing toolkits using the CRISPR technology.
- We are conducting non-transgenic citrus genome editing to reduce the systemic and chronic immune response, and to increase antioxidant enzyme activities.

Summary: CRISPR gene editing has been used to generate multiple canker resistant citrus gene-edited Sweet orange cv. 'Hamlin' via editing the elements in the promoter region and coding region of the canker susceptibility gene CsLOB1, demonstrating its power in generating disease-resistant citrus. The transgene-free canker-resistant 'Hamlin' plants have been approved by USDA-APHIS and are in the process of further evaluation and commercialization. Importantly, we have developed multiple transgene-free genome editing toolkits using the CRISPR technology. Among them, one is based on the ribonucleoprotein, and another is based on a co-editing strategy. The toolkits are highly efficient. Our previous studies also showed that the HLB pathogen stimulates a systemic and chronic immune response in citrus phloem including reactive oxygen species (ROS) production and callose deposition, which causes systemic phloem cell death and subsequent HLB disease symptoms. We are conducting non-transgenic citrus genome editing to reduce the systemic and chronic immune response, and to increase antioxidant enzyme activities. Non-transgenic gene-editing technology for sweet orange is mature now and non-transgenic HLB-resistant lines have a much simpler and easier path for regulatory approval, thus accelerating their potential commercialization.

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