Tansgenic Possibilities

By Rick Dantzler, CRDF chief operating officer

This is the second in a series of columns on "rifle-shot" research, which I define as high-risk, high-reward projects that could lead to a cure for HLB. They are not fast and not inexpensive, but they could get this disease behind us once and for all.

Last month's column discussed using the citrus tristeza virus to carry peptides, genes or other liberibacter-neutralizing agents into the phloem of a citrus tree, where the disease resides. This month's column focuses on transgenics, the introduction of one or more genes of one species into another.

Upon discovery of HLB in Florida, a first hope was to create transgenic citrus that would be resistant to the disease. Several years later, when scientists learned how to transform mature citrus, the possibility arose of greatly speeding the process of getting these transgenics into the field.

This brought significant financial investment in the building and staffing of a mature transformation facility at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Citrus Research and Education Center. The expectation was that researchers from around the world would identify many genes that would protect citrus from HLB, either by resistant or tolerant trees or prevention of spread by psyllids. That expectation has not been met, but transgenic citrus resistant to canker and tolerant to HLB has been made (some are under field tests).

Excitement in the industry about transgenics has not been great, primarily because the fruit from these trees would be considered genetically modified organisms (GMOs), and the time and cost of approvals would be substantial, perhaps in the $10 million to $40 million range. To justify this cost, a transgenic likely would have to be resistant enough to eliminate HLB.

Another approach is cisgenics. With cisgenics, only sequences that could be conventionally bred into citrus by making crosses with other citrus species are introduced. While still genetically modified, it is modified with citrus sequences, which should be more acceptable and less expensive because the regulatory requirements would be less onerous.

Perhaps a more practical approach could be to use transgenic rootstocks that can actively protect the aboveground non-transgenic scion against HLB. In such a scenario, the transgenic rootstock would produce potent compounds that could either move up to the scion through the graft union or remain in the rootstock. In either scenario, liberibacter spread could be checked, and the protected scion would remain non-transgenic. This technology is still in its infancy, but early results are encouraging.

In the meantime, new technologies have arisen. With CRISPR, small, targeted mutations are created at a specific site in the citrus genome. Because there is no new foreign sequence introduced, the expectation is that resulting trees would not be regulated or considered GMOs. The Wang, Mou, Gmitter and Dutt labs of UF/IFAS, along with other labs around the world, are in the process of producing HLB-resistant or tolerant trees using this method.

The Citrus Research and Development Foundation is funding work in all these areas. Even if just one works, it could put HLB in the rearview mirror and allow us to move on to other things.

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