

There are non-GMO options:

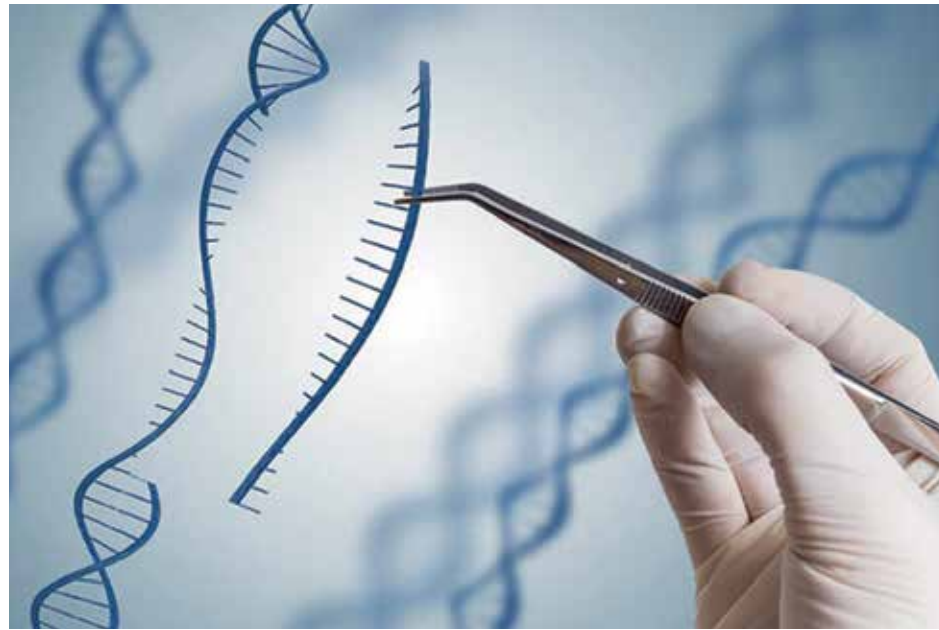
CRISPR technology, gene editing is one where certain susceptible genes could be edited. The article, "Update on CRISPR research in Citrus Improvement," suggests that to remove or deactivate a susceptibility gene is probably one of the easiest approaches to getting regulatory approval for the genome-edited citrus varieties (Wang, N., F. Gmitter, and M. Dutt. 2020. <https://citrusindustry.net/category/breeding/>, December 28.) Another existing "barrier" is that the HLB bacteria remains elusive and to date is unculturable, making it very difficult to pinpoint the genes that make citrus vulnerable to HLB. However, there is no time to wait for this solution that can be dealt with separately in parallel. These scientists are effectively "anticipating the impossible to be solved".

As a result, work continues with this concept, using putative HLB susceptibility genes, where apparent resistance of cultivars such as Aussie Finger Lime, (caused by certain peptides), and antimicrobial defensins found in spinach.

Another option: The technology already exists and is extensively used, providing cross protection and using mild strain Citrus Tristeza Virus, (CTV) isolates to inoculate citrus plant material, protecting it from aggressive strains in our industry. CTV like the HLB bacteria resides in the phloem of the plant where it could deliver these defensin proteins. By the same means it would be possible to engineer CTV to transport toxic compounds to the phloem from where psyllids suck.

Another outcome of exponential thinking in solving a problem are the new possibilities that will be presented.

The same "Florida Citrus Improvement" article lists additional applications



Gene replacement

We have more fruit to sell than ever before, with exponential population growth that requires continued access to the potential markets that this growth provides.

that would assist with other diseases and physiological issues for the easier management of citrus, using the same CRISPR technology.

Some of these possibilities could be:

- Reducing the long juvenile phase that significantly delays the development of new improved cultivars. Genome editing of a gene playing a role in juvenility could potentially result in earlier commercial fruit production.
- Editing genes:

- that negatively affect tree shape could be achieved
- that respond to low temperature, improving cold tolerance
- that negatively affect salt-stress regulation, resulting in improved salt tolerance in citrus.
- Maintaining flavour in fresh and processed citrus juice by editing genes to significantly reduce phytochemicals such as Naringenin and Limonoids, benefiting consumers and thus driving demand for citrus products
- Decreasing phytochemicals such as furanocoumarin levels in grapefruit, which are associated with potential negative effects linked to certain medications, and increasing demand.

The Florida Citrus article concludes that the use of CRISPR genome-editing technology not only improves citrus tree health and reduces disease susceptibility, but it could also provide many spin-off benefits to both producers and consumers of citrus. A positive thought in the face of different challenges confronting farmers in different regions around the world, and in line with Diamandis's positive exponential thinking concepts. 🍊

Growing confidence for producers the River Bioscience way

River Bioscience takes pride in being one of SA's leading biological control companies, supporting both local and international agricultural markets through their high-quality products. By Rob Elfick



Rob Elfick



Through its world-class products, River Bioscience (RB) enables growers to use alternatives to synthetic chemicals, assisting in managing residue profiles, production quality and food safety. Over and above this, RB believes in giving back to the communities in the regions in which they operate. Along with its subsidiary,

XSIT, the organisation also provides an integrated pest management system for the management of false codling moth (FCM), using the sterile insect technique (SIT), virus sprays, pheromone products and other biopesticides. The SIT programme rears, sterilises and releases masses of FCM in areas where FCM is prevalent.

A truly South African entity, RB strives to support its local growers through building strong relationships with technical experts, and ensuring that their product distribution networks are fully trained and able to provide the best possible support in the field. Phytosanitary pests are high on the radar of RB, which manages pests through the effectiveness of its products. This secures critical access to key international markets for the export of citrus and improves its competitiveness globally. Beyond its vested interest in the citrus industry, RB is also expanding its innovative plant protection products into other sectors of agriculture.

Amongst its vast array of tried-and-tested products are those that can be used in integrated pest management

(IPM) programmes for FCM, fruit fly pests, bollworm, citrus blackspot (CBS), and an ant bait that targets both brown house and pugnacious ants. The organisation is also in the process of developing and registering more products, and is investing heavily in new biological solutions for growers to use within their orchards – for citrus and other agricultural sectors. Along with their crop protection products, RB also offers monitoring products and services to monitor pest activity in the orchard and identify if further interventions are required. XSIT also has their own team of monitors that collect data weekly from the SIT orchards to monitor population trends, reporting back to growers and making further recommendations if required.

Focused on having all the right building blocks in place to support citrus and other export crop producers into the future, RB invests in innovation and uses scientific research to serve its clients and the agricultural community of SA, Africa and around the globe. They are sowing the seeds for a fruitful future in agriculture.

The RB company was the first to develop, produce, register and launch a granulovirus targeting FCM, and the first to register and commercialise a bollworm nucleopolyhedrovirus in SA. 🍊

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