

A NEW PERSPECTIVE on the challenges we face

An interesting read of *Abundance* and *Bold*, two books by left-field thinker Peter Diamandis, proposes new ways of thinking and dealing with challenges that the modern world seems to be increasingly throwing at us. By Jon Roberts



My childhood during the 60s - 70s was very much about community and comfort zones where only linear change occurred from generation to generation. In comparison to that, our children and their children will have seen exponential change in mere decades and per year respectively.

Diamandis uses an interesting illustration in comparing linear and exponential change: imagine taking 30 linear paces, i.e. 1,2,3 and so on, and predict where you would be in 30 paces. Humans have an inbuilt ability for linear projection, so we would have a pretty good idea where 30 paces would take us.

However, if we were asked to take 30 exponential steps, i.e. naturally doubling 1,2,4,8,16,32 ... through to 30 exponential paces away, where would that take us? Whilst reading this magazine you would probably be thinking you may have reached somewhere in the middle of the Pacific! Well, actually we would be a billion metres away from where we started.

An article in Fin 24 quoted Justin Chadwick's illustrative estimate of the 2020 season's cartons exported: if each carton was placed side by side, he said, they would extend 40 000 km long, close to the earth's circumference. A big number, but not impossible to calculate, based on every farmer's knowledge of a carton's dimensions and multiplying the 146 million cartons we exported.

The billion metre 30 exponential steps,



Jon Roberts

however, orbit us around the earth 26 times! A powerful image to comprehend. We don't naturally default to exponential thinking.

What has this got to do with citrus or cultivars? you may well ask.

We've had a tough year. Compared to the previous year the challenges in 2021 of COVID-19, load shedding, political violence in KZN closing Durban harbour, cyber attacks on our ports authority causing logistical congestion, along with drought, hail and unseasonal frost in some areas, farmers in those affected areas could easily be thinking, "a perfect storm".

We are living in an exponentially changing world right now. The Kodak story comes to mind: although they developed the first digital SLR camera in 1991, with 140 000 employees at the time and a \$20 billion market cap, Kodak decided the digital camera did not fit their business model. Like the exponential development of computers, digital cameras likewise

improved exponentially, virtually doubling in quality every 12 - 24 months. Long story short, their decision resulted in bankruptcy by 2012. At the same time a small company called Instagram with 13 employees, selling no cameras or equipment, basically only providing a platform app to people using the digital cameras on their phone, was sold to Facebook for \$1 billion.

When I started farming, the 40 million cartons of citrus produced by the industry and sold by Outspan seemed phenomenal then. While not exponential, the 160 million cartons produced in 2021 is a mind-boggling increase, and certainly required innovation by our growers and marketers to produce, pick, pack and sell.

There is no doom or gloom in Diamandis thinking however, it is extremely positive and energising in contemplating the possibilities in the fast changing world we live in. His mantra being; "the best way to predict the future is to create it yourself". This is the type of thinking where people like Elon Musk predicted their future being (the unfathomable, at the time) Mars travel, which has seen him breaking through barriers in other related technologies such as Space X, Tesla and quantum computing. This has incentivised various billionaires to break previously inconceivable limits without a big brother NASA. These new technologies have

required exponential thinking coupled with exponential growth of computer speed and cloud space. Where previously barriers have harnessed spare cognitive thought through incentive prizes, thousands of people around the world break these barriers (Incentive prize models have their origin in such breakthroughs as the first Atlantic plane crossing by Charles Lindbergh who won \$25 000. The total expense of all contestants was well over \$400 000.) Incentivisation is a powerful tool, not limited to money. Hardship experienced in the world wars, where humankind facing extreme dangers, was incentivised to make rapid technological advances. We are in an era where big brother government research budgets are not going to cut it anymore. The citrus industry, through self-funded innovation and research and development (R and D), has seen massive growth against subsidised competitor countries since deregulation.

But there are new challenges. 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. Trade barriers, poverty and climate change are all challenges that demand an exponential thinking hat.

Varieties will not only be required to deal with production, postharvest, quality and customer acceptance. They will increasingly need to be tolerant to higher pH soil, poor water quality, salinity, drought, pest and disease pressure. Not forgetting that we also need to entice customers through our citrus fruit type in a competitive fresh fruit space of flavour, colour, health and easy eating.

Industry publications increasingly feature the new innovations being employed in places like California and Florida, as they grapple with such issues as HLB. The traditional approaches of chemical treatments such as neonicotinoids, and



Trial plants in CRI greenhouse

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beneficial insect releases such as Tamarixia will need an expanded, integrated approach to beat this devastating disease and its Psyllid vector. The new thinking has unfortunately been accelerated by the incentive of hardship, destroying multi-generational farming enterprises and businesses in Florida as this devastating disease rolled across the state.

One such additional approach is the

breeding programme in Florida CREC that I have written about in *SA Fruit Journal*, identifying rootstocks and scions showing tolerance to HLB. Conventional breeding however, will be too slow and achieving asymptomatic disease tolerance will still allow the spread of the disease by psyllids. An obvious approach would be introducing genes transgenically from other organisms to achieve full resistance. However, another "linear barrier" – the global marketplace – remains mostly reluctant to accept GMO citrus products.

Exponential thinking hat:

"Anticipating the impossible," as Diamandis calls it: When the makers of Siri were developing their first rudimentary voice AI tech, the core technologies required to run their concept didn't exist. They had to anticipate that bandwidth, processing speeds and language processing would develop in parallel with their technology. Thanks to exponential change, it did and today we have many variations like Alexa and Cortana being used in daily life, even in Africa. We should therefore, not be constricted by current thinking around GMOs. Food supply in the face of climate change is serious enough to swiftly change mind-sets amidst severe food shortages.

There are non-GMO options:

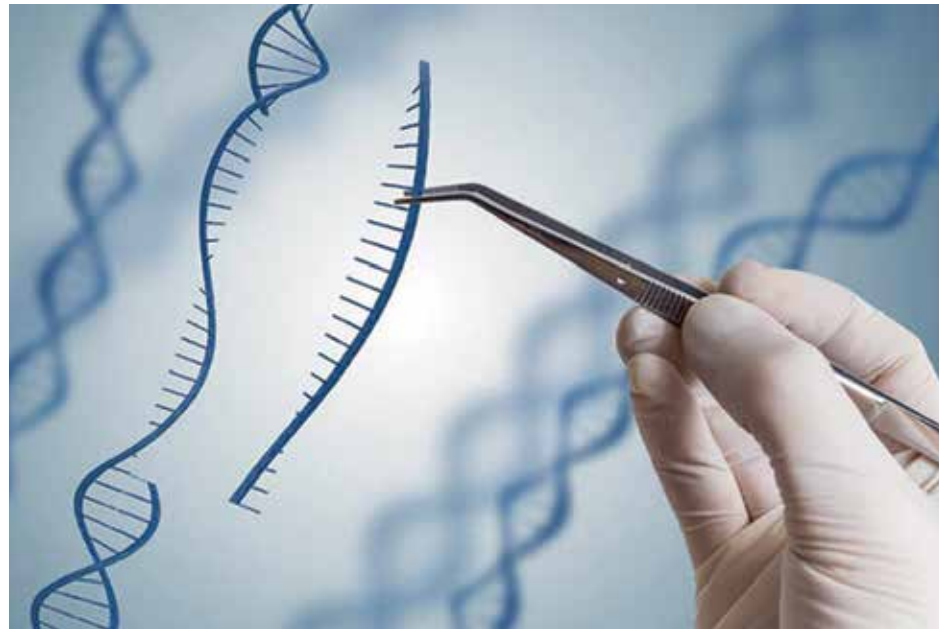
CRISPR technology, gene editing is one where certain susceptible genes could be edited. The article, "Update on CRISPR research in Citrus Improvement," suggests that to remove or deactivate a susceptibility gene is probably one of the easiest approaches to getting regulatory approval for the genome-edited 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

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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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