SEGMENT

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Food. Environment. Society.

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A 200 hectare avocado orchard in the Central Highlands of Viet Nam which is being developed as part of a co-investment partnership between local firm Sam Agritech, Dak Nong province, Plant & Food Research and the New Zealand Government G2G Partnership Office. Read more about Plant & Food Research international development projects in the photo feature on page 20.

PHOTO: **WARA BULLÔT**

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Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

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REGULARS

Welcome to the first edition of Segment magazine.

We've put this magazine together to give you an insight into some of the opportunities we see ahead in the changing landscapes of food production, our environment and society's relationship with food. Each edition will offer a small slice (or segment) of what feeds our curiosity and informs our science, supporting the New Zealand and global food industries in delivering a smart green future for all.

In this inaugural edition, our Chief Scientist Richard Newcomb talks about what he thinks are the most important issues facing future food production; journalist Matt Philp takes a look at whether perceptions of bee decline are as catastrophic as the media report; we look at how robotic technologies are changing the look of orchards; and we talk to Loren Zhao, the CEO of China's biggest online fruit retailer Fruitday, about how his relationship with food has changed over recent years.

I hope you enjoy this view of the things that are influencing our world.

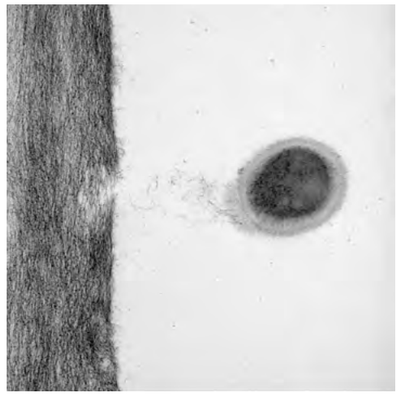
David Hughes.

David Hughes
CEO Plant & Food Research

Holy Guacamole!

Avocado genome has been sequenced

Scientists have sequenced the avocado genome, shedding light on the ancient origins of this buttery fruit and laying the groundwork for future improvements to farming. The project, led by the National Laboratory of Genomics for Biodiversity in Mexico, has found that the popular 'Hass' variety inherited about 61% of its DNA from Mexican varieties and about 39% from Guatemalan ones. The research provides vital reference material for learning about the function of individual avocado genes, boosting productivity, improving disease resistance, and creating fruit with new tastes and textures.



Gut bacteria adapting to our love of fruit and veg

Scientists have discovered a new human gut bacterium, *Monoglobus pectinilyticus*. This is the first specialist bacterium that specialises in breaking down pectin, a hard-to-digest substance found in plants. It suggests that the human gut microbiome is evolving to accommodate our consumption of fibre-rich foods. Plant & Food Research scientists and their research partners analysed the faecal samples and dietary intakes of 44 healthy people in New Zealand. The presence of *M. pectinilyticus* positively correlated to the participants' pectin consumption – the more fibre one eats, the more likely it is that this beneficial microorganism is present.

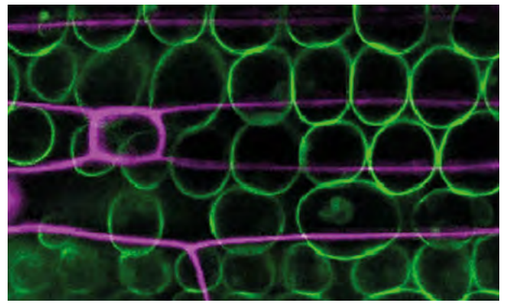
New Zealand blackcurrants may help you get off the sofa

If you want to exercise but aren't motivated enough to stick to a workout regime, juice from New Zealand blackcurrants consumed prior to exercising may help. Scientists at Plant & Food Research looked at the effects of consuming the polyphenolic-rich juice one hour prior to exercising. They found that those who consumed the juice had a significantly lower perception of exercise exertion at time-points over the first 60 minutes than the control group.

Insects as livestock

Insects such as grasshoppers and crickets have been hailed by some as the next superfood, as cheap sources of protein with minimal greenhouse gas emissions. A German-Kenyan research team have for the first time systematically investigated how various feed substrates influence the growth and development of crickets and locusts. They found that locusts can process plant fibres that are indigestible by humans, but crickets, on the other hand, excrete fibre-rich food. Locusts grow quickly only when fed protein, while crickets need starch above all.

The research team led by Dr med. Sevgan Subramanian and Prof. Wilhelm Windisch developed a special feed mix for locusts (*Schistocerca gregaria*)



Plants have "lungs"

Using genetic manipulation techniques, scientists at the University of Sheffield have discovered how plants create networks of air channels – the lungs of the leaf – to transport carbon dioxide to their cells. Their research reveals that the more stomata (pores) a leaf has, the more airspace it forms. Leaves contain channels that act like bronchioles. The study also shows that humans have bred wheat plants to have fewer pores on their leaves and use less water. These findings pave the way to develop more drought-resistant crops.

Seafood shells a potential answer to plastic waste

As governments around the world try to find solutions to process and reduce plastic waste, some scientists are trying to turn seafood waste into an alternative source of bio-based "plastic". The shells of crustaceans, such as shrimp and crab, contain chitin, a material that offers many desirable properties and takes only weeks or months to biodegrade. Mari Signum, an American start-up, is devising ways to make cost-effective, environmentally friendly chitin.

Humanity will probably reach 9.8 billion people in 2050 but feeding 2 billion extra people is no easy feat. These people will mostly live in cities. Unable to contribute much to their own dietary needs, they will rely on others to produce and deliver their food.

Tomorrow's food

To feed the population of the future in a sustainable way we must find new ways of producing and managing food. Innovations in technology and science offer opportunities to do things differently. But one thing is clear — more of the same will not achieve this. Professor Richard Newcomb, Chief Scientist at Plant & Food Research, looks at what food and food production could look like in the coming decades.

Our world has gone exponential. Thirty years ago few could imagine a world of tweets, driver-less cars and the precision editing of genes.

A time traveller from 1990 might take comfort in the enduring popularity of Coronation Street. But they would be stunned by hi-res photographs from Mars, Siri, facial recognition technology and the myriad of milk substitutes for café coffee.

As someone whose day job is to think deeply about research into food and its production systems, I often consider what's over the horizon for what we eat. There's no doubt that much of our diet in a decade or two will be profoundly influenced by a tsunami of technology innovation and trends. Think data analytics, robotics, high-rise urban farming, synthetic biology, gene editing, drones and a much stronger commitment to sustainability. At the same time I wonder what future consumers will want or expect in their diet and how it's produced.

At the 2019 UN Climate Action Summit, Prime Minister Jacinda Ardern told world leaders that New Zealand is determined to be the most sustainable food producer in the world. Through the years ahead, a big challenge for New Zealand will be to maintain the country's reputation as a trusted producer of premium food.

Many more mouths

Humanity will probably reach 9.8 billion people in 2050. But feeding 2 billion extra people is no easy feat. These extra people will mostly live in cities. Unable to contribute much to their own dietary needs, they will rely on others to produce and deliver their food. And they will demand food and supply chains that are as environmentally sustainable as possible – certainly a big improvement on current standards. Avoidable harm to the planet will be off limits.

How to meet the challenge of feeding 2 billion extra people? We require new technologies, fresh ideas and innovative regulatory systems. We will need to apply lessons from the data analytics revolution and the rapid growth in robotics, drones and sensing technologies. Equally, genetic advances such as gene editing and synthetic biology will offer substantial benefits to agriculture.

Conventional wisdom is that New Zealand's contribution will be limited, given it exports food to feed just 40 million people currently. But perhaps new technology will turbo-boost our ability to feed a greater proportion of the global population.

Opportunities and challenges

Sustainability has become a ubiquitous word, although many are unsure what it means. Consumers are now asking more about the sustainability of the products they are buying, especially food. If New Zealand can truly become a sustainable producer of food, then this should add a premium to the value of our food products. However, consumers will require higher standards of assurance that these claims are real.

> "Consumers are now asking more about the sustainability of products they are buying, especially food.

To be truly sustainable we will need to account for all production system inputs, such as water, nitrogen and phosphorus, and then use a model to confirm the truly optimal level of each input for the result we want. Sounds simple, right?

But this will require a model for every crop at every location, and down the track these will need to take into account our warming environment. This will quickly become a "big data" challenge. Some liken it to the scale of computer time used by bitcoin mining. But only a comprehensive approach like this will produce the yardstick for improved sustainability credentials, and make food that is really as light a touch on the planet as possible.


Photo: AeroFarms

AeroFarms has the largest indoor vertical farm of its kind in the world, enabling year-round growth in urban settings with minimal environmental impact.

Sustainability does not end in the field. Supply chain footprints need to be improved. Carbon is used as produce is transported and energy is required for cooling en route. Add to that the plastic in which so much produce is wrapped.

Digitising our food

If food waste was a country it would be the third largest emitter of greenhouse gases. Just think about that for a moment. After massive effort and expense to grow, store, transport and retail produce, a big percentage of it is wasted in transit or not consumed after purchase.

Digitisation of the supply chain will provide some solutions. For example, a technology like blockchain could link the farm to the fork, shorten supply chains, and ensure food arrives at the right place just in time for consumption. Advances like these will help to boost provenance, assuring consumers that their food really is from New Zealand – produced and protected to a high standard. Other improvements that are likely include fruits that do not require so much packaging or cooling in transit, and are edible for longer in the home, to minimise waste.

Urban farms have arrived

With almost everyone moving into the cities, perhaps we should consider making food there instead? This would avoid converting more precious land to food production. In the cities, like the buildings, food production could go up rather than out. Already in places such as Singapore, Shanghai, New York and Chicago, vertical farms are becoming a reality.

Where might this lead? As self-driving cars become the norm, imagine many car-parking buildings in a city transformed into vertical farms. They would use the latest lighting technologies, harness the sun for power, and reuse city water. Or better still, imagine a city designed for zero impact, with more than a million plants to produce oxygen and filter the air, as well as solar and geothermal for power. Well, you can stop imagining, as it has already been built in China – in Liuzhou Forest City.

But New Zealand, with small cities and so much production land, surely doesn't have any vertical farms? Think again. In Wellington a business called Shoots is using hydroponics to grow microgreens for the capital's top chefs.

Currently vertical farms mainly produce leafy greens. But in time other plant production systems will be adapted for use in vertical farms. Think miniaturised trees and vines producing fruit and berries. City dwellers will reconnect with how their food is produced, as they pick fruit from a tree grown in their apartment block rather than off the supermarket shelf covered in plastic.

Out to the ocean

Our not-so-distant future is likely to see a great deal of animal production move from the land to the sea. Fish have lower greenhouse gas emissions than their terrestrial equivalents. Could we really harness the ocean for protein production? Currently aquaculture is largely limited to our coastal waters. However, there is far more space out at sea for production and New Zealand has one of the largest expanses of ocean of any country.

There will be significant challenges to overcome, such as high wave action and currents. The jury is still out on what aquaculture in the open ocean will look like. It could be enormous rigid sea cages that look like oil rigs or ships, or more modest enclosures that flex with a moving sea. Perhaps they will be self-powering and mobile – able to dodge storms and take fish to market. A huge challenge will be sourcing all the food for the fish. Perhaps that can be produced at sea as well?

Already the Norwegians are trialling these ideas. Sea cage production of salmon is moving further out from the protection of the fjords. Aquaculture company Nordlaks is developing Havfarm, a giant ship-shaped fish farm that could revolutionise salmon fishing, while SalMar ASA – one of the world's largest producers of farmed salmon – is also active.

It may be that future consumers demand that the fish they eat comes from sustainable aquaculture rather than harvested wild stock. And one impact of rising sea-levels may be to convince us to look to the ocean as the place to produce our food.

Growing New Zealand's future with science

Based on global trends and opportunities, Plant & Food Research is investing in three areas of fundamental science to support New Zealand's future.

1. Urban horticulture

Our science is developing cultivars and growing systems tailored to indoor horticultural production, helping to produce food where people live.

2. Sustainable production systems and supply chains

Our research is focused on ensuring that New Zealand has the most environmentally sustainable food production systems globally and that we minimise environmental waste and harm in the supply chain.

3. Aquaculture

Our science is exploring how New Zealand's large ocean space can be harnessed for sustainable aquaculture production of high quality seafood.


Photo: SalMar ASA

Ocean Farm 1, in the Norwegian Sea, is the world's first offshore fish farm, created by SalMar ASA, one of the world's largest producers of farmed salmon.

Time for a new conversation about gene editing

ORIGINALLY PUBLISHED ON WWW.STUFF.CO.NZ

In the late 1990s public scepticism cast genetic modification as "The answer to the question no-one was asking". Today, the new technology of gene editing is emerging as a real option in facing some of our world's biggest challenges in food production, medicine, conservation and climate change.

The Institute I lead, Plant & Food Research, has committed our science to helping New Zealand's agri-food sector deliver the best quality foods from the world's most sustainable production systems. We believe gene editing can help us meet that commitment.

Today, Plant & Food Research breeds only 100 per cent GM-free fruit, vegetables and grains. We have never developed GM foods for commercial use and industry does not fund us to do so. Yet our discovery-focused teams routinely use gene technologies to further our knowledge.

They've learned that gene editing can help us achieve our traditional breeding targets around sustainability and nutrition much faster. That means consumers get more healthy whole foods sooner. Growers gain greater ability to fight pests, cut chemicals and delight the global market with innovative new products. Communities get options to keep their horticulture sector thriving in the face of climate change and pressure on the environment.

Colleagues at other Crown Research Institutes have identified similar new options in the crops, farms and ecosystems they work with: greener pastures, fewer pests, more trees where we need them for materials, jobs and carbon reduction without the risk of wild spread into our conservation estate.

> Gene editing offers game-changing capability well beyond earlier GM tools. It allows breeders to make precisely targeted changes to a plant without introducing any foreign DNA. Those changes are the same as those found in nature.

Technologies gain acceptance not because of what their creators promise, but what people value. So it's time for Kiwis to have a grown-up conversation about how much we value these new options. We need a clear view on what role we see for gene editing in creating a smart, green future for New Zealand.

Let's be clear about why we need a new conversation, not a re-run of the "GM Debate".

Firstly, the technology is very different. Gene editing offers game-changing capability well beyond earlier GM tools. It allows breeders to make precisely targeted changes to a plant without introducing any foreign DNA. Those changes are the same as those found in nature. You can't "test" for gene editing because it leaves no trace.

Alongside this leap in the technology we're experiencing big new challenges as a society. Our planet is warming, our climate changing. Biodiversity is declining. Clean water is in shorter supply in many places. Globally we are feeding more people, yet millions still go without while others suffer from excess in a crisis of nutrition, not calories.

New Zealand has changed. We are more diverse in race, religion and politics. The voice and influence of Māori are flourishing. The 100,000 Kiwis born around the time of the Royal Commission on Genetic Modification are now at voting age and have a different world view from earlier generations.

The same demographic shifts have occurred in our traditional international markets and we have added millions more new consumers in China and beyond. These global consumers are consuming and communicating differently. Social media carry brands, ideas, opinions, hopes and fears further and faster. Trends can emerge, engage and influence us within days or hours – and shift again just as quickly.

Our Institute sees great promise for gene editing in helping Kiwis continue to sustain our prosperity, communities and environment in this changing world. We accept that others may not feel the same. New Zealand needs to weigh its options. So we're here to join that discussion, share what we know – and what we don't – and help us agree on a future we can all believe in.

Other voices and roles are also vital. Politicians can seek a continuation of the legacy of Aotearoa's consensus culture. Parliamentary outreach to our institute from across the political spectrum in the past year suggests this is happening.

Industry will continue its efforts to understand how gene editing may affect their markets – and therefore New Zealand's prosperity.

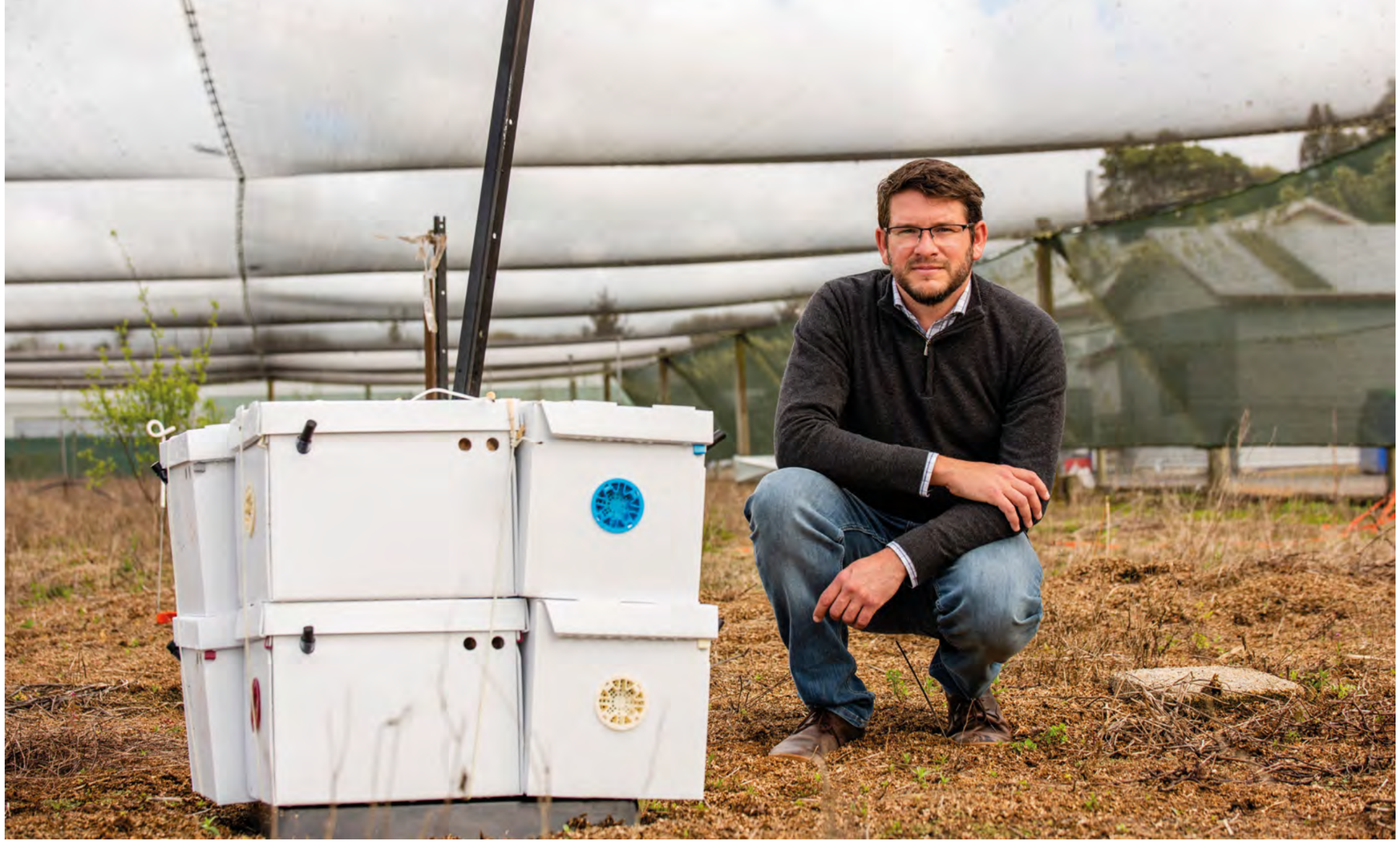
Farmers and growers will share their views on how gene editing influences their options – not just as businesses but as providers of food, environmental stewards and as heartland employers.

The Māori view of an interconnected world of people, animals, plants and environment, combined with principles such as kaitiakitanga, provide Aotearoa with a unique and valuable perspective not available in other nations. We should relish the opportunity to have Māori perspectives and interests strongly represented in discussion.

All New Zealanders should approach this discussion with passion and optimism. I especially hope that we will hear from young people. I urge the new generations of Kiwi consumers, farmers, mana whenua and leaders to tell us about the world they want and how they hope we can get there. Ultimately, when I work to help make a smart, green future, I am working for them.

DAVID HUGHES
CEO, PLANT & FOOD RESEARCH

Bumble bee fitted with a radio transmitter provides scientists with insight into how they choose their nest.



Dr David Pattemore is looking at how to rear bumble bees for managed pollination to support the efforts of honey bees.

The buzz on bees

Matt Philp looks at the latest research on bees and what scientists are doing to protect pollination and biodiversity.

In 2016, pollination expert Dr David Pattemore visited a Waikato blueberry orchard with some unlikely research collaborators – a group of bumble bee queens, each bearing a tiny radio transmitter super-glued to her abdomen.

Dr Pattemore, who leads the Productive Biodiversity & Pollination group at Plant & Food Research, and his team wanted to understand how bumble bees picked their nesting sites. Using an automated tracking system to monitor the bees, the researchers hoped the transmitters would allow them to track which particular landscape features the wild queens found attractive, information that could help to develop methods to encourage more bees to nest. The ultimate goal behind this interest in bumble bees? To harness them to pollinate crops – not as a replacement for the ubiquitous European honey bee, but as a complementary force.

The bumble bee work is part of a Government-funded six-year investigation into alternative pollinators by Pattemore's group. There are compelling New Zealand-specific reasons why developing a pollination "plan bee" makes sense – the tension between the needs of crops such as kiwifruit and the lucrative mānuka honey industry being just one.

Native bees are under threat. In Ireland, almost a third of native bee species are threatened with extinction, and elsewhere are other stories of decline. Although honey bees are not threatened with extinction, it requires more effort to keep colonies alive.

And it's not just bees: the so-called "Insect Apocalypse" may have been overstated, but many pollinating species are declining. The reasons are likely to be multiple, and include the increased use of insecticides (the EU banned neonicotinoids in 2018; however it's not yet clear that the products used to replace them are less harmful), habitat loss, the loss of honey bee colonies from the *Varroa destructor* mite (varroa), and climate change.

Should the worst happen – a mass decline in pollinators – the world won't starve, but it would certainly affect food supplies and damage the ecosystem. Bees, and other pollinating insects, are

involved in the production of one in every three bites we eat, critical pollinators for 70 out of 100 crop species that feed 90% of us.

And the impacts will extend well beyond food. Jane Stout is a Professor of Botany at Trinity College Dublin and an initiator of the All-Ireland Pollination Plan, aimed at reversing decline in Ireland, where wild bees are struggling.

“Crop production is just one of many benefits we gain from healthy populations of wild pollinators,” she says. “They also pollinate wild plants that contribute to ecosystem function. They contribute to cultural and spiritual services, health and wellbeing, a sense of peace, et cetera.”

To sustain crop pollination in future, we need both to protect wild pollinators and also to ensure we have a healthy population of managed honey bees to use for crop pollination.

At Plant & Food Research, much of the research into the health of managed honey bees is focused on varroa, which was discovered here in April 2000 and rapidly wiped out our feral honey bee colonies (honey bees are not native to New Zealand). Thanks to management techniques and synthetic chemical controls, however, varroa wasn’t the hammer blow to managed bees it might have been – in fact, the number of colonies has climbed from 300,000 in the early 2000s to nearly 900,000, largely thanks to the mānuka honey bonanza.

Yet the challenge remains, says Pattemore. “We are seeing more viruses associated with varroa, and varroa also develop resistance to treatments,” he says. “It’s a mission to keep ahead.”

One area being investigated by Plant & Food Research is whether bee breeding can contribute to varroa control. The research focuses on assessing in New Zealand honey bees the value of genetic markers described for a behavioural trait known as “varroa sensitive hygiene” (VSH), where honey bees detect and remove bee pupae infested with the mite. The more VSH exhibited, the better a colony is able to withstand a varroa assault.

“We’re involved in a DNA-based queen selection programme,” says Dr James Sainsbury, the leader of Plant & Food Research’s Bee Biology and Productivity team.

“The question is this: if we look at the DNA of a queen before she produces a colony, can we work out how much of this anti-varroa behaviour that colony will have? We have run a controlled research trial, and this coming year we’re running a citizen science project with beekeepers to test the idea of DNA-assisted selection for varroa resistance.”

If it pans out, it could be a useful tool in managing varroa in New Zealand, he says. “We do not expect it to replace the need for synthetic chemical treatment completely, but it opens the door for us not to rely on them so much.”

Plant & Food Research is also exploring how bees might be made into more effective pollinators. As Pattemore points out, “New Zealand doesn’t have a problem of lack of honey bees; the issue is where the bees are going. It’s much more profitable for a beekeeper to produce a good mānuka honey crop than to put their colonies in for pollination.” Achieving more bang for your pollinating buck has become a priority.

As part of its research, Pattemore’s group has developed an automated pollen dispenser that “pre-loads” bees as they leave the hive, to maximise pollination. The device is now being commercialised.

Meanwhile, Plant & Food Research has been subcontracted, as part of the University of Otago’s “Future Bees” programme (funded by MBIE), to develop pollination effectiveness measures that could be incorporated into breeding. “They’re not planning to breed a super bee, but they’re trying to set up a breeding index such as you have for livestock,” says Plant & Food Research bee scientist Dr Ashley Mortensen.

The team is looking at colony-scale parameters such as the amount of food a colony provides to its larvae. When that is high, so too is the protein demand on worker bees, which the researchers suspect will drive them to collect more pollen.

“We’re also looking at individual bee parameters. For example, we want to see if there’s variation between colonies in the hairiness of workers; if that hairiness correlates to a change in electrostatic charge; and if that change influences pollination efficiency – which we assume it would,” says Mortensen.

Behind all of this is a possibly surprising insight: while the European honey bee is the world’s number one pollinator of crops, pound-for-pound it’s by no means the most efficient. Bumble bees, for instance, forage in ways that make them individually far more effective. And there’s growing understanding of the importance of other pollinators – including some seemingly unlikely species.

Bees, and other pollinating insects, are involved in the production of one in every three bites we eat.

Dr James Sainsbury is looking into queen DNA-based selection for varroa resistance.

While the European honey bee is the world’s number one pollinator of crops, pound-for-pound it’s by no means the most efficient.

Dr Ashley Mortensen is developing pollination effectiveness measures for incorporation into breeding.

Photo: Mike Bentley

An adult honey bee “emerging” from the plate that she was artificially reared in.

At the end of the day it all comes down to fostering biodiversity.

For example, this Plant & Food Research group has discovered that in some Australian regions avocado orchards are almost entirely pollinated by flies. It reinforces a point Pattemore makes about the importance of knowing exactly who is pollinating your crops – if those Australian growers had sprayed for flies, they would have endangered their livelihoods. But it also highlights the rich potential for harnessing pollinators other than honey bees.

Dr Romina Rader, a Senior Lecturer in Community Ecology at the University of New England, in New South Wales, is involved in a new three-year study into the role of flies as pollinators. “Wild pollinators have a big future in Australia for some crops,” she says. “For other crops, a mixed system with both managed and wild pollinators is definitely possible – it’s already happening in many regions.”

As noted, Pattemore is particularly interested in the potential of bumble bees for crop pollination. “There’s the potential to see them sit alongside honey bees as our number one and number two managed pollinators,” he says. “It’s something we’re very motivated to see.”

One stumbling block is economic. Commercial bumble bees are expensive, and for various reasons you need many more bumble bee colonies than honey bee colonies to pollinate an open orchard. Pattemore’s group has been trialling a new rearing system that could dramatically cut the cost.

The New Zealand researchers are also interested in the pollinating role played by flies and other insects.

Pattemore stresses the importance of developing many complementary pollinating options, noting that even in crops where honey bees do 80% of the work, it’s often the “top-up” by other species that makes that crop economically viable. “And the more diversity you have, the more chance that you’re going to achieve pollination regardless of weather conditions or the shape of your flowers.”

At the end of the day it all comes down to fostering biodiversity.

“The dominant theme here is understanding the role played by these alternative species that are in the landscape, but which go under-recognised and under-utilised. It’s about understanding how we should manage farms and orchards as ecosystems, and how we can protect those beneficial species.”

Quick facts

Envy™

1 The child of ‘Royal Gala’ and ‘Braeburn’

2 Combines the crisp, white, juicy flesh of ‘Braeburn’ and the sweet crispness of ‘Royal Gala’ but is sweeter than either of its parents

3 Born of natural plant breeding methods by scientists at Plant & Food Research

4 After being cut, the flesh of Envy™ apples stay white for longer than those of other apples (up to ten hours) because of the high vitamin C content

5 Grown in ten countries around the world – the UK, France, Spain, Italy, South Korea, the USA, New Zealand, Chile, Australia and South Africa

6 Always in season – available in the Southern Hemisphere from May to October and in the Northern Hemisphere from October to May

7 In 2018, 7% of New Zealand’s exported apples were Envy™

8 Contains vitamin C, fibre, B vitamins and minerals

9 The cultivar is called ‘Scilate’, marketed as Envy™ by T&G Global under its quality mark Enza.

Crowned favourite apple two years running

(2017 and 2018) US Apple Association Munch Madness Competition

In the USA, Envy™ was voted the ideal experience for taste, texture and appearance

(April 2019) Blind sensory test

GLOBAL FOOD LEADERS

An interview with Loren Zhao, Fruitday

Loren Zhao launched online fruit retailer Fruitday in 2009, banking on growth in demand for premium fruit from young Chinese consumers who were just starting to shop online.

Since its launch, Fruitday's digital offer of great fruit at sharp prices, delivered fast, has transformed the way millions of shoppers across China purchase and experience fresh produce from all over the world. Roger Bourne caught up with Loren at Hong Kong's Asia Fruit Logistica trade fair to learn whether Loren's own world of food is also changing.

You weren't in the produce industry before you started Fruitday. How has joining the industry changed your life?
I don't think that my life has changed a lot because of the fruit industry, but our lives have changed because of travel. I travel a lot for my work and my family have had opportunities to travel with me. We have had the opportunity to see and taste fruit in orchards – it has been great for my son, a kid growing up in the big city, to see how fruits are grown and where.

When you were a kid — what do you remember about buying fruit?
Wow that was 30–40 years ago! Back then it was quite hard to buy fruit, we didn't have much choice. Most fruit was sold from a fruit stand or even from a truck on the street. Choice was very limited, maybe just bananas and apples. There were no cherries, avocados, no really premium fruit.

When was the last time you purchased from a vendor like that?
We don't have those street vendors right now in China. So I'd be most likely to pop into a shop. Sometimes that's just to check out what the retail prices are doing, but also because, like most people, I am looking for convenience, somewhere close to buy.

Your son is nine years old. What does being a father tell you about what the next generation of consumers want in their fruit?
I think we'll always see tastes changing over time. Everyone says that avocado is great for kids, but when my son was three-four years old he didn't like it at all. He liked a limited range of things, maybe just apples or oranges.

He's older now and tries to eat new things. He likes avocado and of course cherries. His favourite fruit is durian, which is very popular with the younger generation. I think we need to think about how people change over time as they are exposed to new things – the more you are exposed to new foods, the more you grow to accept new flavours. It opens a new world – just like traveling overseas.

How has fruit consumption changed in China and what will be the new drivers for consumption?
I think in the past 20 years it's evolved fast, and even faster if you just look at the last ten years. When we started Fruitday ten years ago, premium fruit in the supermarket were very expensive. Today those premium fruit are much cheaper and it's easier for customers to try something new.

China is such a big country with so many people, so we can't say there are just one or two things that will influence growth in consumption, but there are trends. In the big cities, the young people care much more about nutrition. They want to eat healthily and live a modern lifestyle. They like the gym, they care about their body shape and health, so they want more fruit to help with those goals.

I also think the younger generation have grown up in better conditions than some of us older Chinese. They don't care as much about price; they're interested in the experience of the fruit.

Tier two and three cities have increasing incomes. Many people in the past could not consume premium fruit because they couldn't afford them, and maybe they were only available in the bigger, wealthier cities. But now the modern logistics and e-commerce and new-style retailers are bringing the fruit to them, they're trying them.

Are you adventurous when it comes to new food?
I always like to try new foods, especially when I am travelling. Many Chinese are the same. With social networks, when they do try new things they take a picture and share. And these days it's not just pictures but also small videos. So it's not just the taste, it's the ability food gives you to share which has become a big trend.

Do you post food pictures on social media?
No! I'm old school!

What was the last new food you tried? Is it something you'd try again?
I tried some very special squid in Spain, cooked in a new way. It's a nice idea to think I could cook it at home but I don't have the time to do it!

Do you prefer eating out or dining at home?
Eating out is often about saving time, but it's always special to eat at home – with family, kids and parents. It is part of our culture to eat together – although sometimes you just don't want to cook!

> "... it's not just the taste, it's the ability food gives you to share which has become a big trend."

Growing together

PHOTOGRAPHY **WARA BULLÔT**

Imagine the pride and economic resilience felt by a subsistence farmer who triples production or moves to higher value crops. Horticultural scientists have long contributed to international development, and now they work on projects alongside economists, project managers and commercialisation experts.

Here are two stories of how New Zealand science is helping families improve their livelihood in Southeast Asia.

CAMBODIA

Melon farmer Mai Puy is one of 3,400 farmers in North Cambodia helped by the New Zealand Aid Programme-funded CODES project. Run by non-profit iDE Global, the project has enabled him and 400 other farmers to shift to high value produce. Contracted by iDE, Plant & Food Research scientists have studied local conditions and trained iDE staff in new crop agronomy and pest and disease management.

Collaborative marketing and a new payments system have grown farmer confidence in their Melon Association. Thirty tonnes of the fruit are now sold each month to Phnom Penh supermarkets – a 300% increase since April 2018.

The project has helped many melon farmers increase their income to around US$10,000 per year. Other high value crops to which farmers are encouraged to switch include cherry tomatoes, chillies, cabbage, sweet peppers, broccoli and cauliflower.

Mai Puy: “In the past year I’ve learnt growing techniques and we now have better market access and higher prices. I love farming here. I’m my own boss. I get fresh air and my 3 hectare of land is close to water.”

Reunited: When Mai Puy's younger brothers found out he was farming melons, they gave up their migrant jobs in Thailand and returned home to help out. "They're now learning growing techniques and would like to have their own farms one day," he says.

"As I receive more income from melons," says Mai Puy, "I'll use the money to support my two-year-old daughter's schooling and expand production into chillies and eggplants. My goal is for my daughter to be educated and find work in the city."

VIET NAM

Income has tripled for Vietnamese dragon fruit farmers Mr & Mrs Vu since they adopted a new T-Bar production approach over the traditional “mop top” growing system.

Under the NZ Aid Programme-funded project, the Vu family run a 1.6 hectare model farm showcasing the new approach.

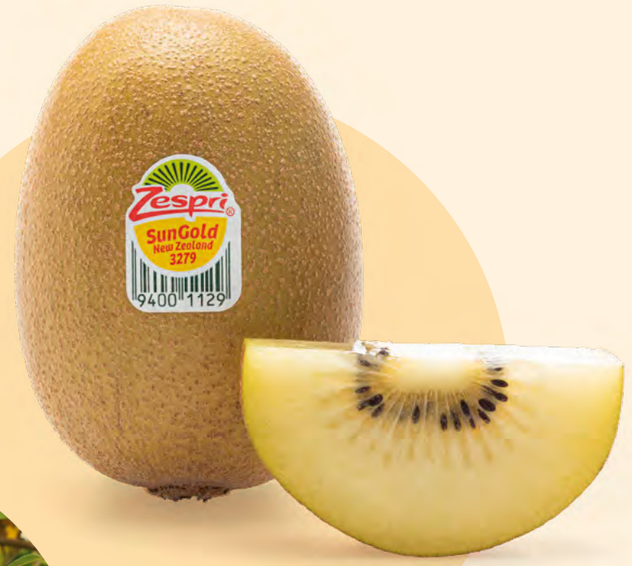
Vietnamese and Plant & Food Research scientists have discovered how to combat the major disease of dragon fruit, called canker, and dramatically improve sustainable growing and postharvest practices. A new cultivar breeding and commercialisation programme is expected to further boost the livelihoods of smallholder farmers and build a lucrative export industry for Viet Nam.

“It’s early days,” says Mrs Vu. “But the extra income so far has covered labour and other costs and we now are able to buy fertiliser. From now on more of the income will be available for our family.”

“Farmers come visit and want to copy us,” says Mr Vu. “The new system is very effective. Our fruit are bigger, use less fertiliser and we manage the farm between us. That’s more time to spend with our grandchildren.”

The jet-setting Kiwi

First planted in a breeding programme in 2002 and commercially released in 2010, Zespri® SunGold Kiwifruit is now enjoyed in almost 50 countries around the world. In 2018/19, more than 75 million trays were sold worldwide.



TE PUKE

The Te Puke Research Orchard of Plant & Food Research is the birthplace of 'Zesy002', the cultivar marketed as Zespri® SunGold Kiwifruit. It was adopted in 2012 as a replacement for Zespri® Gold Kiwifruit ('Hort16A') as a much-needed response to the outbreak of the devastating kiwifruit bacterial disease Psa (*Pseudomonas syringae* pv. *actinidiae*).

SINGAPORE

Zespri Singapore launched its first in-train campaign in 2019, which reached around 800,000 commuters over a five-week period. Besides promoting the nutritional goodness of Zespri® SunGold, it also gave commuters a chance to win discount vouchers via QR codes embedded in the advertisements inside train carriages.

CHINA

Zespri launched a number of campaigns in China in the 2014/15 season to build awareness as a trusted brand that delivers premium quality and taste. The Zespri Juicy Water Fight event in central Shanghai emphasised the attributes of fun, vitality and spontaneity. Footage of the event went viral online, drawing more than 25 million views across China.

JAPAN

In 2017, Zespri's Japan team held one of their biggest sampling roadshows at Maruetsu Lake-town, situated on a 1,000 square metre site within an eco-friendly shopping mall. More than 35,000 shoppers sampled Zespri Kiwifruit during the roadshow. The team hit a new sales record of 5.18 million JPY (70,000 NZD) after the event.

FRANCE

A special Zespri event hosted on the rooftop of Hotel Brach in France offered aqua boxing, bootcamp, yoga, and a cooking class to participants. Children also had fun attending a drawing course with designer Coucou Suzette.

Robots and super orchards

Robots picking fruit between rows of two-dimensional canopies might seem a bit futuristic but it's becoming part of the horticultural landscape in New Zealand.

New Zealand's pipfruit and kiwifruit crops are amongst the most productive globally; however, with a growing population, a sustainable future means being able to produce the same or more food on existing land.

Over the past five decades, the productivity of New Zealand's pipfruit has been achieved using only 55-60% of available light within existing tree arrangements and there have been few advances to planting systems aimed at increasing productivity beyond the current potential.

"According to research, finding a way to increase light utilisation had the potential to double the yield of some fruit crops without losing quality," says Dr Stuart Tustin, Plant & Food Research Principal Scientist, Fruit Crops Physiology.

The Future Orchard Planting Systems (FOPS) research programme – funded by the Ministry of Business, Innovation and Employment (MBIE) and New Zealand Apples & Pears Incorporated – was set up to develop novel orchard systems to raise productivity. To achieve this goal scientists designed ways to increase light interception by an additional 25% and enable more even light distribution, to ensure uniform fruit quality and ripening.

Drawing on their understanding of tree physiology and developmental biology, scientists at Plant & Food Research redesigned orchard systems into narrow, minimally branched, two-dimensional canopies that reduce shading.

"What we are attempting with the new design is to use light energy that is otherwise wasted, and to use the natural growth habit of trees to enhance production," says Tustin.

In the FOPS arrangement, trees are planted with rows only one and a half to two metres apart, compared with the traditional four-metre spacing. The scientists were also mindful that the new system should be simpler to operate, more efficient with labour, and no more costly for growers to maintain.

"Everything in FOPS is simpler and more accessible," says Tustin.

The FOPS blocks at Glenmore Orchard in Hawke's Bay are now in their third leaf. For owners, Glenn Riddell and wife Ingrid, it was the simplicity of the architecture that appealed most because it makes working on trees easier. The narrower rows are also conducive to the use of platforms, which Riddell says "takes a lot of the effort" out of picking. Increasing productivity was only third on their list of reasons to implement FOPS.

"Standardising the canopies makes it much faster to train people with thinning and pruning. Previously, it could take two to three seasons to properly train, but with FOPS it can be done in a day," Riddell says.

Gary Wellwood, Global Variety Development Manager, Apples, at T&G Global, says simpler canopies, unlike three-dimensional canopies, improve the outcome when using new digital technologies for counting and sizing.

"In three-dimensional orchards it's hard to count fruit, as the technology is trying to guess what can't be seen. But in two-dimensional canopies a large percentage of fruit can be seen, so it's just a simple image capture," Wellwood says.

Six years into trials, FOPS has demonstrated significant increases in apple production with higher yields than from conventional planting, while maintaining, or even improving, fruit quality. Light interception has increased to a maximum of 80%, which is over 20% more light interception than any other intensive apple orchard planting system in New Zealand, or internationally. In the Hawke's Bay trial, six-year-old trees have yielded around twice the average of mature conventional orchards and the trees still have two years to mature, making further increases likely.

In addition to its potential for boosting apple production in New Zealand, the FOPS apple plantings provide a model for other crops and are guiding new growing techniques for summerfruit and kiwifruit. Early trials with FOPS plantings of sweet cherry trees have more than doubled the yield potential of conventionally planted trees. MBIE and Prevar are also co-funding a FOPS project for the Piqa® brand fruit.

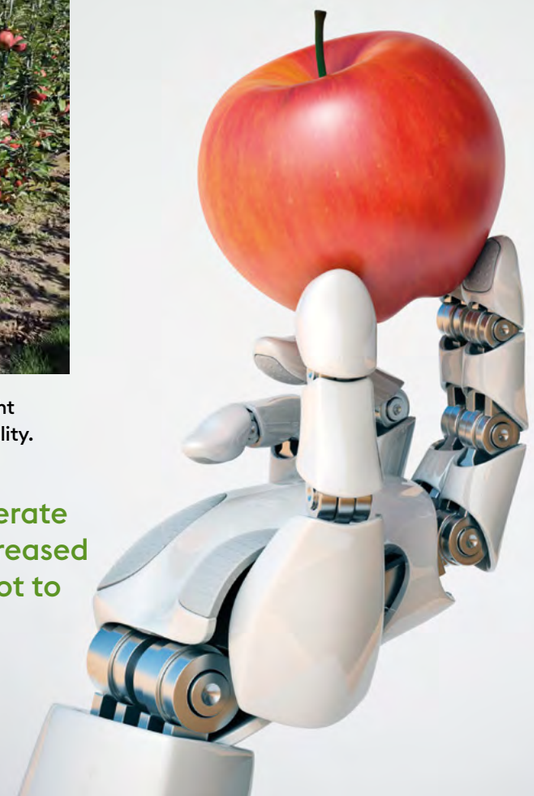
"In Plant & Food Research trials, FOPS has improved fruit quality, uniformity and is also likely to improve productivity of new fruit cultivars developed by Plant & Food Research, such as Piqa®Boo® pear," says researcher Dr Ben van Hooijdonk.

In many orchards, labour shortages are a recurring issue. FOPS, with its two-dimensional canopies, has the potential to enable semi-automated and robotic picking, helping to mitigate labour shortages and improve labour efficiency.

Demonstrating some of the benefits of a two-dimensional canopy system, in 2019 T&G Global achieved a world-first commercial robotic apple harvest using an "on the job" robot to harvest two-dimensional orchards in Hawke's Bay. The robot, designed by Abundant Robotics, is designed to protect both trees and fruit from damage and uses sensory computer vision to scan the trees for ripe apples.

Photo: T&G Global

Apples growing on a two dimensional canopy, increases light interception by more than 20% and improves yield and quality.



Orchards of the future will look and operate quite differently, paving the way to increased production and easier management, not to mention helpful robots.

Photo: Abundant Robotics

In 2019 T&G Global, using technology developed by Abundant Robotics, achieved the world's first commercial robotic apple harvest in Hawke's Bay.

FOPS, with its two-dimensional canopies, has the potential to enable semi-automated and robotic picking, helping to mitigate labour shortages and improve labour efficiency.

Perfect partners

Some food pairs have a special kind of chemistry — on their own the foods are great but together they are even better

Scientists are unsure why wine and cheese pair well, or why some cheeses better suit some wines. Combining astringent and fatty foods may make the mouth feel balanced. A recent study found cheeses influenced the dominant taste of wines in different ways.

WINE

Winemaking is at least 9000 years old and predates written history.

The top global wine producers are Italy, France, Spain and the USA.

The success of New Zealand's wine industry is attributable to our temperate maritime climate, the dedicated winemakers and the distinctive nature of the wine styles.

New Zealand's largest producing regions are Marlborough, Hawke's Bay and Central Otago.

New Zealand's biggest export markets are the USA, the UK and Australia.

One of the oldest food pairings in the world, combining two of the oldest fermented products.

CHEESE

Cheese-making pre-dates recorded history, beginning at least 7,200 years ago.

Cheese probably originated in Europe, Central Asia or the Middle East.

Cheese may have been created by transporting milk. Hard, salted cheese would have suited hot climates, while cooler climates would have produced other varieties.

Plant-based cheeses are becoming popular; however, cheese is harder to mimic than milk or meat because of the complex nature of production, shaped by fermentation, room temperature and ageing.

The world's most expensive cheese is Pule, made from Balkan donkey milk from Serbia and Montenegro.

TOAST

Wheat is part of the grass family and is one of the most important crops globally. The world's largest producer is China, followed by India, Russia and the USA.

Wholemeal wheat flour contains B vitamins, and minerals.

New Zealand wheat is mostly grown in the South Island, east of the Southern Alps.

New Zealand farmers harvest approximately 400,000 tonnes of wheat per year, used in the local food industry, for animal feed or exported.

In 1928 Frederick Rohwedder invented the first bread-slicing machine, giving rise to the phrase: "The best thing since sliced bread".

Smashed or sliced, avocado and toast feature on cafe menus worldwide.

AVOCADO

Avocados are a type of fruit – in fact, botanically, they are classed as a berry.

Avocados are thought to have originated from Mexico and Central America.

Containing B vitamins and vitamin E, avocados also contain dietary fibre and high concentrations of monounsaturated fatty acids.

The two top avocado-growing areas in New Zealand are the Bay of Plenty and Northland.

In 2018 New Zealand's avocado exports were valued at $104.7M.

'Hass' is the primary commercial cultivar.

To ripen avocados put them in a brown paper bag with an apple or banana and store unrefrigerated.

DID YOU KNOW? Scientists recently mapped the complete sequence of the wheat genome. Wheat has one of the most complex genomes – with five times more DNA than humans!

This pair is a menu favourite – first sold in English fish and chip shops in the 1860s, brought to Britain by Jewish immigrants from Eastern Europe.

DID YOU KNOW?
Potatoes are the first vegetable to be grown in space with technology designed to help feed astronauts on long voyages.

FISH

Fish is a high-protein, low-fat food, containing various vitamins and minerals, particularly iodine.

New Zealand favourites for fish and chips are snapper and blue cod, with snapper said to be New Zealand's most popular fish.

Finfish exports reached $954M in 2018, the biggest sellers being hoki, Pacific salmon, ling and snapper.

In relation to size of the land, New Zealand has one of the longest coastlines and largest marine areas in the world.

Precision Seafood Harvesting (PSH) is a world-leading technology that replaces traditional trawl nets and offers a more environmentally-sustainable way of fishing.

CHIPS

Potatoes originated in South America. The word potato comes from the Spanish word "patata".

Potatoes contain dietary fibre, B vitamins and potassium.

The origin of French Fries is disputed, with claims they originated in Belgium and not France.

Canterbury is the top potato-growing area in New Zealand, followed by Auckland and Waikato. French fries are mostly processed in Canterbury.

Kiwis love potatoes – they are one of New Zealand's largest crops with 171 growers nationwide and 527,190 tonnes grown in 2018.

INSIDE SLICE

At Plant & Food Research, we believe science can create a better future.

By finding smarter, greener options today, we're helping secure the world we want to live in tomorrow. With our partners, we use world-leading science to improve the way they grow, fish, harvest and share food.

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

Meet our people

We have 1000 people working across New Zealand at 14 sites. Here are some of their stories.

NELSON

The headquarters of seafood research at Plant & Food Research, the Nelson Research Centre contains two science groups – Marine Products and Seafood Production. It is housed in a purpose-built facility which includes a finfish research hatchery, pilot plant and a variety of labs. Nelson scientists conduct research in diverse areas, including digital fish phenotyping and breeding, to obtain the most value from our seafood products.

Dr Maren Wellenreuther — Science Group Leader, Seafood Production
Maren is an evolutionary geneticist who works on a number of projects, including breeding new species.

I love the diversity of science questions I face on a day-to-day basis and the huge opportunity seafood science brings to an island country like New Zealand. Breeding new species for aquaculture has massive potential to create an aquaculture sector that is resilient, can grow and make the best out of the available space that we have around the country."

PALMERSTON NORTH

Plant & Food Research Palmerston North has a diverse research portfolio including sustainable production systems, bioprotection technologies, food and nutrition, and the breeding of elite cultivars.

Dr Brent Clothier — Principal Scientist, Cropping Systems & Environment
Brent works on the sustainability of primary production systems. He uses science to ensure the sensible and sustainable use of New Zealand soils and waters, helping to produce food from plants profitably, with minimal environmental impact.

Our productive ecosystems are under a great deal of pressure, and climate change will make things even tougher. A challenge for me is to use what we know, and what we are finding out through our science, so that everyone — farmers, growers, and urban dwellers — all recognise the importance of sustaining our natural resources."

KERIKERI

Plant & Food Research Kerikeri houses a research orchard which grows a number of crops, primarily kiwifruit but also avocados, blueberries, raspberries, citrus, persimmons, hops and apples.

Daniel Black — Research Orchard Manager
As Orchard Manager for Plant & Food Research in Kerikeri, Daniel ensures orchard activities are completed at the right time to the best possible standard, and manages workloads between crops.

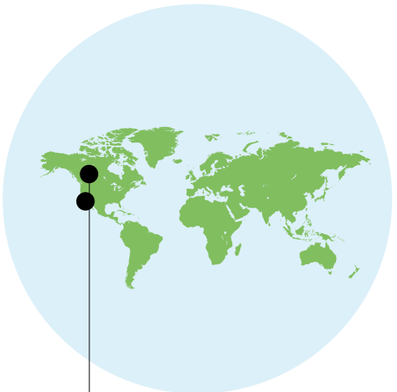
It's satisfying to support the horticultural industries with breeding programmes and growing new plant varieties."

AUSTRALIA

Plant & Food Research Australia works across a wide geographical range, and varied crops including almonds, melon and macadamia. With scientists in Adelaide, Melbourne, and Brisbane, the group has projects in plant breeding, tree physiology, pollination, and post-harvest technology. Australian scientists also work to strengthen links between Australian industries and collaborators and Plant & Food Research staff based in New Zealand.

Brian Cutting — Senior Research Associate, Productive Biodiversity and Pollination Science Group
Brian's research focuses on enhancing crop production by giving growers new tools for managing pollination by honey bees and other insects. His work focuses on pollinator diversity in tropical crops, and the team is currently researching ways to manage pollination in protected cropping environments.

A pollination deficiency can be invisible — you don't miss the fruit that never appear. If every grower spent about four hours a year doing simple assessments of pollination, we could dramatically increase farm production with very little cost."



USA

The US office of Plant & Food Research is located in Davis, California near University of California Davis. This office handles Plant & Food Research's business partnerships in North, Central, and South America.

Dr Lisa Jones — Scientist, Premium Crops & Technologies
Based in Washington, Lisa is a plant breeder and pathologist focusing on floricane fruiting red raspberries grown in the Pacific Northwest of the USA. Her work in breeding is closely integrated with the raspberry industry, requiring her to understand raspberries from breeding, growing, through to finished product.

I primarily focus on red raspberries for the frozen market but I do get to spend some time developing ornamental raspberries. I have several dwarf raspberry plants in the works, along with plants for edible landscaping and hanging baskets."

THE NUMBERS

14 sites across New Zealand as well as offices in Australia and the USA

1000 total staff

750 science staff

424 ha research farms

A smart green future

We believe our science can deliver a smart green future and make the world a better place. Smart, using innovation and technology to create an optimised food production system that offers high-tech jobs; green, protecting our environment with better use of our land, water and technology to produce healthy food; for a future that offers health, prosperity and opportunity for all.

Our strategy focuses on three elements:

INVEST

We are investing in world-class science to support our industries now and in the long-term, so that our science, scientists, customers and partners can excel on the global stage. We are investing our direct funding from the New Zealand Government's Strategic Science Investment Fund (SSIF) in areas of research that we believe will offer the best potential for growth of our sectors into the future, providing new opportunities and supporting them in maintaining their world-leading positions into the future. We call these our Growing Futures™ Directions (see page 9 for more details).

We also invest in science for Public Good where appropriate, for example, in biosecurity research that protects New Zealand's flora from pest and disease.

To deliver world-class science, we are investing in our people, our facilities and our information systems to ensure we have world-class scientists working in world-class facilities.

APPLY

Our science cannot change the world for the better or create value for our partners and customers until it is taken beyond the laboratory and applied in the real world. We work with private companies, levy-funded industry bodies, iwi organisations and Government departments to support the growth of our sectors through the application of science that addresses real needs and offers new opportunities.

Plant & Food Research has a strong reputation as a key R&D industry partner in New Zealand and overseas, and our ability to grow and deliver the best science is strongly linked to this reputation. Building strong relationships with our customers – both existing and new – and the end-users of our science ensures that we can continue to add value for our partners through our research.

Māori, as New Zealand's indigenous people, have a special relationship with the land and our success is intrinsically linked with the success of our Māori partners. The Māori principles of kaitiakitanga (guardianship of the land) and manaakitanga (care of the people) are well aligned with our research priorities. We are committed to supporting Māori organisations by working with them to combine Western science with mātauranga Māori to realise the potential of their land and sea resources.

SHARE

For our science to have maximum effect, it is important that rewards, and the risks, of development and application are fairly shared. We have two models that allow customers and partners to engage with us in the most appropriate way – Science Services, where customers contract our scientists to deliver research that addresses a specific need; and Technology Development, where research is undertaken under a partnership model, with both investment and reward fairly shared.

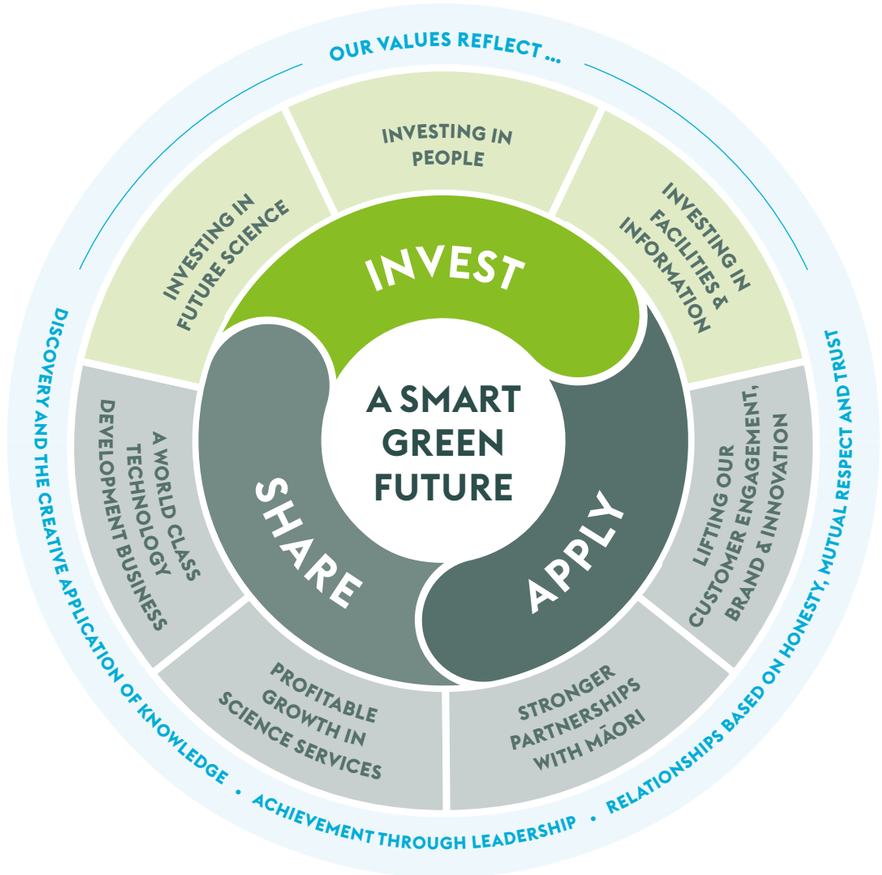
Our provision of R&D services, through our Science Services business, is a critical part of New Zealand's innovation ecosystem. Our Science Services extend across the value chain – protecting crops from pests and disease, increasing the sustainability of food production, and creating innovative food and ingredients for export. By working closely with customers to design and deliver bespoke R&D, we apply our experience and expertise to create value for our sectors.

Our Technology Development activity focuses on investing in a pipeline of products, from early stage ideas through to branded products, with commercial potential. We self-fund, partner and co-invest with other organisations as appropriate to develop these products through to commercialisation. Successful product development creates impact for our partners and delivers a share of the value, through royalties or other business models, back to Plant & Food Research to re-invest in our science.

AT THE HELM

Name: David Hughes
Position: Chief Executive Officer (appointed February 2018)
Education: BTech Manufacturing, GradDip Applied Statistics
Interesting fact: David has held positions in four countries – Bahrain, Japan, the USA and Australia
Favourite foods: Coffee and chocolate

Name: Professor Nicola Shadbolt ONZM
Position: Chair (appointed September 2019)
Education: BSc Agriculture; MSc Agriculture; PGDip Business Studies
Interesting fact: Professor of Farm and AgriBusiness Management at Massey University
Favourite Foods: Cheese and apple



FUNDING

Our activities are funded through direct commercial research for our customers, the reinvestment of royalties and the New Zealand Government's investment in science.

$43.1M
Strategic funding
Government investment allocated directly to each Crown Research Institute

$15.9M
Contestable
Government investment allocated through competitive bidding

$44.6M
Royalties
Commercial return from plant varieties and IP

$63M
Commercial
Direct investment by customers

$2.3M
Other
All other income sources

Plant-based proteins

Research by Plant & Food Research and the Ministry for Primary Industries has revealed a changing attitude to protein in key export markets, including the USA and China. Consumers are paying more attention to nutrition and health and are more aware of the social and environmental impact of their food purchases.

In light of New Zealand's experience as a key exporter of premium meat, dairy and fruit, and its reputation as a trusted food producer, changing consumer preferences could present an opportunity for the country to become an exporter of premium plant-based protein as well. This would support the diversification of our primary production as well as the nation's greenhouse gas emission priorities.

Plant & Food Research believes future consumers will adopt authentic forms of plant protein, rather than mock meat, presenting enormous potential for food scientists and manufacturers to develop plant-based foods that offer better taste, texture, sensory experience and nutrition.

Listen to Dr Jocelyn Eason discussing plant-based foods on the stretchy science series on Scigest: **BIT.LY/SCIGEST**

Breeding new cultivars for warming climates

Apples and pears that thrive in warming global climates will soon be available for fruit growers worldwide. The Hot Climate Programme, a ground-breaking global breeding project, is a collaboration between Plant & Food Research, the Institute of Agriculture and Food Research Technology (IRTA) and Fruit Futur in Spain. The programme, started in 2002, has produced climate-resilient apples and pears that have the sensory qualities desired by consumers.

In 2019 the programme welcomed T&G Global (formerly Turners & Growers) as a commercialisation partner who will use their global reach and expertise to ensure the new cultivars are made available for growers worldwide.

The programme was initiated in the face of challenges experienced by Spanish growers, particularly in the Catalan region; however, these challenges are likely to be faced by growers globally. With warming climates, many growers could experience issues with developing fruit and sunburn, as well as pests and diseases.

The 2019 Science New Zealand Awards

Plant & Food Research scientists received three awards at the 2019 Science New Zealand Awards.

The Precision Seafood Harvesting team (PSH) received a Team Award for creating and developing world-leading technology that is changing the way New Zealand fishes. The Modular Harvesting System (MHS) answers the need for a more environmentally sustainable way of fishing that maximises quality and limits the impact to non-target catch. The MHS was commercialised through a collaboration between Plant & Food Research and three seafood companies (Moana, Sanford and Sealord) and the Ministry for Primary industries.

Dr Brent Clothier was recognised with a Lifetime Achievement Award for a career spanning 44 years. Brent's research on water footprinting, soil science and climate change has prepared our primary production systems for tomorrow's challenges.

Dr Nick Albert received the Early Career Research Award for his plant genetic research which is helping to develop fruit cultivars with novel colours and enhanced health-promoting phytochemicals.

The 2019 Science New Zealand Award winners from left to right: Nick Albert, Benie Chambers (PSH Team), Brent Clothier, Minister of Research, Science and Innovation Megan Woods, Annalise Runarsson (PSH Team), Suzy Black (PSH Team), and Alistair Jerrett (PSH Team).

Māori horticulturalists to be recognised with new Ahuwhenua Trophy

Plant & Food Research has proudly joined Horticulture New Zealand and other sector groups as a sponsor of the first ever Ahuwhenua Trophy for Horticulture.

The Trophy recognises and celebrates the contribution of Māori in New Zealand horticulture. Māori have been exporting horticultural products for over two centuries and have shown innovation in developing businesses in this area, becoming major investors in the sector over the past decade.

The Ahuwhenua Trophy was set up by Sir Apirana Ngata and Lord Bledisloe in 1933, and re-launched in 2003, to highlight the importance of Māori agribusiness to the New Zealand economy.

Scigest – podcast-sized servings of digestible science

Want to find out more about how science is making a difference to our future? Scigest is a podcast channel hosted by scientists passionate about communicating science.

Get a taste of the latest scientific research in one of our podcast series including:

Stretchy science – covers everything from flexitarian diets to preparing for climate change

Innovations for better biosecurity – how is science innovating to protect our borders?

A science life for me – scientists share career stories

Science in the kitchen – what does science say about our food and the choices we make in the supermarket?

Thinking of drinking – the science behind some of your favourite beverages

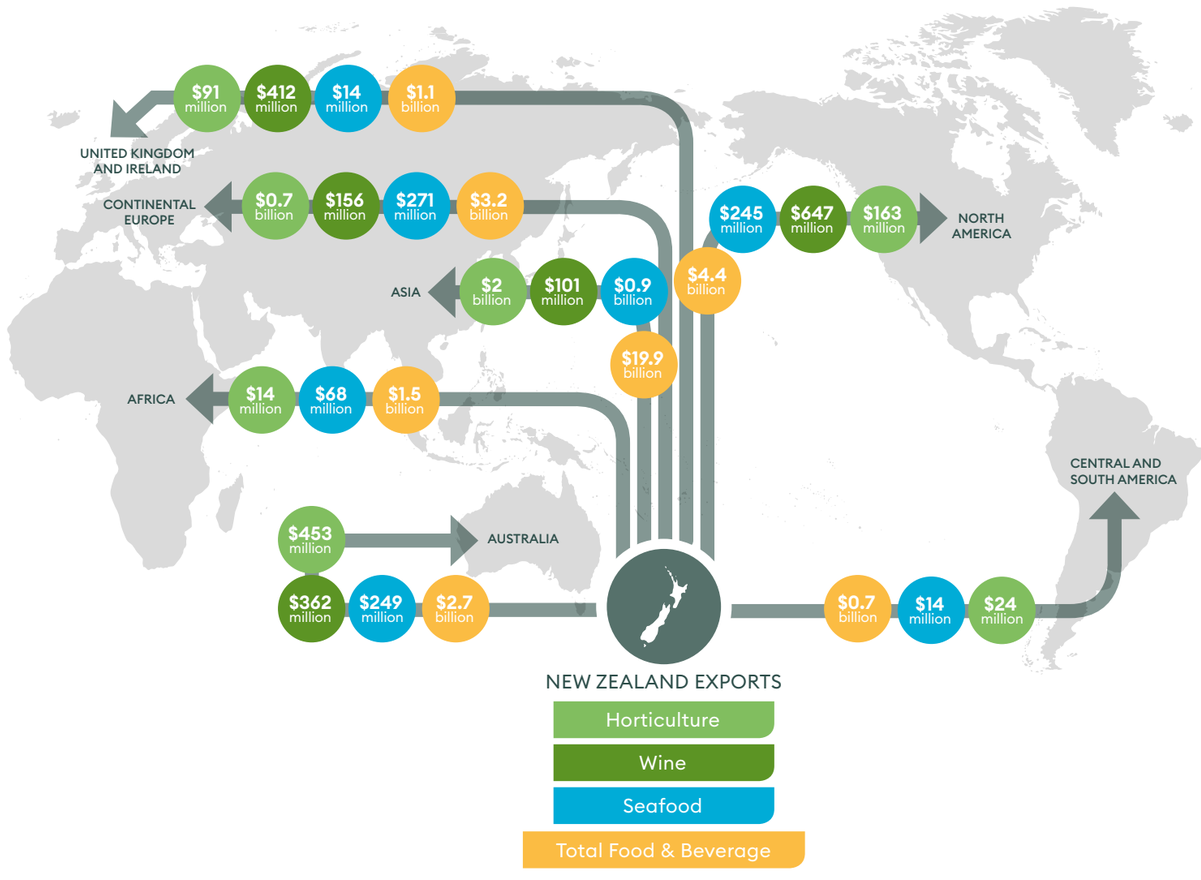
Science movers and shakers – hear from science leaders such as Professor Juliet Gerrard, the Prime Minister's Chief Science Advisor

Six-legged science – insects don't deserve the bad rap they often get, join the experts to find out why

BIT.LY/SCIGEST

Our sectors

In 2018, New Zealand exported close to $35 billion of food and beverage products, 66% of the country's total exports. Plant & Food Research works with partners across the food sector to create new knowledge and technologies. These support development of the most sustainable food production systems in the world, delivering products that meet the demands of the most discerning global consumers.



Horticulture and wine – year to 30 June 2018
Seafood – year to 31 December 2018

Unwanted!

Brown marmorated stink bug (alias BMSB)

ORIGIN: Asia, but has invaded other countries including the USA and Europe.
APPEARANCE: About the size of a $1 coin, shaped like a green vegetable bug with black and white markings.
IMPACTS: It could damage almost any New Zealand horticultural crop. In winter it will move into homes where it overwinters and is not easily treated with insecticides. It omits a nasty odour when squashed.

Queensland fruit fly (alias Qfly)

ORIGIN: Queensland, but has spread to other parts of Eastern Australia.
APPEARANCE: Approximately 6-8 mm long, reddish-brown with yellow markings.
IMPACTS: It will attack around 80% of New Zealand horticultural crops, laying its eggs inside fruit. It was eradicated from Auckland in 2015. MPI are undertaking a response in 2019 after separate male Qfly detections; no breeding population has been found.

Spotted wing drosophila (alias SWD)

ORIGIN: Southeast Asia, but now a major pest in the USA and Europe.
APPEARANCE: Resembles a vinegar fly – about 2-3.5 mm long with a yellow-brown body and red eyes. Males have a black spot near the tip of each wing.
IMPACTS: It lays its eggs in ripening fruit, posing a serious threat to summerfruit, particularly cherries.

Spotted lanternfly

ORIGIN: Asia, but has invaded the USA.
APPEARANCE: About 2.5 cm long, with greyish wings with black spots and a body that looks like it's glowing red.
IMPACTS: It feeds on woody and non-woody plants. It sucks sap, which leaks out and promotes mould growth. It can lay its eggs on smooth surfaces, like shipping containers, and covers its eggs in wax so they are hard to see.

CATCH IT SNAP IT REPORT IT **PEST HOTLINE 0800 80 99 66**

Ko Tātou This Is Us asks all New Zealanders to play a role in preventing pests and diseases from spreading. New Zealand has 4.7 million potential biosecurity champions who can help protect our economy, livelihoods and health from incoming pests and diseases. **ThisIsUs.nz**

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Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

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