Plant & Food RESEARCH

RANGAHAU AHUMĀRA KAI

DISCOVER. INNOVATE. GROW.

More than any other nation, New Zealand owes its health and wealth to the soil and to the sea. We have harnessed both through generations of hard work and clever thinking, and have shared our harvest with the world. The quality of our future relies on honouring that legacy and continuing to deliver our promise:

HEALTHY FOOD FROM A CLEAN ENVIRONMENT

"MA TE PATAI KA MOHIO,
MA TE MOHIO KA MATAU,
MA TE MATAU KA ORA."

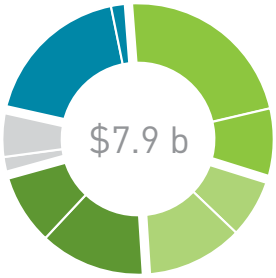
"THROUGH QUESTIONING WE DISCOVER,
THROUGH DISCOVERING WE LEARN,
THROUGH LEARNING WE SUCCEED."

PLANT & FOOD RESEARCH'S PURPOSE IS TO ENHANCE THE VALUE AND PRODUCTIVITY OF THE HORTICULTURAL, ARABLE, SEAFOOD AND FOOD AND BEVERAGE INDUSTRIES TO CONTRIBUTE TO ECONOMIC GROWTH AND THE ENVIRONMENTAL AND SOCIAL PROSPERITY OF NEW ZEALAND.

SEAFOOD
Exports $1.49bn
Domestic spend $0.16bn

OTHER HORTICULTURE
Exports $0.14bn
Domestic spend $0.48bn

WINE
Exports $1.04bn
Domestic spend $0.73bn



FRUITS
Exports $1.62bn
Domestic spend $0.74bn

VEGETABLES
Exports $0.57bn
Domestic spend $0.97bn

Earnings from New Zealand's horticulture and seafood industries exceed $7.9 billion.

Value from fresh ideas

Plant & Food Research has made a clear and public commitment to drive sustainable growth in New Zealand's plant and marine-based food industries. We stand alongside our industry partners as a trusted source of scientific discovery and innovation dedicated to delivering prosperity, health and sustainability from this nation's unique productive environments.

A very real sense of opportunity is emerging across New Zealand's horticulture, arable, seafood and processed food industries as global food and environmental imperatives shift into greater alignment with our established commitment to sustainably produced, high value premium products.

In turn, New Zealand has recognised that primary production remains at the heart of our economic wellbeing. It is our growers, farmers, fishermen and food producers who will generate much of our future wealth by sustainably producing and marketing fresh and processed foods based on flora and fauna unique to or owned by New Zealand.

Key groups within our plant and food production sectors have set their own ambitious goals for growth and have highlighted the need for knowledge, innovation and foresight to drive ongoing competitive advantage. Plant & Food Research exists to ensure the critical mass of research energy required to achieve those goals.

In meeting that core purpose, our Institute emphasises research that aligns with identified opportunities for growth, profitability and sustainability. We then work closely with industry to ensure research is transferred successfully as new industry practices and protocols, tools, technologies or products, so that opportunities can be swiftly pursued and captured.

To ensure consistency of impact across all key sectors, our research direction is driven by awareness of issues that relate to the broader food sector as a whole, including market access, product innovation, biosecurity and environmental impact.

In all cases we integrate science across production, manufacturing, distribution and marketing platforms, combining market insight with a deep and fundamental understanding of the biological potential of New Zealand's food resource base and the systems that ensure its value is realised.

Success in this ensures lower costs across the supply chain, greater efficiencies in resource allocation, innovation in food design and the ability to produce foods that grow New Zealand's share of existing markets while also successfully opening new opportunities in growth areas.

The knowledge we create allows industry to produce more and better food from less land, with reduced environmental impacts and fewer chemical, carbon and water inputs. This is complemented by innovation that supports the production, marketing and exporting of high value fresh and processed foods tailored to meet well-defined global food trends: health, sustainability, convenience, novelty and sensory appeal.

PETER LANDON-LANE
CHIEF EXECUTIVE OFFICER

MICHAEL AHIE
CHAIRMAN

RESEARCH THAT DELIVERS

→ Better cultivars faster™

→ Residue-free pest and disease control

→ More sustainable and profitable systems

→ Proprietary foods with price premiums

Science through the value chain

→ OUR TARGET IS TO PRODUCE NEW PLANT AND SEAFOOD-BASED FOODS, BEVERAGES AND INGREDIENTS FROM ENVIRONMENTALLY AND ECONOMICALLY SUSTAINABLE PRODUCTION SYSTEMS.

BETTER CULTIVARS FASTER™

Strategy

- New cultivars with identified consumer and producer traits
- Identified molecular mechanisms controlling key traits
- Breeding programmes using integrated genomics tools

Main research themes:

- Identifying molecular mechanisms controlling key traits
- Developing molecular markers for key traits
- Genotyping and phenotyping of germplasm collections
- Developing new technologies to support breeding programmes
- Breeding of new cultivars with defined commercial traits

RESIDUE-FREE PEST AND DISEASE CONTROL

Strategy

- New tools and systems for biologically based pest and disease control
- New disinfestation technologies
- Improved biosecurity risk assessment, detection and response
- New cultivars with intrinsic resistance to pests and disease

Main research themes:

- Understanding interactions of plants with pests and diseases
- Identifying genes conferring resistance to pests and diseases
- Developing novel methods for detection and monitoring of pests and diseases
- Developing decision support and risk assessment tools
- Developing novel biological control and disinfestation methods

SUSTAINABLE AND PROFITABLE PRODUCTION SYSTEMS

Strategy

- Whole systems modelling and prediction technologies
- Improved production, pre- and postharvest technologies
- New tools for ecoverification, footprinting and traceability
- New cultivars designed for future environmental conditions

Main research themes:

- Developing land, water and crop management decision support tools
- Developing alternative fish harvesting and storage systems
- Developing intelligent packaging for fresh produce
- Developing sensor technologies for field and postharvest assessment
- Developing methods to ensure crop pollination
- Using system modelling to define plant types for the future

PROPRIETARY, PREMIUM FOODS AND BEVERAGES

Strategy

- New cultivars with functional wellness benefits
- New ingredients from proprietary cultivars developed for specific wellness activity
- New food and beverage concepts based on proprietary cultivars

Main research themes:

- Understanding consumer purchase decisions
- Identifying and isolating compounds conferring health and wellness benefits
- Developing food and beverage concepts based on horticultural and seafood products
- Understanding consumer selection based on odour
- Developing postharvest protocols based on understanding of senescence
- Identifying alternative uses of horticultural and seafood by-products

GENOME SEQUENCING

The genome is the instruction manual of a living cell, with individual genes giving specific instructions on how an organism looks, develops and acts at any given time. The genomes of most organisms, including animals and plants, are made up of DNA, organised into chromosomes.

The study of DNA has boomed in the past 60 years. Although DNA was first isolated in 1869, the double helix structure was not identified until 1953. Since then, the science of studying DNA structure and the genes held within has undergone a massive transformation. New molecular biology and bioinformatics techniques are undergoing constant improvement, reducing the time and cost required to find answers.

The first whole genome sequences to be published were of small viruses in the 1970s. The genomes were mostly around 5kb (5000 DNA base pairs) in size and would have been a laborious undertaking. When the Human Genome Project began in 1990, it was estimated to take 15 years and cost around US$3 billion to sequence the 3 billion base pair genome. Now, a whole genome can be sequenced in just a few weeks for a few thousand dollars.

Plant & Food Research scientists have recently been involved in global collaborations to sequence five genomes of interest – three plant species and two fungi that cause disease in key crops.

Access to the whole genome sequences of plants allows our scientists to identify the genes in crop plants that control characteristics most desired by consumers – such as taste and colour – or producers – such as pest and disease resistance. Using this knowledge, our scientists develop molecular markers that can be used to screen both our breeding populations, to select the most suitable parents, and subsequent crosses, to identify those seedlings with the genetic profile most likely to confer commercial success for advancement into further trials.

In addition to this, the whole genome sequence of insect pests and plant diseases provides our scientists with opportunities to develop highly sensitive detection technologies and new methods of crop protection that target pest and disease at the molecular level.

Plant & Food Research scientists have recently been involved in global collaborations to sequence five genomes of interest – three plant species and two fungi that cause disease in key crops.

APPLE (*Malus* x *domestica*)

Genome size: 742 million base pairs
Number of chromosomes: 17
Estimated number of genes: 57,000
Published: Aug 2010, *Nature Genetics*
Institutions involved: 13 from 5 countries

STRAWBERRY (*Fragaria vesca*)

Genome size: 240 million base pairs
Number of chromosomes: 7
Estimated number of genes: 35,000
Published: Dec 2010, *Nature Genetics*
Institutions involved: 38 from 10 countries

POTATO (*Solanum tuberosum*)

Genome size: 844 million base pairs
Number of chromosomes: 12
Estimated number of genes: 39,000
Published: Jul 2011, *Nature*
Institutions involved: 29 from 14 countries

GREY MOULD (*Botrytis cinerea*)

Genome size: 38 million base pairs
Number of chromosomes: 16
Estimated number of genes: 16,500
Published: Aug 2011, *PLoS Genetics*
Institutions involved: 31 in 12 countries

WHITE MOULD (*Sclerotinia sclerotiorum*)

Genome size: 39 million base pairs
Number of chromosomes: 16
Estimated number of genes: 14,500
Published: Aug 2011, *PLoS Genetics*
Institutions involved: 31 in 12 countries

CONTROLLING NEW PEST AND DISEASE INCURSIONS

Incursions of new pests and diseases can cause major issues for the horticulture industry, reducing productivity and, potentially, creating barriers to export markets. Many countries, particularly in our key export markets of Europe, Australia and the USA, have strict requirements for produce entering the country, not only to ensure the absence of pests in produce but also that pests and diseases are managed in a manner that will leave no detectable chemical residues.

The development of control programmes that manage effectively a new pest or disease whilst minimising the use of chemicals is imperative for the horticultural industry. In some cases, it may be possible to adapt control methods used elsewhere to manage a new pest or disease incursion. However, in some cases significant research is required to understand thoroughly the biology of the new pest and to develop management programmes specifically tailored to the environment it has invaded.

Plant & Food Research works with the horticulture industry and government agencies to develop effective management programmes for new pest and disease incursions. These programmes may include assistance with short term containment, and, where possible, eradication of the pest or pathogen as well as long term management options for the industries affected. Plant & Food Research scientists are currently involved in major research programmes targeted at controlling three pathogenic incursions affecting the New Zealand horticultural industry –the tomato potato psyllid, the kiwifruit bacterium Psa and the varroa mite.

PSA

In November 2010, the bacterium *Pseudomonas syringae* pv. *actinidiae* (Psa) was discovered in New Zealand. Psa is a disease that affects kiwifruit, a $1 billion industry for New Zealand, and can result in the death of infected kiwifruit vines. Since the original diagnosis of Psa in New Zealand, Plant & Food Research scientists have worked with the kiwifruit industry in developing short term management programmes that reduce the spread of the disease. Alongside this, our scientists are developing diagnostic tools, crop monitoring systems, and pollen and budwood disinfestation methods as well as identifying chemical and alternative controls for managing the disease. Our breeders are also screening our germplasm collection for plants with intrinsic resistance or tolerance to the Psa bacterium with the longer term goal of breeding new Psa-resistant cultivars.

TOMATO POTATO PSYLLID

The tomato potato psyllid from North America is estimated to have cost the potato industry more than $120 million since it was first found in New Zealand in 2006. The tomato potato psyllid can transmit a bacterium, *Candidatus liberibacter solanacearum* (Liberibacter), that reduces the quality and yield of a number of crops, including potato, tomato, capsicum, eggplant and tamarillo. Plant & Food Research has been working with the horticulture industry since the first detection of the incursion, and has a comprehensive research programme underway. This research programme includes the development of an integrated pest management programme that incorporates diagnostic and monitoring tools, an understanding the biology of the insect and the pathogen, and investigating the effectiveness of chemical insecticides and natural predators. In addition, our potato breeding programme is evaluating cultivars for resistance to the psyllid or to Liberibacter.

VARROA MITE

Bees currently account for 80% of insect pollination activity and are vital for the horticultural industry. However the global decline of bee numbers has placed increased importance on research for their protection. The varroa mite, first discovered in New Zealand in 2000, is a small parasitic mite which infests honey bees and can transfer fatal viral pathogens. Plant & Food Research is investigating ways both to control the varroa mite in bee colonies and, long term, to breed bees resistant to varroa infection. The research programme is identifying chemical and alternative methods for controlling the mite, including natural predators and other biological controls, and developing best practice guidelines for maintaining the health of bee colonies. The breeding programme has identified bees with resistance to varroa infection with the goal of introducing these into the New Zealand bee population as a varroa management tool.

ENVIRONMENTAL FOOTPRINTING

Reducing the environmental impact of food products is becoming more important to consumers and distributors in the Western world. Supermarket chains in the USA, UK and Europe in particular, such as Walmart, Tesco and Marks & Spencer, now put strict requirements on their suppliers in demonstrating environmental sustainability in food production.

Quantitative measures of the sustainability of the product life cycle are becoming more popular, and the environmentally conscious consumer is beginning to demand these are available for all products, choosing their supermarkets on this basis. As a result, eco-footprints, which quantify the amount of water, carbon or other inputs, are now becoming more widely used.

Life Cycle Assessments analyse each step of a production process to calculate the total volume of a compound used in producing a specific measure of goods, for example, the total water required in the production of a kilo of apples. The Life Cycle Assessment analyses the growing of the product – including irrigation, fertiliser and pesticide applications – the processing of the product, and the shipping of the product. Ideally, it will also include analysis of the process required to develop products used throughout the Life Cycle, for example the manufacturing of packaging.

FOOTPRINTING NEW ZEALAND'S PRODUCTS

Plant & Food Research is working with industry to quantify the environmental footprints of New Zealand's key export products, calculating the water or carbon used in the production process from field to market. The footprints will not only provide quantitative measures for export markets, but also a means to reduce costs by identifying areas where efficiency measures can be applied. Plant & Food Research scientist Dr Brent Clothier is also on the national panel developing guidelines and International Standards for quantifying these footprints.

Published in the Journal of Cleaner Production, the water footprint of New Zealand hydropower was shown to be better than the global average. Hydropower accounts for more than 57% of New Zealand's electricity production, and therefore is a key contributor to the environmental footprint of the country's production systems.

The team have also calculated the water footprint of red meat (with AgResearch), the carbon footprint of three common pesticides, and the water footprint of New Zealand kiwifruit.

In addition to this, the Applied Entomology team is undertaking research on the impacts of New Zealand's production systems on the natural biodiversity. Research is being undertaken globally on how a biodiversity footprint could be applied to products, which would analyse the impact of agricultural land use on the diversity and abundance of living organisms, particularly insects and other invertebrates. This would provide another measure of sustainability for the discerning consumer.

Published in the Journal of Cleaner Production, the water footprint of New Zealand hydropower was shown to be better than the global average.

UNDERSTANDING FLAVOUR IN FOODS

Consumer purchase decisions are influenced by a number of factors, including cost and quality. However, whether a customer repurchases a food product is driven by personal enjoyment, and the taste and flavour of a product will have a large bearing on this decision.

Understanding flavour compounds in foods and ingredients, and how these are perceived by consumers, allows the food and beverage industry to develop new products with high consumer appeal. These products may be developed to appeal to a specific market or, long term, for consumers to personalise their purchase decisions based on their own preferences.

GENETIC FACTORS DETERMINING TASTE

The government-funded Gastronomics project is investigating the links between genetics, sensory perception of flavours and consumer preference. The research aims to identify the genetic variants controlling olfactory perception of flavour, by screening a panel of more than 100 people for their ability to detect and their degree of liking for key flavour compounds from foods and beverages. To date, the research has identified a cluster of around 25 olfactory receptor genes on chromosome 6 and has isolated the specific genotypes of one of these genes encoding ability to smell cis-3-hexen-1-ol, the smell of cut grass and a compound associated with flavours in cucumber, green kiwifruit, olive oil and some white wines. The research has also identified a region on chromosome 11 that encodes the ability to perceive β-ionone, a compound found in many fruits and vegetables, particularly tomatoes.

SAUVIGNON BLANC FLAVOUR COMPOUNDS

As part of the government and industry co-funded Sauvignon blanc programme, researchers at Plant & Food Research are identifying the compounds in New Zealand Sauvignon blanc that create its distinctive flavour and aroma. Using a trained sensory panel, scientists have developed the Wheel of Flavours, a tool that allows winemakers, researchers and tasters to use standardised terminology for describing wine flavour and aroma, and have also identified a number of flavour and aroma compounds specific to New Zealand Sauvignon blanc. This research will be used to determine how regional differences, vineyard management and winemaking practices influence the amounts of these specific flavours, allowing winemakers to direct the flavour composition of their wine from an early stage.

NEW FLAVOURED BEERS

Artisan beers are becoming increasingly popular with consumers. The novel flavour profiles found in these beers are produced by the addition of aroma hops during the brewing process, with different hop varieties producing different sensory characteristics. Plant & Food Research scientists have developed a sensory protocol to screen hop cones for intensity of the specific aromas found in hops, beginning with the citrus trait. The research will also look at how these aroma traits in the hops are translated to flavours in beer, allowing our breeders to identify hops in the breeding programme that confer the flavour profiles desired by consumers and the brewing industry in beer. Alongside this, our genomics teams are using the sensory data to identify the molecular markers associated with aroma in hops to assist in parent and seedling screening in the breeding programme.

THE SCIENCE OF PREMIUM

Our science combines market insight with a fundamental understanding of the biology of our food resources. We support our industry partners in meeting their targets by developing research programmes that address challenges, identify opportunities and support industry growth.

12 Kiwifruit
14 Pipfruit
16 Berryfruit
18 Summerfruit
20 Vegetables
22 Arable
24 Wine
26 Seafood
28 Food & beverages
30 Te Raranga Ahumara

Kiwifruit

INNOVATION IS THE KEY TO MEETING THE NEW ZEALAND KIWIFRUIT INDUSTRY'S AIM OF $3 BILLION IN ANNUAL EXPORT EARNINGS BY 2025.

The New Zealand kiwifruit industry is currently dominated by two cultivars - 'Hayward', which accounts for over 90% of kiwifruit produced globally and 'Hort16A', marketed as ZESPRI®GOLD Kiwifruit.

The industry has identified that extending New Zealand's kiwifruit product portfolio through the release of new cultivars, which demand a premium price via strong consumer appeal, is a key driver in meeting the industry's target of $3 billion of exports by 2025. These products must have excellent taste and flavour qualities, demonstrated health and nutrition benefits, novelty characteristics such as colour and convenience, and good storage potential. Improved productivity across the supply chain will also contribute through increased efficiency and improved product quality and yield. In 2010, the bacterial disease Psa was discovered in New Zealand, making strategies and tools for managing the disease key to the continued success of the industry.

Launched in 2000, ZESPRI®GOLD Kiwifruit now generates more than $610 million in annual global revenues.

Our kiwifruit research ensures the kiwifruit industry is sustainable long term through the development of new, novel cultivars, as well as tools and techniques that increase yield, optimise inputs and enhance market accessibility.

Building on the success of our 'Hort16A' cultivar, marketed as ZESPRI®GOLD Kiwifruit, we are developing new cultivars of superior quality that command a market premium, with a focus on taste, consumer health, novelty and convenience. Our sensory and consumer research identifies the qualities in kiwifruit that appeal most to consumers, such as taste, texture, flavour, convenience and appearance, to inform our breeding programme. Modern molecular biology techniques allow us to identify the plant genes responsible for these characteristics, as well as for traits desired by the producer, such as pest and disease resistance and flower sex, and to select those seedlings with the genetic profiles most likely to confer commercial success. Resistance to Psa is now a key additional target for the breeding programme long term.

We work with the industry to develop orchard management programmes that allow growers, both in New Zealand and overseas, to produce kiwifruit of maximum yield and quality while reducing inputs and cost. These integrated programmes address the control of pests and diseases using biological agents as well as vine and canopy management techniques. A large research programme is also in place looking for ways to manage Psa in the orchard environment and to prevent spread of the disease. We also develop protocols that optimise storage conditions and postharvest management to ensure fruit are delivered to the consumer in premium condition.

KEEPING THE KIWI FLYING

RESEARCH TARGETS

- → NEW CULTIVARS WITH TASTE, FLAVOUR, NOVELTY, HEALTH, YIELD AND CONVENIENCE CHARACTERISTICS
- → SUSTAINABLE PRODUCTION SYSTEMS THAT OPTIMISE INPUTS AND MAXIMISE YIELD, QUALITY AND MARKET ACCESS
- → IMMEDIATE AND LONG TERM SOLUTIONS FOR CONTROLLING PSA

TRIALLING NEW VARIETIES

In June 2010, ZESPRI® Group Limited announced the commercialisation of three new kiwifruit cultivars developed by Plant & Food Research: an early season yellow-flesh (Gold3), a long-storing yellow-flesh (Gold9) and a new sweet green-fleshed (Green14) kiwifruit.

Subsequently, 614 hectares of the three varieties were grafted by growers. In June 2011, an additional 200 hectares of each of Gold3 and Green14 were made available to growers.

Alongside this, Plant & Food Research is undertaking storage and consumer trials to develop postharvest protocols for the new varieties. These will ensure that when the industry reaches commercial volumes, systems are already in place to ensure the fruit reach consumers in premium condition.

On-orchard trials are now taking place for two new red and two gold cultivars to evaluate their commercial potential.

Pipfruit

CONTROLLING PESTS AND DISEASES AND REDUCING CHEMICAL RESIDUES KEEPS PREMIUM EXPORT MARKETS ACCESSIBLE.

Apples account for 22% of New Zealand's fresh fruit export income and 10% of total horticultural export revenue.

New Zealand has an excellent reputation as an apple exporter, based on both its production systems and the wide variety of products offered, including a history of innovative new cultivars such as 'Royal Gala', 'Braeburn', the Pacific™ series and the JAZZ™ and ENVY™ brands.

Meeting market access requirements is a key focus for the New Zealand pipfruit industry. Eliminating pests and diseases that can close export borders whilst reducing use of chemical control agents provides an additional challenge in exporting to premium markets, where fruit with reduced or zero chemical residues have increasing appeal for many consumers. Integrated production systems that control pests and diseases with minimised chemical usage provide an opportunity for New Zealand to differentiate itself from other producers and remain competitive in premium markets.

Plant & Food Research works with the pipfruit industry to develop production systems that minimise the use of traditional chemical sprays to control pests and diseases. Spraying is targeted, using computer modelling, at specific pest or disease threats at appropriate times of the growing season. We are also investigating the use of biological controls – such as natural enemies of insect pests, microbial control agents and natural compounds – to minimise use of chemical control agents. Our chemosensory research is identifying pest pheromones and developing synthetic semiochemicals for use in lures and traps and for mating disruption protocols.

We are also investigating alternative methods of postharvest disinfestation which leave no residues and may reduce agrichemical residues applied preharvest. These include physical treatments, such as temperature, controlled atmosphere and waterblasting, as well as chemical treatments.

Our pipfruit breeding programme is targeted at producing new apple and pear varieties with both characteristics of high consumer appeal – firmness, crispness, juiciness, good appearance and novel flesh and skin colours – and resistance to a range of pests and diseases, including scab, fireblight, powdery mildew, woolly apple aphid and leafroller. Our genomics research allows us to identify promising parents, and to screen subsequent offspring, based on the genetic profile most likely to confer these desired characteristics.

100% PURE APPLES FROM NEW ZEALAND

RESEARCH TARGETS

- → TARGETED CONTROL OF PESTS AND DISEASES USING BIOCONTROL AGENTS
- → PRODUCTION AND DISINFESTATION SYSTEMS WITH LOW CHEMICAL INPUTS
- → NEW CULTIVARS WITH BOTH SENSORY APPEAL AND INCREASED RESISTANCE TO PESTS AND DISEASES

TASTING THE GOODNESS IN NEW ZEALAND APPLES

Consumers demand products that look good and taste good. Ensuring that apples meet the requirements of the most discerning consumer involves not only the right cultivar, but also orchard management practices, harvesting techniques and postharvest protocols that retain the fruit's quality.

Dry matter is responsible for the taste and texture of apples, and can be altered by creating stress at key times in the growing season to drive carbohydrate development within the fruit rather than tree structure and growth. Plant & Food Research is working with the Heartland Group and AgFirst to develop protocols that optimise taste and texture in apples in response to consumer research that demonstrates purchase decisions are based on a preference for higher dry matter. These findings have been used to develop orchard management guidelines for growers based on cultivar type, soil type and rootstock, and will also be used to develop postharvest storage and logistics systems that deliver a consistent eating experience to customers.

heartland
NELSON NEW ZEALAND

Berryfruit

EXPLORING HEALTH PROPERTIES UNIQUE TO NEW ZEALAND CULTIVARS IS HELPING TO ADD VALUE TO A FAST GROWING SECTOR.

New Zealand blackcurrants, blueberries and Boysenberries have high concentrations of natural compounds known to be good for health.

The New Zealand blackcurrant sector aims to establish products from New Zealand as uniquely differentiated, and to encourage ingredients derived from its cultivars to be used in functional foods and beverages worldwide. The blackcurrant industry also seeks to improve production, yields and quality of blackcurrants through breeding of new and novel cultivars tailored to New Zealand conditions.

Identifying new health benefits from blueberries for marketing is the focus of New Zealand's blueberry industry as it builds sustainable growth from fresh and processed product.

Consistent supply of high quality product and development of new products that promote the unique flavour of New Zealand Boysenberries will allow the sector to increase grower returns through sustainable growth in export earnings. In addition, crop management programmes for high yields of healthy berries will improve production efficiency and reduce costs.

Plant & Food Research is assessing the natural phytochemical compounds from berries to identify those that deliver additional benefits for health beyond basic nutrition. We use cellular, chemical, receptor and organ-based bioassay screening to identify compounds that minimise muscle damage, modulate oxidative stress and inflammation, and have a beneficial effect on the immune system. We are also investigating the bioactivity of these compounds to optimise their delivery for increased efficacy. Using this knowledge, we develop ingredients and new product concepts that deliver optimal benefits from these compounds.

Our berry breeding programme is developing new cultivars with agronomic characteristics - such as pest and disease resistance, yield and chill requirements - and consumer characteristics – colour, acidity and size - as well as high concentrations of health compounds, including Vitamin C.

New Zealand's berry industry is worth over $100 million with returns from fresh, frozen, juice and processed markets.

BERRY BOOST FOR HEALTH

RESEARCH TARGETS

- → IDENTIFY COMPOUNDS PROVIDING HEALTH BENEFITS AND PROVE EFFICACY
- → FOOD INGREDIENTS AND PRODUCT CONCEPTS TO DELIVER OPTIMAL BENEFITS FROM HEALTH COMPOUNDS
- → NEW CULTIVARS WITH HEALTH COMPOUNDS

BERRY FRUIT FOR ENHANCED SPORTS PERFORMANCE

There is growing evidence dark-coloured berryfruit can provide additional health benefits beyond basic nutrition. Analysis of the composition of New Zealand berryfruits has shown a number of compounds that may play a role in their unique health offering.

Through work with the blackcurrant industry, Plant & Food Research scientists are investigating the properties of an extract of New Zealand blackcurrants that offers benefits for sports performance. Clinical studies suggest that taking the extract before exercise modulates muscle stress, damage and inflammation to aid muscle recovery. The extract also enhances the innate immune system, which would reduce the risk of infection. Ongoing research is revealing what compounds are responsible for the benefits and the mechanisms of action, and is also looking at how these may be used in other inflammatory responses, such as asthma.

Summerfruit

FILLING GAPS IN SUPPLY IS KEY TO THE GROWTH OF THE SUMMERFRUIT INDUSTRY.

New Zealand is uniquely placed in the world with a late Southern Hemisphere harvest season, particularly for apricots. This presents the New Zealand industry with a strong competitive position in providing Northern Hemisphere consumers with fresh fruit as supply from other producers begins to tail off.

The New Zealand summerfruit industry aims to fill this Northern Hemisphere supply window through the development of unique cultivars with excellent storage qualities and high consumer appeal. The industry also wants to develop new peach and nectarine cultivars with the super-sweet flavours that appeal to consumers in Asia, as well as new apricot, plum, peach and nectarine cultivars that appeal to the domestic market.

Improving crop management processes to produce good yields of cherries, apricots, peaches and nectarines at optimum quality with minimal chemical residues is another industry focus. Better crop management will provide long term sustainability for the industry by optimising inputs and efficiency while maintaining access to export markets.

Plant & Food Research is working with the New Zealand summerfruit industry to improve rootstock and tree management processes to optimise plant nutrition, enhance water use, optimise pollination, minimise pests and diseases and improve frost protection. This work focuses on efficient production of cherries, apricots, peaches and nectarines of the size, colour, texture and taste desired by consumers.

Our summerfruit breeding programme, supported by our consumer and sensory science research, is investigating the qualities in apricots and peaches that appeal most to consumers. We use modern molecular biology techniques to explore our extensive germplasm collections and identify plant genes responsible for desired qualities. Molecular markers are developed to speed up the breeding process by screening seedlings for key characteristics – such as taste, texture and storage potential. Our primary target is new, novel cultivars with high consumer appeal, particularly apricots to fill the spring market window in the Northern Hemisphere.

We also develop harvest and storage protocols that allow growers to pick their fruit at optimum times and store them appropriately, to ensure fruit delivered to the consumer is of the highest quality and taste.

New Zealand's summerfruit industry is worth over $70 million, with nearly half its revenue coming from niche export markets, primarily of cherries and apricots.

HELPING SUMMERFRUIT TASTE SUCCESS

RESEARCH TARGETS

- → NEW LATE-MATURING APRICOT CULTIVARS WITH DESIRED FLAVOUR AND TEXTURE FOR EXPORT
- → OPTIMISED ORCHARD MANAGEMENT PROCESSES
- → FRESHER FRUIT FOR LONGER

BREEDING NEW APRICOT CULTIVARS

In March and April each year, consumers in Europe and Australia find it hard to obtain fresh apricots. Existing cultivars mature early in the season and fruit do not store well for long, creating a gap in the market for high quality fruit.

Plant & Food Research is working with the summerfruit industry to take full advantage of New Zealand's relatively late harvest season compared with that of its competitors. Taking advantage of our extensive germplasm collection, in conjunction with Summerfruit New Zealand, we are breeding new apricot cultivars with unique taste characteristics that harvest late and store longer.

A new company, 'Apricot Co' is being established by Summerfruit New Zealand to commercialise new varieties developed in this breeding programme. The new company will oversee the release of new cultivars to growers and manage the related branding and marketing programmes overseas.

Vegetables

NEW CULTIVARS FOR FRESH CONSUMPTION WITH ADDED CONSUMER APPEAL ARE KEY TO DOUBLING VEGETABLE INDUSTRY PRODUCTION BY 2020.

New fresh vegetable varieties and products are recognised by New Zealand's vegetable industry as essential to future growth. To achieve their target of doubling production over the next decade, the industry is investing in the development of new cultivars and products with the qualities desired by consumers - taste, freshness, nutrition and convenience.

The long term sustainability of the industry is also a major focus. The industry is developing new systems that best use available resources and ensure the environment is protected for the future. New technologies that retain quality during transport of vegetables to offshore markets will also allow the industry to increase value through exports.

Specific sectors of the industry have additional defined needs. The potato sector, currently dominated by the domestic market, is focused on developing high value products for export. In addition, new technologies that protect crops from pests and diseases are highly sought.

The value of processed vegetable exports is expected to more than double by 2020. To meet this target, the sector is looking to extend its product offering to meet increasing demand from offshore markets, particularly in Asia.

Plant & Food Research works with the vegetable industry to develop fresh vegetables, both familiar and novel forms, containing natural compounds known to provide good nutrition. Our genomics research allows us to identify parents for the breeding programme quickly and to screen subsequent offspring based on the genetic profile linked to the desired characteristics – such as taste, colour and high amounts of nutritional compounds. We explore the bioavailability of target compounds to ensure they are delivered to consumers in a beneficial form.

We use our understanding of plant firmness, crispness, colour and appearance to develop systems and technologies that retain vegetable quality and texture after harvest and during transportation. This ensures consumers are delivered products with high appeal, freshness and quality.

Our production research identifies the water and fertilisers needed for optimum growth and to protect the soils for future production. Using this information, we develop decision support tools to help growers with crop management decisions that improve efficiency and environmental sustainability. We also work with the vegetable industry to develop integrated pest and disease management systems that minimise the use of chemical control agents.

New Zealand produces over 1.2 million tonnes of vegetables each year worth $1.5 billion in export and domestic trade.

MAKING THE MOST OF FIVE A DAY

RESEARCH TARGETS

- → NEW CULTIVARS WITH IMPROVED NUTRITION, TASTE, NOVELTY AND PROCESSING TRAITS
- → FRESH VEGETABLES FOR LONGER
- → PRODUCTION SYSTEMS THAT OPTIMISE INPUTS AND MAXIMISE QUALITY AND YIELD
- → EFFECTIVE PEST AND DISEASE MANAGEMENT SYSTEMS WITH REDUCED CHEMICAL INPUTS

HEALTHY SOILS FOR YIELD AND QUALITY

Having healthy soil is vital in maximising quality and yield in vegetable production. The soil provides vital nutrients for plants, stores and supplies water, allows gas exchange and stabilises crops during development.

Growers recognise that soil health can be affected by the practices they use and are aware of the need for new tools that increase the sustainability of vegetable production and minimise environmental impacts. The MAF Sustainable Farming Fund project 'Holding it together' has helped growers test new practices to increase soil health and productivity. These have included initiatives to make the most profitable and effective use of cover crops, reduce the negative effects of water movement across soil surfaces and implement technologies that avoid unnecessary compaction of the soil.

Over the three years of 'Holding it together', Plant & Food Research scientists have worked with growers, industry leaders and land management officers to ensure these approaches are practical for use in the field. In addition, a Good Agricultural Practice template has been developed that allows growers to demonstrate compliance with appropriate regulatory requirements.

Arable

THE SUSTAINABILITY AND GROWTH OF NEW ZEALAND'S ARABLE FOOD INDUSTRY IS UNDERPINNED BY R&D OF NEW PRODUCTS AND TECHNOLOGIES.

The New Zealand arable industry is predominantly a domestic market, producing cereal grains for use by the food industry and as feed for livestock. The industry has two key targets for the future – adding value through new products targeted for specific uses, and innovative farming practices that improve environmental and economic sustainability.

There is increasing demand from premium consumers for foods tailored to their lifestyle and personal preferences. Cereal grains with novel characteristics – such as low gluten or high protein – allow the New Zealand food industry to develop new, innovative products with increased consumer appeal for export markets.

The industry also recognises a requirement for efficient production systems that optimise the use of chemical inputs – including carbon, water, nitrogen and pesticides – and maximise soil health. New cultivars with increased agronomic performance, resulting in higher yields and reduced input requirements, also contribute to the long term sustainability of the arable industry.

Plant & Food Research is working with the arable industry to ensure sustainability through the development of new cultivars with increased agronomic performance and production systems that optimise inputs. Our breeding programme develops new wheat, barley, triticale and oat cultivars with increased resistance to pests and diseases and higher yields, as well as root systems that maximise water and nutrient input efficiencies. We also develop feed and forage cultivars with increased nutritional value for livestock. Our integrated production systems allow growers to monitor soil concentrations and schedule nitrogen and water applications to optimise benefits and minimise environmental footprints.

Our research into gut health and satiety allows us to develop new concepts for foods with added value for both consumers and the industry. Using our knowledge of food digestion, we identify specific characteristics of the grain that result in increased nutrition in processed foods. Combining this with our knowledge of grain processing and food concept development, our breeders develop new, novel cultivars for use in foods with added convenience for consumers.

The wider New Zealand arable foods industry generates $5 billion pa of revenue.

HIGH PERFORMANCE ARABLE FOODS & FEEDS

RESEARCH TARGETS

- → NEW CULTIVARS WITH NOVEL AGRONOMIC, CONVENIENCE AND NUTRITIONAL CHARACTERISTICS
- → INTEGRATED PRODUCTION SYSTEMS THAT OPTIMISE INPUTS, CONTROL PESTS AND DISEASES AND MANAGE SOIL HEALTH
- → NEW LIFESTYLE FOOD AND INGREDIENT CONCEPTS BASED ON CEREAL GRAINS

USING BENEFICIAL INSECTS TO CONTROL PESTS

Pest and disease can significantly affect the yield and quality of a crop. Traditionally, chemical controls have been used but there is an increasing desire from farmers for alternative methods of control that minimise use of broad spectrum chemicals and reduce environmental impacts.

Integrated Pest Management (IPM) is an approach to pest control that maximises the use of biological controls, such as beneficial insects, whilst minimising pesticide use. In a recent MAF Sustainable Farming Fund project, Plant & Food Research has developed IPM strategies for arable crops and worked with growers to increase confidence in and understanding of using these strategies. Use of the IPM system was shown to reduce pesticide use by 50%, whilst retaining yield.

Following the success of the IPM project, a new three-year programme to support the adoption of IPM in the arable sector through training and support has been developed.

The Sustainable IPM Systems in Arable Crops project was supported by the Foundation for Arable Research, PGG Wrightson, Etec, Syngenta and Bayer.

Wine

DISTINCTIVE FLAVOURS AND SUSTAINABLE PRACTICES WILL RETAIN NEW ZEALAND'S PREMIUM WINE REPUTATION.

Wine is New Zealand's largest horticultural export, with more than $1 billion in export earnings annually. The growth potential of the wine industry depends on its ability to establish and capitalise on its reputation as a leading producer and marketer of highly distinctive, premium quality wines. In order to achieve strong value growth and create a platform for the industry's vision of $2 billion exports by 2019, New Zealand Winegrowers (NZW) has identified three major science areas on which to focus – wine quality, sustainability and the appropriate management of supply and demand – to inform their global marketing strategy.

Understanding consumer preferences, as well as how vineyard and winemaking activities influence taste profiles of grapes and wine, will allow the industry to develop wine flavours targeted to premium consumers in both existing and new markets. Tools that assist growers in vineyard decision making – including yield and canopy management, water and energy optimisation, and pest and disease management with nil residues – will maximise grape quality and ensure the industry is economically and environmentally sustainable. In addition, control measures designed to monitor and control grape yields can reduce the potential for oversupply that may affect the reputation of the industry and its premium position in world markets.

Our wine research spans the full spectrum of the industry, supporting industry goals by addressing key issues and delivering applied science and innovation to support its growth.

Our research, as part of the New Zealand Winegrowers Sustainable Winegrowing programme, improves the sustainability of vineyards through the development of tools that optimise nutrient, irrigation and agrichemical use. We also address pest and disease issues – such as mealybugs and botrytis – through the development of decision support models, risk management tools, and cultural and biological controls.

We are the lead partner of the Sauvignon blanc programme – the world's most comprehensive research programme for this variety. Through this programme, we have developed key tools, such as the Grape Yield Model, to assist growers in their vineyard management decisions. We are also investigating the influence of vineyard practices on wine quality and classifying the key aroma compounds that produce the distinct New Zealand Sauvignon blanc style.

We undertake sensory and consumer research to better understand flavour and aroma perception as well as consumer purchase behaviour. This research supports the New Zealand wine industry in understanding consumer decisions and in developing wine styles best suited to both existing and emerging markets such as China.

New Zealand produces less than 1% of the world's wine, but is recognised as the premier producer of Sauvignon blanc.

SUSTAINING SUCCESS FROM BERRY TO BOTTLE

RESEARCH TARGETS

- → TOOLS AND PROTOCOLS TO DIRECT WINE FLAVOUR
- → LOW IMPACT CONTROLS FOR VITICULTURAL PESTS AND DISEASES
- → DECISION SUPPORT TOOLS FOR SUSTAINABLE VINE AND VINEYARD MANAGEMENT

THE GRAPE YIELD MODEL

Managing grape yield and crop load is vital to delivering high quality grapes at harvest. Excess crop load risks both under-ripe berries and a dilution of the components necessary to produce high quality wine. Late season thinning is an expensive, labour-intensive and time-consuming practice. Early prediction of grape yields to guide vine management decisions is therefore far better for growers.

Plant & Food Research scientists in conjunction with New Zealand Winegrowers have developed a temperature-based yield prediction model to forecast Sauvignon blanc fruit supply for the next season. By measuring the average temperature at bunch initiation, approximately 15 months before harvest, growers can estimate the wine grape yield at harvest and manage their vineyard and postharvest logistics appropriately. Through the use of this model, growers can identify years of low yield and plan accordingly, or manage vines to optimise resources where high yields are predicted. The model is now being successfully utilised by vineyards in Hawke's Bay and Marlborough for long term planning.

Seafood

INNOVATION WILL ENABLE EXPORT GROWTH IN THE SEAFOOD INDUSTRY.

New Zealand controls the world's fourth largest Exclusive Economic Zone (EEZ), more than 15 times the size of the country's land mass, and produces about one percent of the world's 67 million tonne fish catch.

Hoki, squid, Greenshell™ mussels, rock lobster, orange roughy and paua currently account for the majority of New Zealand's seafood exports. New Zealand's strong international reputation for high quality seafood products, reliable food safety and, of growing importance with consumers, sustainable management of fisheries resources will support the economic sustainability of the seafood industry. Enhancing the industry's reputation for consistent high quality and supply, continued investment in new technologies, and capitalising on niche marketing opportunities are also expected to enable growth in the world's high value, premium markets.

In order to grow export value, the industry is also investigating the potential for value-added products that utilise seafood components for food, health and industrial applications. The aim is to develop new ingredients for functional foods, nutraceuticals and pre-prepared meal offerings that demand a premium price in export markets.

Plant & Food Research undertakes research to benefit the New Zealand seafood industry by increasing returns from the current seafood harvest through the development and commercialisation of innovative, value-added seafood and marine products.

We undertake live capture, harvesting and postharvest research to ensure seafood products retain quality from capture to consumer and deliver premium returns in global markets. We also develop new, novel capture methods that have improved species selectivity, further enhancing New Zealand's reputation as a sustainable producer of first-class seafood products.

For the aquaculture industry, we are developing new packaging technologies for shellfish products, such as Greenshell™ Mussels, reducing shell damage during transportation and optimising the quality of meat.

Plant & Food Research is also investigating new technologies to deliver high-value ingredients from fish by-products. We develop extraction and modification technologies for high value molecules found in fish, such as functional proteins and nutritionally important lipids. We work with industry partners to scale up these technologies and support manufacturers looking to commercialise new export products based on these molecules.

New Zealand marine fisheries waters (Exclusive Economic Zone & territorial sea) are 430 million ha, 15 times the area of its landmass.

ADDED VALUE SEAFOOD PRODUCTS

RESEARCH TARGETS

- → LOW IMPACT HARVESTING SYSTEMS FOR SUSTAINABLE WILD FISHERIES
- → POSTHARVEST STORAGE AND PRESERVATION SYSTEMS FOR OPTIMISED QUALITY AND SAFETY
- → HIGH VALUE INGREDIENTS FROM SEAFOOD BY-PRODUCTS

ADDED VALUE PRODUCTS FROM HOKI

Fish by-products contain compounds that can be developed for high-value industrial applications, providing an additional value stream for the New Zealand seafood industry.

Hoki is New Zealand's most important commercial fish species, with around 110,000 tonnes taken each year under the Quota Management System. The majority of hoki is processed for sale as fillets or minced meat. Plant & Food Research scientists have developed a new method for extracting and formulating collagen from hoki skins, a by-product of the seafood industry, for use as an industrial biomaterial.

Through a government-funded Technology for Business Growth (TBG) grant, a novel formulation containing natural antimicrobial agents was developed for processing by electrospinning into nanofibres. These collagen nanofibres are now being used by Revolution Fibres Limited in the manufacture of air filters for home ventilation systems.

RevolutionFibres

Food & beverages

NEW PRODUCTS AND IMPROVED PRODUCTIVITY ARE VITAL IN GROWING NEW ZEALAND'S FOOD AND BEVERAGE INDUSTRY.

The food and beverage industry is critical to New Zealand's economic wellbeing. Securing sustainable future growth in this sector requires productivity improvements and innovation. The major sub-sectors of the industry cover a range from commodity to premium markets and encompass a large number of industry organisations and companies. As a whole, the New Zealand food and beverage industry recognises improved productivity, new products and new markets are essential to growth.

Primary production sectors – such as agriculture, horticulture, aquaculture and viticulture – are focused on the development of new technologies that ensure environmental and economic sustainability in the production of raw materials. These raw materials must have qualities desired by processors, retailers and consumers.

In both the fresh and the processed food and beverage sectors the demand is strong for products in the nutrition and health areas. Foods offering health and lifestyle benefits are a rapidly growing segment of the global market and the efficacy of these products require scientific proof for maximum consumer appeal.

An understanding of country-specific differences and what appeals to 'local' consumers will provide the industry with a unique opportunity in new and existing export markets. Increasing the knowledge of New Zealand's food industry of consumer preferences and behaviour will allow the industry to better deliver the foods and beverages desired by discerning consumers.

Plant & Food Research works with the horticulture, viticulture and seafood industries to develop technologies and products across the food value chain, from grower to supermarket.

Our consumer and sensory science identifies consumer preferences in different market segments to inform our breeding and food innovation programmes. We breed new and novel cultivars with the qualities desired by the consumer – such as taste, texture, convenience and nutrition - for the fresh and process markets.

Our integrated production systems allow growers to deliver produce that is environmentally and economically sustainable. This is combined with an understanding of pests and diseases, allowing us to protect our borders and ensure access to our offshore markets.

Our food innovation research identifies food components, their structure and how they interact in our diet. We also create delivery systems for valued components, develop new ingredients and concept products and provide the scientific validation that assures foods and drinks are beneficial for our health and wellness.

In the specialty food and beverage sector there are 2000 manufacturers in New Zealand, earning over $8 billion from major export markets.

FRESH THINKING IN FOOD

RESEARCH TARGETS

- → NEW PLANT AND SEAFOOD-BASED PRODUCTS WITH SUBSTANTIATED HEALTH AND LIFESTYLE CLAIMS BASED ON PROPRIETARY INTELLECTUAL PROPERTY
- → NEW GENERATION OF FUNCTIONAL FOODS BASED ON HOLISTIC HUMAN PHYSIOLOGY MODELS
- → UNDERSTANDING CONSUMER PURCHASE DECISIONS AND THEIR APPLICATION IN PREMIUM PRODUCT DEVELOPMENT

FOODS FOR MANAGING STRESS

Stress is a major issue in the modern world and products that reduce anxiety are of key interest to many consumers. At the same time, these consumers are demanding more food and beverages sourced from natural produce.

The flowers of the hop plant have long been used in traditional medicines to alleviate symptoms of stress. Plant & Food Research is investigating extracts from commercial and proprietary hops cultivars for their effectiveness in reducing stress in humans. *In vitro* screening has identified two hops extracts with potential in this area when compared with a number of other varieties, and these are now being tested in a clinical trial.

In anticipation of successful trial results, the hops extract is also being developed as an ingredient for a new concept beverage with potential functionality in reducing stress and anxiety.

Te Raranga Ahumara

SUSTAINABLE MANAGEMENT OF MAORI-OWNED RESOURCES WILL SIGNIFICANTLY AFFECT NEW ZEALAND'S ECONOMIC GROWTH.

Primary industries in New Zealand, key to the country's economic growth, have a strong Maori presence. Research and innovation have the potential to add value to existing Maori assets, particularly in agriculture, horticulture, forestry and aquaculture, growing not only the contribution of Maori activities to the New Zealand economy but also the national economy overall.

Maori enterprises are investing in scientific research and development to promote innovation and success. One key element for ensuring economic growth is the sustainable use of resources owned by Maori, Iwi or Maori organisations, including research that allows better management of these resources, such as sustainable land use practices or products based on indigenous flora and fauna. New technologies and products that extend participation in and value of Maori activities are expected to contribute greatly to New Zealand's success and growth.

Plant & Food Research works with Maori organisations to develop new products and technologies in the fields of horticulture, aquaculture, food and flavours and sustainable land use. We work with Maori organisations to identify opportunities for research and innovation that combine indigenous knowledge and modern techniques to support the economic aspirations of Iwi and Maori business of New Zealand.

Our Maori Business Unit, Te Raranga Ahumara, was established in 2009 to ensure research is undertaken with an understanding of the social, environmental, economic and cultural aspirations of our Maori partners.

We are working with Maori partners to develop new foods and ingredients based on indigenous flora and fauna, particularly traditional food plants and seafood, as well as new technologies and techniques to manage the production of native plants. We are also developing new tools for the control of pests and diseases and techniques for sustainable production of conventional crops, such as wine grapes, pipfruit, vegetables and arable crops, that recognise Maori tradition and culture.

Maori land development activities account for 7.4% of New Zealand's total agricultural output.

ADDING VALUE TO MAORI ASSETS

RESEARCH TARGETS

- → FOODS AND INGREDIENTS BASED ON INDIGENOUS FLORA AND FAUNA
- → SUSTAINABLE CROP AND SEAFOOD PRODUCTION SYSTEMS
- → NATIVE PLANTS FOR HORTICULTURE

FINDING THE FLAVOUR OF NEW ZEALAND

Indigenous New Zealand flora produce unique flavours that can be used in the development of novel ingredients for foods and beverages with significant export potential.

The government-funded Flavours of New Zealand project is supported by the Federation of Maori Authorites (FoMA), and aims to use Maori knowledge of indigenous plants to identify and extract flavours that can be incorporated into new ingredients and food concepts for export with a distinctive New Zealand taste.

The research screens native plants for unique flavours, as well as variations caused by geographical source and growing conditions; uses chemistry techniques to identify the aroma and flavour compounds present; uses sensory evaluation to determine the key combinations of compounds that provide the best flavour; and develops extraction methods that can be scaled up for industrial use. The research will also establish optimal cropping conditions for the plants and inform breeding programmes focused on producing cultivars with high concentrations of the desired compounds.

The programme has so far screened twenty potential plants and five of these – manuka, kawakawa, nau, horopito and taramea – are now being investigated further. Flavoured product concepts such as sausages, beverages and dairy products are being presented to potential industry development partners. The aim is to provide economic benefits to Maori business along the value chain – from land owners with native forests who can supply raw materials to food and beverage processors and exporters.

NEW ZEALAND

AUCKLAND
120 Mt Albert Road
Sandringham
Auckland 1025
Private Bag 92169
Auckland 1142
Tel 09 925 7000
Fax 09 925 7001

CLYDE
990 Earnscleugh Road
RD 1, Alexandra 9391
Tel 03 904 7300
Fax 03 904 7301

DUNEDIN
Dept of Chemistry
University of Otago
Box 56
Dunedin 9054
Tel 03 479 8354
Fax 03 479 7906

HAWKE'S BAY
Cnr Crosses and
St George's Roads
Havelock North 4130
Private Bag 1401
Havelock North 4157
Tel 06 975 8880
Fax 06 975 8881

KERIKERI
Keri Downs Road
RD1, Kerikeri 0294
PO Box 23
Kerikeri 0245
Tel 09 901 7360
Fax 09 901 7361

LINCOLN
Gerald St
Lincoln 7608
Private Bag 4704
Christchurch 8140
Tel 03 977 7340
Fax 03 325 2074

MARLBOROUGH
85 Budge Street
Blenheim 7201
PO Box 845
Blenheim 7240
Tel 03 984 4310
Fax 03 984 4311

MOTUEKA
55 Old Mill Road
RD 3, Motueka 7198
Tel 03 907 3595
Fax 03 907 3596

NELSON
300 Wakefield Quay
Port Nelson
Nelson 7010
Box 5114
Port Nelson
Nelson 7043
Tel 03 989 7600
Fax 03 546 7049

PALMERSTON NORTH
Batchelar Road
Palmerston North 4474
Private Bag 11600
Palmerston North 4442
Tel 06 953 7700
Fax 06 351 7050

PUKEKOHE
Cronin Rd
RD 1, Pukekohe 2676
Tel 09 904 8204
Fax 09 237 1619

RUAKURA
East Street
Hamilton 3214
Private Bag 3123
Hamilton 3240
Tel 07 959 4430
Fax 07 959 4431

TE PUKE
412 No 1 Road
RD 2, Te Puke 3182
Tel 07 928 9800
Fax 07 928 9801

AUSTRALIA

Birrabee Park
204 Wymah Road
Bowna via Albury
NSW 2642, Australia
Tel +61 2 6020 3221
Fax +61 2 6041 3939

PO Box 116
Avoca Beach
NSW 2251, Australia
Tel +61 2 4382 6379
Fax +61 2 4382 6703

USA

430 F Street, Suite F
Davis CA 95616, USA
Tel +1 530 758 1612
Fax +1 530 758 1612

THE NEW ZEALAND INSTITUTE OF PLANT & FOOD RESEARCH
Corporate Office, Private Bag 92169, Auckland 1142, New Zealand
Tel: +64 9 925 7000, Fax: +64 9 925 7001

www.plantandfood.co.nz

FOLLOW PLANT & FOOD RESEARCH ONLINE: