
IN THIS ISSUE

Food for the future

Horticulture

Life cycle management

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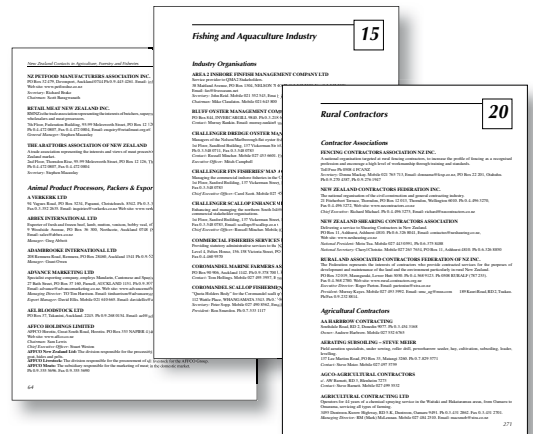
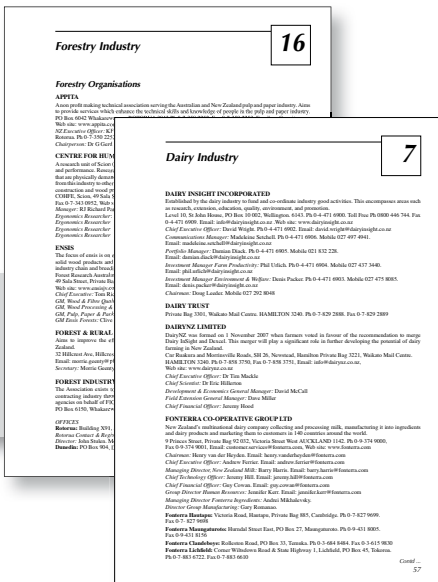
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Contents

Editorial

Food for the future and how we grow it
Julian Bateson 2

Foods for the future

Food futures for New Zealand unlimited
Jacqueline Rowarth 3

Foods of the future – six things you need to know
Mike Boland 6

Horticulture

Fresh fruit and vegetables as functional foods
Julian Heyes 12

Horticulture New Zealand *Chris Ward* 14

Vegetable growing in New Zealand *Chris Ward* 16

Can we hear the pips squeak? *Chris Ward* 19

The kiwifruit industry – state of the nation
David Darcy 20

General

Building capability to transform the New Zealand economy using agriculture
Mark Paine 24

Farmers and rural entrepreneurship *Neil Gow* 26

Life cycle management – a new way of doing business
Sarah McLaren 29

Succession planning in farm consultancy and valuation practices
David Montgomery 32

Clover rhizobia inoculation – a job well done
Bill Lowther 34

Proposed merger of Lincoln University and Telford Rural Polytechnic
Roger Field and Jonathan Walmisley 42

Overseas views

Australian dairy farming systems – adapting to large changes
David Chapman 36

Issues facing the UK agricultural sector
Michael Lambert 40

Julian Bateson

Food for the future and how we grow and sell it

Back in the 1960s there was concern about feeding the ever increasing world population. It seemed to me at the time that famine was expected to be a world wide permanent event, unless we reduced the numbers of people on the planet. Then came the green revolution and we were able to get significantly more plant protein and carbohydrates from similar areas of land. The crisis was averted, and although there have been some tragic food shortages in some parts of the world, particularly around Ethiopia and the Sudan in the early 1980s, the world has muddled on.

Now we have around six billion mouths to feed, a figure which is expected to reach nine billion within 40 years, and we will need perhaps 70 per cent more food than we do now. At the moment there are few places with serious food shortages. This is easy to say from where I am. There are many starving people around the world, but food would probably be available for them if only we in the western world were not so wasteful, and if the politicians in these countries could get their act together.

New Zealand is in a great position to be a net exporter of food for the foreseeable future. But we need to do this in a sustainable manner so that it can continue in perpetuity without detriment to the environment. We can produce food for around 20 million people, and with less than five million in the country at the moment, there is a lot of spare capacity.

The first two articles in this issue, by Jacqueline Rowarth and Mike Boland, give a good insight into foods for the future and the role New Zealand can play. Health, happiness and wellbeing are all part of the mix. Later in the issue the article by Sarah McLaren on life cycle management adds to this mix. We need to demonstrate our sustainable credentials, not just trade on the clean green image.

The future of horticulture

The last few weeks have not been good for horticulture in New Zealand, well, not for kiwifruit.

Horticulture is becoming more important as time passes. Over the next 10 years Hort NZ has plans to increase the value of their exports from just over \$3 billion to \$10

billion. This is an ambitious target, especially as recent reports, commissioned by Hort NZ, show that trade barriers are getting worse, not better. The report, just released, reckons that exporters paid over \$235 million in importers tariffs last year, which is over \$30,000 per grower.

A potentially serious problem is the kiwifruit disease pseudomonas which has been discovered on vines in various parts of the country. The target to tackle this problem has been set at \$50 million, half from the industry and half from government. At this stage we do not know where the infection came from, although imported pollen is a prime suspect, or how long it has been in the country. What we do know is that good biosecurity is fundamental to the success of primary industry in New Zealand. But who pays?

Plans are afoot for primary industry to cover a large part of future costs involved in biosecurity, which is what is also being planned in the UK. The article by Michael Lambert outlines how foot and mouth disease and TB have been very costly for both the government and primary industry in the UK.

There is an interesting parallel concerning TB transmission in the UK and in New Zealand. In both countries TB is harboured in a wild mammal and it does not matter how much TB is controlled in the farm animals, re-infection from wild animals continues. The difference in New Zealand, of course, is that possums are not welcome, are not popular and killing them does not outrage conservationists. In England, the main TB vector involves badgers, which are a protected species. This brings up a whole new set of problems and conflicts between town and country, farmers and non-farmers.

We need to avoid any such conflicts here in New Zealand. We should and make sure that everyone continues to take biosecurity very seriously and that, for example, MAF's use of 1080 to kill possums and prevent the spread of TB is seen as good for all concerned, except possums. In addition, all other biosecurity controls must be retained or improved. We cannot afford to let our guard down. We have seen what happens with bees and the varroa mite and now kiwifruit with psn. The latter may not be so financially damaging, but only time will tell.

Jacqueline Rowarth

Food futures for New Zealand unlimited

New Zealand's future is global and therefore faces all the same challenges as the rest of the world – as well as some that are unique. Difficult decisions will have to be made between environment and economic development, connected to the vision of international export potential and also the national belief of being clean, green and innovative. Meeting the challenges to make sure that any inherent opportunities are turned into realities will take leadership, education, research and adoption of new technologies. It will also take hard work and consolidated effort towards an agreed goal. The unique nature of the New Zealand workforce in primary production – the educated and hands-on farmers working with agri-business professionals and researchers – augurs well for an unlimited future.

A basic need

Food is our most basic need – a component remains for sex, but even that suffers for most people during hunger. Settlement, civilisation or war, food security is at the root of all progress. It is also the basis of the resurgence in interest in food this century as food stocks have been depleted as population increases, particularly in the less developed countries.

At the same time, a bizarre relationship with food has become apparent. This is epitomised by the fact that there are now more overweight than undernourished people globally.

In the United States, the Bon Appétit Café at Seattle University advertises on the basis of using only sustainably-produced ingredients, such as low carbon chicken burger with sun-dried tomato aioli. However the Heart Attack Grill with the strapline 'Taste worth dying for' has a menu featuring double, triple and quadruple bypass burgers with flatliner fries.

In New Zealand 'Food in a Minute' which relies heavily on frozen, bottled and canned products, is currently screened on Saturday between 'New Zealand on a Plate' and after the news on 'Annabel Langbein Free Range Cook'. In both these programmes fresh and local is presented as the best of all possible choices which is nice for the domestic market, but not so good for exporter.

And then there is the organic question, which is the subject of emotive debate and a collapse in overseas markets during the recession. Given that there is 'Nowt so queer as folk' how does New Zealand position best for the future?

The facts as far as we know them

The world's population is growing and is predicted to reach over nine billion people by 2050. The 2010 United Nations

FAO report suggests that food production must increase by approximately 70 per cent by 2050 to feed the extra people. Professor David Tilman, University of Minnesota, calculates that at current yields the 70 per cent extra food requirement would need an extra 1.5 to 2 billion hectares of land being brought into production.

This would mean the loss of a considerable amount of carbon from trees as the result of felling tropical and boreal forests, along with soil loss as cultivation leads to loss of organic matter during the transition phase. Change of land use has been reported by the Food Climate Research Network in a report entitled 'How low can we go?' released earlier this year, to be responsible for approximately 40 per cent of greenhouse gas emissions associated with food production. The alternative is intensification of land currently in production.

Agricultural intensification

Research at Carnegie Institute and Stanford University in 2010 reported that agricultural intensification between 1961 and 2005 enabled protection of forests and native grassland. Had these areas been brought into production, an extra 161 giga tonnes of carbon would have been released into the atmosphere. This is over and above the emissions associated with intensification in terms of, for example, increased fertiliser use.

These calculations support researchers such as Professor Anthony Trewavas, University of Edinburgh, have been saying for some time in prestigious journals such as *Nature*, that intensification allows protection of the natural environment. Of the 13.5 billion hectares of land globally, just over 60 per cent, approximately 8.3 billion hectares, is pasture and woodland, with only 1.6 billion in agricultural use. A further two billion hectares are considered suitable for irrigated cultivation. Only around 10 per cent of the increased growth is expected to come from increasing the

area of land, most of the growth required is expected to come from intensification.

Organic has its problems

Intensification is, sadly, at odds with the organics movement, and is therefore the subject of emotive outcry and misunderstandings. Both systems, and the range between the extremes, allow certain inputs in terms of fertilisers and pesticides. Some of these inputs come from a factory, and some are relatively unprocessed – but even organic fertilisers and pesticides are increasingly processed to improve consistency of desired attributes.

There is no consistent and conclusive evidence that organic production systems can yield as highly as conventional systems. Similarly, there is no consistent conclusive evidence that any of the systems are better for the environment than any of the others based on production. Nor is there any consistent conclusive evidence that on a per kilo yield basis, less energy is needed, stock is healthier, soil is more active in terms of bugs, or that food contains more nutrients. Frequent and repeated calls to compare nutritional composition have shown that there is more variability in food nutrient content to do with cultivars and time of harvesting than there is to do with production system.

Claims that modern-day food is killing us should also be taken with a low sodium grain of salt. The World Cancer Research Fund and American Research Institute for Cancer Research published a report in 2007 showing a conclusive relationship between lifestyle choices and incidence of different types of cancer. The overall result is that obesity is linked to many different cancers, as is high consumption of red meat and lack of dietary fibre. The problem is post-farm gate, rather than pre-farm gate production system. It is the quantity of food we choose to put on our plate, and the amount of processing that it has endured, that make the difference in terms of health.

Given the evidence, perhaps it is time to move away from time-consuming wrangles and accusations and concentrate on what New Zealand does best. This is fresh, minimally processed, high quality food produced in sustainable fashion in the knowledge that New Zealand farmers are superb managers of intensive production systems. This allows considerable income to be gained, not only from exporting food, but also from tourism based on the managed farmland as well as native landscapes.

Sustainable production

Sustainability is increasing in importance as an indicator of the likelihood of consumer purchase. The self-styled canny supermarket shopper, Phil Lempert, ranks new products in terms of their likely market success based on the following –

1. Taste 30 points
2. Value 20 points
3. Health 15 points
4. Ingredients 15 points
5. Preparation 5 points

6. Appearance 5 points
7. Packaging 5 points
8. Sustainability 5 points

Under the headline 'For American consumers, a responsibility revolution' last year, *Time* reported that 38 per cent of people were the responsables, altering behaviour towards sustainable consumption. Another third were toe dippers, who were prepared to make the move as long as it was easy. Recent research from Planet Ark reported by FoodNavigator.com suggested that 60 per cent of Australians are more likely to buy a product displaying a carbon reduction label.

Meeting needs

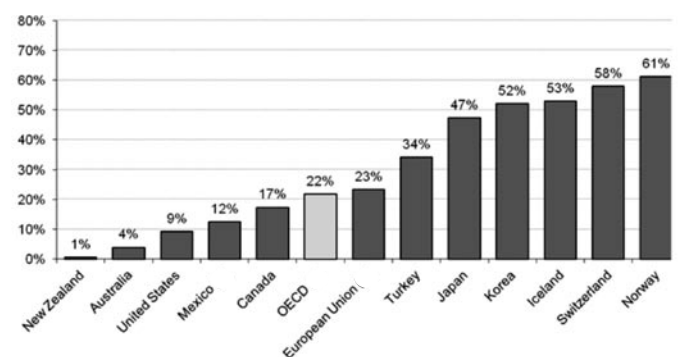
Although research results released in the press recently from the University of Otago suggested that people are not as rigorous about checking sustainable as other surveys have indicated, people do choose supermarkets that generally meet their needs. Walmart, Sainsburys and Waitrose have already declared that they are checking for carbon and water use on the products they stock in an effort to ensure that what they are selling is best management practice for sustainability.

Considerable effort has gone into trying to define sustainability, and a Google search will result in over 33 million hits. A framework for sustainability, formulated by Smyth & Dumanski, was adopted by the International Soil Science community during the 1990s. The five components of the framework are –

- Maintaining or improving yield
- Decreasing risks to production
- Preserving resource capacity for the future
- Economically viable
- Socially acceptable.

For production agriculture, the inclusion of all the components is important. Economic viability is vital for sustaining the agricultural enterprise, noting that in most developed countries, farmers are supported with subsidies.

Producer support estimates as a percentage of gross farm receipts, 2007-09 average



The five components of the sustainability framework can be met via a range of different approaches, as they have been in the past. The difference in the future will be that verification is likely to be required, and that will be possible only from scientific research and rigorous validation.

Trends

New Zealand can feed only approximately 20 million people based on calories available. World wide there is an increase in demand for premium products. In 2009 the US market, for example, grew by four per cent. It is now worth over US\$67 billion. It would seem logical, therefore, for New Zealand to target the approximately 20 million people who are prepared to pay a premium for high quality food.

Consumers recognise premium products from high quality ingredients, the main indicator of a premium product by survey respondents, followed by recognised brand. New Zealand is the only country in the world to have a globally-recognised brand, according to research by global branding company Interbrand. Although people do not necessarily know where we are geographically, they do know about '100% Pure' and 'clean and green'. Lesser indicators of premium products, considered by under a quarter of respondents, are free-range, organic, local and fair trade.

Given current understanding by our markets, developing markets, agribusiness professionals and farmers, it should be a relatively easy move to market New Zealand Food Inc internationally – except that it requires consolidation and traceability. Consolidation is a challenge given the set-up of some of New Zealand's main export industries.

Working together

Fonterra's global marketing position, and that of Zespri, is considered by the overseas supermarkets to be a hindrance in achieving good prices for their customers. For the New Zealand producer, however, this is an advantage. The problem of undercutting is well known, and several initiatives recently have attempted to pull the industries together. Silver Fern farms and Alliance are in negotiation, again, recognising the importance of working together.

Earlier this year, Microsoft's Greg Shields wrote on the importance of consolidation. He explained that the dominant position of Microsoft in terms of branding and market share was because all related activities had been kept within the Microsoft umbrella. In the light of food security concerns, the time for consolidation and positioning is ripe. Traceability will be the next concern.

In order to gain the benefits in premium markets, farmers need to achieve full accountability and tracing systems back to individual farms. Professor Hamish Gow, Massey University, believes low footprint production is insufficient to create a marketing advantage. High value opportunities will be achieved only with validated and verified concepts to create high-value opportunities, along with a brand story from manufacturers and retailers.

Identification preservation and a full trace-back to farms is fundamental. For meat production full trace-back should be relatively easy to achieve in comparison with milk where bulking and co-mingling of milk from different farms is common. But individual meat companies are too small to make a difference internationally on their own – a New Zealand approach is required.

Requirements

At the same time as New Zealand is positioning to become a preferred supplier of sustainably produced, high quality food, the world is being urged to consider behaviours. The Food Climate Research Network's report early in 2010 suggested five points for action –

- Increase production efficiencies
- Improve crop yields
- Change animal feed to decrease methane
- Use non-carbon fuel
- Change human consumption.

The first two, require research and probably increasing intensification. The third point is the subject of research by the New Zealand Agricultural Green House Gas Centre which involves all land-based Crown Research Institutes and universities. Feed, rumen bugs and animals are being investigated.

Housing animals could alleviate some of the greenhouse gas problem as waste products can be trapped and recycled, and may be the way of the future, at least for part of the year. Careful management would be required in terms of brand, but as most northern hemisphere animals are housed for some of the time, housing is unlikely to be an issue.

The fourth point, using non-carbon fuel, is increasingly easy for New Zealand as wind power catches on and hydro-power management improves. Renewable energy is part of the marketing and brand story for New Zealand that can be developed under the clean green image.

Globally, the big challenge lies in changing human consumption. Not in terms of the general understanding, or misunderstanding, of the effect of becoming vegetarian. This would mean more land being cropped. Going organic would require even more land to compensate for the overall decreased yields currently offset by premiums. However if the whole world was organic, there would be no premiums.

Conclusions

Sustainably produced food is reaching a status in developed countries. At the same time as the supermarkets are putting carbon stamps on the stock on their shelves, restaurants are moving to similar declarations on menus. New Zealand has a unique combination of climate, resources and people to capitalise on the trends and move into leadership in sustainably produced food.

Intensification on currently managed agricultural land, while protecting soil, native grassland and bush areas, all supported by world-leading research, is a 100% pure, clean, green and productive future. Clearly it will not happen overnight, and there are some hard decisions that will have to be made in terms of supporting the agricultural sector in a move to intensification. But equally clearly it should be obvious to all New Zealanders that a great future lies in New Zealand Food Inc.

Professor Jacqueline Rowarth is Director, Massey Agriculture, Massey University, Palmerston North.

Mike Boland

Foods of the future – Six things you need to know

Food is a major part of the New Zealand economy, accounting for more than half our export earnings. In this, New Zealand is unusual for a developed economy, and is particularly vulnerable to competition from developing economies with lower labour and infrastructure costs. One of New Zealand's advantages to date, and one that will be critical for the future, is our level of scientific and technical expertise in food production and processing. This has led to some of the lowest costs of production and processing in the developed world, while producing food of unparalleled quality.

The demand for food is continually increasing. This is a result of a growing global population and increasing affluence in developing countries demanding more food, and higher value food, particularly animal-based products such as meat and dairy. This will place ever increasing pressure on food supply and sustainable production.

Although the growing population needs food security, requiring food from numerous countries and supply chains must also come with food assurance. This means confidence that the food is safe, that it is what it is claimed to be and comes from where it is claimed to be produced.

The challenge for New Zealand today is to understand the sources of its competitive advantage in food production, and how best to use them to maintain a competitive edge. To do this, we need to develop a clear view of the main reasons why foods of the future in first-world markets and strategies meet these needs, as well as ways of meeting demand from developing economies. This article suggests a set of ideas that may provide a background on the development of these strategies as well as some developments currently underway.

Institute for the Future report

A 2008 report from the Institute for the Future, *The Future of Health and Wellness in Food Retailing*, developed seven forecasts for a 10-year timeframe for the US food consumer. This report was developed for Coca-Cola, but has been publicly released. The forecasts are based on extensive review and analysis of consumer perceptions and state of technology.

- Wellness goes mainstream – consumers are recognising wellness as a dimension beyond not sick, to include overall physical, mental and spiritual well-being
- Anytime, anyplace health – health considerations are moving outside the medical environment and affecting

decisions in all aspects of life

- Bio-citizens and social networking – these are networks of consumers that join around particular health and environmental concerns
- Health in the food system – all health related aspects of any food product, including environmental health and freedom from additives perceived as artificial or unnatural
- Health-driven transparency – suppliers and producers must be able to substantiate any health claims for their products
- Spectrum of green health – consumers are linking the health of the planet with their own health, so that concerns about sustainability and risk management are becoming important.
- Nutrition information gets customised – consumers will require a more personalised nutritional message and balance in their food with personalised nutrition.

All of this makes clear that consumers are concerned first and foremost about their health and the potential benefits from the right food. Secondly they are concerned about sustainability and the health of the planet.

Six things to know about food of the future

The future is in the past

Man has been eating food for thousands of years. Accumulated wisdom and traditions around food are often for good reasons with a sound scientific basis and which have only recently been appreciated, or may be yet to be understood.

My grandmother had much of such wisdom. Her admonition to eat lots of roughage corresponds to today's requirement to consume fibre. Her predilection for dosing us with cod liver oil was giving us a good dose of long-

chain omega-3 fatty acids and the concept of a square meal corresponds approximately to a balanced diet.

We need to pay more attention to traditional and cultural views about food, and particularly to old wives' tales and ethnic food traditions and beliefs. The accumulated wisdom of the ages has not been well tapped in our search for the foods of tomorrow. One significant initiative is that of the French researcher Hervé This under the banner of molecular gastronomy, and aims to either find the scientific basis of French culinary traditions or to show they are not valid. It is of considerable value to study old recipe books and culinary traditions and try to understand the scientific basis of the recipes they describe.

Wellness foods are here to stay

The concept of wellness, meaning not only not being sick but having robust health that will resist disease, is relatively new to the western world, although it is well embedded in some other cultures. The Institute for the Future report makes it clear that the ideas of wellness, and the ability of certain foods and diets to promote robust good health, are becoming widely accepted in western society by many consumers.

The position of the medical fraternity is somewhat more reserved. As more of the benefits of certain foods and diets are demonstrated scientifically, there will be increased recognition of the benefits of healthy diets by both consumers and the medical profession. It is to be hoped that some of the myths around food consumption patterns, driven by bad science, lobbying and corporate interests will be debunked and good science-supported diets will prevail. The internet, social networking and other 21st century means of communication mean that scientific information, as well as folk wisdom, can be rapidly disseminated. It will be important to give the good science about food and health the same exposure now enjoyed by quackery.

One aspect of food and health that has still to fully emerge is food synergy. Although many foods have been demonstrated to have beneficial effects on health when fed in isolation, or as part of a model diet, interactions between foods in a real world diet can modify these effects to negate or intensify them.

This is believed to be why many foods that show beneficial effects in model systems and tightly-controlled diets do not show quite the same effects in normal everyday diets. Much more work is needed to understand the

Hierarchical structure for dietary patterns, foods and nutrients for the study of food synergy

Food synergy level		Example
Level 5	Dietary pattern	Prudent diet, Western diet, etc.
Level 4	Food groups sector	Whole grain, dairy, fruit, vegetables, meat
Level 3	Whole grain	Whole wheat, brown rice, rolled oats
Level 2	Whole wheat	Bran, germ, endosperm; extract of fat-soluble portion
Level 1	Bran, or a single phytochemical	Specific nutrients or phytochemicals

metabolic effects of functional foods when consumed as part of a person's normal diet.

Water is all

The world currently has a population of around six billion and this is generally expected to increase to around nine billion by 2050. Feeding this population will require a doubling of present food production, and poses an important emerging problem, but is likely to be possible if intensive farming is carried out on a widespread basis.

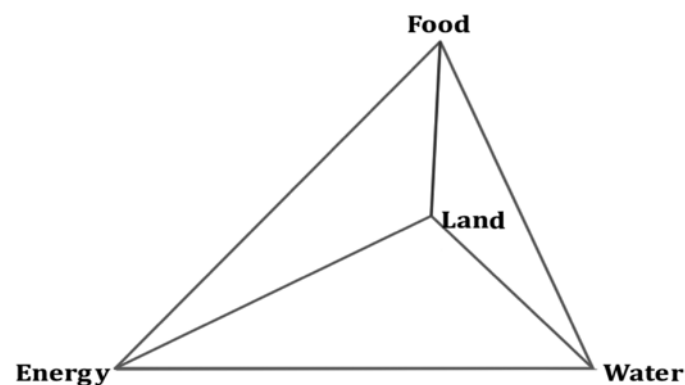
About half a hectare of cropland is needed to feed a person, an estimate based on an East Coast US diet. Any variation is due to animal content and fat content, with convergence of all diets at higher levels of fat.

Food production involves a trade-off between land use, water use and energy use or production. Intensive food production requires use of fertilisers and irrigation as well as mechanisation of farming processes. This consumes considerable amounts of energy, usually from fossil fuels. The recent attempt to solve the sustainable energy problem with biofuels resulted in a reduction in food production as a result of competition for land, and exacerbated the food supply problem.

Fertiliser production, particularly of nitrogenous fertilisers, needs a lot of energy. Irrigation needs energy for distribution and for desalination in some cases. Conversely, use of water for hydro power generation can make water unavailable for irrigation.

New Zealand is relatively unsophisticated in the management of water because there is a year-round adequate supply of water in most areas. Loss of land due to population growth, desertification and salination are reducing available productive areas in many countries. Even in New Zealand, the increasing conversion of prime productive land to housing and lifestyle estates is, or should be, a matter of concern. Retention of rainforest for ecological reasons means new land is not being brought in.

Relatively large areas of productive land for a country of its size and adequate rainfall give New Zealand a considerable advantage in efficient production of crops and animals. Animal production is a particular area of advantage because of the high water requirements. One kilogram of



Food production is a trade-off with land, water and energy

Livestock virtual water exports and imports between 1995 and 1999

Country	Export (Gm ³)	Ranking	Country	Import (Gm ³)
Australia	146	1	Japan	112
New Zealand	71	2	Italy	93
USA	62	3	Hong Kong	46
Canada	48	4	Russian Federation	39
Argentina	33	5	Korean Republic	35
Ireland	31	6	Taiwan	29
Denmark	28	7	United Kingdom	20
The Netherlands	24	8	Indonesia	15
Uruguay	23	9	Mexico	14
France	22	10	The Philippines	14

grain requires about 1,000 litres of water to produce, while a kilogram of beef needs over 40,000 litres of water. These water requirements are used in calculations of virtual water to track global flows. Because of this natural advantage, despite its small size, New Zealand was recently found to be the world's second largest exporter of virtual water in livestock products, after Australia. It is important for New Zealand to understand the importance of its climate in the context of global trade, and to value water-intensive products appropriately, as well as paying more attention to water management for production of food.

Healthy planet rules

In addition to attention to the effect of food on the health of the individual, consumers and governments are increasingly concerned about the effects of food on the ecosystem and the welfare of the planet. This applies to production methods – whether they are sustainable, ethical and pay due attention to human and animal welfare. It also applies to distribution – an awareness of the effect of distribution on the carbon footprint of a product, and to waste from the food itself and its packaging and advertising.

There is a conflict between sustainability and animal welfare. Intensive farming methods such as dairy barns have a much lower ecological footprint than free range pastoral farming. However, public perceptions about animal welfare and an affinity for more traditional methods of production mean that the consumer in western cultures will pay more for the free range or more traditional product. They do not understand or accept the additional production costs in terms of the environment.

Packaging is an important issue in the context of environment and distribution. High quality foods need proper packaging to preserve their freshness and maintain food safety, but increasingly packaging is required to be zero waste, to be either easily biodegradable or returnable to the processor.

Life-cycle analysis will be increasingly important in understanding the sustainability of our food products and their acceptability to consumers. But politics will continue to be a problem as competing countries try to encourage the thinking that New Zealand's distance from markets mean

higher ecological cost, as in food miles. A recent analysis of the energy footprint for production of milk powder in New Zealand and distribution in market as recombined UHT milk showed that about 70 per cent of the total energy footprint came from processing, packaging and distribution.

Distribution will continue to be a problem

New Zealand is a long way from the major food markets. Transportation involves distance and time. Therefore efficient methods for managing the supply chain are increasingly important, and it is necessary to stabilise foods for a sufficient time to allow a reasonable life after they reach the customer.

Consumers increasingly want fresh products, and this has led to the rise of the local farmers' market, where food is perceived to be local and fresh, although often it is not. The reality is that local production is in no way able to cope with the demands of large urban environs, and shipping food over long distances is inevitable. In addition, local production in most climates is seasonal, and shipping from other parts of the world will be necessary to provide out-of-season fresh foods.

A big issue for New Zealand is that distance from market leads to a perception of a large carbon footprint for transportation, highlighted by the term food miles. Most of our food products are shipped by sea freight, which is remarkably energy efficient. The carbon cost of shipping is quite low, around 125 kg of carbon dioxide for each tonne shipped from New Zealand to the UK, and this is greatly offset by the benefits of efficient production systems.

A recent detailed report from Lincoln University concluded – 'This report has shown that in the case of dairy and sheepmeat production, NZ is by far more energy efficient even including the transport cost, than the UK, twice as efficient in the case of dairy, and four times as efficient in case of sheepmeat. In the case of apples, NZ is more energy efficient even though the energy embodied in capital items and other input data was not available for the UK. In the case of onions, the UK is more energy efficient in production than NZ. However, when storage costs are included for UK onions to replace imports from NZ the UK, is less energy efficient than NZ.'

Proper attention to life cycle analysis and energy footprints, using internationally accepted methods and standards, will be increasingly important for New Zealand food products. It is also important to get the message to the customers that New Zealand's efficient production methods and logistics mean a sustainable, low carbon footprint product. It is also important that New Zealand plays a part in setting standards for life cycle analysis methods to prevent overseas lobbies skewing methods for political means. This has happened in the past for at least one measure of nutritional value, and in this respect Fonterra probably has an important part to play, with its involvement with the International Dairy Federation and Codex.

Getting food products to market in a fresh state

involves a range of technologies and will continue to be a challenge for the New Zealand food industry. Traditional heat sterilisation and drying processes cause changes to products, resulting in cooked flavours. Novel processes such as high pressure processing will be important for new fresh long life products without heat processing. In Australia, high pressure processing is being used for new high quality extended shelf life apple and other fruit juice. In New Zealand, several high pressure processing plants are in use for natural health products, although not yet for the mainstream food industry. There are an estimated 200 commercial high pressure processing plants in the food industry worldwide in 2010, and this number is growing rapidly.

Packaging is the other important aspect of getting food to market. Proper packaging protects the food and maintains its fresh properties, while at the same time allowing labelling for branding and traceability. New low residue and high resistance packaging materials are likely to be available from new material science, especially at the nanometre scale. Active and intelligent packaging will become increasingly important. Active packaging includes materials which actively protect the product in some way, such as packaging –

- That contains an oxygen scavenger
- Containing bacteriocin to protect against bacterial growth
- With active enzymes, such as lysozyme, that can attack bacteria
- For dairy containing lactase that will hydrolyse the lactose in milk to produce a sweetened, more digestible product during transportation to market.

Intelligent packaging uses various devices which communicate information about a product. It may be as simple as a colour change which indicates if a product has suffered heat abuse or other damage during distribution. It could be as smart as an intelligent radio frequency identifier (RFID) device embedded in the package that can trace the origin and shipping history of a product as well as the temperature-time profile of that history.

Radio frequency identifier

RFIDs are the emerging technology for traceability and for carrying product information, and have been in existence for many years. The limiting factors in the adoption of RFIDs have been the ability to produce reliable devices at a low enough cost, and the development and acceptance of a single or dominant industry standard. There are two types, active and passive.

Passive RFID chips are essentially the same technology as that used in many building security systems – they are transponders, energised by radio signals from the scanning device and able to transmit back a lot of data. The typical capacity is a few kilobytes for a passive device, and increases to up to a megabyte for active devices. The cost of production of RFID chips is decreasing as volumes increase, is now less than a dollar at present and is expected to go to around 10 cents for passive devices in the near future.

Active transponders carry an inbuilt battery and have

the advantage of being active over a greater range and of being able to carry a greater amount of information. They have the disadvantages of being more expensive to produce, up to \$75 a chip and of having a limited battery life.

Traceability goes beyond just product and batch identification, and a range of packaging indicators has been developed. The most common of these are so-called temperature-time indicators. There are also indicators of oxygen exposure and of growth of bacteria usually based around pH changes. Enhanced RFIDs with inbuilt clocks and temperature sensors have been developed and are able to provide a history of any particular container, and other sensors such as gas indicators, pH sensors and biosensors can be incorporated. Smart RFID traceability is expected to become the norm for food packaging over the next decade.

Some major retailers and end users, notably Wal-Mart and the US Department of Defense, already require the use of RFIDs for some products. As the cost decreases and their efficiency and reliability increases, these will be an important part of packaging for New Zealand's food products. They are already in extensive use in some parts of our export horticulture industry.

Despite considerable advances in the last decade in development of intelligent and active packaging concepts in the laboratory, few have yet made it to market. Five major factors have been identified that will affect the introduction of active and intelligent packaging –

- Legal hurdles, particularly EU regulations which will not permit the use of many intelligent packaging concepts available in the US, Australia and elsewhere
- Reliability and effectiveness which still needs to be shown
- Technical hurdles particularly for more sophisticated systems measuring levels of microbial contaminants
- Costs
- Producer, consumer and retailer acceptance.

Despite these hurdles, active and intelligent packaging can be expected to have an increasing effect in both ingredient and consumer food businesses in the near future. New Zealand producers must be ready for it.

Personalised nutrition is coming

We are all different, and have different needs, including those for food. This is a consequence of both our genes and our environment. The study of the interaction between food and an individual's genetics is called nutrigenomics and has been an emerging area of science over the past decade. Some early studies suggested an early appearance of important single gene interactions with food. An example is the differential response of individual women, with different forms of a gene called APOA1, to polyunsaturated fats. This study concluded that women with the A form of the gene benefitted from consuming polyunsaturated fats by increasing their good cholesterol. Women with the G form of the gene did not, showing a small adverse effect. Unfortunately, the situation has been found to be much more complicated for most other

food interactions.

At present several major international collaborations are attempting to clarify these interactions. Nutrigenomics New Zealand is a collaboration between AgResearch, Plant and Food Research and the University of Auckland. Nutrigenomics New Zealand can be expected to provide important insights to the New Zealand food industry over the next decade.

Individual food needs go beyond just the genetic component and include environmental and situational factors, as well as the effect of any disease and or medication. These go together to form what is called a nutritional phenotype which defines the true needs for personalised nutrition.

The appeal for personalised nutrition goes beyond the expected health benefits as it appeals to the sense of being an individual. The success of individualised products is because they appeal to today's sophisticated consumer, and allow them to feel different from the crowd. It has been noted that the success of Starbucks is not about coffee, but about empowerment. Apparently the harried office worker can make six unchallenged executive decisions on the way to the office when ordering their individualised coffee.

Recent studies have indicated several reasons why personalised nutrition is still some years away, for reasons relating partly to science, but more to issues around regulation and social acceptance and acceptance of benefits by the medical fraternity. The Institute for the Future has identified six issues for nutrigenomics and personalised nutrition –

- Nutrigenomic science is still in its infancy
- The cost of genetic testing may be higher than its perceived value
- Support services for interpreting and using nutrigenomics lag behind the technology
- The health care establishment is slow to adapt
- Ethical concerns about DNA testing
- Regulatory concerns.

There is not yet any strong ethical or legal framework to manage these issues, and until they are resolved and there is a degree of acceptance by the medical profession, the genetic basis for personalised nutrition will not advance. As a consequence, personalised nutrition is still some years away, but it is coming probably in the next decade. The New Zealand food industry needs to be prepared, with a view to being a preferred supplier for ingredients and whole foods that can make up a defined individual diet.

The need to respond

The previous section presents the author's view of six aspects that will define the food industry of the future. Although the detail is speculative, the framework is robust and based on a wide range of well researched papers and reports in the scientific literature.

The New Zealand food industry and New Zealand as a whole need to pay attention to these in preparing for the future. The food industry makes up more than half of the export economy and is a source of competitive advantage in

the international market place. Much of our competitiveness has been achieved on the back of good science in the past and our future competitiveness will be based on good relevant science to be done now and in the near future.

We need to –

- Clearly understand the value of our natural advantages in being able to produce high quality food efficiently and of our expertise in making the best of both production and processing
- Enable the development of innovative ways to add value to our food exports
- Develop novel sophisticated processing and packaging technologies that will enable fresh products to be in the market with all the necessary traceability and a low ecological footprint
- Be prepared to export our technology, in the form of offshore processing, licences and other intellectual property, to benefit our knowledge in other markets.
- Develop new human capital to support New Zealand's future food industry in both the industry itself and in our research communities that support the food industry.

Important government initiatives

Over recent years the New Zealand government has recognised the importance of a vibrant food industry and has made several important initiatives by different channels. These include the funding of the Riddet Institute food Centre of Research Excellence (CoRE), the New Zealand food innovation network, the Primary Growth Partnership and a new FRST-funded consortium.

Food CoRE – Tertiary Education Commission

The centres of excellence were established by the New Zealand Government in 2002. In contrast to other science funding schemes, CoREs are funded from education and promote excellence first and foremost, as judged by international referees. The vision is to –

- Support world-class research by having critical mass, interdisciplinary focus and internationally recognised capability
- Enhance New Zealand's ability to be a knowledge society
- Act as a change agent to alter the research culture in New Zealand
- Develop a closer co-operation between universities and research organisations
- Make close interaction with industry and the community more acceptable
- Enhance the profile of science via public education programmes
- Create an inspirational environment.

The Riddet Institute was established in the second round of applications for CoRE status in 2007, the only new one to succeed in that round. The Riddet Institute is named on behalf of Professor William Riddet, the co-founder of Massey University and generally recognised as the progenitor of food science in New Zealand. The Riddet Institute is a

partnership between three universities – Massey University, the University of Auckland and the University of Otago – and two Crown Research Institutes, AgResearch and Plant and Food Research.

This brings together much of New Zealand's top scientific talent focusing on food in a cross-disciplinary programme of research. The Riddet offers a New Zealand Inc approach to meeting the challenges facing the food industry via –

- True research excellence
- National collaboration
- Cross-disciplinary collaboration
- Superb international science linkages
- International industry linkages

New Zealand Food Innovation Network

As a response to the recommendations of the Food and Beverage Taskforce, the Ministry of Economic Development is funding a series of regional hubs to enable new product development. These are based in Manakau, Hamilton, Palmerston North and Lincoln. The focus of three hubs is to provide food companies with access to pilot plant equipment that will enable trial production and early commercial production of novel food products.

The Palmerston North hub is somewhat different and will involve supplementing existing research on food equipment that can allow production and use trials of completely new food products. It is expected that there will be interplay between the Palmerston North hub and the other hubs as research-driven products scale up, or commercial initiatives are scaled down for problem solving.

Primary Growth Partnership

The Primary Growth Partnership was announced by the government in 2009 as a replacement for the previous government's Fast Forward programme. Both programmes are similar in their intent – to boost New Zealand's primary industries and the associated processing and support industries using research and technological innovation.

The \$170 million dairy industry programme, announced in August, will involve a substantial post-farm gate package of food research which can be expected to benefit not just the dairy industry, but many sectors of the New Zealand food industry. The package involves three new research programmes – food physics, smart process control and nutrition, with substantial funding from government and matching funding from industry over a period of seven years.

The food physics programme will enable New Zealand's food industry to design and manufacture increasingly complex foods to meet growing demand for healthier foods, customisation of foods and ingredients and will pave the way for personalised nutrition. It will help the creation of new ingredients and processing solutions which will enhance the consumer sensory experience in finished foods, with features such as low fat, low sugar, low additives and higher protein without compromising the sensory qualities and keeping qualities.

The smart process control programme will develop new approaches to food manufacturing for existing food types, and the manner in which food processes are managed. This will lead to increased efficiency in production and manufacture along with enhanced supply chain logistics. The programme can be expected to reduce post farm-gate supply chain costs and environmental effects and to increase food safety. More importantly, it will also enable the manufacture of new complex and high-specification ingredients and finished foods with greater consumer appeal.

The nutrition programme aims to establish world leadership in the development of nutritional and bioactive food ingredients, to help meet the growing demand for healthier foods and the emerging demand for personalised nutrition. It will be expected to create momentum in a broad collaborative international approach to protein nutrition science using a wide range of partnerships.

Food Synergy Consortium

A joint research consortium programme has been proposed between Fonterra, Zespri and the Riddet Institute called Synergistic: combinatorial functional foods that addresses the issue of food synergy. Food synergy is an important emerging area of food science and nutrition, and this initiative can be expected to place the New Zealand food industry in a leadership position.

The Palmerston North Centre

Palmerston North is a significant centre of agri-food research, comparable in scale to that in the 'food valley' of Wageningen in the Netherlands. There are more than 400 science professionals working on various aspects of food along with a substantial farm and agri-business capability. This critical mass has led to an initiative to create greater sharing of resources between the principal players, the Riddet Institute, Massey University, Fonterra and AgResearch, with the potential of co-location of leaders and centralisation of key equipment and instrumentation. The Riddet Institute provides an important catalyst and potential vehicle to enable this development.

Acknowledgements

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Mike Boland is principal scientist and executive officer of the Riddet Institute.

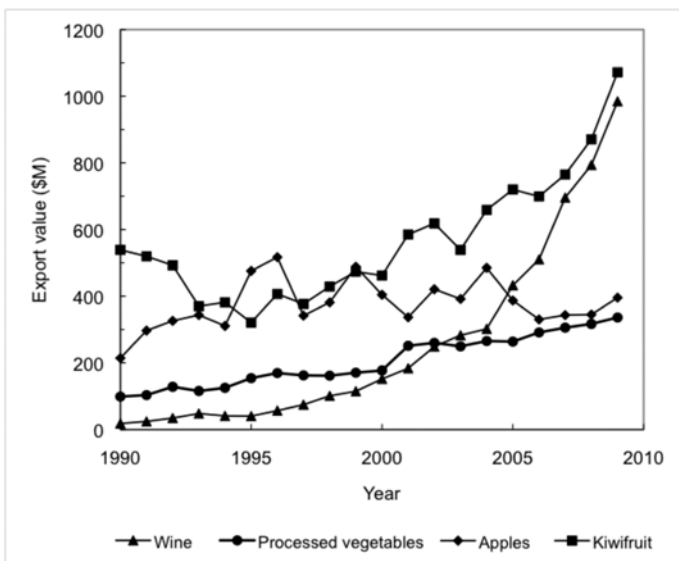
A full list of references used in the researching and writing of this article is available from the editor of Primary Industry Management or directly from the author.

Julian Heyes

Fresh fruit and vegetables as functional foods

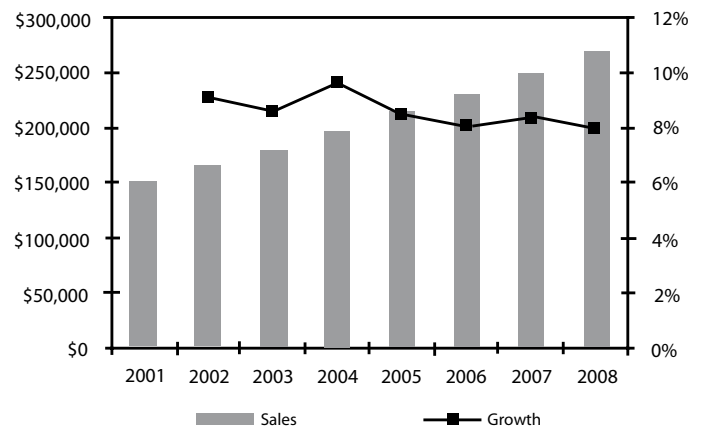
This year, Horticulture New Zealand announced its somewhat eye-watering strategic target of achieving \$10 billion of horticultural exports by 2020. Given that total horticultural exports in the year to June 2009 were \$3.4 billion, this may seem a little overblown. In fact it is achievable, if some critical success factors are recognised and the necessary changes are adopted, and provided the kiwifruit industry is not devastated by the recently discovered Pseudomonas infection.

The vision has some detail. The planned increase in exports will come from sustainable production and will not be accompanied by an equal growth in the area of land devoted to horticulture. Instead the vision is for increasingly high value products exported to affluent and discerning consumers in a diverse array of markets.



Change in export value of apples, kiwifruit, wine and processed vegetables

The horticultural sector has several recent success stories to examine as it looks for models of sustainable export growth. Three of the four products on the graph have grown in exports over the last 20 years but they typify very different growth patterns. Exports of New Zealand wine have demonstrated a phenomenal record of year-on-year increases in total export value. But there have been massive increases in productive area, and we are teetering on the brink of commoditisation with a glut of inexpensive wine threatening to devalue the New Zealand brand.



Global growth of nutritional supplements industry

Vegetables, by contrast, tell a different growth story. The most consistent increase in vegetable exports has been in processed vegetables, trading on the world's appetite for cheap, convenient products. The growth of kiwifruit exports is the pattern New Zealand needs to keep replicating.

Here, the introduction of a novel product in the last decade, the Zespri Gold fruit, did not come at the cost of sales of the traditional green Hayward variety. Instead the market was offered something fresh and different from what was available in the rest of the world. It was a product with an attractive colour and flavour, and the benefit of a co-ordinated and well-resourced marketing strategy.

Apple exports have not grown over the same period and struggle without a co-ordinated marketing plan. The introduction of improved production technologies and apple varieties with specific flavour and texture attributes, designed to appeal to consumers in particular market sectors, has increased the yield per hectare and the value of the fruit per kilogram. For example, a similar export value of apples in 2009 comes from only 60 per cent of the production area that was harvested in 1999.

Health and well being

When considering what aspects of novelty will appeal to consumers and attract higher prices, we need to consider such taste, texture, convenience and freshness. There is an additional but relatively untapped reason for consumer behaviour that our horticultural industries are all exploring. This is the fact that affluent consumers around the world are making purchasing decisions based on a belief in the value of their purchases, in terms of their own and their family's health and wellbeing.

The determination to improve health and wellbeing from diet is not a new phenomenon. Hippocrates, the father of modern medicine, wrote in about 400 BC, 'Leave your drugs in the chemist's pot if you can heal your patient with food'. What is new is the sense of urgency around demonstrating functionality in food, in terms of increased health or wellness, because of the modern epidemic of obesity that accompanies the adoption of a Western lifestyle in every country where it occurs.

Risk factors

Obesity is associated with increased risk of type II diabetes, cardiovascular disease and some cancers. The mechanisms by which the Western diet rich in saturated fats and sugar and low in fibre, coupled with a lack of exercise that leads to poor health, are quite well known. The World Health Organisation has published a list of five risk factors, all of which have clear connections to diet and lifestyle – obesity, high blood pressure, high blood sugar, high blood triglyceride content and insufficient good cholesterol in the blood.

There are published risk thresholds for each of these indicators. If you exceed those thresholds in any three indicators you are considered to have the so-called metabolic syndrome that predisposes you to the risk of premature death. The lifestyle changes that are needed to reduce your risk are equally well known. They include reducing your intake of saturated fats and sugar, getting some exercise, stopping smoking, reducing your alcohol intake and increasing your intake of fruit and vegetables.

Making these changes is associated with a reduction in incidence of metabolic syndrome and a resulting increase in life expectancy. In particular, there is a significant accompanying increase in disability adjusted life years, meaning that you do not just live longer, but you remain healthy for more of those years. In the current debate about permissible nutrition and health claims for use on foods sold in Australia and New Zealand, it is noteworthy that there is a high-level pre-approved statement 'A diet rich in fruit and vegetables has been shown to reduce the risk of coronary heart disease'.

Eat more fruit

What is very surprising is how poor consumer understanding is about the benefits of a diet rich in fruit and vegetables. New Zealanders have been encouraged to consume 'five

plus a day' servings of fruit and vegetables for many years, but our intake still sits somewhere around three servings a day. There are many reasons for our dogged reluctance to eat more fruit and vegetables.

People cite a lack of time for preparing or eating fruit and vegetables, a dissatisfaction with the flavour of modern varieties, concerns about spray residues, lack of knowledge in terms of how to prepare and cook vegetables, and the widespread availability of pre-prepared products high in fat and sugar. Many of these reasons seem utterly trivial if only the enormity of the problem were more widely recognised.

In a remarkable paper published in 2007, a group of New Zealand medical researchers calculated that, based on present-day knowledge, some 1,559 deaths in 1997 could be directly attributed to an inadequate intake of fruit and vegetables. Given that our newspapers are full of debate about how to reduce the road toll, it seems bizarre that a four-fold larger number of preventable deaths is simply ignored.

The epidemic of obesity that accompanies the adoption of the Western lifestyle has led to a search for magic bullets. They are looking for short cuts that will allow people to retain their fast pace of life and unhealthy lifestyle choices. This has helped to drive the apparently recession-proof growth of the nutraceutical supplements industry, reaching some US\$250 billion in 2008-9. Tragically, the evidence for the efficacy of these supplements is sketchy. There is an excellent website, www.informationisbeautiful, that reviews the evidence for the efficacy of supplements based on the gold standard of health research, the Cochrane database of randomised, placebo-controlled, double-blind clinical trials. It is clear from that website that only a few of the well known supplements have beneficial effects. But this has not stopped the phenomenal growth of the industry.

Other reasons

Part of the reason for the inadequacy of supplements, compared to the strong evidence for the benefits of eating a diet rich in fruit and vegetables, may well be that there is something particularly good about eating the whole fruit and vegetables. The fibre in the matrix and the combinations of diverse plant chemical compounds may work synergistically to provide a far larger benefit than individual extracts supplied in concentrated form. Specific research results are tending to support this concept.

Another part of the benefit is the simple fact that few people who eat a diet rich in fruit and vegetables also eat a diet rich in saturated fats and highly refined foods. They tend to be mutually exclusive.

There is now a global trend for researchers to try and understand the specific contributions fruit and vegetables make to human health and wellbeing. Differentiating fruit and vegetable products around particular health benefits is a well-established route to increased sales. Examples include blueberries for mental acuity, cranberries for urinary tract

Continued on page 15 >>

Chris Ward

Horticulture New Zealand

Horticulture New Zealand (Hort NZ) represents New Zealand's 7,000 commercial fruit, vegetable, berryfruit and olive growers. Horticulture occupies 90,000 hectares of productive land and our products are exported throughout the world earning \$2.4 billion. The industry has grown from exports of \$200 million to \$2.4 billion in 25 years.

We have a strategy and action plan to increase the size to \$10 billion, both domestic and exports, by 2020 by taking advantage of the natural environmental advantages of New Zealand and the skilled management and labour force on horticultural properties. Horticulture is dependent on the availability of a skilled fulltime and seasonal work force.

Hort NZ is funded by a compulsory levy under the Levies Act 1987. This is voted on each year. The levy is \$100 per \$15,000 of value at the first point of sale. On a percentage basis this is low relative to some other levies but there are no directly funded research or extension activities. Hort NZ is the umbrella organisation for 22 individual product groups.

Strategic development

In 2009 Hort NZ finalised an industry strategy. This widely accepted planning document has a target to move the sector from an annual \$4.2 billion to \$10 billion by 2020. To achieve this, the report focuses on export growth and capitalising on intellectual property. The report states that the industry should maintain a heavy focus on scientific research and development of new cultivars. More needs to go into developing young people with an interest in making a career in the industry, including leadership training.

Natural resources and environment

Most regional and district council plans are vetted with particular emphasis on how these are likely to affect the

growers. We are especially active to ensure that within the plan, horticulture has the capacity to grow sustainably the crops best suited to the area. The list of our desired results under the natural resource portfolio includes that growers –

- Have access to clean and reliable water for production
- Know about climate change and the likely effects
- Have continued access to education relating to the latest developments in pest management technology.

Resource Management Act

Linked to the above, but specifically related to the RMA, Hort NZ advocates for grower interests with local and central government to minimise regulatory risks faced by growers and to capture the opportunities to access resources. This is an area of work into which Hort NZ puts a significant financial resource. Recent successful results are claimed for growers in the Horizons regional council area and with Environment Waikato's water allocation plan.

Labour and employment

Another big area for Hort NZ is about the attraction of a suitable workforce, both permanent and seasonal, as well as training and developing leaders for the industry. This work includes working with schools at one level and offering leadership courses at another.

Hort NZ has played an instrumental role in the Recognised Seasonal Employer programme. In this

Membership of Hort NZ

Hort NZ acts as an umbrella organisation for the 22 affiliated product groups listed here. The chairs and managers of these groups regularly met with HortNZ to discuss national representation of the industry on issues such as resource management planning, biosecurity protection and labour needs. Some of these groups collect their own levies, independent of Hort NZ.

- | | | |
|-----------------|--------------------|------------------------|
| • Avocados | • Fresh tomatoes | • Persimmons |
| • Blackcurrants | • Fresh vegetables | • Pipfruit |
| • Blueberries | • Kiwiberry | • Potatoes |
| • Boysenberry | • Kiwifruit | • Processed vegetables |
| • Citrus | • Nashi | • Strawberries |
| • Export Squash | • Olives | • Summerfruit |
| • Feijoas | • Passionfruit | • Tamarillo |

programme Pacific Islanders come here for up to seven months to approved and registered employers mainly for picking and pruning in the field. This scheme has been remarkably successful. Productivity per orchard worker has improved, as has reliability.

Compliance and biosecurity

Like most industry good organisations Hort NZ lobbies government on a range of compliance and compliance related issues often through the submission process. Recent submissions have related to changes to the Holidays and Employment Act, ACC, the Rating Act and agricultural vehicle use on roads.

Biosecurity is near and dear to all growers. The big issue of the day is the proposed Government Industry Agreement. Under this government initiated proposal, growers would be asked to contribute financially to eradication or containment of an incursion. In return, growers and grower organisations will have more say on the best course of action. Growers fear the liability they could be taking on with this arrangement, and small sectors especially could face bills they simply do not have the money to pay. Overall there is a heightened awareness of bio-security brought about by the physlid which is currently costing the potato, tomato, and tamarillo industries millions to manage.

Country of origin labelling

Most people favour country of origin labelling for obvious reasons and Hort NZ strongly advocates for this information

to be available. Reasons for it not to be so, especially on foods which are made up of very predominately one type of food, seem to be spurious.

Communications

Communications is a major and important role to get right. We advocate for our growers and need to know just what the growers want us to advocate. On the other side we need to foster and maintain links with government in our lobbying role on behalf of growers. Every month the *Grower* and *Orchardist* magazines are produced and every week a Hort NZ newsletter is written and emailed to growers.

Trade and global

Hort NZ is involved with promoting and helping the government with prospective free trade agreements. We also keep statistical information on trade flows worldwide in horticultural products and promote New Zealand horticultural produce at some international trade shows.

Horticulture in New Zealand has a bright future with increasing market access in Asia, variety developments, and pre and post harvest production efficiencies accumulating over time. We are not a low wage economy so we have that challenge, but we have great soils, dedicated growers and generally in a globalised world we have better water resources than many other nations.

Chris Ward was, until recently, a business manager for Hort NZ. He is now an independent consultant.

<< Fresh fruit and vegetables as functional foods – continued from page 13

concern that these claims may be overblown, and unlike supplements, it is very hard to do a double-blind study when people know full well what fruit and vegetables they are being asked to eat.

Finally, there is a strong awareness that fresh products are not shelf-stable as are processed food or nutraceutical products. There is enormous compositional variation between different varieties of the same species. The composition is strongly affected by inputs during growth such as water, light, nutrients and temperature. Composition changes markedly with plant maturity and is not fixed at harvest, but continues to change during storage and transport.

Integrity

Despite this apparently insurmountable list of variables, there are now some research programmes that aim to produce fresh, functional fruit and vegetables, based on elite germplasm, controlled growing conditions and closely managed protocols for post harvest handling. Capitalising on this research and offering fresh products with validated claims for efficacy in terms of promoting health and wellbeing will be an important contributor to the growth of New Zealand's horticultural industries.

To retain market leadership we will need New

Zealand's unique germplasm and New Zealand managed partnerships to get the products to affluent consumers, with the composition guaranteed at the point of sale. Increasing convenience and stabilising composition by processing will provide additional opportunities. Compositional changes during the production of chilled or frozen pre-prepared meal components, or minimally-processed fresh product mixes, or even juices and smoothies, can be quantified and managed. Providing consumers with specific information at the point of sale may help to emphasise the value proposition.

Fruit and vegetables differentiated in what they can do for improved health and wellbeing should provide a global export growth opportunity for New Zealand. We have an enviable international reputation for integrity. If we claim something is spray-free or organic, the world understands that we will have some form of accreditation or validation process in place. New Zealand needs to trade more on integrity, just as Switzerland is known for the reliability of its products. Trading on our integrity is a more defensible strategy than our supposed clean and green image that is founded, as Simon Upton once famously remarked, 'on a low population density and a strong Westerly wind'.

Professor Julian Heyes, Institute of Food Nutrition and Human Health, Massey University

Chris Ward

Vegetable growing in New Zealand

We have 1,980 commercial vegetable growers in New Zealand with annual turnovers of \$100,000 or more. They range from growers with over a million dollars in turnover, who have individual contracts with the supermarket chains, to smaller growers mostly supplying farmers markets.

Squash, onions and potatoes dominate fresh exports, whilst frozen peas, sweet corn and beans dominate the processed export vegetable export sector. Some vegetables are canned and exported, examples being asparagus and tomatoes. Newer industries include carrots grown for juicing. The bagging of fresh greens is also increasing.

Like so many primary sectors, vegetable prices to growers have not kept pace with the consumer price index or more especially the input costs. The old cost and price squeeze is alive and well. And with few exceptions such as glasshouse production, vegetable production suffers as much as anything from adverse climatic events. So what are the most important issues for growers?

Costs of production and who has the power

Input costs have risen dramatically including fertiliser, freight, rates and labour. Economies of scale are important for survival or niche marketing of niche products at the other end of the scale. At the same time the supermarkets in New Zealand, as they have worldwide, are centralised and more powerful. We only have two major supermarket chains in New Zealand and both aim to buy the best produce at the cheapest price on the day.

Growers either supply supermarkets directly or via an agent. Some do not supply supermarkets at all. For example we have two major asparagus producers in New Zealand who supply 250 gram bunches of asparagus to supermarkets, export to Japan and will send surplus production to the two operating canneries.

At the other end of scale we have almost boutique suppliers of asparagus. These growers would typically have between one and three hectares of asparagus and sell their entire crop locally through their own contacts. The worst place to be is in no man's land with perhaps 10 hectares of asparagus where you are not exporting and do not have special supply arrangements, or sell to a farmers market or restaurants.

Not enough being eaten

There is a reluctance for people to pay for quality vegetables. Despite all the evidence proving their value in a diet, the temptation to keep on sucking up the Coke continues. Perhaps it is just convenience, perhaps it is taste, but sales per head are quite static and the obesity epidemic just rolls on. In October 2010 a new national survey concluded that two thirds of young people were not getting their daily recommended intake of fruit and vegetables.

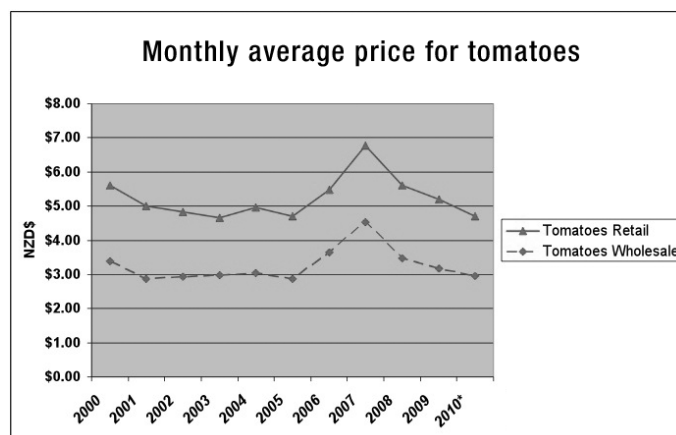
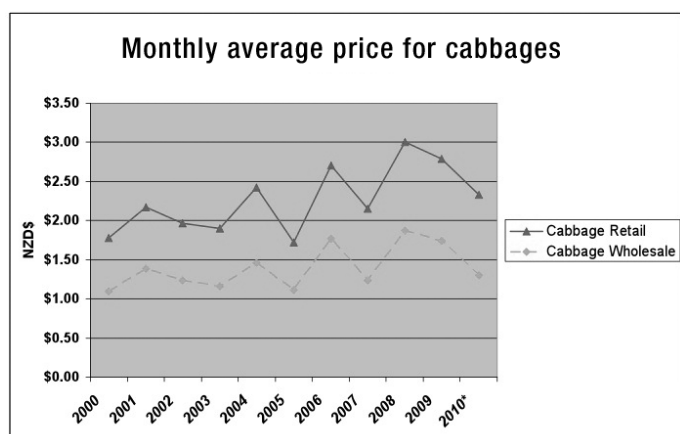
Year	Retail price	
	1999	2009
Broccoli	\$1.03	\$1.32
Cabbage	\$1.11	\$1.13
Carrots	\$1.13	\$0.90
Kumara	\$1.83	\$2.03
Lettuce	\$1.66	\$1.63
Onions	\$1.32	\$1.66
Potatoes	\$3.52	\$4.36
Tomatoes	\$5.42	\$4.49
Average	\$2.00	\$2.13



Fresh and processed vegetables	Growers number	Planted area hectares	Crop volume tonnes	Sales value in millions of dollars			
				Domestic 2005-2009	Exports 2009 Fresh	Exports 2009 Processed	
Asparagus	90	570	2,052	10.0	4.1		
Beans	184	724	20,000	12.8		8.0	
Brassicas	260	3,875	82,000	80.3	1.5		
~ Broccoli	150	2,247	18,000				
~ Cabbage	150	768	40,000				
~ Cauliflower	120	860	24,000				
Capsicums	80	56	11,500	29.3	36.1		
Carrots	50	1,150	80,000	30.0	9.8	0.8	
Cucurbits	200	283	1,770				
Garlic	28	268	1,427	6.5	0.6		
Kumara	75	1,264	17,500	33.8			
Lettuce - outdoor	80	1,309		41.8	1.1		
Lettuce - greenhouse	70	22					
Melons	46	259			1.2		
Mushrooms	21	42	8,500	41.1	1.6		
Onions	108	4,657	144,300	25.0	76.3		
Peas	600	10,720	59,000	50.0		85.3	
Potatoes	225	9,787	487,000	516.0	15.9	83.1	
Pumpkin	129	1,066	31,000				
Shallots	10	25			1.2		
Silverbeet/Spinach	94	306	4,000	13.4			
Squash	63	6,601	85,000	2.9	69.3		
Sweetcorn	256	5,800	100,000	10.0	0.1	45.5	
Tomatoes - greenhouse	300	100	40,000	108.0	6.6		
Tomatoes - outdoor	20	757	50,000	5.0		3.6	
Mixed vegetables	Made from combinations of the above crops						37.1
Dried veg. (excl. peas, beans, corn)							8.4
Vegetable preparations							41.4
Vegetable juices							11.9
Other Vegetables		2,609			2.7	10.9	
Total	3,409	52,250			228.1	336.0	

The accompanying graph and table, with figures from the last 10 years, shows the picture. During this time the

CPI has risen 33 per cent, a lot more than the 6.5 per cent that a basket of vegetables has risen.



Biosecurity

Biosecurity weighs heavily on growers' minds. This has been heightened by the recent outbreak of a psyllid and its capacity to spread along with its effects on yields and the quality standards of potatoes, tomatoes and tamarillos. Millions of dollars in yield and spraying costs have been lost and spent, not to mention the insecurity and personal pain it has inflicted on growers.

Growers are very concerned about the proposed introduction of what government has termed Government Industry Agreements whereby, in return for joint decision making on eradication and containment, the industry also shares the costs. In the case of smaller crops especially, an outbreak with an agreement in place, has the capacity to bankrupt the sector. We have a situation where government has generously put in place the Primary Growth Partnership with millions of dollars, whereas most growers would prefer a beefed up bio-security system.

Water

Water issues dominate a lot of grower concerns. Unlike a pastoral situation, vegetables must have water availability throughout the growing period. If water is restricted the crop withers and fails to meet a quality standard.

For this and other reasons, such as the lower water footprint and high labour input, water for horticultural crops should receive priority. Growers are concerned about the life of their permits and their ability to renew permits to extract water. In time we are bound to see more use of water storage either on farm or in community schemes.

Labour

Leadership and labour supply have dropped down the list a little in a time of economic uncertainty and the increased willingness of New Zealanders to work in horticulture. In addition the Recognised Seasonal Employment Scheme has greatly helped growers with labour intensive crops.

As with many primary sectors, the average age of growers continues to creep up. The challenge is to make the sector sufficiently attractive to young people and make succession planning possible.

Import threats

Vegetable imports threaten the viability of some sectors. In 2009 New Zealand imported frozen vegetables from 37 countries worth \$59 million. Australia, and increasingly China, dominate as source countries and the growth in frozen imports from China over the last five years stands out.

Frozen potatoes come mainly from Australia, whilst China sends a lot of vegetables which end up in mixed vegetable and stir fry packs. Growers are concerned about

the cost structures and quality standards in China especially and also what is termed leakage. This is because neither China or Australia have an emissions trading scheme, so it increases our domestic costs and helps exporting countries to compete with our own grown vegetables.

Not a prosperous time

In conclusion, like most primary sectors we are not enjoying a prosperous period. There are plenty of challenges and some good work is being undertaken to position the sector for a brighter future.

Country of origin labelling is being encouraged by Horticulture New Zealand the Green Party and many businesses and consumer groups. The reasons for it not happening are becoming flimsy and we continue to push for the obvious benefits of country of origin labelling. People are entitled to know where their food is grown.

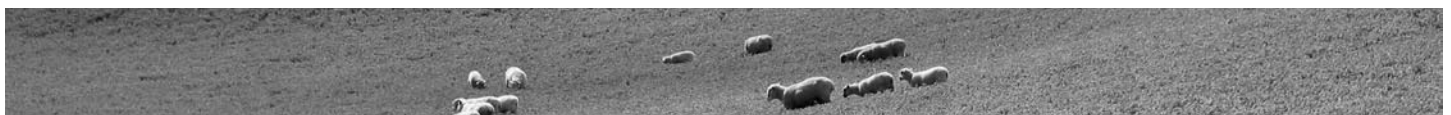
The removal of GST on fruit and vegetables, would in many peoples minds, help consumption. Many New Zealanders almost expect to get their vegetables for rock bottom prices. As much as anything, there is a public assumption that fruit and vegetable prices will always be cheap. The removal of GST would tip the balance more in favour of healthier eating with the obvious health cost savings.

Research on precision farming to increase yields and lower soil compaction is all about using GPS technology to steer in straight lines so that tractors and other wheeled vehicles always stay on the same tracks. The ground in between remains uncompacted, soil quality is much improved, and drainage improves along with irrigation efficiency and root growth. We can expect much more adoption of precision farming in the next few years.

Water rights and allocation is a big issue and getting bigger with climate change and our heightened desire to protect our environment. Successful vegetable growing needs irrigation. Growing vegetables without irrigation is not a sustainable operation.

The cost of energy continues to rise and now we have superimposed the added weight of climate change concerns demanding the world changes the form and the amount of energy consumed. We have to prepare for and adapt to the influences of climate change, pay the Emissions Trading Scheme associated higher energy costs and where possible, explore insurance options.

We need to benchmark the vegetable growing businesses. Vegetable growers do not freely compare business data and ratios as readily as say dairy farmers or sheep and beef farmers. The reasons for this mostly lie in the diversity of the businesses and the fact that many vegetable businesses compete in the domestic market. Often the prices they have negotiated with the supermarket have to remain confidential



Chris Ward

Can we hear the pips squeak?

Not long ago John Key met with pipfruit growers in the Nelson area. He learned about financial strain and the growers took the opportunity to request government help to bring about cohesion in the industry. Growers he met were also quick to point out the single selling advantages in the kiwifruit sector.

Just about any analysis of the pipfruit sector will show that the last 10 years have been a struggle and only general optimism seems to keep growers going. There are other factors such as growing new varieties, that other nations do not have, and which will strengthen the sector.

We have seen a sharp decline over the last 10 years in the number of owner operators from 1,400 to just over 500. Some of the survival has been attributable to orchardists switching to varieties that appeal to the Asian market. Braeburn in Europe is not the selling opportunity it was seven years ago and the variety has been under pressure. Growers who switched to sweeter apples, such as the Pacific series and Fuji, for the Asian market are feeling more confident with justification.

So how have orchardists fared financially over the last 10 years? One analysis is the MAF Orchard Monitoring Programme. Let us just look at Nelson.

If we take the typical Nelson orchard we note that it has grown in size between 2000 and 2010 from 15 to 22 owned hectares and seven leased hectares. The reasons for this are ever eroding margins and the need to spread whatever fixed costs over an increasing production area.

The table below shows the picture per hectare for the three years 2000 to 2002 compared with 2008 to 2010. As can be seen the income, after operating costs, per hectare has dropped.

To maintain relativity with the first period in terms of buying power, it would have needed to increase to \$6,740. Fortunately the last 10 years have been less inflationary than previous periods. It is no surprise that the average size of pipfruit orchards in the monitoring report for Nelson has

	2000 to 2002 average	2008 to 2010 average
Gross revenue per hectare	\$40,261	\$49,679
Operating cost per hectare	\$34,826	\$45,936
Gross revenue less operating cost per hectare	\$5,435	\$4,282
Land and buildings value per hectare	\$58,973	\$102,378

increased from 15 planted hectares in 2000 to 22 planted and an additional seven leased. This is almost a doubling of growing area just to stand still. There have useful capital gains ahead of the consumer price index but not over the last two years, and capital gains do not buy the groceries.

Yet there is still a number of families out there who have small growing areas – nationwide half of all orchardists have less than 12 hectares. Some lease their orchards to bigger operators but many do the work themselves. Despite demands on their time for government and local government compliance, somehow they keep going.

How do they do this? There are number of reasons including working for families top-ups, off orchard employment and not living extravagantly. These people tend to like being their own boss, can work hours that suit them and during the season can and do work 12 hours days, seven days a week. They like the country environment and being outdoors in relatively good weather and they like their local communities. They make a lot of use of family labour and get by with older or shared equipment.

Will owners of small orchards numbers continue to dwindle? Probably they will, but this sort of sociological change takes longer to occur than you would think economic circumstance would force. Now that we are facing decreasing work opportunities, this might further slow the pace of change as other opportunities are not so apparent.

Recently we heard about a new happiness study, which showed that in the United States family incomes up to US\$75,000 resulted in improving happiness. It was suggested that in New Zealand this translates to at least \$100,000. If we look at the amount of 'drawings' for a typical orchard owner in the monitoring reports we see that it was \$28,000 in 2000 and budgeted to be \$42,000 in 2010.

So we all look to the other wonderful attributes that New Zealand provides to add to our happiness. Can John Key help? Well, as they say, what goes around comes around, so I predict the forces for change, meaning fewer stronger marketers, will just keep gathering momentum. Right down to one exporter – stranger things have happened.

David Darcy

The kiwifruit industry – State of the nation

This article was written before the recent outbreak of PSA in kiwifruit in the Bay of Plenty was discovered

Recently in the media there has been a number of calls from other primary industries for the sort of coordination that exists in the kiwifruit industry. Pipfruit growers in Nelson told the Prime Minister that ‘a similar system was needed for apples’. Minister of Agriculture David Carter was reported in October as saying the government is ready to help the meat industry consolidate. So it is timely to look at the kiwifruit industry story so far, its current structure, and future plans.

The background

Currently New Zealand kiwifruit export earnings exceed a billion dollars annually. Zespri, the industry’s marketing company, has announced a target to triple its export earnings by the year 2025. To triple the industry’s billion dollar earnings in 15 years is an ambitious target. However the increase in productive hectares will only be around 18 per cent. For growers this means a significant increase in orchard productivity and changes in the varietal mix.

Past growth and the future aspirations of this industry hinge mainly on one group of people – the growers. New Zealand Kiwifruit Growers Incorporated (NZKGI) is the representative body for New Zealand’s kiwifruit growers. All kiwifruit growers have an opportunity to vote for NZKGI’s members who meet regularly in a forum to consider and address industry issues. Many organisations in the industry have relationships with growers and can claim to represent groups of growers, but NZKGI has the unique position of having a democratic mandate to speak for all growers without having a commercial relationship with any other industry party.

The purpose of this article is to give readers a state of the nation overview of the New Zealand kiwifruit industry. Being written from the grower organisation, the focus is not on the strictly technical and commercial aspects of our industry. The article will focus on the state of the industry from the overall grower perspective. What kiwifruit growers have achieved and what they hope to achieve will be of interest to other primary industry readers.

To understand the state of the nation in terms of kiwifruit, there are several points to understand –

- The kiwifruit story
- Grower investment in the industry

- The single point of entry structure
- Controls on the single point of entry
- Market signals
- Lessons from the current varieties
- The future with new varieties, market opportunities and risks

The kiwifruit story

If you want to build a successful primary produce industry in a relatively short space of time, a study of the New Zealand kiwifruit industry would be a good place to start. This is not to say that the industry is a textbook case – there also are lessons in what not to do. But it is fair to say that overall the kiwifruit story is something growers can be proud of. Current forecasts are for returns for growers than on average are significantly higher than production costs.

It is beyond the scope of this article to do more than sketch an outline of the complicated history of the kiwifruit industry in this country. However, a brief history of the cultivation of kiwifruit vines in this country helps to give some context.

In 1904 the first actinidia seeds were brought into New Zealand. Many different varieties were bred and grown in the early years but it was in the 1920’s that the Hayward variety that is now sold as Zespri Green was first propagated. The Hayward is also grown all around the world by competitor nations. The 1950s saw the first export consignments. The first Hort16A vines were released to growers in 1995 and first exported in 1998 as Zespri Gold.

Phenomenal growth

Just over a century from those first seeds is not a long time, remembering that we are talking about the establishment of a whole new member of the world fruit bowl. The export history is even shorter at 60 years. The latest officially published statistics based on export documentation show the value of kiwifruit exported was \$1.07 billion for the year ended June 2009. To exceed a billion dollars in export earnings demonstrates phenomenal growth for what is a young commercial crop.

However, looking at a start point and the end point

tells you nothing about the journey. The growth from zero to a billion was definitely not linear. There have been several devastating periods in the industry, particularly where supply increases were not matched by demand and exporter competition contributed to abysmal returns for growers. Many of today's growers lived through the roughest years so these are more than a story to them.

Perhaps because of its relative youth as a commercial crop, within the industry there is a strong awareness of history. Kiwifruit is young enough that many pioneer families are still part of the industry and many prominent players from earlier parts of the story are still involved in the industry. This shared history and awareness of the tough years are part of why the current industry structure is treasured by growers.

Grower investment in the industry

A look at the investment in the industry gives context to why growers value control of their supply chain. A summary of investment in the horticultural industries is compiled by Plant and Food research as part of their *Freshfacts 2009* publication. Kiwifruit growers have by far the greatest investment in the industry and have taken the greatest financial risk. By contrast, the off-farm investments in most of the other fruit categories is on par with the farm investments, apart from wine grapes where the off-farm investment far exceeds the on-farm.

Kiwifruit industry investment

Orchard investment	\$3.9 billion
Gross revenue per hectare	\$40,261
Operating cost per hectare	\$34,826
Gross revenue less operating cost per hectare	\$5,435
Land and buildings value per hectare	\$58,973

Because the bulk of the investment in the industry is on the orchard, growers consider it appropriate that ultimate industry control is retained by the orchardist.

Single point of entry structure

The kiwifruit industry enjoys a regulated structure. It is unusual to use the words enjoy and regulation in the same sentence, but grower support for the structure is overwhelming. A February 2010 survey of 500 randomly selected growers indicated that 90 per cent of growers think that the single point of entry is critical for the future success of their industry.

So what is the single point of entry? The Kiwifruit Export Regulations 1999 created a monopsony – meaning a single buyer or single desk – for kiwifruit export other than to Australia. The industry's single desk marketer is Zespri. There is an opportunity for other exporters to have collaborative marketing export programmes approved. A collaborative marketing programme must be in collaboration with Zespri and proposals must demonstrate an overall wealth increase to New Zealand growers, so simply displacing an existing programme would not be approved. This single desk structure is referred to as the single point of entry.

Kiwifruit industry roles		
Growers	Producers	Grow fruit for export, respond to market signals
NZKGI	Grower representative body	Represents growers interests to industry and others
Kiwifruit New Zealand	Industry regulator	Authorises Zespri to export, approves collaborative marketing programmes, monitors and enforces regulations
Zespri	Marketer/exporter	Sole buyer of fruit for export to markets other than Australia, communicates market signals to growers
Collaborative marketers	Marketer/exporter	Run approved programmes to export fruit in collaboration with Zespri
Post-harvest sector	Managing fruit between the orchard and wharf	Commercial relationship with both growers and Zespri packing and cool-storage of fruit and order fulfilment for export

Controls on the single point of entry

At first glance a single desk model gives unusual power to the marketing body. This is because growers have a reliance on that body for their export returns. If the growers and marketers are independent, there is an opportunity for profits to be driven away from the grower towards the marketer. The kiwifruit industry has tempered with the following features.

- Only growers can buy shares in the marketer – this restricts new investors to growers.
- Shareholders in the marketer can only vote to the extent of their production – this ensures that non-supplying shareholders, such as growers who have sold orchards, have no control. It also ensures that although growers can acquire shareholdings which exceed their proportion of industry production, their control of the marketer is limited to their production.
- A majority of Zespri's directors are grower directors and all are elected by shareholders whose votes are tied to production.
- Of the five Kiwifruit New Zealand's directors, three are elected by growers, one is appointed by the grower organisation, and the independent chairperson is appointed by the other directors
- Zespri's commission is negotiated every three years by

an industry committee that includes elected grower representatives. This is a further check that would prevent the marketer from achieving abnormal profits to the detriment of fruit payments to growers.

- The marketer takes possession of the fruit at the wharf which allows onshore competition right up to the wharf. A very competitive post-harvest sector has developed, meaning that growers' costs are pushed down by competition and there is a commercial incentive for the post-harvest sector to continuously improve their businesses.
- Collaborative marketing opportunities for exporters other than Zespri increase overall grower returns but also provide a benchmark for Zespri's performance.
- The grower organisation exists separately from Zespri and this ensures that growers have an advocate without commercial conflicts.

All of these features of the industry structure work together to help growers retain industry control.

Outside the regulatory functions performed by Kiwifruit New Zealand, many industry decisions are made in consultation with input from Zespri, the growers represented by NZKGI and the post-harvest sector. Almost all industry decisions are in consultation with these three parties. An example of this was Zespri's process to commercialise three new varieties this year, where the whole process was designed in consultation with industry.

This structure works for growers. NZKGI's number one project is to retain the single point of entry, and one of its guiding principles for decision-making is to ensure that the decision maintains or strengthens the single desk. This is a direct result of grower conviction that the single point of entry structure is critical to the future of this industry.

Market signals

Another feature of the structure that has a direct effect on the growers is market signals. Because the off-shore marketing is co-ordinated it means that signals from markets have a single channel to feed back through. What this means is that a specific market signal can be fed back to growers and all growers can aim to grow the most marketable fruit. Zespri is able to feed these market signals back to growers via the payments system. A prime example of this sort of market signal is taste.

There is an accepted relationship between kiwifruit's dry matter content and good taste. The markets pay more for good tasting fruit. Dry matter can be tested. This allows Zespri to make a specific taste payment which incentivises growers to use orchard practices to increase dry matter. The result is growers provide better tasting fruit because there is a clear market signal with a financial incentive attached. This in turn allows Zespri to manage its inventory so that the best tasting fruit goes to markets that are prepared to pay top dollar.

Similar market signals exist for the preferred fruit sizes. Without the co-ordinated approach it is unlikely such clear market signals would exist. Price competition between

multiple exporters would mean that the growers' main price signal would be at the exporter level. This could tend to push the product offering towards commoditisation rather than premium positioning.

Lessons from the current varieties

As mentioned previously, Zespri's goal is to triple export revenue by 2025 with only an 18 per cent increase in productive hectares. This means that grower yields per hectare, varietal mix and markets need to change. More specifically the industry needs to take the lessons from both Hayward and Hort16A and apply them to new varieties and in new markets.

Lessons from Hort16A include –

- High returns result from products that appeal to high paying markets such as Japan
- Being the first gold or yellow on the market gave it a first mover advantage
- The variety has plant variety right protection so Zespri has been able to control plantings and manage the supply
- The variety is higher yielding than green and yield is the main reason for orchard profitability
- Production costs are higher than Hayward green, but more than offset by increased returns.

Lessons from the Hayward variety include –

- The taste appeals to some market segments, particularly in Europe which sells significant volumes
- It stores very well, meaning an extended selling season
- It has a high health benefits, and this is increasingly becoming a selling point
- The lack of plant variety right protection for Hayward means that other countries produce significant volumes, particularly Chile who shares the same selling season. In addition other nations do not have New Zealand's export co-ordination and so damage the green category by over-supply, and low price offering of often poorer quality fruit. This puts pressure on Hayward returns despite New Zealand's high quality.

The future lies in continuing to maximise the returns from the existing varieties, and developing new varieties at least as good as the existing ones.

The future

New varieties

In 2010 Zespri commercialised three new varieties – a hybrid sweeter green, an early maturing gold and a potentially long-storing gold. All these varieties will be plant variety right protected. The company also announced trials of new red varieties. In addition there is a large breeding programme looking for promising varieties.

Although there are many plants in the breeding programme, there is no suggestion that there will be a large number of varieties in the New Zealand portfolio. The aim is to sift the large number of potential varieties into a few very successful offerings.

New varieties will offer opportunities for growers to

move from Hayward if it is low-returning on their orchards. For the industry, new varieties present opportunities to capture new market segments, extend the selling season for existing segments, and increase per hectare returns from higher yielding varieties and better market mix. Other characteristics, such as the new gold's lack of a 'beak' will decrease supply chain costs as the beaks can damage other fruit during picking and storage.

New varieties have a high hurdle to cross. They have to convince growers that they can exceed the returns of Hayward and that they will approach the earnings that the existing Hort16A product offers. Growers take the biggest risk with new cultivars, cutting off an existing income producing vine, and grafting one with market and horticultural risks.

The future markets

The growth opportunities afforded by emerging kiwifruit markets such as the south east Asian market, China and India are significant. These markets also present infrastructure issues for a product that needs cool storage.

More mature markets such as Japan and Europe will offer more restrained growth rates but with opportunities such as extending the sales window for existing customers with early and long storing varieties, and new customers via novel varieties. The existing relationships and infrastructure in these markets makes it easier to test and introduce new offerings to existing customers.

The future risks

Many of the risks that are faced by kiwifruit growers are faced by all primary producers in this country. New Zealand is a high cost producer with significant distance to markets, and issues such as planning constraints and access to resources such as water are likely to get harder. New Zealand producers will never be able to compete on price alone, and this means that success relies on quality products with a strong and disciplined marketing.

Risks specific to kiwifruit in this country include –

- **Biosecurity** An example of this is the vine disease known as Psa/Batteriosi which has had devastating impact on kiwifruit vines in Italy and is present in other countries. Just after this article was written Psa was discovered on a number of orchards in the Bay of Plenty. The industry will treat it as a potential risk until science proves otherwise.

- **New varieties** Many growers have grafted over parts of their orchard to new varieties. While the trial processes are robust, any new variety is capable of presenting unforeseen problems on the orchard or in the market.
- **Category** Low quality offerings from competitor nations can damage the whole kiwifruit category, especially for first-time purchasers.
- **Substitution** Kiwifruit represents a very small proportion of world fruit consumption at around 0.5 per cent. As a premium offering, New Zealand kiwifruit must fight to stay as the smaller players are always more likely to be replaced as opposed to a staple like bananas.
- **Structural** The government has made it clear that while the current regulated industry structure is supported by growers, it will remain. There is a court case in progress challenging the structure, but as detailed earlier growers have no appetite for change.
- **Supply** Some competitor nations are projecting significant volume increases.
- **Customers** As overseas supermarkets consolidate they become more powerful and as buyers this allows them to negotiate hard on price which could put pressure on returns
- **Consumption changes** Indications that younger consumers are eating less fruit, and what they are eating is more convenient fruit such as mandarins and bananas. This is a concern for less convenient products, and means that other aspects of the product must be good enough to make it worthwhile for consumers.

Summary

This article presents a state of the nation view of the kiwifruit industry from the perspective of the grower organisation. The kiwifruit industry has a great number of opportunities ahead. There are also significant challenges ahead as there are for all New Zealand primary industries.

However, the focus of this article has been on one of the kiwifruit industry's most valuable asset, the single point of entry structure. This structure serves growers well and retains profits and control of the industry in the hands of its greatest risk takers and investors – the growers.

David Darcy is a business analyst with New Zealand Kiwifruit Growers Incorporated.



Building capability to transform the New Zealand economy using agriculture

Someone told me recently that corporations in China view Australia as a mine and New Zealand as a farm. This image of New Zealand has emerged from years of perseverance and innovation by our farmers. Agriculture is the main source of our export earnings. The government has recognised this from a new partnership scheme – the primary growth partnership. This article looks at the significance of the scheme in relation to agricultural innovation. A new programme for the dairy industry is used as a case study.

The changing fortunes of agriculture

In the 1960s New Zealand was ranked third in the OECD countries. We had privileged access to UK markets during a period of commodity price booms. By 1984 we were in the doldrums following a series of oil shocks and protectionist policies, with national debt servicing costs rising to 50 per cent of GDP. The Lange Government instituted wide sweeping changes that removed subsidies and radically altered the science system to form Crown Research Institutes.

According to Lange, agriculture was a sunset industry for New Zealand. Free market reforms resulted in a deregulated financial market and the removal of all subsidies to agriculture. If agricultural industries were to survive they would have to prove their competitiveness on the international stage, often against other countries that retained their protectionist policies. Some industries prospered such as dairy and kiwifruit, while others such as wool and pipfruit have contracted. These changes signalled a new era in farming. The challenge to all farming businesses was to increase productivity. Innovative farming practices were an essential ingredient to building resilient businesses.

What do we mean by innovation?

Government attitudes towards agriculture seem to have changed from those of the Lange era. It is no longer considered a sunset industry. The new view is to aim for economic stimulus by public-private partnerships. In one of the most ambitious developments since deregulation the Government launched the primary growth partnership in September 2009. The Ministry of Agriculture and Forestry administer the programme and state in their guidelines to co-investors that the purpose is ‘... to benefit New Zealand through programmes of investments in research and innovation that produce substantial gains in economic growth

and sustainability in the primary and food sectors.’

The intent here is to build on the existing strength of New Zealand agriculture. We have a number of natural advantages such as abundant water resources, but our greatest advantage is our people. Effective partnerships adapt knowledge to create economic gains for the nation. The primary growth partnership guidelines define innovation as ‘the introduction of new methods of production and harvesting, new goods, new qualities of existing goods, development of a new market and development of new raw materials or ingredients derived from the primary sector. It may occur at any point along the value chain.’

Innovation applies something new, it might be a technical widget or a new method, to create value along a supply chain. A partnership approach allows an industry to combine the very best capabilities from across different organisations to achieve change. This was the thinking that underpinned the dairy industry programme, ‘Innovation to transform the dairy value chain’.

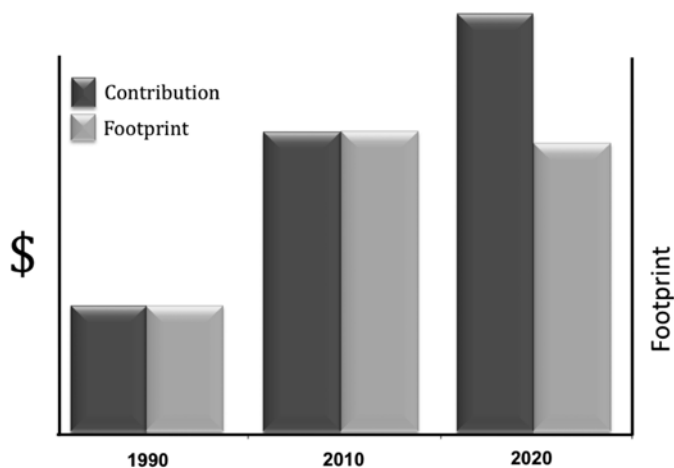
A strategy for the New Zealand dairy industry

The New Zealand dairy industry launched its strategy for dairy farming 2009 to 2020 in May 2009. Five outcomes were specified in the strategy. A competitive industry would build on a backbone of profitable farm businesses that had a strong positive reputation with the public and consumers. These results depended on skilled people and effective partnership with government. A total of 27 targets have been developed to define the results in terms that can be measured.

A systems approach is used in recognising that farm performance is determined by interactions between the physical components of the farm, such as cows and grass, as regulated by the farm management. The strategy for New

Zealand dairy farming provided a launching pad for the industry primary growth partnership programme. A general direction was charted by the strategy, but the programme allowed planning for a level of transformational change wanted by industry, government and the New Zealand public.

New Zealand depends on dairy exports for 25 per cent of its export revenue. To reach this level of contribution to the economy the industry has had to double its production in the past 20 years. The growth has come at a cost in terms of a growing environmental footprint. A combination of higher nutrient loadings, more water demands and greater greenhouse gas emissions can be seen as an expanding footprint. It has now reached the maximum carrying capacity which the New Zealand public will tolerate. Any further increase in production must be achieved within the existing footprint. The situation has created a dilemma for New Zealanders. If we want to enjoy the benefits of economic growth then the industry must continue to increase its export revenues.



Contribution of dairying to the New Zealand Economy

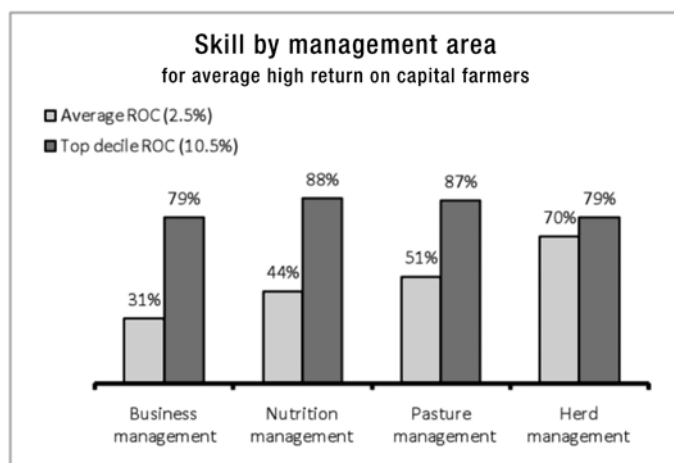
Transformational change will be required if we are going to continue growing export revenue without increasing the environmental footprint. Change of this scale is like the transformation that occurred in the airline industry from the 1960s to the 1970s with the advent of the jumbo jet. Many more people travelled further and faster at a lower cost as a result of technological advances. Under the primary growth partnership, the dairy industry will tackle on-farm change by working with human capability and technical innovation together.

How will we achieve the change?

A Tasmanian extension programme has been analysed which provided dairy farmers with coaching to support better business management decisions. Tasmania maintains a database of economic farm performance containing over a decade of records for individual farm businesses.

A skills audit was conducted across farms taking part in the extension programme. In summary the audit compares

current practice on farms with industry agreed best practice in relation to critical decisions such as animal nutrition or pasture management. Correlating the results of the skills audit with the economic performance of the farm businesses revealed that farm performance varied according to four main decision areas – business management, nutrition management, pasture management and herd management. The average return on capital was 2.5 per cent across farms in the database, with top decile farms returning 10.5 per cent. Comparing the skill levels between average and top decile farm businesses revealed significant differences in business, nutrition and pasture management practices. Top businesses operated close to best practice across all areas of management.



Comparison of management skills from average and top decile farms

Benefits of higher education

This study is particularly revealing in that business management is the lowest rated area for the average performing farms. It is high – equal to herd management expertise – for the top decile farms who are achieving four-times higher return on capital. From this we can assume that business management ability is a defining characteristic of high performing farms. This is also a skill that generally needs formal tertiary education to develop fully.

The Tasmanian study suggested that higher education could make a significant improvement in management skills, resulting in better farm performance. The study estimated a return of approximately A\$50,000 a year, this corresponding to 25 per cent of the performance gap between the average and top-quartile performers. It is reasonable, given the relative components of the performance gap, to suggest that at least A\$15,000 of this opportunity should be attributable to an improvement in business management.

No equivalent study has been undertaken in New Zealand. However the findings suggest that considerable economic gains can be achieved from consistently good practice on farm. This reasoning guided the design of a significant component in the primary growth partnership programme.

Continued on page 28 >>

Farmers and rural entrepreneurship

Ryan Howard, in his paper to the 2009 IFMA Congress 'Investing in the future of the rural community', discusses the role of the Leader programme, an initiative that gives funding to community-led, autonomous local action groups. This article will attempt to identify and illustrate what was happening in a different way in rural New Zealand over a similar time period. So that this can be made meaningful it is important to remind readers of the different social, political and economic contexts of Ireland and New Zealand.

In 1991 Ireland was then a nation that received EU subsidies focused on supporting its ailing rural community. New Zealand on the other hand was restructuring its whole territorial administration and introducing a revolutionary new resource policy in the RMA. All this was under the umbrella of a market-led philosophy of no rural subsidies. So what happened in New Zealand and more particularly the South Island, which the author has studied more intensively?

Rural boom

In a nutshell, rural New Zealand boomed through the 1950s following the Korea War wool boom. Gore, for example, had the highest retail sales per capita for the nation. Southland farmers decided that Wellington decision makers were too busy solving other problems to be concerned about their southern kin, so they decided to build a new port at Bluff, a new freezing works at Lorneville and a new fertiliser company as well. This entire new infrastructure was to ensure that the rapidly changing and expanding Southland agriculture was well serviced.

This was the period when 40 small dairy factories closed and the Lands & Survey Department moved in to develop the Te Anau basin. The focus was more production to satisfy the UK market.

Then in 1972 came a major shock, the UK joined what was then the European Economic Community, Commonwealth trading preferences came to a halt and President Nixon opened up the Russian grain market. The New Zealand dollar was worth more than the US dollar and New Zealand had record overseas reserves. However this was not for long, because the first world oil shock and the Labour government took care of that.

Some brave new young farmer entrepreneurs were stirred into life and were prepared to use their own risk capital and innovative flair to gradually establish the new industries

of venison, deer velvet, kiwifruit and blackcurrants. Similarly new business models appeared in the form of GEMCO and Cattle Services.

At the same time the farmer-owned producer co-operatives were growing in strength and market power. At the farm level, farm improvement clubs were beginning to change into consultancies and MAF was starting to withdraw from traditional extension work. At the macro level, price signals were being distorted by SMPs and other forms of subsidy, causing agriculture to become increasingly uncompetitive internationally.

Boom and bust

In a paper given at IFMA 2005 about farmer entrepreneurship I wrote that: 'the kiwifruit industry exploited a favourable environmental niche, the deer industry was born out of the realisation that a pest could be refocused on profitable production rather than extermination, and the blackcurrant was transferred from the home garden on to a commercial scale. In the main these developments were driven by farmer investors and other associates who were looking for new challenges and who could, with the help of taxation concessions, take the financial risks involved without jeopardising their core business. It is important to note that all these industries had to survive a period of boom and bust before they consolidated back to a stable production base operating successfully in an open economy and a globalised world.'

The big bust came in the 1984 to 1986 period when a new government restructured the economy by devaluing and subsequently floating the currency, removing subsidies and rewriting the agricultural balance sheet with the Rural Bank Discounting Scheme. Farmers marched in the streets in protest, rural communities lost many services, young women fled to urban jobs and the rural remainder concentrated on survival. Agriculture was shocked into the realisation that

it need to stand on its own feet and to clearly identify its sources of competitive advantage. Rural communities were forced to change to adapt to the new economic signals, the restructuring of territorial authorities and the introduction of the RMA.

Focussing on the market

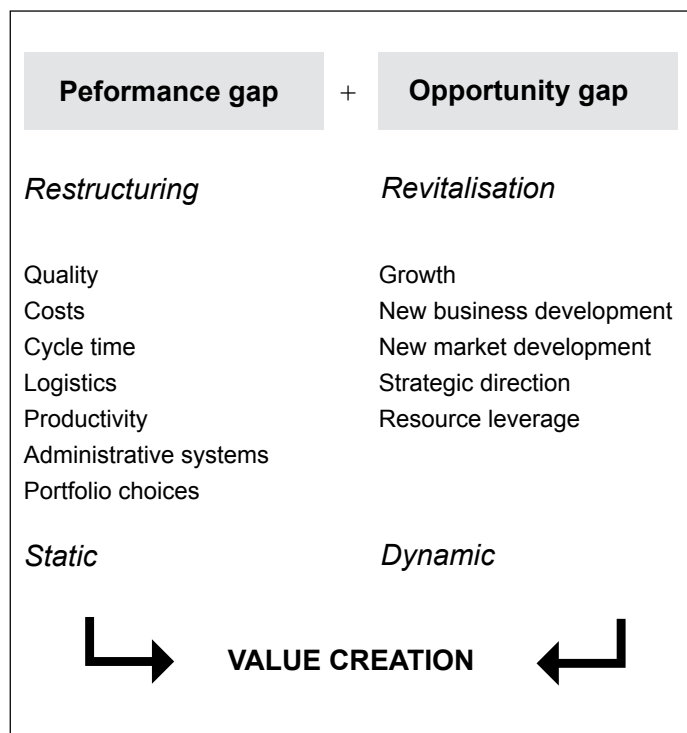
Traditionally New Zealand farmers and agribusiness firms had concentrated on efficiency and least cost strategies to beat their competitors overseas. Now the brave and innovative started to think of using product differentiation as a mechanism for creating value in the new environment, even if it meant some creative destruction. It meant a change from being production oriented to being market focused.

As agribusiness firms consolidated and supply chains shortened, and as the commercial environment became less restrictive, farmers collectively and individually realised that establishing new supply chains and retaining ownership further down the chain could bring increased rewards. It also meant a move from commodity markets to niche ones, and a move from adversarial relationships to relationship management. All this was with little or no assistance from government in any shape or form.

The changes

The diagram below is an approach to conceptualising the change in some farmer thinking in New Zealand. Generally farmers and others in New Zealand have responded to economic stress by focusing on the performance gap by restructuring in a static context. The entrepreneurial farmers on the other hand responded more dynamically to revitalise their operations, to think laterally and to exploit the opportunity gap.

In his masters thesis studying sheep and beef farmer



entrepreneurs, Giera concluded that the circumstances likely to encourage entrepreneurship in New Zealand farmers were –

- Achievement of most farm production goals
- Facing increasingly poor returns
- Seeking new challenges
- Frustration with the current system for selling and rewarding products
- Awareness of opportunities for competitive advantage
- Resources to withstand a transition period of uncertain income
- Having the confidence to manage a new non-traditional business.

He concluded that these farmers have looked at their current farm situation and actively looked for alternative measures to improve it. The farmers were not bound by convention or image, but perceived change as exciting and often necessary to enhance their farm business. The major change the entrepreneurial farmers have made is that they have gained more control over the price they receive by increasing the scope of their position on the value chain.

Opportunity gaps

So what are the examples of farmer based entrepreneurship, the creators and exploiters of opportunity gaps. Wallis, Elworthy and Pinney kick-started deer farming, Aclands marketed Richey ear tags and Wilding began producing sheepskin car seats. Cattle Services, which became Fortex and then pioneered a number of innovations including shift work in the meat industry, use of new technology, marketing contracts based on product specification with overseas clients and supply contracts with farmers.

Atkins Ranch exploited the Captek bag technology, stable product pricing and good relationship management to capture a specialist market in the San Francisco basin. Cellars of Canterbury used some trading input to establish a hard network between five local Christchurch winegrowers to form a separate business whilst maintaining their individual enterprises.

Motivation

All of these examples involve the development of appropriate organisational structures and the need for excellent relationship management both internally and externally. Gourmet Potatoes, a group of Kakanui growers, created and launched their black box Jersey Bennies into our major supermarket chain. Murrellen Pork of Sheffield developed and launched an innovative pork supply chain that marketed New Zealand's first quality assured pork.

Others turned their attention to fibre rather than food, which led to the emergence of Merino NZ, Icebreaker, Donna Lambert and Untouched World, among others. The list continues to grow, diversify and become more community based, the new indoor ice centre at Naseby being a good example. As time has passed and district and regional councils have grown into their roles, so has their support for rural initiatives, but it is clear that motivated

individuals have continued to be the prime catalysts of entrepreneurial action.

When contemplating the canvas of rural entrepreneurship in New Zealand and especially the development of new supply and value chains, consideration has to be the importance and role of the chain captain. In most of the examples quoted above, the entrepreneurs who established the chains have remained as the chain captains. Not only have they retained a clear vision of objectives but they have demonstrated the required ability in relationship management to ensure continuity.

In some circumstances where the business has grown to substantial proportions, the role of chain captain has become a professional one and the personnel changed. At the same time the chain architecture may also have been significantly modified. Suffice to say one model does not fit all cases and the ability to adapt and modify is a key factor in successful growth.

Ireland is not New Zealand

This author would argue that the New Zealand and Irish experiences are different, not necessarily in terms of results

<< Farmers and rural entrepreneurs – continued from page 25

The dairy industry programme addresses the whole value chain, supporting on-farm innovation and enhancing off-farm outputs. Dairy partnership funding totals \$170 million over the seven years of the programme, with partnership funding of \$84.6 million. DairyNZ is contributing \$29 million and Fonterra \$47 million. A further \$9 million is being contributed by the other industry partners – Synlait, Landcorp, LIC, Young Farmers, Agricultural Services Limited and Zespri.

More research and staff

Approximately 60 per cent of the programme is focused on pre-farm gate activities, including new research and training to boost on-farm productivity and sustainability. Research will boost on-farm productivity and reduce the environmental footprint of dairying. It includes the use of new genomic tools to identify genes that boost production, while reducing emissions and waste. The main genetic markers for fertility, lameness and mastitis will also be targeted.

Field staff numbers at DairyNZ will increase, with 17 new positions to support farmers with nutrient management planning, effluent, animal husbandry and whole farm planning. The partnership will boost the level of professionalism across the industry from new training programmes at Massey and Lincoln Universities and through AgITO training providers.

Post-farm gate research focuses on human nutrition, food structure and supply chain processes. A main priority is to understand food structures which lead to the design of new foods that meet future consumer requirements.

but rather differences of route. New Zealand has seen a flowering of individual and group rural entrepreneurial activity devoid of governmental support. Ireland has had extensive governmental and especially NGO support and help from programmes like the Leader approach and SECAD.

I am given to understand that there are something like 1200 NGOs involved in rural development in the EU, very different from here. In more recent times the growth of tourism has led to a broadening of the range of rural based entrepreneurial activities, mostly land based but not necessarily farmer inspired or initiated.

Ski fields at Cardrona and Mt Lyford were farmer initiated, while others like Hanmer Pools, Naseby Indoor Curling, Lawrence internet and the Central Otago Rail Trail are much more community efforts. Perhaps we are moving closer to the Irish EU model as territorial authorities mature in their vision and cease being distracted by things environmental. It remains a moot point as to the correct role for territorial bureaucracy in rural community development in New Zealand.

There will be a significant increase in staffing numbers in industry and partner research organisations for the post farm gate research programme, including three new professorial appointments.

A new era

The primary growth partnership programme for the dairy industry is a positive response to the highly volatile operating environment for dairy businesses. Partnerships between our leading research and education organisations will develop capability, while breakthroughs are looked for in areas such as genetic improvement. Collaboration across the value chain will increase the speed for innovations to affect markets and farmer returns. A unifying industry strategy ensures all organisations play their part in a larger plan that will monitor progress against targets.

If organisations work effectively together it will enable New Zealand to build a new level of social capital for other rural industries. This capital can then be used as a renewed capacity to innovate, by new research or higher education. Smart farmers, supported by a highly coordinated research and extension sector, will be the new backbone of the nation.

Mark Paine is Strategy & Investment Leader (People & Business) for DairyNZ

A full list of references used in the researching and writing of this article is available from the editor of Primary Industry Management or directly from the author.

Sarah McLaren

Life cycle management – A new way of doing business

The case for New Zealand companies to integrate sustainability into their management systems and strategic decision-making has been made for a long time. It is well recognised that the clean and green image of New Zealand, integrally linked with the pure tourism branding by Tourism New Zealand, provides a point of differentiation in our export markets. Much of this differentiation occurs by association with images of typical New Zealand landscapes, and the unpolluted environment in which our export products are produced.

For some time now there have been warning signs that New Zealand companies cannot expect this added value as a right. Companies must be able to demonstrate their environmental credentials and wider commitment to the sustainability agenda.

Keeping the image pure

Recently KPMG interviewed a number of New Zealand's leaders in the agribusiness sector, and published an agribusiness agenda which summarises the analysis of the most critical issues facing the sector in the short to medium term. It states that 'an overriding objective for the agribusiness sector must be ensuring that actions and behaviours are consistent with New Zealand's golden goose, our clean, green pure image in the global market place'.

It is tempting to think that actions to demonstrate environmental credentials are a drain on a company's resources and are not worth the effort. Opinions vary on whether this is the case or not. However the KPMG report notes that, in their view, the ability to demonstrate adoption of a sustainable business model to a verifiable standard will become a minimum requirement to be invited to the negotiating table with the leading retailers and food processors.

Proof is needed

So what is a sustainable business model? How do New Zealand companies go about improving and demonstrating their environmental and wider sustainability credentials? This article outlines an approach which is oriented towards a company products and services – the approach is called life cycle management.

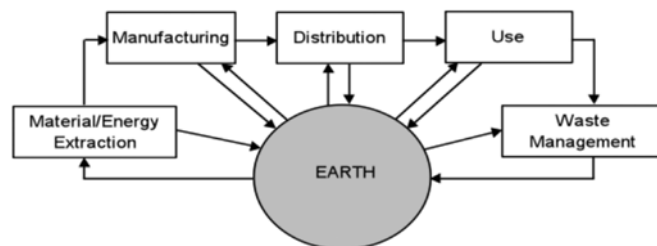
It complements the organisational based environmental

management systems supported by programmes such as Enviro-Mark NZ and guided by standards such as ISO 14001. However, by focusing on products, it addresses the fact that our export markets are increasingly requiring proof of environmental sustainability all the way along supply chains – from cradle to grave.

Life cycle thinking

The concept of life cycle thinking underlies the approach used in life cycle management, as shown in the diagram. Starting with a product such as an apple, a merino jumper or a pack of dried milk, the whole supply chain can be modelled back through the retail, distribution and agricultural production stages. It can even look back to production of the fertilisers and pesticides used in agricultural production.

In addition it can also be modelled downstream through transport from the retailer to the home, storage at home, use by the consumer and final end-of-life management of the packaging and any other waste. In contrast, as noted above, the traditional approach to environmental management has a focus on site or organisation. For example, a cool store may focus on energy use and refrigerant losses associated with its own operations, and a dairy processor may concentrate on energy efficiency and waste minimisation in its operations.



The concept of life cycle thinking

Not always obvious

There are two main reasons for taking this life cycle perspective. One is that it enables identification of activities in the life cycle of a product associated with the greatest effects and therefore gives priorities for improvement. The second is that it enables comparison of alternative systems that have the same service and compares alternative improvement options. Understanding these hotspots, and the trade-offs between alternative production processes, means that ideas can be stimulated from a life cycle perspective for creative redesign of existing product systems or development of new products.

Sometimes it is not always obvious where the hotspots occur in the life cycle of a product. For example, some of the early media articles on the food miles debate assumed that the greatest environmental effects of products, particularly food, are associated with the distance travelled between the point of production and point of consumption.

This was subsequently shown to be true for some products, and some types of environmental effects, but not for others. In such cases, an environmental management tool called life cycle assessment is used to undertake a quantitative analysis of the environmental effects along the supply chain. This goes all the way from extraction of raw materials, refining and manufacturing, distribution, retailing, use and on to end-of-life management. The life cycle assessment identifies the hotspots in the life cycle of a product, such as the relative importance – or not – of transportation. It can be used to support subsequent decision-making with respect to product system innovation as outlined above, criteria to be used in certification systems such as labelling programmes, and policy development for more sustainable consumption and production systems.

Life cycle management

Organisations that are interested in using life cycle thinking may implement a life cycle management programme. Life cycle management is an integrated framework of concepts, techniques and procedures to address environmental, economic, technological and social aspects of products and services from a life cycle perspective. The aim of life cycle management is to make life cycle thinking operational for organisations and give continuous improvement along the product value chain.

It usually consists of three overlapping phases. First is to understand the life cycle issues associated with the organisation's products. Second is to define a life cycle management strategy and prioritise actions, and third is to implement life cycle management projects.

Implementation of life cycle thinking

A life cycle approach is increasingly used by companies around the world. Below are three examples of life cycle-based initiatives from some of the world's largest companies.

Wal-Mart

Wal-Mart is the world's largest retailer, and overall the largest company in the world. In July 2009 it announced a new initiative, the sustainable product index. It began a process of sending questionnaires to its 10,000 suppliers asking them about their greenhouse gas emissions, waste generation and water use, use of certification systems and sustainability purchasing guidelines, as well as commitment to responsible and ethical production. Wal-Mart's plan is to support development of a simple sustainability product rating index for consumers based on a life cycle approach.

Tesco

In January 2007, Sir Terry Leahy, Chief Executive of Tesco, the fourth largest retailer by revenue in the world, announced a raft of environmental initiatives. It signalled Tesco's commitment to leading a consumer revolution in green consumption.

One of these initiatives was to work towards labelling all its products with a carbon footprint label based on measurement along the life cycle of products from production, to consumption. To date, it has assessed more than 500 of its products, has labels on 120, and aims to label all 70,000 of its own brand products.

Unilever

As one of the world's leading consumer goods companies, Unilever has undertaken life cycle assessment studies for many years to inform its product design processes and strategic decision-making. Its environmental policy states its commitment to 'evaluate our environmental impacts at every stage, from sourcing of raw materials for our products all the way through to when our consumers use and dispose of them.'

Their website notes that that sourcing of agricultural and chemical raw materials can incur greenhouse gas emissions that are ten times the emissions associated with Unilever's own operations. They note that greenhouse gas emissions during consumer use and disposal of Unilever products can be up to 60 times those of Unilever's own operations. Unilever recently teamed up with the Coca Cola Company to produce a guide for small and medium sized companies on implementing life cycle management with a specific focus on greenhouse gas emissions.

These initiatives illustrate that a number of companies around the world are taking a greater interest in the environmental and wider sustainability effects associated with activities in their supply chains both upstream and downstream of their own operations. Currently much of this interest is being seen in research and information collection projects. However, there is also evidence that this type of thinking is being included in strategic decision making by these companies. What may currently be regarded as voluntary requests to suppliers are likely to change into real market barriers, or opportunities.

New Zealand activities

Around five years ago the New Zealand government and food exporters had to reactively respond to the risks associated with popularisation of the food miles concept. Since that time, industry and government have been working to support businesses in preparing for the rapidly changing sustainability agenda in overseas markets.

Four recent initiatives support this work the Greenhouse Gas Footprinting Strategy, Life Cycle Association of New Zealand, the Life Cycle Management Project, and the New Zealand Life Cycle Management Centre.

New Zealand Greenhouse Gas Footprinting Strategy

This strategy for the land based primary sectors is an initiative developed, at the end of 2007, by the Ministry of Agriculture and Forestry in partnership with the primary sector. To date, 13 carbon footprint studies have been undertaken on primary agricultural sector products and reduction options have been identified. In addition, an international review group on life cycle assessment has been convened to provide expert input from New Zealand into the development of international standards through the International Organisation for Standardisation. This group is currently involved in development of draft standards on carbon footprinting and water footprinting.

Life Cycle Association of New Zealand

The Life Cycle Association of New Zealand was established in June 2009 as a professional association providing a focal point for life cycle assessment and management work conducted in New Zealand. It currently has 21 corporate members and 40 individual members. In March 2010 it co-hosted the first New Zealand life cycle assessment and footprinting conference with the New Zealand Life Cycle Management Centre. This was attended by more than 80 people, and included 24 presentations and 15 posters on life cycle assessment and management.

Life Cycle Management Project

The life cycle management project is managed by Landcare Research, and has been supported by Business New Zealand, the Ministry of Economic Development, the Ministry for the Environment and New Zealand Trade and Enterprise. Over the last two years Landcare Research has worked with six manufacturing companies to integrate life cycle thinking into their operations, management and strategic decision-making systems. A training programme in life cycle management has been developed to support implementation in companies.

New Zealand Life Cycle Management Centre

The Ministry of Agriculture and Forestry awarded a substantial grant to Massey University in June 2009 to set up the New Zealand Life Cycle Management Centre. This is a partnership between Massey University and four Crown Research Institutes – AgResearch, Landcare Research, Plant

& Food Research and Scion Research.

Its focus is to build capability and awareness, and facilitate implementation in New Zealand, of life cycle management and assessment. Already a postgraduate paper in life cycle assessment is being offered at Massey university, and professional short courses will shortly be available in methodology, use of software and interpretation of life cycle assessment studies.

Environmental integrity

In 1999, Klaus Toepfer, Executive Director of the United Nations Environment Programme, commented that it was becoming more and more evident that consumers are increasingly interested in the world that lies behind the product they buy. Consumer surveys provide conflicting views with respect to the accuracy of this statement. In a sense this is irrelevant because it is the retailers who are now increasingly acting as the gatekeepers for guaranteeing the environmental integrity of products on their shelves.

They are using questionnaires to find out about the environmental practices of their suppliers, and working in partnership with selected suppliers to implement environmental management along the supply chains using a life cycle perspective. Third party certification and labelling of products are increasingly being used to support environmental claims. International standards exist and are being developed towards standardisation in environmental measurement and reporting using life cycle assessment and related footprinting techniques. All these activities mean that companies that do not keep up with this agenda may find themselves marginalised.

Mike Barry, Head of Sustainable Business at Marks & Spencer in the UK, made the point in a recent interview with Rod Oram, that it is important to be ahead of the game as regards sustainability, but not to be too far ahead. There are risks of alienation from the marketplace as nobody understands your business model. He also commented that New Zealand companies are pushing at an open door with respect to differentiating themselves in the marketplace using their environmental credentials.

Innovation in pursuit of a sustainable business model requires some lateral thinking, some risk-taking, and a long term commitment because it takes time to understand and integrate life cycle thinking into company practices. However, this may be a small price to pay for staying in the marketplace of the future and continuing to build a New Zealand economy that means prosperity for all.

Sarah McLaren is Director of the New Zealand Life Cycle Management Centre, and Associate Professor at the Institute for Food, Nutrition and Human Health, Massey University.

A full list of references used in the researching and writing of this article is available from the editor of Primary Industry Management or directly from the author.

Succession planning in farm consultancy and valuation practices

Farm management consultants and registered rural valuers have a lot in common. For example, they have a similar and aging client base – the average age of farmers in New Zealand is in the late 50s. Similarly, both the farm management consultants and rural valuers professions are aging. There is a general lack of young blood going back into family farms because families have encouraged their children to get a qualification and work in professions away from the farm. Again, this is similar to farm management and rural valuation practices, where there is a general lack of young people entering the professions.

The conclusion can only be that, just as farm succession planning is a key issue for many New Zealand farming families, it should be given the same priority with our consultancy practices. Farm management consultants and rural valuers are all generally very busy people but like our clients, I believe that we need to think more creatively about our own business succession planning and valuation methods for our practices.

The big questions we need to answer are –

- How we are going to exit our practices?
- How we are going to value them?
- How can we make them attractive to new blood
- Are our businesses so personal to ourselves that we should simply focus on maximising profit each year and just shut the doors when we retire?

Business valuation

This writer is aware of one farm consultancy business sold in Canterbury several years ago by the owner operator, with a client list of approximately 200. This business sold for \$25,000 good will.

In Southland a long standing farm consultancy business sold to a well managed, New Zealand-wide consultancy group that was aiming to expand their national coverage. The goodwill paid is not known. As a result the lack of open, recent comparable sales is a problem in establishing valuation methods for private farm management practices.

New graduate career paths

Years ago the various government departments, banks and fertiliser companies were the major training organisations for new agricultural graduates from Lincoln or Massey. A typical

career path was four to five years experience in one or more of the above, followed by a decision to either –

- Make a career out of that employment path
- Do the big OE before settling down
- Go back to university for higher education
- Go home to the family farm
- Look for employment with an established private group of farm consultants.

With the demise of the MAF consultancy service and many other government departments, this career path diminished significantly from the early 1990s and with it many of the career opportunities for new agricultural graduates. Many private practitioners have had mixed blessings from employing new graduates. This is especially so in valuation work where the new graduate works under a Registered Valuer for a period of years until becoming registered themselves.

Reluctant employers

A common reaction from many such employers is that they have invested considerable time, energy, greater litigation risk and capital in training these new graduates but as soon as they become registered they move on. This moving on could be to travel overseas, change career path, or look for further education, but could also be to take clients and set up in competition with their trainers. Therefore we see a general reluctance to take on new graduates and instead target and head hunt keen staff from banks and other employers.

Our challenge is to find new methods of attracting and retaining these motivated and innovative new graduates into our private farm management consultancy and rural valuation practices. One option is to look for new graduates with the attributes best needed for our particular client base

and find innovative ways to attract them into becoming part owners of the business.

This provides a business opportunity, leading towards eventual part or full ownership for them, and ensuring medium to long term commitment to the business by the new graduates for the current owners who provide the opportunity and the training. We can also learn from the employment paths offered by other professions such as solicitors and accountants.

Valuation of professional practices

Valuation can be by using comparable sales, as in the examples above, of other practices or by using a goodwill calculation method. Before we do this we need to make some assumptions. Long standing farm management practices tend to be very personal relationships with their clients, with high client loyalty and a preference to want to work with the name rather than a new junior advisor

The new generation of potential farm consultants and valuers appear to have different work values and longevity in any particular work endeavour. Therefore how can we meet both these different generational aspirations and have a thriving, motivated, growing rural profession?

Working example

For this example I will use 60 per cent rural valuation and 35 per cent farm management consultancy. The average business targets after two years training are 2,200 hours to be worked each year.

The target for chargeable hours is 1,425 hours with an average hourly rate target of \$150 per hour. For a working year there is a target of 48 weeks at 46 hours a week total, averaging 30 chargeable hours per week.

Work area	Target hours percentage	Total hours a year	Average hourly rate	Total
Farm supervision	5	110	\$150	\$16,500
General farm consultancy	30	390	\$135	\$52,650
Rural valuations	60	925	\$170	\$157,250
Sub total chargeable hours	95	1425		\$226,400
Estimated disbursement recoveries				\$23,600
Administration, marketing and training	5	110	Nil	Nil
Totals	100	1465		\$250,000

Goodwill valuation

The value of goodwill is the present worth of future profits likely to accrue to the business after servicing the capital involved. Factors affecting the value of that goodwill are –

- Probable transferability of client goodwill and numbers to the new purchasers
- Historic amount of super profit the business
- Length of time these will continue under the new owners.

The most transitory part of the calculation is how much personal regard the current business owners have. The most tangible and lasting would be any specific restrictive licensing of the business, which is rare in the businesses in question.

Methods of goodwill valuation generally look at surplus profits and business sales then subtract the assets. The following example is an idea of how it can work.

The business has a gross revenue of \$250,000 and direct operating costs of \$100,000 which leaves an effective business surplus of \$150,000 before tax. If wages are \$100,000 the net business profit is \$50,000. The interest on capital is \$11,200 which is 8 per cent of \$140,000, so the 'super-profit' can be worked out at \$38,800.

The goodwill factor in this example is worked out as being 3.5 times the super-profit which comes to just under \$140,000. There are wide variations on the goodwill factor to use. This can range from 1.5 to 12 times this annual figure and it comes down to negotiation skills and the motivation of the seller and buyer.

You also need to consider what else is happening in the business location. For example are other similar businesses growing or shrinking and what is the age of your competitors. You could also agree to a restraint of trade for a fixed period or perhaps reduce work hours as a consultant for two or three years to ease client transition.

Conclusions

Comparable sales is the most accurate method of goodwill calculation but there is no one simple formula. The opportunity for ownership participation for new graduates can be a very attractive and sustainable option for everyone involved. We must innovate if we are to grow our professions and services to our rural clients

The above examples should be used as a guide to stimulate thought-provoking discussion on this topic. Good professional advice is essential for any practitioner considering their own future. Succession planning requires planning several years before the event. Every case will be different and these examples are intended to for discussion and are not a guaranteed formula for all cases.

David Montgomery is a Registered Farm Management Consultant and a Registered Valuer.



Clover rhizobia inoculation – a job well done

For more than 40 years, inoculating clover seed with live rhizobia before sowing has been standard practice in New Zealand pastoral farming. Today, clover rhizobia are so well established in New Zealand soils that in over 95 per cent of situations inoculation is no longer required. Inoculated seed is still recommended as an insurance policy in certain, highly specific circumstances. Seed coating remains a valuable technology to help ensure good clover establishment from pest and disease protection and increased availability of key nutrients.

This article has its origins in a review of more than 70 scientific papers on clover rhizobia research, dating back to 1940, and covering the history of development, commercialisation and use of clover seed inoculation in New Zealand agriculture. The review was undertaken in the first half of 2010, at the request of NZ Agriseeds, which was looking for scientific confirmation of the continued necessity of inoculating clover seed with live rhizobia.

Microscopic hitchhikers – a happy accident

The first clover rhizobia are presumed to have arrived in New Zealand with early European settlers. They would have been introduced accidentally as contaminants in soil and dust on plants, agricultural equipment, seed and stock hooves.

These microscopic bacteria enable clover to fix atmospheric nitrogen into a form which is available to a plant by the formation of nodules on clover roots. The natural transformation of one form of nitrogen to another, at no cost, is a cornerstone of New Zealand's internationally competitive pastoral agriculture industry. Without this, dry matter production from our predominant white clover based pastures would suffer.

Since the days of European settlement, rhizobia have spread widely throughout the country by similar means to their initial dispersal, and as windblown dust as well. They are now widespread in the soils, sometimes beyond the range of their host clover plants, although they are still absent from some areas.

Once established, rhizobia can survive in the absence of clover as long as soil conditions, particularly soil pH, are suitable. Resident populations in New Zealand pastoral soils can be up to three million in a single teaspoon of soil. They comprise a variety of different strains, some of which are at least as good as, if not better, at fixing nitrogen with

white clover than the selected rhizobia we use to inoculate seed today.

Why inoculate seed in the first place?

In early years the natural spread of clover rhizobia in soils accompanied pastoral development, and allowed nodulation of sown clover without the need to introduce rhizobia by seed inoculation. However, with the advent of large scale land clearing and development in the 1950s, particularly on acid soils cleared out of scrub, areas were identified where clovers failed to nodulate because of low, scattered populations of resident rhizobia. Lack of rhizobia was also identified as a problem with large scale aerial oversowing of tussock grasslands. To overcome this, clover seed needed to be inoculated with rhizobia before sowing.

Farmers could and did inoculate their own clover seed simply by mixing cultures of rhizobia with seed. However, on-farm inoculation was difficult, and not always practical.

Recognition of the importance of rhizobia to continued agricultural development led to both government research organisations and commercial seed companies becoming involved. They identified viable factory-scale methods of inoculating clover seed with live rhizobia and protected that inoculant once it was applied, in a seed coating.

Technical challenges

Inoculation of white clover has always been recognised as difficult. Once they are applied to the seed, rhizobia can die very quickly, particularly by desiccation during the first few hours on the seed. After this first rapid death of some rhizobia, there is a continual slow decline. Death rate is also affected by temperature.

Early clover seed coating used a mixture of lime and adhesives to protect the rhizobia once it was inoculated on to the seed. Lime coating of inoculated seed was developed

in Australia to reduce the amount of lime fertiliser required for nodulation and establishment of clover. It was also found to enhance the survival of inoculated rhizobia on the clover seed.

The first commercial seed coatings in New Zealand were of low quality because of poor commercial inoculants, ineffective adhesives and poor coating materials. Commercial coated seed had very low numbers of rhizobia. Although it performed satisfactorily when sown into cultivated soils, results from oversowing were so poor that farmers were advised to inoculate their own seed just before sowing to avoid nodulation failure.

Improved effectiveness

During the 1960s and 1970s, considerable research and development was applied to improving the effectiveness of inoculation, including identification of more suitable adhesives and strains of rhizobia better adapted for survival. As a result of laboratory and field trials in the 1970s, the government set up a voluntary testing service and certification scheme to ensure the quality of commercially inoculated and coated clover seed. This set a minimum standard of at least 300 viable rhizobia per seed after storage at 20°C for 28 days after manufacture.

Following these improvements in technology and quality, commercially inoculated and coated seed became an important component of the extensive land development that occurred. However, survival of rhizobia on the seed remains a problem and numbers at sowing are often less than 100 per seed under the storage periods experienced through the rural distribution chain and on farms prior to sowing.

No research or testing on rhizobia survival has been published in New Zealand since the 1970s. However Australian results published in 1975 demonstrate the difficulty of maintaining sufficient numbers of rhizobia on white clover seed under practical farming conditions. The majority of commercially coated samples collected from seed retailers for the study had low rhizobia populations. A total of 66 per cent had less than 250 rhizobia per seed, and half the samples had less than 100 rhizobia per seed.

Better nitrogen fixing ability?

It has been suggested that inoculated coated clover seed may improve clover growth by introducing more effective rhizobia. A review of the scientific literature suggests that any significant response from this is unlikely.

Resident populations of rhizobia in New Zealand soils are high, up to a million per gram of soil. Within each soil there are a wide range of individual rhizobia strains varying in the amount of nitrogen they can fix, from those that fix little to those that fix as much or more nitrogen than the inoculant strains.

Numbers of rhizobia on commercially inoculated and coated seed are probably in the low hundreds or less per seed. Results from trials here and overseas show that at these rates the inoculant strains form such a small portion of nodules

they will have little or no effect on clover growth. Even if a process was developed to supply higher populations of rhizobia on coated seed at sowing, perhaps over 1000 per seed, it is unlikely that consistent significant increases in clover growth would be achieved because of the complexity of the nodulation process.

Where inoculation is needed

Although clover rhizobia have spread throughout most New Zealand soils there are some areas they have not fully colonised. In these situations rhizobia may well be present in sufficient numbers, but it is prudent to err on the side of caution and recommend the use of inoculated clover seed in certain situations.

One of these is on undeveloped tussock grasslands with no evidence of resident clover. Although soil in much of the tussock grasslands now contains clover rhizobia as a result of natural spread, there are still areas devoid of rhizobia. In addition, even where rhizobia are present their distribution may be patchy.

Another situation where the use of inoculated clover seed is recommended is virgin pastoral land cleared directly from scrub. This is a precautionary recommendation, as little survey work has been done since the 1980s. Rhizobia may be absent or present in low, scattered populations, particularly if soil pH is low.

The third area where rhizobia are needed is on paddocks cropped continuously for maize for 10 years or more. This is a precautionary recommendation following a clover establishment failure attributed to the absence of rhizobia in a paddock that had been in continuous maize for 13 years. A later survey of paddocks continually in maize detected rhizobia in all paddocks sampled, even after 32 years in maize, although numbers were sometimes low.

Other benefits of seed coating

Although the recommendation for use of inoculated coated clover seed cannot be justified for pasture renewal, the lime coating can provide a localised increase in pH. This will enhance nodulation when clover is oversown on to low pH soils where it is not economical to apply broadcast lime.

There is also considerable evidence to support the use of seed coating for other reasons. One is to enhance seedling growth by targeted application of nutrients to the germinating seedling, such as molybdenum, the other is protecting seedlings from pest or fungal damage by using insecticide and fungicide.

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David Chapman

Australian dairy farming systems

Adapting to large changes

In 2001/2002, total milk production of the Australian dairy industry peaked at around 11.2 billion kilos after growing steadily from around 6.2 billion kilos in 1989/90. In 2001/02, the Australian and New Zealand dairy industries were about the same size in terms of total volume of milk produced. Australian milk production subsequently fell to just over nine billion kilos in 2008/09, while milk production in New Zealand surged ahead to over 14 billion kilos. What happened to the Australian industry in this time, and where does it go from here?

Structural changes for dairy production

To understand why the Australian industry has contracted since this year 2000, we need to go back further in time to review structural developments in the industry. Milk is produced in all of the Australian states. In 1989/90 the percentages of national production was –

- Victoria about 60 per cent
- Tasmania six per cent
- New South Wales 14 per cent
- Queensland 10 per cent
- South Australia six per cent
- Western Australia four per cent.

In all except Victoria and Tasmania, the majority of milk produced is consumed in the domestic market as drinking milk, yoghurt and other fresh dairy products. Until 2000, milk production in these states was supported by various arrangements of pricing and quotas. The net effect was that milk producers received higher farm gate prices than their counterparts in Victoria and Tasmania, where less than 10 per cent of milk was used in the domestic market.

Production growth

Through the 1990s milk production grew in all states, fuelled by higher inputs, particularly feed when the 1990s marked the advent of grain concentrate feeding as a standard management practice across the Australian industry. Extra milk production went almost entirely into manufactured products, so that by 2000, nearly 60 per cent of all of the milk produced in Australia went to export markets, up from about 40 per cent a decade earlier. In the background, the number of dairy farms steadily declined, as it did in New Zealand, from 15,396 in 1989/90 to 11,839 in 2000/01.

This growth in production was not accompanied by

increased operating profits, and the real asset value of dairy farms in Australia hardly changed either. Taken together, these factors meant that the return on assets including capital appreciation fell steadily from about nine per cent in 1993 to zero in 2000. In New Zealand real return on assets in the dairy industry was highly variable over this period, fluctuating from over 20 per cent in 1993 to minus four per cent in 1998.

De-regulation

In 2000, the national industry in Australia was de-regulated, meaning that price support systems and quotas for fresh milk supply were removed. The price differential between the predominantly fresh milk supplying states – New South Wales, Queensland, South Australia and Western Australia – and the predominantly exporting states of Victoria and Tasmania gradually evened out. By 2006/07, a blanket could be thrown over the average farm gate price paid across all states –

- Victoria 32.0 cents a litre
- Tasmania 36.5 cents a litre
- New South Wales 35.7 cents a litre
- Queensland 38.8 cents a litre
- South Australia 32.6 cents a litre
- Western Australia 32.0 cents a litre.

Throughout the 1990s, producers in the predominantly fresh milk supplying states were accustomed to a solid margin being available between prices and costs. Production systems developed accordingly, with generally much higher rates of supplementary feeding being used to sustain production compared with Victoria and Tasmania. For these producers, the challenge of reducing variable costs and securing sufficient margin to pay a return on higher fixed costs post de-regulation was substantial.

Many left the industry as this challenge started to bite

Characteristics of the Australian dairy industry

	Victoria	Tasmania	New South Wales	Queensland	South Australia	Western Australia	Australia
Number of registered farms							
2000/01	7,559	638	1,391	1,305	587	359	11,839
2007/08	5,422	463	886	664	332	186	7,953
Percentage change	-28.3	-27.4	-36.3	-49.1	-43.3	-48.2	-32.8
Number of cows in thousands							
2001/01	1,377	148	268	186	124	72	2,176
2007/08	1,055	134	195	100	103	54	1,641
Percentage change	-23.3	-9.5	-27.2	-46.2	-16.9	-25.0	-24.6
Percentage of national production							
1989/90	60.5	5.5	14.0	10.0	5.7	4.3	100.0
2000/01	64.3	5.6	12.6	7.2	6.6	3.7	100.0
2007/08	66.2	7.2	11.4	5.4	6.6	3.5	100.0

and profitability nose-dived. The effects on farm numbers and herd size are clear, as shown in the table, with more substantial proportional falls occurring in the predominantly fresh milk supplying states compared to Victoria and Tasmania.

The total number of farms nationally fell by about a third over the period 2000/01 to 2007/08 – the equivalent fall in farm numbers in New Zealand over the same time period was about a fifth. While other factors were also changing over the same period, much of the effect can be attributed to the structural adjustment that followed deregulation. It is notable that this change was from within the industry itself, in recognition of the need for reform to ensure long-term sustainability.

Climate variability

Like the New Zealand dairy industry, the Australian industry is largely pasture based and therefore subject to variability in conditions between years for pasture growth. However, there is an important difference. Despite the surge of production from Canterbury and other parts of the South Island where irrigation is crucial for pasture production, the Australian industry has relied to a greater extent on irrigation. The estimated relative proportions of total feed energy supplied on Australian and New Zealand dairy farms were 0.45 and 0.85 respectively for rain-grown pasture, 0.30 and 0.05 respectively for irrigation-grown pasture, and 0.25 and 0.10 respectively for bought-in feed.

The most significant region in Australia for irrigated milk production is northern Victoria and southern New South Wales where irrigation water is supplied by 17 different systems. The most significant of these, supplying more than 80 per cent of total water, are the Murray system fed from the Hume and Dartmouth reservoirs, and the Goulburn fed by the Eildon storage in the Victorian highlands.

In 2000/01 the region supported by these irrigation

systems supplied more than 25 per cent of Australia's total milk production. These were from relatively simple but highly profitable systems relying on between six and 10 megalitres per hectare of irrigation entitlement to fully water ryegrass pastures from late spring to autumn.

Average changes

Throughout the 1970s and 1980s and into the mid 1990s, irrigation storages were full. Water management policy resulted in irrigators receiving between 100 per cent and 200 per cent of their water entitlement, more often the latter than the former. The industry in northern Victoria grew rapidly throughout this period.

However, since 1997, south-east Australia has experienced consistently below average winter and spring rainfall, which is the source of run-off water for irrigation storages. Allocations were capped at 100 per cent of entitlement as storages fell, and then dropped to between 30 per cent and 50 per cent of entitlement after 2005 as the effects of the dry conditions really began to bite following the 2002 and 2006 droughts.

Whereas dairy producers had previously been able to plan for a known amount of water at a known price, both of these were suddenly subject to large and unpredictable change. Milk production in the region has contracted relatively slowly, but farm business profits tell the real story of industry resilience and the story is not a happy one. Without water to grow relatively cheap feed from pasture, producers have been faced with importing large amounts of forage to meet herd requirements and large associated feed costs. Total farm numbers have fallen steeply, from around 2,500 in 2000/01 to around 1,500 in 2007/08. This explains much of the drop in Victorian farm numbers.

Recent changes in federal water policy in the troubled Murray Darling Basin region offer little hope of direct government support for irrigators. Indeed, the water

management plan for the region recently released by the Murray Darling Basin Authority elevates environmental water provisions to a higher priority than irrigation extractions. This means that irrigators will receive what is left after losses, stock and domestic, and environmental flows have taken their share.

Where to from here?

Recently Dairy Australia undertook an analysis of the types of production systems found within the industry and identified five broad categories according to relative reliance on home-grown and purchased feeds, and calving system. A simplified description of these categories is shown in the table

While three-quarters of the national herd is currently farmed in systems dominated by pasture feeding with moderate capital investment in feeding infrastructure, this disguises variation among the states. As noted earlier, the historically higher milk price paid in the mainly fresh milk producing states is reflected in a higher proportion of farms appearing in systems three to five compared to Victoria. At the other extreme, the Tasmanian herd is estimated to fall entirely in systems one to three, with 56 per cent of cows in system one exploiting the cooler, higher rainfall climate which favours pasture growth.

Feeding dominates the processes and shaping forces used to describe the farming systems in the table. However other critical management factors include poor reproductive performance of the Holstein-Friesian breed that dominates the national herd, rising input costs and the shortages of skilled farm labour – factors that are also significant in the New Zealand industry.

In contrast to New Zealand, there is relatively little regulatory pressure on dairy producers in Australia to change

practices in order to meet nutrient and greenhouse gas loss targets. Water is the dominant environmental resource issue confronting the industry now, although nutrients, greenhouse gases, animal welfare and other factors will become more prominent.

Risk and resilience

Risk and resilience are the new buzz words in the Australian dairy industry. The focus is being trained more tightly on the home-grown forage base of the industry. The concept of complementary forages has emerged, where complementary refers to crops and pastures that can fill feed gaps left by the traditional ryegrass-based pasture. While there are definitely good options available, there are no silver bullets here, and a carefully planned approach to diversifying the forage base is essential if producers are to gain higher profits and avoid risks.

The rain fed regions of southwest Victoria, Gippsland in Victoria and north-west Tasmania have natural advantages associated with their warm temperate climate along with winter and spring rainfall pattern. These will probably become more important contributors to total national milk production.

Industry benchmark information for these regions confirms the long recognised positive relationship between the amount of pasture consumed per hectare and profitability. While it is dangerous to over generalise, it is fair to say that farms falling in the top 20 per cent of profitability rankings in benchmark data consistently show some or all of the following indicators of efficiency and risk management –

- 60 per cent to 65 per cent of total feed requirements coming from the home farm and support areas
- Less than 25 per cent of home grown feed re-processed in the form of silage and hay

General characteristics of Australian dairy system types

Farm type	1	2	3	4	5
Description	Dominantly pasture	Pasture with mod/high supplementary feeding	Pasture with partial mixed ration	Hybrid pasture total mixed ration	Total mixed ration
Key processes					
Percentage total feed purchased	Less than 30%	Over 30%	Over 30%	Over 50%	Significantly over 50%
Concentrate per cow	Less than 1 tonne	More than 1 tonne	More than 1 tonne	More than 1 tonne	More than 2 tonnes
Feed infrastructure	Bail in dairy	Bail in dairy	Bail plus feed pad and wagon	Bail plus feed pad and wagon	Mostly fully housed
Shaping factors					
Stocking rate	Low	Mod to high	Mod to high	Mod to high	n/a
Major management focus	Pasture harvest	Forage and milk production	Forage and milk production	Forage and milk production	Milk production per cow
Results					
Milk production per cow	Less than 450 kg milk solids	More than 450 kg milk solids	More than 450 kg milk solids	More than 450 kg milk solids	More than 600 kg milk solids
Main source of risk	Climate variability	Combinations of climate variability and feed supply and price			Quality, supply and price of feed
Percentage of national herd	25	52	13	5	2

	2006/07	2007/08	2008/09	Mean
Total pasture consumed - tonnes dry matter per hectare	6.48	8.31	7.49	7.43
Total pasture consumed - tonnes dry matter per cow	3.02	3.69	3.33	3.35
Percentage total feed home-grown	56.7	72.8	66.0	65.2
Milk price dollars per kg milksolid	4.80			
Operating profit - dollars per hectare	1,927	2,253	2,218	2,133
Operating profit - percentage	29.0	32.0	34.0	31.7
Return on capital - percentage	10.8	10.9	10.1	10.6

- At least three tonnes of pasture dry matter consumed per cow per lactation
- An operating profit margin of at least 25 per cent.

Basic success

Physical and financial data from the Ryegrass Max system operated in the Project 3030 farmlets at Terang, in south west Victoria, illustrate the power of attending to the basics. This sits squarely in system two above. It was based on perennial ryegrass pasture with no crops, a moderate amount of purchased grain concentrate and hay.

Long term average rainfall in the locality is about 780 mm, but rainfall was a lot less during the experiment including a one-in-100 year drought in 2006/07 when 450 mm rain fell. At a stocking rate of 2.25 cows, comparable to that of the top 10 per cent of businesses in the region, this system comfortably and consistently returned 10 per cent on capital invested as shown in the table at the top of the page. A constant milk price was used for this analysis even though the actual milk price varied from A\$4.35 per kg milksolids in 2006/07 to A\$6.40 per kg milksolids in 2007/08.

The keys to success in this system included close attention to pre- and post-grazing pasture mass, accurate daily allocation of pasture, early identification of spring pasture surpluses, and careful balancing of the total diet. All of this can be implemented by farmers, irrespective of their current farm resource base. Undoubtedly there is potential for growth in production from the rainfed regions of the southern states without the need for major system adaptation just yet. If current landowners do not make the step-up in management intensity required to realise the potential of their land, then the land resource will be acquired by more proficient dairy farmers. This assumes that milk prices are adequate to support a competitive return on asset for good management skill.

In the irrigated region of northern Victoria and southern New South Wales, the factors which are likely to push future profitability are much less certain. More diversity in farming systems is probable as farmers weigh up their current resources including their water entitlement and its value on short- and long-term water markets. Preliminary modelling carried out as part of the farms, rivers and markets project conducted by University of Melbourne, suggests that competitive profitability is still possible in systems relying

on home grown forage, despite much reduced irrigation water allocations.

This will require, among other responses, moving to annual pastures and crops, maximising the water and harvest efficiency of these feed sources, and using water market reforms to manage total annual water availability via carry-over and short term purchasing decisions. The management decision framework needed for these changes has not yet been developed, nor has the true profitability of such systems been fully tested. In the meantime, farm types three and four are likely to comprise a higher proportion of total herds remaining in the region.

Change to what and where?

Competition for land and water against a backdrop of climate change and uncertain milk price futures will see a re-shuffling of the relative proportions of the national herd which is managed under each of the five main system types. The physical resources and personal preferences and skills of individual farm businesses will dictate how these changes play out.

The possibility that the industry will move from traditional strongholds to marginal rainfall zones, and change toward system five, has been canvassed seriously in many quarters. Examples include northern Victoria, due to changes in irrigation water availability and Gippsland, due to spiralling land prices on the periphery of the Melbourne urban area. Cheaper land and close proximity to broadacre cropping regions offering the prospect of lower feed costs are proposed reasons for this sea-change in the industry.

However, if future milk prices stay at or close to historical levels in real terms, then well managed, pasture based systems are the only clear winners that can be picked from the field. There is substantial potential for improving the efficiency with which land in the medium to high rainfall zones of southern Australia is managed under these systems.

Dairying is a highly competitive land use in these zones, with only sheep meat looming as a significant competitor at the moment, apart from urbanisation. It is reasonable to expect that these land resources will transfer to skilled dairy producers over time, and that the industry will consolidate around this trend and perhaps grow back slowly toward 2000/01 levels.

Michael Lambert

Issues facing the UK agricultural sector

The agricultural sector in the UK enters the second decade of the new millennium in a much stronger position than it did ten years ago. The last ten years has seen the industry face a number of challenging events. The BSE crisis and the two foot and mouth disease outbreaks caused much financial hardship, in particular the livestock sector. However these are over and the industry has recovered quickly from the setbacks.

The sector as a whole has coped much better than many of its European counterparts with the extreme volatility in prices that the agricultural sector worldwide has experienced, and it is in a considerably better position to cope with the challenges that lie ahead. These challenges can broadly be divided into three areas – environmental, political and financial, though all three are very much intertwined. These challenges can be seen both as a threat to the future of the sector, in particular from a financial point of view, but also as an opportunity as well.

Climate change

Climate change and global warming probably pose one of the greatest environmental threats to the future of the industry, but also can be seen as a great opportunity. The UK agricultural sector will be no different from any other sector in having to deal with climate change and global warming, whether natural or man made. The fact is that temperatures are rising and the agricultural sector will be one of the first to experience its effects.

The UK is fortunate in that it resides in global lines of latitude where global warming offers more opportunities than threats. Food is always going to be grown in the UK, but the types of food may change, or even increase. For example with rising temperatures some production that at best was considered marginal may now become mainstream. This can be seen in particular in the wine sector where a small cottage industry run by enthusiasts is now expanding rapidly with some big estates of over 40 hectares being planted in southern England. The sparkling wine sector in particular has benefited from the temperature increase and has attracted widespread French interest.

Challenge for livestock

The horticultural sector is also likely to benefit, with crops such as tomatoes, currently widely imported from southern Europe likely to expand in the UK. There will of course also be challenges and the industry will be no different from others in being required to reduce its carbon footprint.

It is in the livestock sector where perhaps the greatest challenge lies as the growing realisation of the contributions made by methane to carbon emissions becomes more evident. The industry is already working together to see how it can reduce these emissions, but at the same time make use of the emissions for the greater environmental good. The UK is already seeing a number of bio digester plants and the government is providing grants to see more of these constructed.

There is also a growing realisation that the ruminant sector's use of grass as an important feed is making use of one of the great carbon sinks. Grass covers more than 60 per cent of the usable agricultural land in the UK. To be an effective carbon sink, the grass needs either to be cut or grazed, therefore the important part this sector can play indirectly in reducing the UK's carbon footprint.

Climate change and a growing world population have raised the question of the world's ability to produce enough food for future population needs. This in turn has focussed politicians' minds on the need for greater food security. Ten years ago in the UK it was quite normal to hear politicians say that food production was no longer the number one priority in considering land usage in the countryside. Today the tone is very different.

There is a growing recognition of the important role that the UK agricultural sector will play in meeting the nation's food requirements. Food production needs to be increased but the challenge for the industry will be how this is done in a sustainable way taking into account environmental and animal welfare requirements.

Budget changes loom

The big political and financial challenge facing the sector is the upcoming changes to the EU budget and further reform of the Common Agricultural Policy (CAP) in 2013. The last changes made to the CAP were in 2003 when the EU Commission introduced the policy of de-coupling agricultural support. This in effect broke the link between agricultural support and the product. The farmer was given a payment in exchange for meeting certain environmental and

animal welfare requirements. The de-coupling of agricultural support and removal of certain trade distorting measures was also part of the EU's response to the WTO trade talks.

The 2003 reform package was to last 10 years before the issue was looked at again. The Commission has now started its discussion process on both the EU budget and the future of the CAP. The two are very much intertwined as agriculture represents 40 per cent of the EU budget.

Serious challenges face the sector after 2013. How much of the EU's budget will be devoted to agriculture, how will the agricultural budget be distributed amongst the 27 member states, what will be the requirements made of farmers in order that they can receive the payments and how long will they last post 2013? Lastly, how will this all fit into any future WTO deal?

Changes to the EU budget are likely to be very contentious and there is a strong feeling that as a result of the world financial crisis, and many of the EU governments own budgetary crises, there is unlikely to be any increase in the total EU budget. That in turn is likely to put considerable pressure on the EU Commission to reduce the amount of money allocated to the agricultural budget. The new member states from the east ask that more of the budget is used for improvements in the infrastructure, hospitals and schools as was done for Spain, Portugal, Ireland and Greece.

The new member states in the east will also ask for a fairer sharing out of the agricultural budget after 2013. In the last reform round they only received two-thirds of the payments the original 15 member states received. All of this will mean cuts in the payments made to producers and there is likely to be a steady reduction in the single farm payment made to farmers in these countries from 2013 to 2020.

Political uncertainty

The agricultural sector in the UK faces added political uncertainty. Cutbacks in government expenditure are inevitable and the agricultural sector will not be spared. As a considerable amount of EU expenditure is dependent on co-funding by the national government there is a real danger that the UK could lose some of this funding. With the prospect of more EU expenditure being conditional on co-funding in the future, the agricultural sector in the UK could be a real loser compared with our other European partners.

All of this comes at a time of great financial uncertainty, and the pound Sterling remains outside the Euro zone. In the past few years there has been a sharp fall in the value of Sterling against the Euro which has benefited the UK agricultural industry greatly.

The 20 per cent fall has had the effect of increasing EU payments which are made in Euros and has had the effect of making exports much more competitive, with imports costing a lot more. This has been especially marked in the livestock sector where British beef, lamb, and pork and poultry have been very competitive. However there is uncertainty as to whether this will last as the Euro has been affected by the government budgetary crisis in Greece and weakness in both Spain and Portugal.

Living without support

The UK agricultural sector has been no different from many other agricultural sectors around the world in experiencing great volatility in prices. In the past the CAP has protected the agricultural sector from much of this volatility through its system of price support and intervention buying. With the continuing reform of the CAP and the removal of many of these mechanisms, the sector is losing much of this protection. The agricultural sector is going to have to learn to live without these support mechanisms. This will be difficult and will potentially have a considerable affect on farm profitability. The agricultural sector will increasingly need to learn to use other mechanisms to help reduce this volatility.

Other countries, notably Australia, New Zealand and the United States, have used such mechanisms as forward buying and selling to iron out some of the volatility. It is not a total panacea but it will help reduce the some of the volatility, notably in the area of profitability. The UK agricultural sector has already had some experience of this as a result of currency volatility and should be better able to deal with this than other EU countries.

Disease control measures

Finally there are a number of other issues facing the agricultural sector which are more UK specific. In the past, disease control measures, in particular in the livestock sector have broadly been born by the UK government. The government now wants to change this and require the agricultural sector to bear a substantial amount of the cost.

Two outbreaks of foot and mouth disease and the saga of TB have greatly increased the cost of disease control. TB in particular is a very contentious situation. In England and Wales the spread of the disease in recent years has been rapid. Much of this has been as a result of the spread in the wildlife population.

The government has refused to authorise control measures in the wildlife population. As a result the incidence in the farm animal population has escalated to such an extent that it is costing the UK government large sums of money in compensation. As a result the government would like the agricultural sector to bear a majority of the cost related to this disease.

The same will also apply to foot and mouth disease which is very contentious. The cause of the two recent outbreaks lay at the hands of UK government as a result of poor biosecurity controls. These costs are likely to be born by an industry funded levy.

There are a number of other issues on the agenda which will, in due course, affect the industry. These are further controls on the use of agricultural chemicals for the control of weeds and fungicidal diseases in crops and further measures to improve water quality. They are both likely to add further cost to an industry which is being required to increase food production to aid food security. Challenges indeed.

Proposed merger of Lincoln University and Telford Rural Polytechnic

On 1 January 2011 Telford Rural Polytechnic, after 46 years as an independent training provider in agriculture, will merge into Lincoln University. While most in the rural sector see this as a natural progression, others see this as a Machiavellian move which will see a massive reduction in sub-degree training and the eventual closure of Telford. Nothing could be further from the truth and the results expected from the merger will show this.

Lincoln University

Lincoln University was founded in 1878 as a school of agriculture and is the third oldest tertiary education institution in New Zealand. Lincoln University has an international reputation in land-based learning and research relevant to industry needs. The university is situated at Lincoln, Canterbury, a few kilometres from central Christchurch.

It is on a campus that includes specialised laboratories and facilities, student accommodation and teaching facilities. In addition it has large and important faculties in commerce and environment, society and design. The land-based sciences and related disciplines form a significant component of Lincoln University's core business, and differentiate Lincoln University within the university sub-sector.

The university operates seven farm properties for demonstration or research purposes, covering dairy, arable and cropping activities, high country runs, and light land research mainly devoted to intensive pastoral systems and sheep research programmes. The campus also hosts the Biological Husbandry Unit, which features a diverse range of established model organic agricultural and horticultural systems used for research, demonstration and education.

Mostly on campus

The majority of Lincoln University students are based on campus, although there are approximately 50 off campus equivalent full time students (EFTS) undertaking Level 5 diplomas by correspondence and professional masters degrees. Sixty-five percent of Lincoln University EFTS are at degree level (Level 7) with 20 per cent at post graduate degree level. Lincoln University EFTS are a combination of funded domestic and qualifying international students and full fee paying international students.

Telford Rural Polytechnic

Telford Rural Polytechnic is a specialist land-based polytechnic recognised for its applied approach to teaching its core competencies. These are agriculture, horticulture, apiculture, forestry, equine studies, rural business, rural safety along with rural fire and rescue, all at sub-degree level. Owing to the specialised nature of its activity base, Telford Rural Polytechnic has a unique role in supporting the rural sector as part of the Tertiary Education Network and is situated on large scale commercial deer, sheep, beef and dairy farms in South Otago near Balclutha.

Telford Rural Polytechnic traces its origins to the Telford Farm Training Institute set up under the Telford Farm Training Institute Act 1963 to provide training in the management of farm stock, pastures, crops, forestry and farms. From 1965 to 1974 the Institute fell under the auspices of the Ministry of Agriculture, both for the running of the farm and for curriculum, with the Ministry for Education becoming responsible for providing funding for teaching from 1974. In 1990 the teaching part became Telford Rural Polytechnic whilst the Institute retained control of the farm

The majority of Telford Rural Polytechnic's students are part-time, attending courses in various locations around New Zealand. In 2009 over 70 per cent of the students were in work studying part time and only 15 per cent were on campus. Almost all of Telford Rural Polytechnic's students are at Levels 1-4 on the National Qualification Framework with only four per cent at Level 5. These are aimed at a different student profile from those Level 5 ones at Lincoln University.

Telford Rural Polytechnic's students are predominantly government funded domestic students with some international and some funded by Industry Training Organisations. Telford Rural Polytechnic has a strong relationship with schools via

high school students and through the recently announced trade academies.

Reason for the merger

Lincoln University and Telford Rural Polytechnic have shared a history of providing education to support agriculture and other land-based industries. Since 2001, the Vice-Chancellor of Lincoln University has nominated a representative to the Telford Rural Polytechnic council before the most recent change in the composition of the council.

The institutions have shared expertise, such as in the development of a demonstration farm, with some similarities in approach to those on the Lincoln University dairy farm. The requirement for certificate-level education in organic husbandry was identified by the Biological Husbandry Unit trust that operates the unit on behalf of Lincoln University. There is a national Telford Rural Polytechnic Certificate in Organic Horticulture, and the availability of the site at Lincoln, through the trust, provided an opportunity to present the programme on the Lincoln University campus. Lincoln University has provided annual scholarships to encourage students completing Telford Rural Polytechnic qualifications to study towards a degree at Lincoln University.

National priorities

Given the current and future contribution of agriculture and other land-based industries to New Zealand's economic well being and development, it is necessary to address strategic national priorities for education and research at all organisational levels. Both Telford Rural Polytechnic and Lincoln University councils support a solution in the best long-term interests of the needs of the land based industries and the nation. This includes promoting the retention and growth of teaching, research, science and scholarship. The main reason for the merger is to protect and develop national capability in the land based sectors for the benefit of New Zealand. The core reasons for the merger are –

- Both institutions have strengths in and a strong focus on land-based learning
- Both institutions present land based learning at different levels with little duplication, the merged institution providing a coherent portfolio of education
- A merger will provide clear, cost-effective opportunities in agriculture and related areas from school to doctoral study with curriculum alignment and transparency of appropriate study pathways
- There is greater opportunity for technology transfer of research to support on-farm practice change in a single tertiary institution. This will extend Lincoln University's current model of technology transfer. Telford Rural Polytechnic's existing network of provision could be used to improve availability nationally
- There is the opportunity to achieve improved financial viability for the merged institution.

The merged institution

The merged institution will reflect a focus on national needs and ensure that essential capability is retained to support the land based industries and agriculture at all organisational levels. It will promote the retention and growth of research, science and scholarship in the land based sector for the benefit of New Zealand.

Priorities of the proposed merger include –

- Increased national reach of land based education
- Positive contribution to national benefit from land based industries
- Enhanced research capability in land-based industries
- Maintenance of a focus on teaching and research
- Enhancement of student learning experiences and opportunities
- Strengthening of staff career achievement and opportunities
- Maintenance of the Lincoln University and Telford Rural Polytechnic's reputations and brands
- Support for and contribution to development of staff, students and industry.

Under the merger Telford Rural Polytechnic will become a division of an enlarged Lincoln University. Telford Rural Polytechnic will retain its brand, the Telford campus and the majority of their current programmes. The courses will be rationalised and better integrated to improve opportunities and meet industry requirements, with the expectation that Telford will take the lead role for agriculture programme up to degree level.

Telford Rural Polytechnic will retain most of its existing management structure and will be represented on the Lincoln University council. A major success factor is the retention of Telford campus as a vibrant, facility, and a significant employer in the South Otago region.

Land based education and research

Given the current and future contribution of agriculture and other land-based industries to New Zealand's economic well being and economic development, it is necessary to address strategic national priorities for education and research. A combination of the two institutions enhances land based education and research in the following ways.

- The merger creates opportunities for improved structural alignment within the tertiary education sector and addresses the issue of national leadership for land based tertiary education
- The merged institution will provide a portfolio of land based education up to Level 10
- There is greater opportunity for technology transfer of research to support on-farm practice change in a single institution. This will extend the current successful model of technology transfer
- It will provide an improved land based learning pathway to students at Telford, by having Telford qualifications recognised by Lincoln University. Level 4 learning is an entranceway to higher learning

- It offers the opportunity to expand research. Currently Telford Rural Polytechnic has no research projects, though there are contracts with DairyNZ and AgResearch and has formed formal alliances with Beef and Lamb New Zealand, Ravensdown, Agriseeds and Clutha veterinarians for research projects. The Telford dairy farm is the South Otago monitor farm for the South Island Dairy Development Centre and received funding from DairyNZ for the Telford dairy project, which has a comprehensive monitoring programme. The Telford sheep and beef unit is also involved in a number of externally funded research projects

Contribution to the Tertiary Education Strategy

The development of a closer relationship between Lincoln University and Telford Rural Polytechnic addresses government's tertiary education priorities.

More with degrees

The first of these is increasing the number of young people aged under 25 who will achieve qualifications at Levels 4 and above, particularly degrees. The merger provides an opportunity to clearly define the learning which is appropriate for different contexts and levels. It will also integrate and rationalise the range of mid-level qualifications and provide clear pathways through the levels from secondary school to higher levels of learning.

The merger will improve the proportion of young people achieving qualifications at Level 4 and above at the merged institution by recruiting and retaining students in these areas. Graduates and other employees who have education and training in fields that support the export sector will make a greater contribution to economic growth and development for New Zealand.

More Maori students

Another priority is to increase the number of Maori students to succeed at higher levels. This will require higher participation rates of Maori at all levels in land-based programmes. Relevant initiatives include working with Te Runanga o Te Rarawa in Kaitaia and with Te Tapuae o Rehua in Canterbury to provide opportunities for Maori students.

In addition, Lincoln University has established a Maori agricultural academy, the Manawa Whenua Agricultural Academy. This initiative focuses on building Maori capability in agricultural related study using a whanau based approach and programme at the sub-degree level. Academic programmes offered through Telford afford an opportunity for these students to move through to higher level education which is not available at Lincoln University under the current structure.

More tertiary education

The merger will provide clear, cost effective opportunities in agriculture and related areas from school to doctoral study with effective curriculum alignment and transparency of appropriate study pathways. The merged institution will be able to cater to and support the learning and career aspirations of a greater number of young people.

This also supports the intention to increase the number of young people achieving qualifications at Levels 4 and above. It also builds on the recommendations of the Review of Land-based Provision.

Improving educational performance

The Crown and tertiary education agencies recognise that merger proposals are significant strategic opportunities for change and increased educational and financial value in the tertiary education sector. The merger will improve educational performance as a result of higher completion rates to higher level studies.

The merger will improve the financial performance of the merged institution. In addition it will add to the economy by more higher-level learning which both leads to greater employment opportunities for students and greater benefit to New Zealand and contribution to economic growth.

Strengthening research

The merger complements the network relationships Lincoln University is building with AgResearch Limited, other Crown Research Institutes and Massey University, using the Partnerships for Excellence by providing a mechanism for the transfer of research to on-farm practice change. One clear benefit of the proposed merger is the enhancement of opportunities for new technology along with science and business solutions to the end users.

Agriculture is unlike many business models. Knowledge transfer is more clearly required at all organisational levels from on-farm practitioners to small and large scale farm managers, and through the value chain to agricultural service industry providers and those closer to the end market. Agricultural industry sectors recognise the current lack of effective knowledge transfer and the value of linking through education providers to support improvement.

The Primary Growth Partnership is one of the potential funding sources for industry, in association with education providers. The merger will allow improved opportunity to engage with agricultural practitioners at every level and enhance a wide array of professional development and knowledge transfer initiatives.

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