

AgScience



Inside

Science and the
Budget

Drought and its
costs

Vital Vegetables



Added Value – in lots of ways!

TWO QUITE DIVERSE TOPICS are highlighted as our feature articles in this issue of *AgScience*. The first is Vital Vegetables and the development of a range of prepared vegetable products that are differentiated on the basis of their nutritional benefits; the other is an analysis of the nature and impacts of the largest drought affecting the country in over 70 years of recorded history. We are often exhorted to add value to our export products and as researchers it is satisfying to think that our work has been useful. I think these two articles show how science can add value, but in different ways.

The range of Vital Vegetables products recently released in New Zealand and Australia is a great example of science and industry co-operating to provide a high quality product, with clearly defined benefits to the consumer. A number of factors stand out. Perhaps the greatest is the number of steps at which science and technology input has been utilised. This covers genetics and cultivar selection, production and agronomy, biochemistry and nutrition, through to the technology associated with processing and presentation. The most notable achievement may be the co-ordination required to put all those aspects together in a crop sector not always recognised as one of New Zealand's major horticultural strengths. "Functional food" doesn't necessarily sound appetising but a combination of verified nutritional status, attractive appearance and convenient packaging, certainly appears to have added value.

The comparison of soil moisture deficit maps gives a very dramatic picture of just how severe and how widespread the recent drought was. Despite some people enjoying an extended summer, the weather pattern brought a period of real stress and concern to farmers across most of the country and the effects will have an impact for some time. Autumn was somewhat kinder and

so an explanation of the weather patterns associated with the drought and how it did compare with previous years will provide information as to how to manage resources in future years. The use of meteorological data to manage resources is not new and is used across a range of industries, not just agriculture and horticulture. The extra component here is the number of climate scientists commenting on the drought and how it relates to longer-term trends in our weather patterns. So consideration then must be given to how that information is built into long-term planning rather than dealing just with the current year.

On another matter, the recent government budget provided some good news for science funding with an estimated increase of \$50m per year. This comes from money allocated for the Great New Zealand Science Challenges, an increase for the Marsden Fund, Business Research and Development Grants and Repayable Start-up Grants. The National Science Challenges initially seemed a little vague but they are a positive step at a number of levels – promotion of public awareness of science, increased funding, the inclusion of primary production within one of the challenges, and a longer time frame than some other funding options. There was some criticism about the challenges being less than innovative but Sir Peter Gluckman asks us to look further than the title and at what is in the description of the challenge.

It was interesting to see an article recently in the *New Zealand Herald* commenting on the topic of "natural capital" and how conventional measures of economic growth do not capture the value of the services that ecosystems provide. This can then distort planning and policy-making decisions by local and national government. The article highlights a recent paper on natural capital by the New Zealand Institute of Economic

Research and an upcoming conference on this topic in Wellington. It is always nice to be up with the play. Natural capital was our lead science topic in the March issue of *AgScience*, highlighting the implicit value in our ecosystems and the wider services that they provide.

NZIAHS is one of the host organisations for the International Horticultural Congress to be held in Brisbane next year (17–22 August 2014). An outline of the science programme and the themes for the conference are featured in this issue of *AgScience*. Despite the congress still being a little over 12 months away, submissions for abstracts are open and registration opens at the end of September. I encourage you to get involved. This is only the second time in its history that the congress has been held in the southern hemisphere. It's not just for scientists, so check out the web page, www.ihc2014.org and let's be part of making this congress a big success.

Mention of the IHC2014 web page reminds me that the Institute is catching up with some of the trends in social media. I invite you to like us on Facebook www.facebook.com/NZIAHS and to visit the NZIAHS blog www.agscienceblog.wordpress.com. The aim of the Facebook page is more regular contact with members especially with links to items of interest or upcoming events. It also provides an avenue to people with an interest in agriculture and horticulture but for whom the internet is a preferred path of communication. The blog is a summary of news items of interest relevant to agriculture and horticulture. It does provide readers with an overview from other news sources and its content will likely evolve as we become more familiar with using it.

David Lewis
President

Science and the money maze

READING – OR TRYING to read – the science component of the 2013 Budget is a science in itself.

All the hard numbers are tucked away in a set of documents grandly named The Estimates of Appropriations for the Government of New Zealand for the Year Ending 30 June 2014.

A summary table of the total appropriations for each vote shows Science and Innovation had an appropriation of \$800,315,000 in 2012/13. This is lifted to \$927,302,000 in 2013/14.

But the total annual and permanent appropriations, on Page 234 of The Estimates of Appropriations (etc) shows the 2012/13 figure of \$800,315,000 easing to \$785,802,000 in 2013/14. That looks like the bottom line.

It isn't. Turn the page and you find details of multi-year appropriations. These show two sums that add to the spending for the year ahead: research and development growth grants will take care of \$90.9 million in 2013/14 while "targeted business research and development funding" accounts for \$50.6 million.

But somewhere among the flood of media statements was something that explained we shouldn't look only at Vote Science and Innovation to see where science money is going.

The Government's total cross-portfolio funding for science and innovation rises from \$1.24 billion in 2012/13 to \$1.36 billion in 2013/14.

Total direct cross-portfolio science, innovation and research funding has risen by 28% over the past four years.

New funding over the next four years includes:

- \$75.2 million for business R&D grants.
- \$31.3 million for repayable grants for start-up businesses.
- \$73.5 million for the National Science Challenges.
- \$20 million for the Marsden Fund.

The Government's total cross-portfolio funding for science, innovation and research in 2013/14 includes:

Vote Science and Innovation	\$927.3 million
Vote Education (Tertiary)	\$313.2 million**
Vote Primary Industries	\$ 97.7 million
Other Government Budgets (estimate)	\$ 18.3 million
Total	\$1.36 billion

** This includes the additional \$100 million over four years for the Performance-Based Research Fund (PBRF) announced in Budget 2012.

You can do it the easy way, of course, and just listen to Science and Innovation Minister, Stephen Joyce.

Budget 2013 saw a net increase of around \$50 million in science and innovation funding, he tweeted in response to something Sciblogger Siouxsie Wiles had to say about his budgeted science spending.

According to one of his several statements, Budget 2013 is investing nearly \$130 million into Callaghan Innovation to encourage businesses to invest more in research and development, and to support new start-ups.

Another \$107 million from the additional funding is part of the \$400 million internationally focused growth package which Joyce described as a centrepiece of Budget 2013. The remaining \$23 million is reprioritised from within Vote

Science and Innovation.

An additional \$98 million over four years will be added to Callaghan Innovation's business research and development grant schemes. This increase brings the total funding for these schemes to \$566 million over four years (\$141.5 million a year).

More of New Zealand's top R&D performing businesses will be eligible for the schemes, which will extend the impact of their research and development programmes.

"When the Government reviewed the schemes in 2012, businesses asked us for a simpler approach that provides greater certainty. The revised grant schemes respond to this," Joyce said.

This doesn't make analysing the new spending any easier.

The revised grant schemes replace the previous Technology Development Grants, TechNZ Project Grants, TechNZ Capability Grants, and Technology Transfer Vouchers.

There's more detail in a media statement about the \$130m boost for Kiwi R&D and start-ups and explanations about the new business R&D programmes.

And there's money for R&D Growth Grants, R&D Project Grants, R&D Student Grants...

But wait. There's more.

The goodies for science and innovation include allocations announced before Budget Day, such as the National Science Challenges which receive \$73.5 million in funding over the next four years.

The Challenges are designed to take a more strategic approach to our science investment by targeting a series of goals which, if they are achieved, would have a major and enduring benefit for New Zealand, Joyce said.

The Government is supporting this with an additional \$73.5 million of funding over four years on top of the \$60 million allocated to the Challenges in Budget 2012.

The primary industries do nicely, thank you, from these challenges. Among them are high-value nutrition, our land and water and resilience to nature's challenges.

The Challenges – by the way – will affect the Government's funding of science in future.

A proportion of the Government's contestable contract funding – over time – will be transferred to support the achievement of the challenges. Existing contracts will not be affected, but where their research outcomes contribute to the challenge, it will be important that there is general awareness among challenge participants of the research, thereby ensuring that the challenge research programme avoids duplication and identifies new opportunities and activities.

Where appropriate, the Crown Research Institutes, the Health Research Council, Callaghan Innovation and other government research funders will align their research investments to support the challenges.

The important thing is that more money for science is promised.

The Government says it is committed to continuing to increase public science and innovation funding towards 0.8% of GDP – hurrah.

The dampener is that this will happen "as fiscal conditions allow".

– Bob Edlin



Drought – the most costly climate hazard

THIS GROWING SEASON New Zealand experienced a historic drought that was the most severe for agriculture in over 70 years of climate records. It is hard to imagine how drought could occur in this cluster of damp islands immersed in a huge ocean. But the cogs of the Southern Hemisphere weather machine do get stuck at times, and droughts have disrupted New Zealand life at various times since humans first settled the land. Indeed, they are our costliest of climate disasters. Drought is sneaky. Unlike the other climate hazards, it tends to creep up on us unobtrusively until suddenly a disaster is upon us.

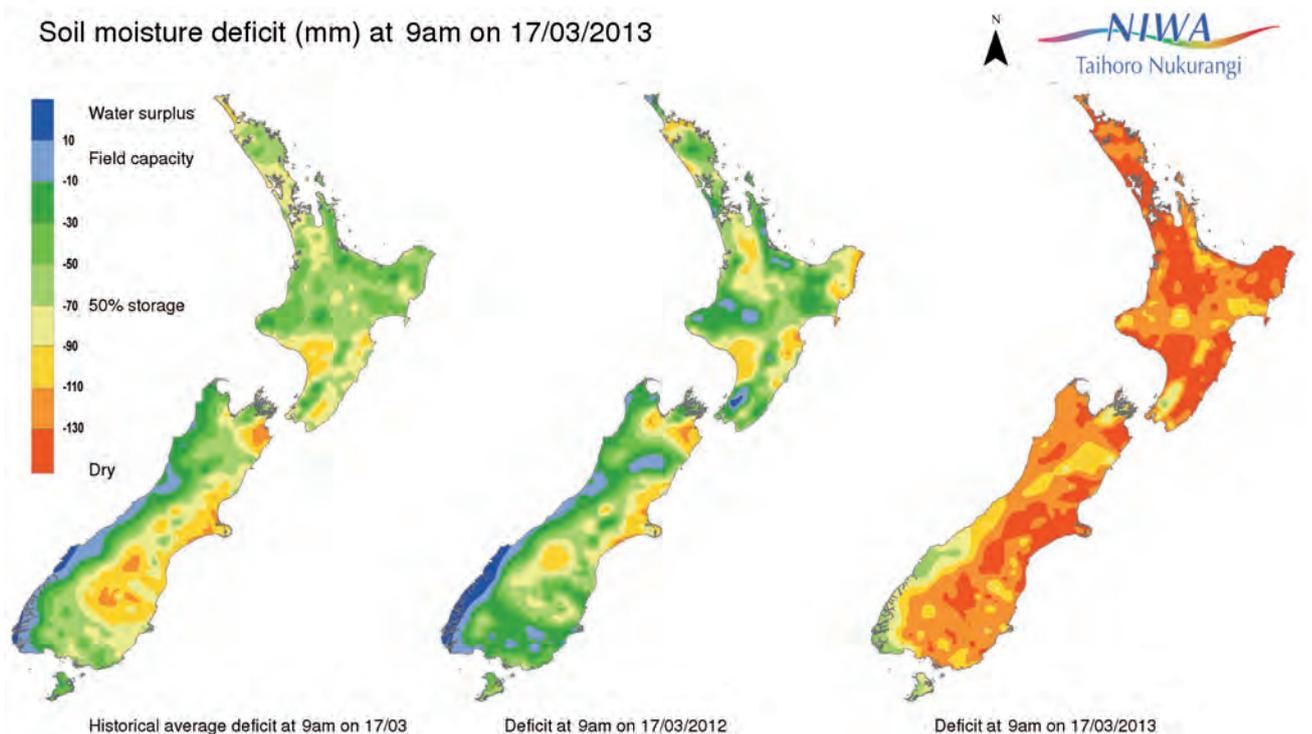
When it rains, water tops up the soil for plant growth and fills up our water-supply reservoirs and hydro lakes. As time passes, plants conduct moisture out from the soil to the air, home-owners and industries use the water in the reservoirs, farmers use the water on their land for their animals or to irrigate their crops, and water from the hydro lakes is used to generate electricity. Eventually, if there is no rain to replenish the water that is being used, the lakes and reservoirs run dry. It is as simple as balancing the spending against your income in one's cheque book. Although droughts in New Zealand are not as frequent as heavy rainfall, they have a huge impact.

The number-one cause of droughts is anticyclones (highs), which bring fine weather and light winds. It is when these get stuck in the New Zealand region, especially in summer, droughts happen. Lack of drought periods are caused by more frequent troughs – think of these a bit like cake mixers combining a batter of air. They produce rain because they mix warmer moist air with cooler drier air and lift it up high. (Usually the warmer air contains tonnes of moisture, which then falls as rain.) A 'front' is the line along which the cold air meets the warm air. The regional patterns are very sensitive to the persistence of atmospheric circulation anomalies, and for most of these regions, more anticyclones or 'highs' than normal occur in the New Zealand region. Similarly, in some regions, seasons with more troughs than normal are responsible for a low occurrence of drought. Despite

New Zealand's maritime location, and hence the intrinsic variability in weather patterns, seasons do occur when there is persistently anomalous atmospheric circulation, or an increased predominance of particular weather types. There are large districts of New Zealand where agricultural drought is spatially coherent.

Research shows five districts where agricultural droughts occur with three in each island. The districts in the North Island are the north, the west and the east. For the South Island it is the north, east and south. Droughts in the north of both islands coincide. In the west of the South Island droughts are very uncommon. In the north of the North Island and Nelson drought is caused by strong westerly flow over southern New Zealand and west to southwest flow over New Zealand. This pattern generally predominates with anticyclones to the north west of New Zealand in the Tasman Sea, with dry west to southwest flow over New Zealand. These areas are wet when north easterly flow prevails over the country. For the west of the North Island dry conditions occur with easterly flow over the North Island. This occurs with anticyclones to the east of the South Island. Lack of drought is caused by strong westerlies and troughs over the North Island. When droughty conditions occur in the east of the North Island the west of the South Island is very wet. This situation transpires when the westerlies of the Roaring Forties blow strongly over New Zealand. The opposite – strong easterlies make it wet in the east of the North Island, and dry in the west of the South Island. When it is very dry in the east of the South Island from Marlborough to North Otago strong south westerly flow occurs over southern New Zealand, and dry southwest flow over New Zealand. The opposite – more east and north east flow gives wetter than normal conditions here. The final pattern affects central and eastern Otago and eastern Southland – and ensues when easterlies prevail over southern New Zealand.

So how does the current agricultural drought rate historically? The regional spread is borne out by the dramatic soil moisture deficit



status maps for 17 March from NIWA. For the North Island and New Zealand as a whole, this drought ranked as the most severe for the record from 1941. The districts most severely affected were those in the northern half of the North Island, the east of the North Island, and Buller and Westland in the South Island.

And how are agricultural droughts changing and expected to change in the future? In NIWA's latest report on drought released last year, New Zealand can plan for around 10% additional time spent in deficiency by the middle of this century for key agricultural regions in the east of both islands. Their projections from climate models show that by the 2080s much of New Zealand's agricultural zone will experience some increase in drought, even under lower climate warming scenarios. The trend towards a hotter climate overall and drier in parts raising the incidence of a doughtier climate is clear.

And this is exactly what has been happening recently. Mean temperatures have now increased 1°C since the 1900s. The diagram below shows the potential soil moisture deficit over each growing season – the amount of water that would be required to keep pastures topped up with moisture for grass growth. The higher the deficit, the more severe the soil moisture deficiency is. In the New Zealand record overall the nine-year period from 2004/05 has recorded the highest potential soil moisture deficit (PSMD) record in observations from 1941/42. Fortunately last season was wet. The last six years have recorded PSMD almost 100 mm higher than from the 1940s to the 1960s. For the North Island the increase is 75 mm. Potential evapotranspiration deficit (mm) for New Zealand for 47 stations for the July/June growing season 1941/42 to 2012/13. The value for 2012/13 is for the 11 months June 2012 - May 2013. The curved line is smoothed annual values so as to depict trends.

The economic impacts of this drought are very likely to be huge. Earlier droughts have forced farmers to send livestock to the freezing works early, or truck their stock to unaffected areas of the country. Dairy farmers have had to dry off their herds early, and feed out or buy in feed. Drought also affects other farming activities, with fewer

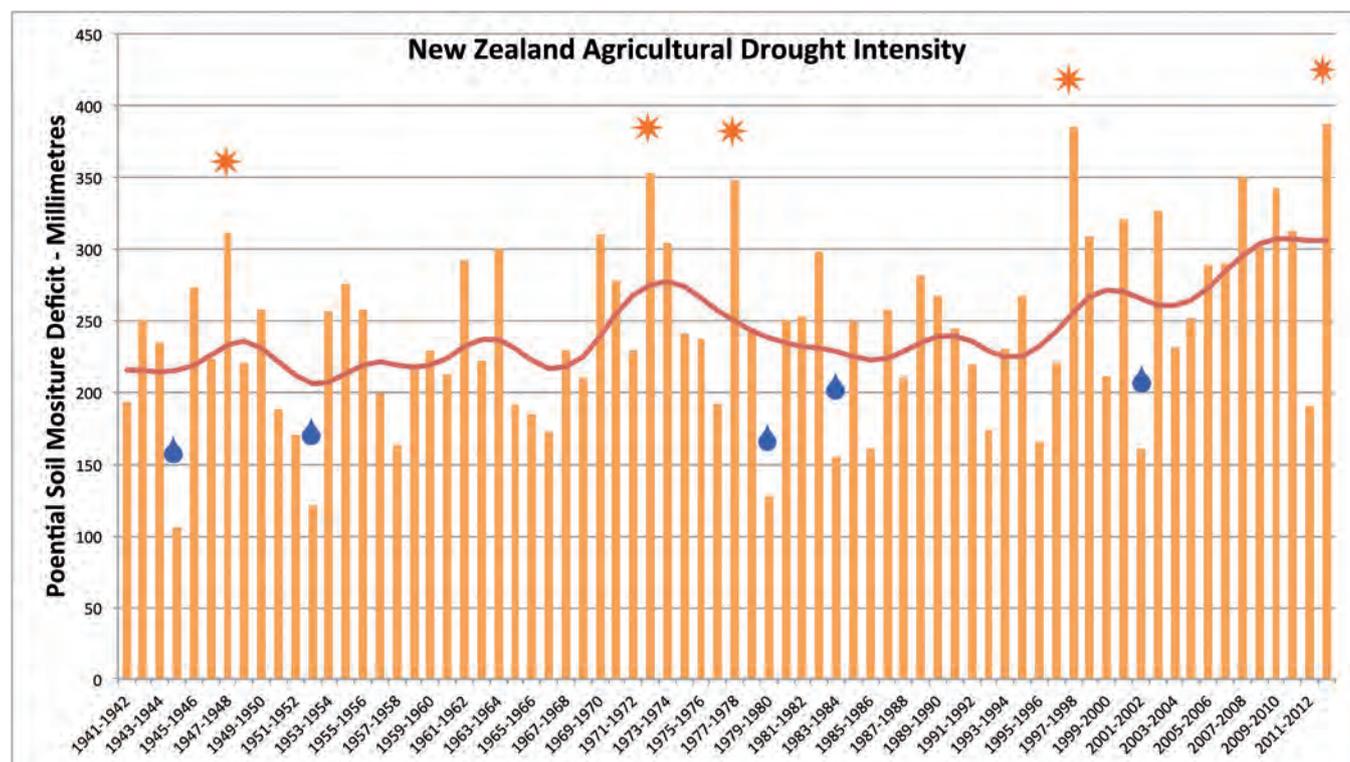
crops such as maize being harvested. Financially, earlier droughts last century have pushed some farmers to the wall, and they walked off their land. This last point brings us to the fact that major droughts have knock-on effects. For instance, those farm animals that have survived are left very weak, and in the following spring, many fewer lambs and calves are born than usual. The direct financial toll of earlier droughts has been huge. The total costs of the 1997/98 El Niño and 1998/99 La Niña droughts have been estimated at \$2.5-\$3 billion (2010 dollars). Similarly the nationwide drought between spring 2007 and autumn 2008 cost the New Zealand economy \$2.8 billion. Already initial estimates of the 2012/13 drought are a decrease in national GDP by 0.7%. The Government was correct this year in leaving assistance measures in place until spring 2013.

The message is clear – nature is showing the trend towards a future where major drought is more common – a more “Mediterranean” climate for the north and east of the country. Anticyclones have become more prevalent in the last decade. Management options to reduce risk to this new trend include larger water storage (dams and so on) on farms, lowering the carrying capacity when droughts are indicated, utilising more drought-resistant pasture cultivars and developing irrigation schemes. ☒

Seasonal climate forecasts are another tool that can assist in drought risk management. There are a variety of social interventions (such as rural financial counsellors, farm resilience programs) and taxation/financial instruments (income equalisation deposits, for example) that assist livestock farmers to manage the variable climate. These diverse drought policy instruments need to be well coordinated and synergistic for best outcomes to be achieved.

Those involved in land-based industries will need to adapt their decisions and management to fit the trends towards more water and soil moisture deficiency in a warmer world.

For more information: Dr Jim Salinger
Email: Salinger@orcon.net.nz



Fresh, flavoursome and functional

VITAL VEGETABLES IS A trans-Tasman collaborative research and development programme charged with developing and commercialising new high-value, health-promoting vegetables for the Australian and New Zealand horticulture industries. At its inception, the philosophy underpinning Vital Vegetables was to provide a research, germplasm and marketing framework to enable Australian and New Zealand vegetable growers to move their industry towards differentiated, higher-value products that delivered enhanced health benefits to consumers. This shift in thinking was partly driven by recognition of the growing strength of low-wage economies in the international vegetable market reducing the viability of commodity vegetable production in Australia and New Zealand, coupled with the desire to grow the profitability of the local vegetable industry.

Addressing this trend remains a priority for the vegetable industries in both countries.

The research programme has been funded through Horticulture Australia Ltd by the Australian national vegetable levy and funding from voluntary contributions by Horticulture New Zealand, The New Zealand Institute for Plant & Food Research Limited, the Department of Primary Industries Victoria, with matched funds from the Australian Government and support from the New Zealand vegetable sector. The first Vital Vegetables contract (VV1) was funded for five years (2002–06 inclusive), receiving additional transition funding through to mid-2008. A second programme (VV2) was funded under a separate contract for a further period through to December 2012.

VV1 established research principles and analytical methods that supported target vegetable crops:

- Crop science and understanding of critical production processes;
- Germplasm screening and selection of elite cultivars;
- Analytical methods for key nutrients;
- Phytochemical content for a range of NZ-grown vegetable crops;
- Vegetable nutrient databases.

VV2 built on this platform of scientific capabilities but focused more on developing and commercialising vegetable products that embodied high-health functionality along with flavour and freshness. The second Vital Vegetables programme took on board the lessons learned from the launch of Booster Broccoli in Australia in 2009, and its subsequent withdrawal from the market in 2010, and the programme was subsequently redesigned to address the commercial realities of new product development. This resulted in the operational structure changing from

one that was science-driven to a product-development framework. A streamlined decision-making process was established, and the product development process guided and facilitated rapid and successful development and commercialisation of new product ideas by addressing critical success factors:

- Continued commitment of senior management, including involvement at critical decision points in the process;
- Quality decision-making based on reliable and compelling information;
- Market-driven, consumer-focused development;
- Integrated planning and development through effective and competent cross-functional project teams;
- Adequate resource allocation to projects and an optimal number of projects in the pipeline;
- Transparency – a documented process that could be easily followed to ensure all aspects of product development were covered at the appropriate stage.

Plant & Food Research worked closely with partners in New Zealand to develop strong collaborative marketing partnerships to commercialise the vitalvegetables® products. These partners are leaders in the horticultural foods industry, hold a significant market share, and have the appropriate infrastructure in place from production to market. They are enthusiastic and committed to the vitalvegetables® strategy, willing and able to trial new cultivars, and support research and development initiatives by adopting new ideas and innovations. Each step of production from seed selection, agronomy, harvesting, processing, packaging to distribution was investigated and optimised to ensure consistent year-round quality of vitalvegetables® products. Technologies in the form of agronomy and post-harvest protocols were taken up by the industry partners during pre-commercial and commercial trials. The technologies were improved to fit the needs of commercial practice and embedded in product manuals for a suite of viable vitalvegetable® products.

Each product has been designed with a specific health benefit in mind. A quality assurance process for nutritional value is in place so that a consumer will get a relevant proportion of their recommended daily intake (RDI) of vitamins in one serve. For instance:

vitalbones™ salad mix contains 138% of the estimated safe and adequate dietary daily intake (ESADDI) of Vitamin K.

The key vitamin present in vitalbones™ products that contributes to normal bone structure and function is Vitamin K. Vitamin K plays a prominent role in the maintenance of healthy bones by helping to keep calcium in bones and working synergistically with Vitamin D to build bone mass. Good sources of Vitamin K are green leafy vegetables, such as kale and spinach.

vitalsight™ salad mix contains 26% RDI Vitamin A (carotenoids).

A key antioxidant vitamin present in vitalsight™ products that contributes to the maintenance of normal vision is Vitamin A. Vitamin A (in vegetables this is derived from carotenoids such as beta-carotene) is necessary for normal vision and essential to proper functioning of the retina. It also helps prevent night blindness by helping the eye to adapt between bright light and darkness.

vitalimmunity™ medley contains 61% RDI Vitamin A (carotenoids), 86% RDI Vitamin C and contains phenolics and glucosinolates. Two key antioxidant vitamins present in vitalimmunity™ products support a healthy immune system. Vitamin C, also known as ascorbic acid, is a water-soluble vitamin and unlike many animals, humans do not have the ability to make their own Vitamin C.



Therefore, we must obtain Vitamin C through our diet. One way in which Vitamin C may support the immune system is through its antioxidant activity. Although many people think of citrus fruits as an excellent source of Vitamin C it is also present at high levels in many vegetables. Vitamin A is a fat-soluble vitamin which comes in a number of forms – pre-formed Vitamin A is found only in animal-derived foods but fruits and vegetables contain selected carotenoids that have Provitamin A activity.

The outcome of the programme is a mechanism and proof of concept that supports the commercialisation and marketing of differentiated vegetable products in the global market. The ultimate goal is to increase vegetable consumption by providing consumers with a series of new health-benefit value propositions. The benefits are embodied in vitalvegetables® sub-brands: vitalheart™, vitalsight™, vitalbones™, vitalfibre™ and vitalimmunity™. But health benefits aside, vitalvegetables® products have been developed for their naturally high nutrient levels, great taste, flavour and long shelf life.

The vitalvegetables® category of vegetables was successfully introduced to the New Zealand market in October 2012. The

first five products marketed by the New Zealand Vital Vegetables Marketing Partners include vitalheart™, vitalsight™ and vitalbones™ salad mixes; vitalimmunity™ slaw; and vitalimmunity™ medley. The success of designing mixed products was a turning point for the product-development strategy. It became clear that mixed products provided:

- Product differentiation through a mixture of unique components and clearly labelled packaging;
- Consumer value through convenience;
- Greater branding opportunities;
- Value to the growers by providing a channel for minor crops (such as purple cauliflower) or less viable mainstream crops (such as high-lycopene tomato).

The vitalvegetables® programme has provided a path to market for functional fresh vegetable products that provide consumers with detailed nutritional information about the products they are eating while adding a premium for growers above commodity vegetables. ☒

For more information visit <http://www.vitalvegetables.co.nz>

International Horticultural Congress

– By David Lewis

The 29th International Horticultural Congress is being held in Brisbane in August next year, only the second time the once-every-four-years event has been convened in the southern hemisphere.

Attracting more than 2,000 delegates, the congress is a world forum covering all aspects of horticulture and horticultural science. It is the major event for the International Society for Horticultural Science and in 2014 it is being hosted by the Australian Society of Horticultural Science, the New Zealand Institute of Agricultural and Horticultural Science, and the Secretariat of the Pacific Community.

As one of the host organisations, the NZIAHS wants the congress to be a success and to have a strong New Zealand presence. It is an opportunity to showcase our research and our horticulture on the world stage and I encourage you to make the most of it in as many ways as possible.

The focus will be on the South Pacific and the conference is likely to attract attendance from a range of Asian countries.

Three NZIAHS members are on the organising committee. Others are involved in the planning and will chair symposia and be involved in the communications and promotion of the congress.

The call for abstracts for presentations at the congress is already open and early-bird registration opens in October.

Because the NZIAHS council see this congress as an important opportunity to engender interest and promote the careers of scientists and technologists starting out in this field, it is offering up to ten \$500 awards to young and emerging scientists. We are aware this is not going to cover the costs of attending the congress but it does offer the chance to leverage funding from other sources and we invite applications (*see details in the advertisement*).

This conference is not just for scientists. It is also expected to attract technical specialists from the various horticultural sectors, progressive growers, packhouse operators, industry consultants, service providers, academics, and students. Industry involvement does not have to be limited to just the week in Brisbane – by encouraging particular international specialists to come earlier or stay later, there are unique opportunities for them to interact with industry groups in New Zealand to help solve industry problems, overcome constraints and increase efficiency, productivity and profitability.

The science programme is organised around four major themes, each involving a range of symposia topics including:

SUSTAINING LIVES

Horticulture and Health, World Food Production (including Food Safety), Water Scarcity and Use, Medicinal and Aromatic Plants.

SUSTAINING LIVELIHOODS

Fruit Crops, Vegetables, Ornamentals, Production & Supply Chain, Plant Breeding & Molecular Biology.

SUSTAINING LANDSCAPES

Biosecurity, Eco-efficiency, Horticulture, Human Health & Wellbeing: the value of plants in open spaces, urban environment & gardens.

TROPICAL HORTICULTURE

Bananas & Plantains, Pineapple, Papaya, Mango, Tropical Fruit, Tropical Ornamentals.

The full science programme can be viewed at www.ihc2014.org/scientific_program.html.

Important Dates

Call for Abstracts closes 1 November 2013.

Registration opens 30 September 2013.

Early bird closes 17 February 2014

Further details on the Congress may be found at <http://www.ihc2014.org>

NZIAHS Postgraduate Student/ Emerging Scientist Travel Award to attend IHC2014

17-22 August 2014 – Brisbane

Up to 10 awards at \$500 each

This 2013 special award is offered to NZIAHS students and recent graduates to present a paper or poster at the IHC2014 meeting to be held on 17-22 August 2014 in Brisbane (www.ihc2014.org).

The award will provide leverage for further funding from other bodies.

Applicants should be NZIAHS Full or Student members and must be in the first three years of postgraduate employment.

Closing date 30th September 2013.

Contact secretariat@agscience.org.nz for an application form.

Pat Dale

(Patrick Stuart Dale)

18 February 1928 – 13 February 2013



PAT WAS AN ACTIVE participant in Institute affairs over many years, particularly at Auckland Section meetings, and his wit and wry smile will be remembered and missed. Throughout his life Pat maintained an enquiring mind tempered by his personal warmth and humanity. We offer sincere condolences to his wife Pam and their family, and thank them for access to the website <http://eight.zero.co.nz> – a superb collection of Pat's reminiscences and some personal tributes.

The earliest NZIAHS record of Pat I found was in the 1970 membership list as a Senior Lecturer at Massey University. More interesting was a 1974 note by Pat when the Institute was debating re-organisation; this is titled *Is the Institute a Professional Body?* but the subtitle (*...a society united by a delusion*) gives an insight into Pat's stance on this and other issues. To me it reflects his questioning attitude, his humour and his disregard for unnecessary pomp and ceremony. In the note he argued for greater participation by a wider, more diverse range of members in order to more effectively promote science in agriculture.

The 'Dale' may sound English, but the man was more like a charming leprechaun. I have heard him give an after-dinner speech from the midst of the assembled members when, for reasons unknown, there was no arranged speaker. It may have been impromptu but was apt, skilfully crafted and presented with wit. Pat was a very gifted story-teller and teacher, as his reminiscences so very clearly demonstrate.

Pat had an eye for detail and a questioning mind but remained practical and down to earth. In recent years his business card simply put his expertise as 'Plant Protection, Biosecurity, Pest Management'. He enjoyed solving problems and helping others. His international experience with FAO employed these attitudes, but the full extent of this work has not been appreciated by most of us. Throughout, Pat was supported by Pam, who is a very skilled and talented entomologist in her own right.

Most Institute members think of Pat as an entomologist but I first encountered him as a nematology adviser to the Pesticides Board. At this time he was leader of the MAF Diagnostic Service Laboratories on the Mt Albert DSIR campus. Actually his science career began after he discovered entomology as an escape from teaching when he spent three years in Samoa as an entomologist. Then came ten years lecturing at Massey University in Palmerston North before moving to MAF and Auckland. Teaching and the Islands remained powerful influences on him.

At Auckland he was involved in research into what has become biosecurity, including work on treatments to allow fresh Island produce to be imported into New Zealand. A vital technique he developed was the use of "residual disinsection", treating the interior of planes with permethrin to prevent mosquitoes and other insects spreading disease outbreaks with vectored pathogens. A very practical but important achievement that deserves more recognition.

Pat retired from MAF in 1984 but undertook more overseas reviews for the FAO and other agencies. He also had a joust at politics, being a Labour city councillor for Mt Albert from 1986 for a term, gained a BA in Pacific History and French, and became a farm forester. He continued to lecture at Unitec, retiring again in 2002. He was a versatile teacher covering pretty well everything except physical education and religion, and motivating those he taught.

Pat enjoyed life and lived it fully and well, but always with an understatement and that wry smile. ☺

– Dr David Steven, FNZSHS
Auckland Section

New members We welcome

Karyn Froud (Auckland)
Agam Nangul (Auckland)
Shane Max (Bay of Plenty)
Roshean Fitzgerald (Canterbury)
Sarah Pethybridge (Canterbury)
Brad Aitken (Otago)

Corporate members

- AGMARDT
- AgResearch
- Ballance Agri-Nutrients
- Catalyst R&D
- Plant & Food Research
- DairyNZ
- Federated Farmers of New Zealand
- Horticulture New Zealand
- Lincoln University
- Massey University
- PGG Wrightson Seeds
- Ravensdown Fertiliser Co-op

The New Zealand Institute of Agricultural & Horticultural Science Inc

National Secretariat

P O Box 121 063 Henderson, Waitakere City

Phone 09 812 8506 Fax 09 812 8503

secretariat@agscience.org.nz

Contributions to the Editor

Phone and fax 04-237-8074

bob.edlin@xtra.co.nz

www.agscience.org.nz

AgScience is published by the The New Zealand Institute of Agricultural & Horticultural Science Inc. The opinions of contributors are their own and not necessarily those of the publisher or editor. The entire contents of AgScience are copyright and no material may be reproduced in any form without the permission of the NZIAHS Council. All enquiries to the editor.

ISSN 1175-3927 (Print)

ISSN 2253-5675 (Online)