Vital Vegetables 2 - New Zealand Component

Dr Jocelyn Eason
NZIPF

Project Number: VG08141

VG08141

This report is published by Horticulture Australia Ltd to pass on information concerning horticultural research and development undertaken for the vegetable industry.

The research contained in this report was funded by Horticulture Australia Ltd with the financial support of:

Horticulture New Zealand

The New Zealand Institute for Plant and Food Research Ltd

The vegetable industry

ISBN 0 7341 3066 X

Published and distributed by:
Horticulture Australia Ltd
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179 Elizabeth Street
Sydney NSW 2000
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HAL

Horticulture Australia

Plant & Food RESEARCH
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www.plantandfood.com

HAL Final Report

Project Number: VG08141

Project Title: Vital Vegetables 2: New Zealand Component.

Research Provider: Plant &Food Research, New Zealand

Completion Date: 31 December 2012

A report prepared for

Horticulture Australia Limited

Jocelyn R Eason

Plant & Food Research, Palmerston North

PFR SPTS No. 7778

HAL Project Number:	VG08141
Project Title:	Vital Vegetables 2: New Zealand Component.
Research Provider:	Plant & Food Research, New Zealand
Project Leader:	Jocelyn Eason
Purpose of Report:	This final report addresses the outcomes of the four year project researching and commercialising functional vegetable concepts for the Australian and New Zealand vegetable industries.
Funding Sources:	This research programme has been funded through HAL by the Australian national vegetable levy and funding from voluntary contributions by Horticulture New Zealand, Plant & Food Research, the Department of Primary Industries Victoria, with matched funds from the Australian Government with support from the New Zealand vegetable sector.
Completion Date:	31 December 2012

PUBLICATION DATA

Eason JR. November 2012. HAL Final Report: Vital Vegetables 2. A report prepared for: Horticulture Australia Limited. Plant & Food Research Contract No. VG08141, Job Code No. P/271001/01, SPTS No. 7778.

This report has been prepared by The New Zealand Institute for Plant & Food Research Limited (Plant & Food Research), which has its Head Office at 120 Mt Albert Rd, Mt Albert, Auckland.

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11 December 2012

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11 December 2012

Contents

Completion Date: 31 December 2012. PFR SPTS No. 7778

Abbreviations

DPI	Department of Primary Industries, Victoria
FRST	Foundation for Research Science and Technology
FSANZ	Food Standards Australia New Zealand
HAL	Horticulture Australian Limited
ItL	Idea to Launch Process
KPI	Key performance indicators
NIP	Nutrition Information Panel
P293	FSANZ proposal 293 – nutrition, health and related claims
PFR	New Zealand Institute for Plant and Food Research Limited
R&D	Research and development
RDI	Recommended Dietary Intake
VV1	Vital Vegetables Programme 1
VV2	Vital Vegetables Programme 2
VVGG	Vital Vegetables Governance Group
VVGP	Vital Vegetables Genetics Partners
VVMP	Vital Vegetables Marketing Partners
VVOT	Vital Vegetables Operations Team
VVRP	Vital Vegetables Research Partners

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Completion Date: 31 December 2012. PFR SPTS No. 7778

Vital Vegetables 2: a trans-Tasman collaborative program to produce fresh, flavoursome & functional vegetables

Media summary

The Vital Vegetables Program is a trans-Tasman collaborative research and development joint venture charged with developing and commercialising new high-value, health-promoting vegetables for the Australian and New Zealand horticulture industries. At its inception, the philosophy of 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 in part 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 profitability of the local vegetable industry. Addressing this trend remains a priority for both the Australian and New Zealand vegetable industries.

vitalvegetables® products have been developed for their naturally high nutrient levels, great taste, flavour and long shelf life. To achieve this, the project first established research principles and analytical methods that supported production of high-health vegetables. Each step of production from seed selection, agronomy, harvesting, processing, packaging to distribution was investigated and optimised to ensure consistent year-round quality of **vital**vegetables® products.

The outcome of Vital Vegetables 2 (VV2) is a mechanism and proof of concept that supports the commercialisation and marketing of differentiated vegetable products in the global market. The ultimate goal of this program is to increase vegetable consumption by providing consumers with a series of new health benefit value propositions. The benefits are embodied in **vital**vegetables® sub-brands: **vital**heart™, **vital**sight™, **vital**bones™, **vital**fibre™ and **vital**immunity™.

vitalvegetables® is a new category of vegetables that has a strong focus on consumer health, and has been successfully introduced to the New Zealand market (October 2012). The first five products marketed by the New Zealand Vital Vegetables Marketing Partners include **vital**heart™, **vital**sight™ and **vital**bones™ salad mixes; **vital**immunity™ slaw; and **vital**immunity™ medley. Each product contains naturally high levels of nutrients known to be good for health, and each serve contains at least 25% of the suggested daily intake of antioxidants.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Vital Vegetables 2: a trans-Tasman collaborative program to produce fresh, flavoursome & functional vegetables

Technical summary

The Vital Vegetables Program is a trans-Tasman collaborative research and development joint venture charged with developing and commercialising new high-value, health-promoting vegetables for the Australian and New Zealand horticulture industries. At its inception, the philosophy of 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 in part 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 profitability of the local vegetable industry. Addressing this trend remains a priority for both the Australian and New Zealand vegetable industries.

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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 (e.g. purple cauliflower) or less viable mainstream crops (e.g. high-lycopene tomato).

The **vital**vegetables® programme has provided a path to market for functional fresh vegetable products that are a significant step above commodity vegetables. We recommend that Horticulture Australia Limited (HAL) monitors the progress of Vital Vegetables' commercialisation and provides support where specific research requirements are identified. We also recommend that HAL continues to support the development of differentiated vegetable products to enable the industry to add premium products to their offer.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Vital Vegetables 2: a trans-Tasman collaborative program to produce fresh, flavoursome & functional vegetables

J R Eason, December 2012, PFR SPTS No. 7778

1 Introduction

The Vital Vegetables Program is a trans-Tasman collaborative research and development joint venture charged with developing and commercialising new high-value, health-promoting vegetables for the Australian and New Zealand horticulture industry. At its inception, the philosophy of Vital Vegetables was to provide a research, germplasm and marketing framework that enabled 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 in part 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 profitability of the local vegetable industry. Addressing this trend remains a priority for both the Australian and New Zealand vegetable industries.

The Vital Vegetables program has been supported by Horticulture Australia Limited (HAL) funding from the outset. The first Vital Vegetables contract (VV1, VGO3095/VGO3096) was funded for 5 years (2002-06 inclusive), receiving additional transition funding through to mid 2008. A second programme (VV2, VG08141/VG08142) 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 (primarily Brassica). Fundamental and applied knowledge was generated to support the program and a strong relationship with the primary genetics partner was established. 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 program took on board the lessons learned from the launch of Booster® Broccoli in 2009: the program 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. VV2 had a stronger commitment to pursuing commercial opportunities and building relationships with partners and collaborators. A streamlined product development decision-making process was established (**vital**vegetables® Idea-to-Launch Process). In particular VV2 worked closely with partners in Australia and New Zealand to develop strong collaborative marketing partnerships to commercialise the **vital**vegetables® 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 **vital**vegetables® strategy, willing and able to trial new cultivars, and support research and development (R&D) initiatives by adopting new ideas and innovations.

The outcome of VV2 is a mechanism and proof of concept that supports the commercialisation and marketing of differentiated vegetable products in the global market. The project showed what could be realised from developing a range of phytochemical-specific agronomy and postharvest protocols in terms of increasing the competitive and sustainable growth of Australia and New Zealand vegetable industries. The ultimate goal of this program is to increase vegetable consumption by providing consumers with a series of new health-benefit value propositions. The benefits are embodied in **vital**vegetable® sub-brands: **vital**heart™, **vital**sight™, **vital**bones™, **vital**fibre™ and **vital**immunity™.

2 Materials and methods

2.1 Funding and research investment

The Vital Vegetables program is jointly owned by the Vital Vegetable Research Partners (VVRP): Horticulture Australia Ltd (HAL), the New Zealand Institute for Plant & Food Research Limited (PFR), the Department of Primary Industries, Victoria (DPIV) and Horticulture New Zealand. Prior to October 2010 the Australian Vegetable Industry (AUSVEG) was also a joint partner. The PFR voluntary contribution came from internally funded projects and from part of a New Zealand government funded research program (Future Vegetables[1]). Horticulture New Zealand funds were sourced from grower levies. Australian national vegetable levy funding contributed to Vital Vegetables until June 2010.

2.2 Program structure, management and governance

The **Vital Vegetables Research Partners** (VVRP) provided the research expertise for the program and took the initiatives required to establish genetics and marketing groups plus product teams. Governance for the program was provided by the **Vital Vegetables Governance Group** (VVGG). VVGG was formed to oversee the delivery of the research program through the participation of the CEO or suitably qualified delegate from each of the research partner organisations, Plant & Food Research[2] (P Landon-Lane, CEO) Horticulture Australia Limited (J Lloyd, CEO), Department of Primary Industry (R Prestidge , Executive Director Future Farming Systems Research Division), Hort NZ (C Smythe, Board Director). At the April 2008 meeting, the VVGG Charter was agreed to as follows:

- To establish strategic directions and policy framework to guide the science program, commercialisation, communication and IP management;
- To monitor the science program based on reports from the Vital Vegetables Executive Manager on progress towards milestones contained in the science plan;
- To monitor progress in the management and commercialisation of intellectual property generated by the science program;
- To monitor performance of marketing and genetics partners.

The **Vital Vegetables Executive Manager**, Russell Sully, was responsible for the delivery of all aspects of the program which included the Science Team, Commercialisation Team and coordination of activities with the genetics and research partners. This role did not have line management responsibility: that was the responsibility of the research organisations who had the contracts with HAL.

The **Vital Vegetables Operations Team** (VVOT) was tasked with the day-to-day management of the program and interfaced between science, marketing and commercialisation. VVOT was composed of the Executive Manager (as above)**,** Research Leaders from PFR (J Heyes, then J. Eason) and DPI (R. Jones, G. Thomson, B. Tomkins), Commercialisation/Marketing Managers (J. Howson then M. Slater, D. Hughes then A. Bourhill), ex-officio observers from HAL (P. Roeth, D. Moore, K. Lee). Key responsibilities of VVOT included:

- Science planning, monitoring and reporting.
- Aligning science with product development (in line with commercial and marketing needs).
- Implementing and managing a formal product development decision-making process that involved all key partnering organizations.
- Risk assessment and mitigation planning.

[1] Future Vegetables was a negotiated research agreement between FRST (now Ministry of Business, Innovation and Employment), PFR and the vegetable sector that supported the development of high value vegetables produced sustainably and exported to world markets, including development of product concepts with enhanced consumer values and underpinned by new and improved production technologies that support economic and environmental sustainability.
[2] Formerly Crop and Food Research until Dec 2008.

- Managing the commercialisation of intellectual property generated by the program.
- Managing the research delivery obligations as set out in the Vital Vegetables Collaborative Research Agreement and Project Agreements.
- Managing the relationship and commercialisation of IP between the partners and stakeholders.
- Supporting coordination, sound governance and management for the project.
- Communications with all stakeholders.

Operational plans were developed on an annual basis. Activities were drawn into an agreed plan at the Annual Research Meeting (alternating between Australia and New Zealand). After the transition to a product focus (October 2010), project team teleconferences were scheduled regularly[3] and meeting minutes were lodged on the research website. The R&D actions that arose from specific products were drawn into the annual science plan, along with other generic research that future-proofing the program. This plan was agreed by the operations team, governance group, and the funding agency (HAL).

Within VVRP the **Commercialisation Team** directed the development of the **vital**vegetables® brand and business models that involved genetics and marketing partners. The transition to a product-focused structure for VV2 led to the establishment of **Project Teams**. The role of the project team was to draw on research, genetics and marketing partner expertise to co-ordinate science, production and marketing that underpin the successful development and commercialisation of the product. As each new product idea was developed, a new project team was established.

The **Vital Vegetables Genetics Partners** (VVGP) provided access to global breeding programs and selections of germplasm for targeted screening.

Vital Vegetables Marketing partners (VVMP) were grouped by territory (Australia, New Zealand). The role of the marketing partners was to provide the growing, processing and marketing capability. VVMPs identified individual product preferences and could be the sole grower, processor and marketer of the vegetable product, or license growing and processing with selected suppliers. In all situations the intention was that the marketing partner would be responsible for distributing and marketing specific products in their territory.

[3] Monthly or quarterly depending on the stage of the project.

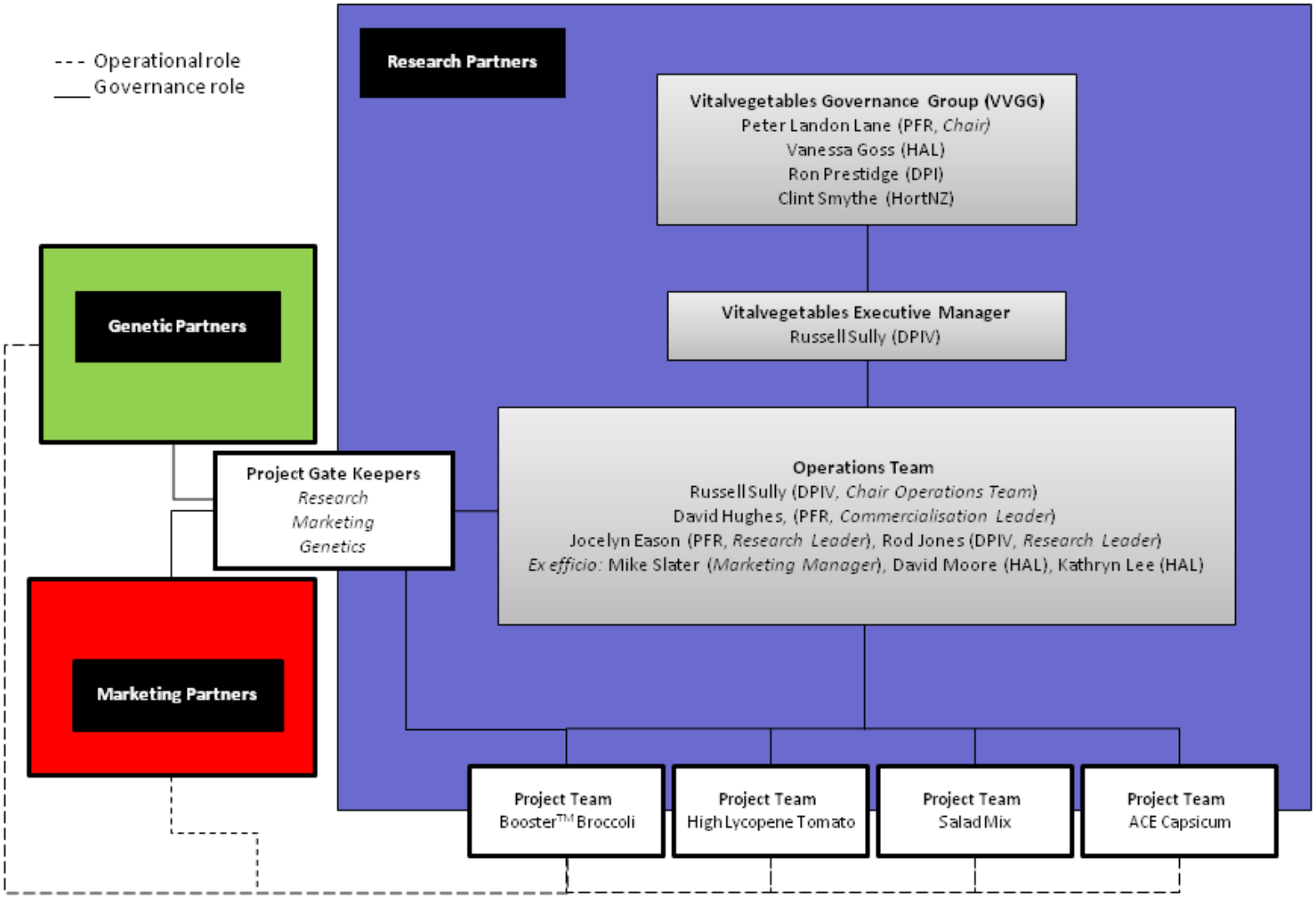


Figure 1 Structure and Governance of Vital Vegetables Program (as in December 2010).

Completion Date: 31 December 2012. PFR SPTS No. 7778

2.3 Stakeholder engagement and communication

A stakeholder engagement plan was developed and implemented after the mid-term review (May 2011). The plan provided a critical path to launch in New Zealand and included reporting schedules, product manual preparation, product development status updates, and meetings specific to Project Gate Keepers, Marketing Partners (both within territory and trans-Tasman), Research Meetings (both within territory and trans-Tasman) and VVGG meetings.

Two separate websites were developed as part of the communication strategy.

1. A secure VVRP site built to retain all IP generated as part of the program.
2. A consumer website was developed for marketing purposes (http://www.vitalvegetables.co.nz/)

2.4 Risk assessment

A risk management process was put in place in May 2011 to generate a comprehensive list of events that might affect objectives and operations within VV2. The process ranked risks and ensured treatments were implemented. The risk plan was reviewed quarterly by the Operations Team.

Table 1 Vital Vegetables Risk Register

Risk Category	Specific Risk	Description of Risk
Management of stakeholder relationship	Marketing partners & retail sector do not commit to the success of VV2.	The program is unable to successfully commercialise the products. Partners cannot cover and support the product range with adequate marketing and promotion. VVMP Do not sign agreement, which can lead to leakage of IP.
Planning & delivery	Marketing claims are not robust, meaningful & permissible.	The products do not have strong enough point of difference to encourage purchase at a premium price. Partners are at risk of litigation. Marketing approach lacks substance and consistency.
Planning & delivery	Difficulty creating differentiated product portfolio, competitive advantage and economic returns.	VV products may not achieve required economic yields. Products are not distinctively different. Products do not have economically viable turnover levels (i.e. not composed of cornerstone vegetables).
Management of stakeholder relationship	Loss of genetic partner.	Cannot use exclusive rights to create competitive advantage. Difficulty in obtaining suitable germplasm which is distinctive and commercially viable.
Governance & strategy with partners	Governance and stakeholder relationship management poor.	Program goes off track, and does not achieve the desired goal. Partners are not all working towards the same goal. Inefficiencies created that undermine momentum Poor communication and collaboration.
Planning & delivery	Weak product portfolio.	Product concepts do not transition into a firm product portfolio and viable range. Business cases and product manuals do not progress to launch ready stage. Trials fail to produce scientific evidence to support robust claims. Partners do not contribute in a timely way to enable the product to progress to next phase and meet deadlines. Products are not commercially viable.

2.5 Market research

Although there was market research in VV1, further market research was seen to be necessary in the second phase of Vital Vegetables, VV2. This decision was taken in part due to the review conducted in April 2010 following the launch of Booster® Broccoli in Australia in August 2009. In addition, the development of the risk mitigation plan identified market research as a key approach to managing some of the specific risk the program faced.

The purpose of the consumer market research conducted in 2011 was to obtain consumers' reactions to the concept, confirm brand positioning and identify factors that would stimulate initial trial purchase and ongoing repeat purchase in order to establish and grow the brand and category. A qualitative consumer research study was conducted in Australia and New Zealand – four groups of vegetable purchasers and users (i.e. young singles/couples no children: mums with children <12 years; mums with children >12 years; older singles/couples (empty nesters) were assessed in each country in a total of 10 groups each with seven to eight participants and a 1.5 h duration.

The overall research objective was to explore consumer response to the **vital**vegetables® concept in order to ensure optimisation of the launch of **vital**vegetables® into the marketplace. The key outputs from the study were:

- An understanding of the overall reactions of target audience to the **vital**vegetables® concept.
- Establishing the most effective way/s of positioning **vital**vegetables®.
- An understanding of the factors that stimulate initial trial and ongoing repeat purchase.
- Identifying the claims (health v. lifestyle) that are most relevant to the concept.
- Identifying how best to differentiate **vital**vegetables® from regular vegetables.
- An assessment of pricing options.
- Evaluation of the creative directions that had been developed.

2.6 Product development (phase and gate process)

To address the key success factors of broadening the product range to develop a **vital**vegetables® category and to gain greater commitment from all partners, a phase and gate process was implemented from July 2010. The **vital**vegetables® Idea to Launch Process (ItL) was designed to support the commercialisation of all new product ideas generated by the research partnership (Figure 2).

The purpose of ItL was to provide a transparent system to guide and facilitate rapid and successful development and commercialisation of new product ideas. A user guide clearly defined the process, roles and responsibilities, and provided templates (e.g. business case template, pre-concept template) and tools (e.g. risk analysis, cost benefit analysis, integrated product development, project planning tool, PESTE analysis) to ensure objective decision-making, to allow a consistent strategic approach, and to provide streamlined execution and transparency for all stakeholders (Appendices 1 – 7).

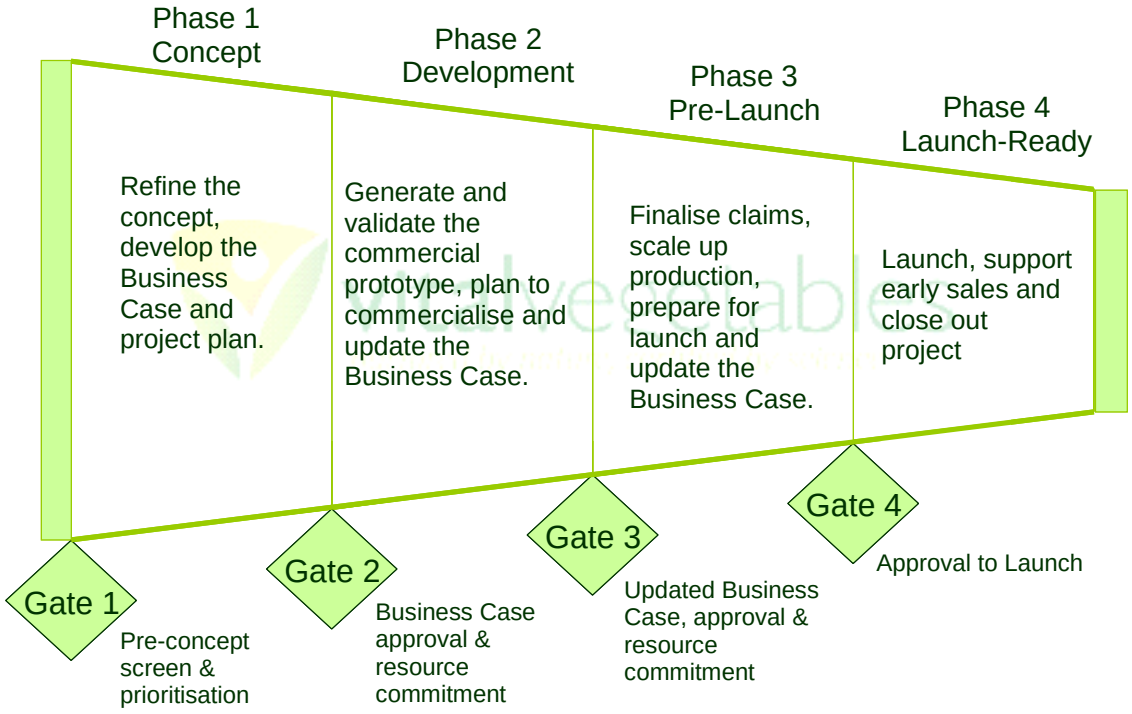


Figure 2. Vital Vegetables Idea to Launch Process.

The ItL process provided a consumer and marketing focus to our product development. Key personnel from the marketing partners were fully involved in the ItL process, providing a critical point of contact and communication between research and marketing organisations. It also ensured commercial activities, logistics, and production and postharvest activities were integrated into the project. ItL was designed to enable the core project team to ask key questions in a timely way, capture the core knowledge generated from the research program and deliver products with consistent composition and quality that had acceptable or enhanced flavour and optimum shelf life/freshness. Key members of the Project Teams were provided with training to identify opportunities, clearly define the product, and identify and evaluate risks associated with the products in order to increase the chances of success.

Each gate provided a critical decision point to manage business risk by pre-determining a time to stop, review and decide whether or not to release resources (people, equipment and funding) to work on the next phase. Formalising these decision points helped to minimise risk and to ensure focus for resources on high-quality project opportunities. Gates were structured with deliverables from the previous phase, gate decision criteria and outputs (Appendix 1).

Completion Date: 31 December 2012. PFR SPTS No. 7778

3 Results

3.1 Business goal – naturally healthier vegetables, industry and community

The purpose of the Vital Vegetables Program was to grow the market for high-value vegetables that deliver scientifically verified benefits to the entire supply chain, health and well-being for consumers, and generate financial prosperity for all stakeholders. The experience of releasing and subsequently withdrawing Booster® Broccoli from the Australian market led to a significant reconfiguration of the business model and a redesign of the approach to differentiation and marketing **vital**vegetables® products. The reconfigured business model was composed of six strategic elements that supported development of a **vital**vegetables® category.

1. **Market-driven product innovation.** Our strategy was to drive the program by consumer demand, creating visibility at the store level and providing consumer choice through a range of products. We have focused on generating sustainable volumes by targeting popular large-selling products (e.g. leafy salad mixes) that have the potential to achieve a reasonable market share and create critical mass for the **vital**vegetables® brand. A feature of these targeted products is that they provide relevant nutrients with specific consumer health benefits, while still being fresh and good to eat.
2. **Strength through strategic partnerships.** Strategic partners provided research expertise, supply chain expertise, commercial and marketing expertise and consumer intelligence. The program attracted partners that would benefit from the growth and success of the **vital**vegetables® brand. This is achieved by:
    - **Investing and aligning risk and reward**. Establishing a commercial model that ensured protection of intellectual property, trademarks and brand value by providing guidelines that defined and monitored the standards, testing and approval protocols;
    - **Exclusivity**. Partners have exclusive rights to the brand and product information for their territory;
    - **Engagement**. Partners are engaged in planning, decision-making, setting and meeting performance targets;
    - **Roles and responsibilities**. Clearly defined and agreed roles and responsibilities for each of the stakeholder group were communicated (Appendix 8), together with their roles and responsibilities in product development (Appendix 2).
3. **Brand development and management.** The essence of the **vital**vegetables® brand (Figure 3) was developed in collaboration with all partners in 2008 and is supported by the Brand Usage Manual (version 3, September 2012). The marketing program for spring 2012 differentiated **vital**vegetables® products from regular vegetables through consumer benefit claims, product format, packaging, branding and content labels. Planning, investment and execution of marketing plans was through marketing partners in each territory.
4. **Scientific innovation.** The program established scientific data to support production and marketing of **vital**vegetables® products. Evidence-based dossiers link specific nutrients in vegetable products to consumer health benefits under a series of strategic benefit claims – **vital**heart™ to support heart health, **vital**sight™ to support healthy vision, **vital**bones™ to support bone health, **vital**immunity™ to support the immune system, **vital**fibre™ for digestive health.
5. **Leadership and a Sustainable Business Model:** Although we envisaged a long-term management and commercialisation body that would seed R&D investment to support ongoing product development after the current HAL funding stopped, this has not yet become a reality. The development of a sustainable business for **vital**vegetables® product development required a successful category launch which has occurred in New Zealand in 2012, but not in Australia. This

seriously limited the income in the form of royalties which had been mooted as a source of funding for this ongoing R&D: a financing/resourcing model to provide a revenue stream for R&D in still under investigation.

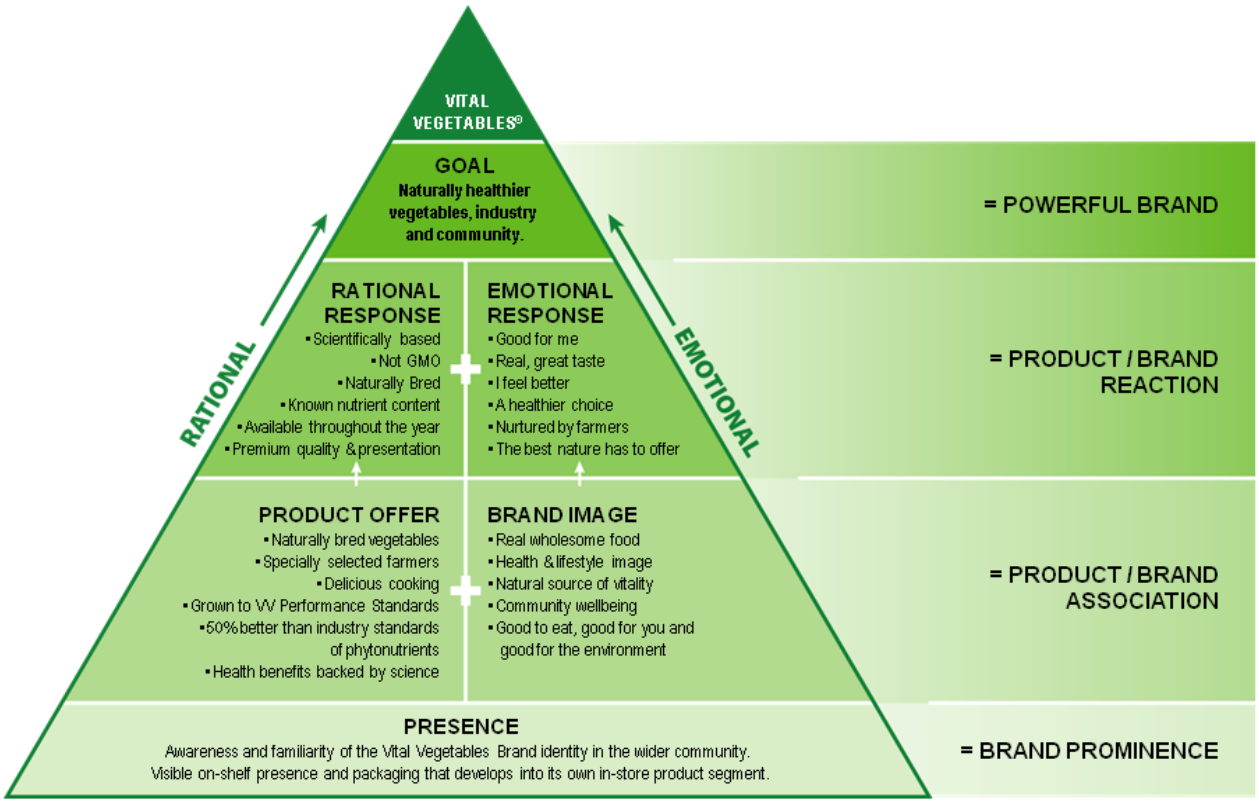


Figure 3. Vital Vegetables Brand Loyalty Pyramid. The pyramid provides a frame work to create long-term consumer loyalty and successfully deliver the goal of the business plan. The opportunity is to drive an emotional bond to **vital**vegetables® in conjunction with rational drivers of choice. The Brand Loyalty Pyramid was developed in conjunction with Di Marca Brand Performance Pty Ltd, 2008.

3.2 Product development (Idea to Launch Process)

A **vital**vegetables® product is a vegetable that, after rigorous testing, has been proven to deliver a guaranteed minimum content of a signature nutrient that is superior to the industry standard and delivers a measurable benefit to the consumer in a standard serving size. The health benefit of these products is in addition to the nutritional benefits that vegetables normally provide. **vital**vegetables® products must meet the following criteria;

1. A known content of nutrient (at least 25% greater than the industry standard) that delivers a specific health benefit to consumers based on current knowledge.
2. Taste equal to or more acceptable to consumers than industry standard.
3. Shelf life equal to or greater than the industry standard product.

ItL provided a transparent process that guided and facilitated rapid and successful development and commercialisation of new product ideas in the form of **vital**vegetables® concepts. The process was implemented with the initiation of Project Leader training in July 2010. By October 2010 the first series of projects were migrated into ItL at the phase 2 (High Glucosinolate Broccoli Florets, Baby Leaf Salad Mixes, ACE Capsicum) with further migration of projects into the product development process in February 2011 (Purple Potatoes, High-Lycopene Tomatoes, Se-sprouts) and June 2011 (High Vitamin Carrots, Orange Cauliflower, Floretted White Cauliflower, Slaw, Baby Carrots). The status of the product portfolio was reported to the Operations Team in a tabulated form at monthly intervals (see Table 2), and to HAL at the completion of each milestone (see Table 3). A snapshot of the portfolio was provided on a quarterly basis to VVGG (Table 4).

The initial suite of products (milestone 108: April 2011, Table 3) were primarily based on elite germplasm – vegetables that had higher levels of nutrients than standard commercial varieties, e.g. high-glucosinolate broccoli, high-antioxidant salads, high-lycopene tomatoes, high-vitamin capsicum. Product concepts were based on perceived opportunities for vegetable based products. However, as the project teams undertook cost-benefit analyses for the single vegetable products, it became clear that 'on-shelf differentiation' and 'perceived value for money' was going to be difficult to achieve, particularly when the yield of the certain elite varieties was lower than that of standard varieties (i.e. ACE Capsicum and High-Lycopene Tomatoes were ca. 50% lower-yielding than standard varieties when grown in similar glasshouse conditions and the first line of high-glucosinolate broccoli took longer to head than standard varieties). Product differentiation was further challenged when health benefit claims could not be made for the most valuable nutrient present in the vegetable. For example

- glucosinolates in floretted broccoli – glucosinolates are not core nutrients and under FSANZ P293 health benefit claims associated with glucsoinolates are prohibited.
- pro-carotenoid A in carrots – standard varieties also contain >25% RDI for pro-carotenoid A and claims for a contents greater than 25% RDI cannot be made.

In certain circumstances on-shelf differentiation could not be paired with sufficient nutritional benefit to support a health claim, e.g. orange cauliflower contains pro-vitamin A carotenoids but the levels are <10% RDI, and therefore we could not make a health claim for the product.

For these reasons the portfolio of products was regularly assessed to prioritise products and to identify opportunities near market as well as secondary products that had a greater chance of success once the **vital**vegetables® brand was established (e.g. floretted broccoli, vital carrots).

The success of developing mixed salad products was a turning point for the product development strategy. It became clear that mixed products provided:

1. Product differentiation through a mixture of unique components and clearly labelled packaging;
2. Consumer value through convenience – meal solutions;
3. Greater branding opportunities (trademarks, icons, health messages, Nutrition Information Panels (NIPs), website address on pack)
4. Value to the growers by providing a channel for minor crops (e.g. purple cauliflower).

In light of this, VVRP and VVMP reassessed the product portfolio on 28 August 2012 and introduced a new range of mix concepts (Milestone 111, September 2012, Table 3). It was anticipated that these products would have greater speed to market, as the project teams had greater experience with product development, and nutrition and health claims. By the end of September 2012, the program had six products in launch-ready phase, one product in pre-launch, four in development and six new concepts.

3.2.1 ItL outputs – product manuals and business cases

The product manuals were developed by the project team and had input from both research and marketing partners. The manuals contain generic information developed by the Research Partners applicable to all territories as well as territory-specific information. This takes into account the unique production characteristics of the environment under which the products were tested and subsequently produced. A template for the product manual is provided in Appendix 5. The product manuals for seven different **vital**vegetables® products that had reached pre-launch and launch-ready stages were significant outcomes of the VV2 Programme (i.e. High Glucosinolate Broccoli Product Manual for NZ Territory; **vital**heart™ Salad Mix Product Manual for NZ Territory; **vital**bones™ Salad Mix Product Manual for NZ Territory; **vital**sight™ Salad Mix Product Manual for NZ Territory; **vital**immunity™ Medley Product Manual for NZ Territory; **vital**immunity™ Slaw Product Manual for NZ Territory; Selenium enriched sprouts Product Manual for NZ Territory).

Business cases for each project were developed as part of the ItL process with input from the research, marketing partners and genetics partners where appropriate. A template for the business case is provided in Appendix 6. The business cases for seven product concepts were prepared for the VV2 Program. The business cases included projects that had reached "launch-ready" status (High Glucosinolate Broccoli Business Case for NZ Territory; Baby Leaf Salad Mixes Business Case for NZ Territory; Vegetable Medley Business Case for NZ Territory; Slaws (**vital**immunity™ slaw) Business Case for NZ Territory) as well as projects that had been stopped (ACE Capsicum Business Case for NZ Territory; High Lycopene Tomato Business Case for NZ Territory) and a product that was in pre-launch phase but had not yet been commercially tested (Selenium enriched Sprouts Business Case for NZ Territory).

Launch-ready **vital**immunity™ medley product

Table 2 Progression of **vital**vegetables® products through ItL process (situation as at 30 November 2012). The status of the product portfolio was reported to the Operations Team in this tabulated form at monthly intervals.

Project Number	Name	Entry into ItL phases: 1	2	3	4	Status
N001	High Glucosinolate Broccoli Florets	*	Oct-10	Feb-11	Sep-11	**On Track** - packaging tests successful. This product will now not be launched by VVMP in October 2012. There is real concern that consumers will not pay a premium for a broccoli only product - limited differentiation from commodity vegetables; no health benefit can be claimed for glucosinolates therefore consumer value proposition not strong enough.
N002	Purple Potatoes	*	Feb-11	Feb-12		**On Hold** (Sep 11) - first variety had poor cooked colour, new variety testing to commence next season.
N003	Baby Leaf Salad Mixes	*	Oct-10	Dec-10	Feb-12	**Launch** - Three salad products launched October 2012 (**vital**heart™, **vital**sight™, **vital**bones™).
N004	ACE Capsicums	*	Oct-10	Feb-11	X	**Stop** (Apr-11) - yield too low for commercial viability ca. 17kg/m2, need min of 25 kg/m^2.
N005	High-Lycopene Tomatoes	*	Feb-11	X		**Stop** (Apr-11) - yield too low for commercial viability (too-few trusses/plant and late to fruit).
N007	High Vitamin Carrots	*	Jun-11	Jun-12		**On-Track** - we note that differentiation will be a challenge.
N008	Orange Cauliflower	*	Jun-11	X		**Stop** - lack of suitable germplasm, carotenoid content <10% RDI, opportunity for mixed product.
N009	Floretted White Cauliflower	*	Jun-11	x		**Stop** - lack of suitable elite germplasm, cannot link a health benefit claim to glucosinolate content, opportunity for mixed product.
N010	Slaw	Jun-11	Sep-11	Feb-12	Jul-12	**Launch** - **vital**immunity™ slaw launched in market from October 2012.
N011	Mini Cabbage	X				**On Hold**. Awaiting elite germplasm from Australia (DPI) for nutrient testing.
N013	Se-Sprouts	Feb-11	Jul-11	Apr-12	Nov-12	**On Track** - commercial testing of production protocol with low Se-waste stream.
N014	Coloured Sweet Corn					**On Hold**, pre-concept introduced Mar-12, seeds not available for testing.
N015	Calebrini	X				**Stop** - VVMP-NZ not interested in a calebrini product.
N016	Broccoli Heads	*	Jul-12	X		**Stop** (Jul-12) - no differentiation from commodity broccoli market.
N018	Vegetable Medley	*	Jun-11	Feb-12	Jul-12	**Launch** - **vital**immunity™ medley launched in market from October 2012.
N019	Asparagus	Oct-10	X			**Stop** (Jul-11) - no varieties had superior nutrient content (nutrients that would support a health claim) relative to industry standard.
N020	Stir Fry	Mar-12	Nov-12			**On Track** - prototype formulation and testing.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Project Number	Name	Entry into ItL phases: 1	2	3	4	Status
N021	Frozen Medley	X				**No Activity** - no partner in NZ for frozen products (lower priority than fresh products).
N022	Frozen Stir Fry	X				**No Activity** - no partner in NZ for frozen products (lower priority than fresh products).
N023	Baby Carrots		Jun-11	X		**Stop** (Sep 11) - anecdotal evidence suggested elevated health benefit with UV - we could not repeated/confirm data.
N024	Se-Capsicums	X				**Stop** - low priority, science risk.
N025	Se-Tomatoes	X				**Stop** - low priority, science risk.
N026	Green Light Snacks	Mar-12	Nov-12			**On Track** - production methods under development with VVMP.
N027	Oriental Leafy Vegetables	Feb-12	X			**Stop** - Interest by VVMP for Chinese Vegetables (leafy greens, small size). VVGP do not have breeding program. This pre-concept needed focus on format/differentiation, see Asian salad.
N028	Pre-Dinner Munchies	Mar-12				**No Activity** - New concept to leverage consumer value of mixes and different end use. Low priority within product portfolio (Nov-12)
N029	Sweet Potato - Purple	Mar-12	X			**Change Concept** - purple sweet potato will be a component of the 'Winter Roast Veg' concept.
N030	Asian Salad	Oct-12				**On Track** - New concept to leverage consumer value of mixes/ Asian-style.
N031	Purple Cauliflower	Mar-12	X			**Stop** - Not suitable as a single product, include in vegetable medley and cauliflower medley concepts.
N032	Summer Mediterranean Grill	Aug-12	Nov-12			**On Track** - New concept to leverage consumer value of mixes. Parallel development with Winter Roasties (N033).
N033	Winter Roasties	Aug-12	Nov-12			**On Track** - New concept to leverage consumer value of mixes. Parallel development with Summer Mediterranean Grill (N032).
N034	Salad Dressings	Aug-12	X			**STOP** (Nov12) **–** Guidelines for developing healthy dressings will be provided to VVMP (Dec12) in order to develop dressing components in house for new **vital**vegetables® products**.**
NO35	Cauliflower Medley	Aug-12	X			**STOP** (Nov12) **–** production risk and consumer value proposition considered too low (VVMP - limited differentiation from commodity vegetables, unable to make health benefit claim for glucosinolates).

Phases: 1 = concept; 2 = development; 3 = pre-launch; 4 = launch-ready
* – Project was migrated into phase 2 of ItL process.
X – Project did not progress through gate into next phase

Table 3 Changes in the **vital**vegetables® product development pipeline over time. Products in brackets are on hold, products with strike through them have been stopped (situation as at 30 September 2012). The status of the product portfolio was reported to HAL in this format at the completion of each milestone.

Pre-Concept	Concept (phase 1)	Development (phase 2)	Pre-Launch (Phase 3)	Launch Ready (Phase 4)
Milestone 108: April 2011				
	Se-sprouts	Lyco-Tomatoes	Salad Mix ACE Capsicum Broccoli florets	
Milestone 109: October 2011				
Green light veg snack	White cauliflower ~~Asparagus~~ (Purple Potato)	vitalslaw Veg medley Se-GR sprouts Orange Cauliflower Broccoli Heads ~~Baby Carrots~~ (Lyco-Tomatoes)	Vital Carrots Salad Mix ACE Capsicum	Broccoli florets
Milestone 110: May 2012				
Purple kumara	'green light' snacks Pre-dinner munchies Oriental leafy veg Coloured sweet corn	vitalfibre™ slaw vital stir-fry Purple cauliflower White cauliflower Orange cauliflower (Lyco-Tomatoes)	Se-sprouts vitalmedley™ vitalimmunity™ slaw Purple potatoes Vital carrot ~~ACE Capsicum~~	Broccoli florets vitalheart™ salad vitalsight™ salad vitalimmunity™ salad
Milestone 111: September 2012				
(Purple kumara)	'Green light' snacks Pre-dinner munchies Salad dressings* Mediterranean grill** Winter roast mix ~~Oriental leafy veg~~ Asian Salad (Coloured sweet corn)	vitalfibre™ slaw vitalimmunity™ stir-fry Cauliflower medley*** ~~Lyco-Tomatoes~~	Vital carrot Se-sprouts (Purple potato)	Broccoli florets vitalheart™ salad vitalsight™ salad vitalimmunity™ salad vitalimmunity™ slaw vitalimmunity™ medley

* potential to include capsicum and tomato.
** potential to include purple kumara and purple potato.
*** mixed product to include white, orange and purple cauliflower.

Table 4 Product Portfolio of **vital**vegetables®, 30th September 2012, New Zealand. This snap shot view of the portfolio reported to VVGG at quarterly intervals.

Pre-Concept				
Concept			'Green-light' snacks Pre-dinner munchies Salad dressings Mediterranean Grill	Winter Roast Mix Oriental leafy veg
Development		**vital**fibre™ slaw **vital**immunity™ Stir-fry	Cauliflower medley Se salad/slaw/stir-fry	
Pre-Launch				Vital Carrot
Launch-Ready	Broccoli florets* **vital**immunity™ medley **vital**immunity™ slaw **vital**heart™ salad **vital**sight™ salad **vital**bones™ salad			
	Spring 2012	**Autumn 2013**	**Spring 2013**	**Autumn 2014**

*The packaged Booster® Broccoli floret product is in launch-ready phase but a commercial decision has been taken not to launch the product in October 2012 in New Zealand (i.e. spring 2012). VVMP-NZ MPs believe consumers do not understand the benefit of Booster® Broccoli, we cannot link glucosinolates to health claims, and they consider that including the product in the October launch risks jeopardizing the whole range.

Completion Date: 31 December 2012. PFR SPTS No. 7778

3.2.2 Case studies

Examples of the **vital**vegetables® product development process are given in the two following case studies. The high-lycopene tomato product has been stopped because of issues over productivity and the salad mix product has proceeded to launch.

HIGH-LYCOPENE TOMATO – CASE STUDY

The New Zealand glasshouse-grown tomato market had a sales value of NZ$108 million in 2011. Tomatoes are a large volume mainstream vegetable crop. An opportunity exists to market a great tasting bright red high-lycopene tomato. The product concept envisaged that this product would be differentiated in the market through:

- **Colour intensity**: Ultra-high-lycopene tomato has a vivid outer colour and high internal colour that will provide a visual point of difference;
- **Nutrition and health benefit**: The health benefits of eating vitalvegetables® tomatoes will flow from eating tomatoes that have twice the lycopene content of standard lines, ≥15 mg/100 g fresh) and have greater vitamin C and total phenolic content. A recommended dressing will also be included in the product pack to increase bioavailability of lycopene.

Germplasm check-list – A check-list was developed to define genetic material most appropriate for production under New Zealand's growing conditions (Appendix 9).

Research trials – High-lycopene lines were obtained from Hazera Genetics Ltd (Israel), and tested under New Zealand growing conditions. The high-lycopene tomato lines had stronger colour than standard commercial lines, with double the lycopene and 1.5 times more vitamin C and total phenolics than the standard tomato variety (Table 5). The best high-lycopene line tested was a similar size to standard tomatoes but had greater dry matter, firmness and sugar content when mature, which suggests it might provide a superior taste (Table 6).

Table 5 Colour and nutritional status of high-lycopene tomatoes. Fruit were analysed after ripening at 20°C.All values are the averages of three replicates (four fruit per replicate).

Tomato Line	Colour		Nutritional Status		
	Chroma value[4]	Reflectance ratio (R670:R540)[5]	Lycopene (mg/100 g FW)	Vitamin C (mg ascorbic acid/ 100 g FW)	Total Phenolics (mg GAE/100 g FW)[6]
Westland	29.8	4.0	8.6	11.8	24.5
Hi-Lyc-1[7]	35	5.1	20.4	17.6	35.9
LSD p<0.05	1.9	0.6	2.2	2.3	5.6

[4] The chroma value measured the perceived strength of a colour. Therefore while the high-lycopene line is the same colour as 'Westland' (i.e. red) it had stronger colour and more depth of colour.

[5] Reflectance of light at a particular wavelength (as opposed to absorbance) is considered to indicate the colours that are seen. Ratios of reflectance of 540 nm (maximum reflectance of lycopene for red colour) against reflectance at 540nm (maximum reflectance of chlorophyll for green colour) gives a comparative measure of the amount of red colouration in the surface of the fruit.

[6] GAE, gallic acid equivalents.

[7] Sourced from Hazera Genetics Limited.

Table 6. Taste and quality of high-lycpoene tomatoes. Fruit were analysed after ripening at 20°C.All values are the averages of three replicates (four fruit per replicate).

Tomato Line	Taste			Quality			
	Total soluble solids (°Brix)	Acidity[8] (g CAE/ 100 g FW)	Sweetness[9]	Firmness (N/m)	Dry Matter (mg/g FW)	Fruit diameter (mm)	Fruit weight (g)
'Westland'	3.81	0.382	23.4	124.8	55.8	66.9	140.9
Hi-Lyc-1	5.69	0.3437	27.8	196.1	74.6	65.6	142.5
LSD p<0.05	0.4	0.03	-	30.9	4.1	2.8	10.7

Postharvest protocols – Due to the different colour and firmness of the developing high-lycopene tomatoes, the ripening stages needed to be investigated, and harvest-maturities specific to the high-lycopene varieties defined within the postharvest protocol.

Pre-commercial trials – Commercial viability of the crop was tested in pre-commercial trials relative to a standard tomato variety. This research established that the high-lycopene tomato lines were only productive for a short season – they were late to set fruit (~4 weeks) and the crop yield was only 50% of standard commercial varieties. We concluded that selection of the Hazera Genetics Ltd high-lycopene tomato lines occurred under a hot outdoor growing environment, quite different to the New Zealand situation. As the lines were not suited to New Zealand growing conditions and production systems, this led to a failure of the lines to meet the New Zealand grower specifications for commercial viability.

Project stopped – The high-lycopene tomato project had two critical flaws that resulted in this project being stopped. (1) Nutrition and health benefit claims under FSANZ P293 excluded any link between lycopene and a health benefit; (2) The yield of the tomatoes was too low yield relative to standard commercial varieties under New Zealand production conditions. The project was initially put on hold while other phytochemical targets and product formats were investigated, and then stopped when alternative nutrient targets and production systems were discounted.

[8] Titratable acidity, citric acid equivalents
[9] Sucrose equivalents

VITALBONES™ SALAD MIX – CASE STUDY

Concept - Salad mixes are a mainstream vegetable product in the minds of consumers. Bagged salads are one product category that has seen considerable growth in recent years and they are currently being marketed on taste, convenience and novelty, but not health. This project aimed to launch salad mix products in New Zealand to gain first-mover advantage in the functional food market segment for health-benefit branded salad products.

Research trials – research trials were undertaken to build an analytical database that contained data on the nutrient composition of a wide range of leafy salad components that would be suitable for a bagged salad mix. Seasonal nutrient analysis was undertaken to ensure a consistent product could be produced.

Pre-commercial trials – Prototype mixes were designed to taste and look unique as well as containing high levels of key nutrients. Prototype testing confirmed the high antioxidant activity (ORAC), vitamin C and vitamin K content of the prototype (Table 7). Baseline sampling of competitor products was undertaken to ensure the **vital**bones™ salad had at least 25% more nutrients than similar mesclun-type salads.

Table 7. Nutritional status of **vital**bones™ salad mix. Nutrient analysis was undertaken at the end of shelf life. The **vital**bones™ salad mix was compared with mesclun-type mixes available from retail outlets during the same month (January 2011).

Nutrient	**vital**bones™ salad mix	Commercial Standard
ORAC (µmol TE/100 g)	6673	4133
Vitamin K (µg/100 g)	266	185
Vitamin C (mg/100 g)	34	25

Nutrition and health claims – The nutrition and health benefit claims of the **vital**bones™ salad mix product were linked to vitamin K and vitamin C content. It is recognised that consumption of these two vitamins supports bone structure. In addition, the salad contains a minimum of 1,250 ORAC units per 40 g serve. A scientific evidence dossier was compiled to support the antioxidant content claim.

Product Launch – The product was launched in October 2012 in New Zealand. A supporting product manual defined the qualification factors that must be met in order to produce a high-quality **vital**bones™ salad mix that can carry the specified health benefit labelling:

- "Designed with your bone health in mind – contains vitamin K and vitamin C to support bone structure".
- "These **vital**vegetables® have been regularly tested to ensure each 40g serve of salad contains a minimum of 1,250 ORAC[10] units, which is considered 25% of your suggested daily intake for antioxidants".

Marketing image for **vital**bones™ salad product

[10] Oxygen radical absorbance capacity

3.3 Nutri**tion** and health benefit claims

3.3.1 Legislation regarding making nutrition and health claims

There are a number of regulations that are relevant to claims on foods. Of prime importance is the Food Standards Code (Food Standards Australia New Zealand, FSANZ). In addition for each territory there are consumer protections. For New Zealand these are:

- Fair Trading Act (1986)
- Advertising Standards http://www.asa.co.nz/code_food_2006.php
- 'Labelling Logic' recommendations http://www.foodlabellingreview.gov.au/internet/foodlabelling/publishing.nsf/content/labelling-logic
- The Food Standards Code (Food Standards Australia New Zealand, FSANZ) http://www.foodstandards.govt.nz/

Nutrition claims are claims that tell consumers about a nutritional property of a food, i.e. how much of a particular compound (e.g. a phytochemical[11]) is in a food. These claims can indicate the presence of a particular nutrient or biologically active substance in the food and they can also indicate the amount. Certain nutrition claims have special conditions regulated by Standard 1.2.8. Health claims are currently regulated by a transitional Standard 1.1A.2. Under Standard 1.1A.2 the only health claim that can be made about a serious disease is a claim about the benefit of maternal folate consumption for women, i.e. that folate may reduce the risk of having a baby with a neural tube defect, such as spina bifida.

FSANZ is currently working on a new health claims standard (Proposal P293 - Nutrition, Health and Related Claims). Claims have to be scientifically substantiated and not misleading. It is proposed that foods carrying general and high-level health claims will need to meet certain eligibility criteria, and all products will have to be put through the Health Claims Nutrient Profiling Calculator to make sure they are eligible to make a claim (this is particularly important for products with a dressing/sauce). The new standard will regulate three types of claims:

- Nutrition content claims - statements about the presence or absence of a nutrient, energy or a biologically active substance in the food.
- General level health claims - claims about the effect of a nutrient or substance in a food on a health function or a non-serious disease.
- High-level health claims - claims about the effect of a nutrient or substance in a food, that make reference to a serious disease or biomarker of a serious disease (biomarkers of serious disease include blood cholesterol and blood pressure).

Only the first two categories of claims will be used when marketing **vital**vegetables® products, i.e. nutrient content claims and general level health claims (also called nutrient function statements).

3.3.2 Applying nutrition content claims to **vital**vegetables® products

Content claims require justification that a nutrient is present in a product at the stated level. The nutrient and the amount present must then be listed in the Nutrition Information Panel (NIP) on the pack. Content claims are the type of claims best suited for use when marketing **vital**vegetables® products.

Products that contain nutrients that have a recommended dietary intake (RDI) may have 'source'/'good source' claims and general level health claims made for them. For products that contain nutrients that do not have a RDI (i.e. non-core nutrients like phenolics, anthocyanins, glucosinolates) only presence claims may be made (i.e. 'contains').

[11] Compounds found in vegetables that have functionality such that they may support good human health, e.g. maintain a healthy immune system, contribute to heart health, be necessary for normal vision, contribute to building healthy bones and healthy digestion. The phytonutrient(s) used to define a **vital**vegetables® is the compound(s) or class of compounds directly responsible for the health benefits, e.g. vegetables contain a class of compounds known as carotenoids, some of which are directly related to health benefits. Some carotenes (primarily beta-carotene) found in orange/yellow/green vegetables can be converted by the body to Vitamin A. Consuming the pro-vitamin A carotenoids found in vegetables supports healthy vision.

- *'Source'* **-** a vegetable product can be termed a 'source' of a key nutrient (vitamin or mineral) when the key nutrient is present at 10% of the RDI per serve.
- *'Good Source'* **-** a vegetable product can be termed a 'good source' of a key nutrient (vitamin or mineral) when the key nutrient is present at 25% of the RDI per serve.

3.3.3 Applying general level health claims to **vital**vegetables® products

For core nutrients (i.e. where there is a RDI) there are published nutrient function statements that may be used under P293 (the current P293 recommendation includes 115 pre-approved food-health relationships[12]). It has also been stated verbally that "claims" approved under European Food Safety Authority will be allowed (pers. comm., Janet Goodman, Senior Advisor Labelling and Composition, MAF, 15th November 2011). It is important that health claim statements are linked to the particular nutrient rather than the vegetable. For example, we cannot say "**vital**vegetables® salad is good for the immune system" but we can say "**vital**vegetables® salad is good source of vitamins A & C which contribute to a healthy immune system".

Health claims cannot be made for non-core nutrients (phytochemicals such as phenolics, anthocyanins, glucosinolates). Care also needs to be taken with wording of claims. For example,

- We cannot refer to disease – so we talk about bone health not osteoporosis.
- We must refer to health maintenance, not reduction or enhancement of function. This means avoiding verbs like "inhibit", "reduce", "boost", "increase" as they all imply either inhibition or acceleration of a normal function.

3.3.4 Nutrition and health claims used in product communications

Health claim information for all forms of product communication (e.g. on-pack, point of sale pamphlets, articles, websites, brochures etc) falls under the same regulatory framework as information appearing on packaging and products. The messages must be consistent; however there is opportunity to be more expansive in some forms of product communication. References and research reports may be cited as well as provision of information regarding scientific support for the nutrient and its effects. Consumers are better at comprehending non-technical terms and those they are familiar with. Hence the terms "phenolics" or "glucosinolates" will require careful explanation whereas "nutrients" and "antioxidants" are immediately accepted.

On-pack labelling for each launch-ready product has been written to align with FSANZ P293 – nutrition, health and related claims, using regulatory information available at 31 July 2012. Three separate sets of information were compiled:

- *Nutrition Information* – the NIP data is based on testing of the finished product manufactured by VVMP. Nutrition information is presented as salad with dressing and salad only (when a dressing has been included). The serving size and number of servings per packet is included in the NIP.
- *Ingredients* – the ingredients must be listed from highest to lowest content and any allergenic components must be highlighted (e.g. wheat, egg, soybean, sesame seeds – these may be found in dressings).
- *Health benefit messages* – a clear link between nutrient content and a specific health benefit is made.

[12] Food Standards Australia New Zealand 2012. Call for submissions – Proposal P293 Nutrition, Health & Related Claims. Consultation Paper 17 February 2012

vitalbones™ salad mix:

"designed with your bone health in mind – contains vitamin K and vitamin C to support bone structure"

vitalheart™ salad mix:

"Designed with your heart in mind. This mix contains more than 10% of the recommended daily intake for vitamin C and contains phenolics"

vitalsight™ salad mix:

"Designed with a focus on your vision. Naturally high in pro-vitamin A carotenoids to support healthy vision"

vitalimmunity™ medley:

"A good source of vitamins A & C to maintain a healthy immune system"

vitalimmunity™ slaw:

"A good source of vitamins A & C to maintain a healthy immune system"

The first five products also had the following message on-pack:

"*These vitalvegetables® have been regularly tested to ensure each 40g serve of salad contains a minimum of 1,250 ORAC units, which is considered 25% of your suggested daily intake for antioxidants*".

3.3.5 Evidence dossiers to support the use of nutrition and health claims for marketing **vital**vegetables®

The pre-approved list of nutrition and health claims relevant to **vital**vegetables® together with the overarching regulatory support for nutrients linked to healthy heart, healthy vision, healthy bones, digestive health and immunity support health benefits have been summarised into a dossier. A separate evidence support dossier has been compiled to support the "25% suggested daily intake of antioxidant" claim. Any claims not included in the pre-approved list would require further rigorous applications in order to be added and used on-pack. In this context, the substantiation framework (pre-approval process) for new claims has been defined. An external expert dietitian (Angela Berrill, ABC Nutrition) and a regulatory consultant (Anny Dentener-Boswell, Adecron Food Tech Consulting) were used to finalise the health benefit messages. The **vital**vegetables® Brand User Manual (version 3, September 2012) guides use of nutrient and health claim messages for marketing of the products.

3.3.6 Quality assurance procedures to support nutrition and health claims

A quality assurance procedure for each product supports the following **vital**vegetables® product criteria:

1. A known content of nutrient (at least 25% greater than the industry standard[13]) that delivers a specific health benefit to consumers based on current knowledge.
2. Taste equal to or more acceptable to consumers than industry standard.
3. Shelf life equal to or greater than the industry standard product.

The product manual for each product clearly defines the critical parameters for crop production, postharvest handling and storage, processing and distribution and product end-use. In addition, a specific quality assurance procedure for each product has been developed. QA protocols include:

- Target nutrient content of product;
- Appropriate replicated end-of-shelf-life sampling;
- Analytical protocols;
- Approved laboratories
- Defined industry standard to benchmark nutritional quality against
- Procedures for off-spec product

Recipe suggestion for **vital**immunity™ medley

[13] The industry standard is defined as the highest volume selling product in the category (Gate Keepers Meeting Minutes, 10th February 2012) and is based on Neilson scan data where possible.

3.4 Communicating **vital**vegetables® to consumers

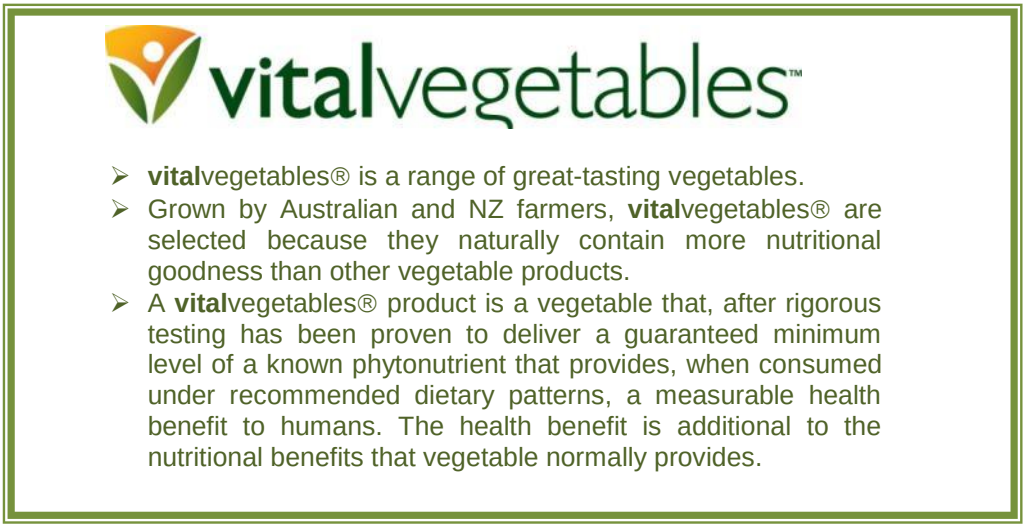
3.4.1 Market research

The market research highlighted the need for **vital**vegetables® concepts to move towards convenient, packaged mixed products that are effective in delivering meal solutions linked to recommended serving size that would help consumers achieve daily intakes of key nutrients. All respondents were female (the main supermarket shopper, regular buyers and preparers of fresh vegetables), and mainly bought fresh vegetables from the supermarket. Recurring questions that were raised by respondents during the market research have been incorporated into the communications plan. Specific issues to be addressed include responses to the following:

- Is it genetically modified?
- How are extra nutrients achieved?
- What is the difference to organic vegetables?

There was also consumer interest in the history and origin of the project, i.e. the fact that it is a government initiative to benefit local farmers and increase health and well-being resonated with the respondents. Questions that were raised during this part of the market research suggested that all terminology and language must be consumer-friendly, not include complex scientific terms, and there was a preference for "% more" information when making claims.

3.4.2 Reaction to vitalvegetables® concept



In summary, the **vital**vegetables® concept had appeal with the respondents. It suggested:

- A promise of increased health and well-being – are even better for you.
- A perception among some respondents that nutrient levels have been declining.
- Some families are not eating five serves per day – added nutrients will help achieve daily intakes.
- 'NZ-grown' had two benefits, it provides assurance of better hygiene/food safety and has emotional appeal to support local farmers.
- The logo and name were universally endorsed with all respondents. There was universal endorsement of both the logo design and the name. The word 'vital' evoked both functional and emotional benefits (necessary, vital). The logo created a positive image (the sun/sunrise/sunset, vitality and vibrancy, health, nature, a tick of endorsement). All respondents saw the **V** in the logo as representing: Vegetables; Vital, a Vital, alive healthy person. One of the key learnings from the Booster® Broccoli launch was the need for visibility at shelf level – this can be achieved through a strong **vital**vegetables® branded range. Due to the apparent strength of the word **vital,** its usage has been extended in sub-brands that can link products across ranges and through health benefits/claims.

Completion Date: 31 December 2012. PFR SPTS No. 7778

3.4.3 Reaction to claims

Both health claims (e.g. healthy heart) and lifestyle claims (e.g. body balance) were tested in the research. Health claims were the clear winners, being seen as far more relevant to vegetables. Of the claims tested, five had appeal, namely immunity, healthy heart, digestive health, healthy vision and bone health.

3.4.4 Marketing mix

In store location – the majority of respondents felt that the products should be displayed together in store, so they have more impact and are easier to find. There was an expectation (especially early in launch) of in store signage, together with leaflets and product information.

Pricing – the respondents felt that the price should sit between regular vegetables and organics. Price premium was greater and more acceptable with pre-mixed/packaged products, and convenience added to consumer value.

Product range – the most preferred product format option (single crop v. mixed product) was the pre-packed mixed product with appealing packaging clearly stating the health benefit.

3.4.5 Factors that stimulate trial and repurchase

Price - The issue of price has implications for repurchase, and the customer must be able to judge whether the price premium is justified and repurchase warranted.

Quality - To achieve repurchase it will be crucial that all produce carrying the **vital**vegetables® logo are consistently of the highest quality standard:

- Look good - no discolouration, vibrant colour.
- Feel good - firm texture, not limp.
- Taste great – there is some expectation that more nutrients mean the product is better tasting. In the absence of any immediate/visible 'proof' of more nutrients, taste will be a key measure/indicator.
- Keep fresher for longer - storage and handling of the product by the distribution and retail outlet will be an important link in the chain.

3.4.6 Differentiation from regular vegetables

The appeal of **vital**vegetables® lies in two core platforms:

- Increased nutritional content - so even better for you.
- 100% NZ-grown - the emotional pull of local origin.

3.4.7 Assessment of pricing options

A key issue in all of this is price. If the price of **vital**vegetables® is the same as regular vegetables then there would be much greater consumer acceptance, but little benefit to the grower/marketer. Therefore, when asking consumers to pay more there must be an accompanying justification for the price premium.

3.4.8 VVRP communication strategy

A communications strategy was developed by VVRP to build awareness of the **vital**vegetables® brand with primary audiences and to support the initial launch of products in New Zealand in October 2012. The strategy provided a solid basis for product marketing activities undertaken by the VVMP; however it was not the purpose of the VVRP communication plan to directly promote the products. Product promotion was the role of the Marketing Partners in each territory at the time the product entered the market. The VVRP communication strategy was implemented in the three months leading up to the October 2012 launch in parallel with VVMP pre-launch activities. The objective of the communication strategy was to:

- Build awareness of and generate interest in **vital**vegetables® concept by telling the science and research story in a simple, yet engaging way.

- Build a compelling story for consumers about the value of **vital**vegetables® by differentiating the products' benefits over regular vegetables and dispelling the myths identified during consumer market research.

The communications strategy used media relations and social media as key communication tools. The media plan did not include communication with the supply chain, such as supermarkets, grocers and wholesalers, as this is considered direct product marketing rather than concept awareness. The messages were primarily of interest to consumers but, through the media relations campaign, also built awareness with the secondary audiences.

- Primary audiences
    - Educated, health-conscious vegetable shoppers
    - Mothers responsible for household shopping
    - Healthy lifestylers
- Secondary audiences
    - Food health and nutritional professionals
    - Growers/vegetable industry
    - Retailer trade

To gain media interest, the Communications Team drafted press releases designed to provide science support for the **vital**vegetables® category consumer messages, e.g.,

- How to keep your vegetables fresh.
- If you are low in selenium, then make sure you eat your broccoli.
- Consumers confused about vegetables (Myths).
- What plants should I grow?
- Eat the Rainbow.
- All vegetables are created equal, aren't they?
- What's so good about vegetables anyway?
- Vegetable Vitamins.

The previous Vital Vegetables consumer website (which focused on the single Booster® Broccoli product) was taken offline in 2012. A new consumer website that focused on the products for release in New Zealand (with a separate skin designed for the Australian territory) was developed to meet the pre-launch and launch needs of **vital**vegetables® category. The research and marketing partners developed a brief that described the requirements of the consumer face of the website and quotes for building the website were sought. Cactus Lab produced the successful quote and the website was built and went live on 14 September 2012 (http://www.vitalvegetables.co.nz/). The website pages provided consumers with information:

- The **vital**vegetables® story
- Products
- Health benefits
- Questions and Answers
- Recipes
- Where to buy
- Contact (postal address, freephone and email).

The website also encouraged consumers to subscribe to the email newsletter to get the latest news and updates, to join us on facebook and to follow us on Twitter. YouTube videos were produced as part of the communications plan.

A list of the outputs linked to consumer communication activities are provided in Appendix 10.

3.5 Category launch strategy

The Vital Vegetables team met with Foodstuffs South Island Ltd and Progressive Enterprises Ltd in a series of meetings between June 2011 and June 2012. The trade presentations were led by VVMP-NZ with PFR providing scientific support for this new health-benefit branded category. The strategy for the presentations was to build a picture of the **vital**vegetables® concept that the retail trade could engage with, for instance:

- The **vital**vegetables® concept - new range, 100% natural, locally grown, scientifically proven, nutritional goodness.
- The history of the program and significant capabilities of the team.
- Learnings from Booster® Broccoli launch in Australia.
- Product pipeline in New Zealand (Figure 4, 5).

Figure 4 Products ready for launch October Launch (May 2011, Trade Presentation)

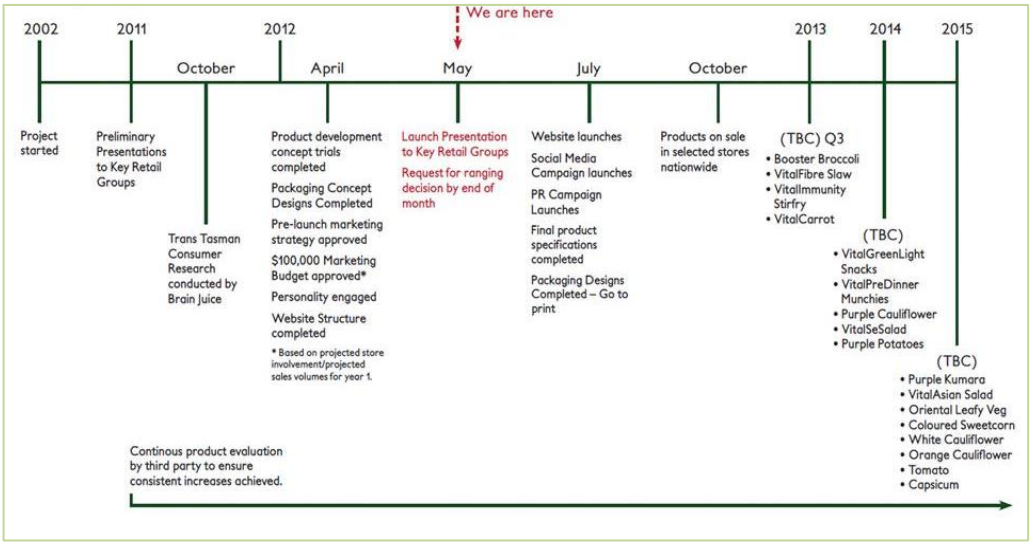


Figure 5. Vital Vegetables Program Timeline (May 2011, Trade Presentation).

The retail trade accepted the new category and agreed to a nationwide rolling launch from 1 October 2012. The key findings of the consumer market research were leveraged by the marketing partners to develop a launch strategy with the retail trade. In particular, they highlighted:

- *"Quality and freshness are intrinsically linked and judged by taste, appearance, longevity and texture"* - all **vital**vegetables® must meet these three criteria, the consumer will focus on

how these values are achieved. All **vital**vegetables® are locally grown. Products are produced from superior seeds and blends.

- *"Attitudes to organic vegetables provide an important frame of reference for **vital**vegetables®"* - it is imperative that **vital**vegetables® is positioned and perceived to occupy the space between standard and organic vegetables.

- ***"**Once the non-commercial information had been provided and some credibility established, interest in **vital**vegetables® was encouraging **…"*** - the increased nutrients claim must be translated into instantly recognizable health benefits, packaging/labelling must clearly show the health benefit(s) and identify the increased nutrients to support it. The message must be consistently applied to all marketing and point of sale collateral so that the **vital**vegetables® brand is associated with increased nutrients and specific health benefits.

VVMP-NZ contracted Angela Berrill to deliver the **vital**vegetables® message. This strategy leverages off Angela's existing profile as an expert nutritionist.

As an expert nutritionist, Angela is passionate about educating the public on the importance of diet and is regularly called on to share her expertise and opinions by the media. For a number of years, she was also the nutrition adviser and expert for TV3's Target, and used her skills as a nutrition writer to contribute to a number of well-known publications. In addition, Angela has acted as a nutrition spokesperson for well-known brands such as Jenny Craig and Symbio.

The launch plan included both pre-launch and post-launch activities. The call-to-action for all pre-launch media activity was to visit the **vital**vegetables® website[14]. Website visitors were also encouraged to engage in social comment both on facebook and the website.

Pre-Launch activities funded by VVMP included:
- PR campaign supported by the VVRP communications strategy;
- Announcement on facebook;
- 'Days Until Launch' counter on the website and email to website database;
- PR kits to key food editors and writers.

Post Launch activities funded by VVMP included:
- Angela Berrill – leverage expert nutritionist to deliver the **vital**vegetables® message;
- Build on social media base;
- Paid advertising commences;
- **vital**vegetables® recipes on website and facebook;
- Coupon promotion on website.

3.6 Intellectual property (brand, trademarks, trade secret)

3.6.1 Form of intellectual property

The form of IP that was considered most valuable and commercialisable was the collated packages of knowledge specific to a particular product concept. Some of this information was in the public domain and not all was proprietary to the partners, but the value was secured through collation of the data into a relevant and useful format. There is some copyright protection for the

[14] www.vitalvegetables.co.nz

collation into a report, manual or spreadsheet but trade secret was the primary protection mechanism adopted by the program. The IP captured in the IP register during VV2 is listed in Appendix 10. It includes product manuals that contain protocols covering crop production, postharvest handling, phytochemical analysis, and nutrition and health claims. As well, numerous entries identify the capability and know-how relating to **vital**vegetables®.

vitalvegetables® is based on a closed loop system. Marketing partners, genetics partners and growers have specific agreements that ensure the know-how associated with the various protocols remains a trade secret. To avoid infringement of intellectual property rights, the **vital**vegetables® IP strategy ensures that PFR intellectual property specialists provide a "freedom to operate" report for each project, and these are used to make informed recommendations for each project.

3.6.2 Protecting the brand and trademarks

In 2003 New Zealand Vegetable & Potato Growers Federation Inc on behalf of the Vital Vegetables Research Partners registered Vital Vegetables trade marks in New Zealand and Australia. The registration covered the word VITAL VEGETABLES (946203) and Symbol extended Form (Logo) (1025460) in four classes of goods:

> **Class: 5** Dietetic substances adapted for medical use, food for babies; nutritional additives for medical purposes; medical and health preparations.
>
> **Class: 29** Preserved, dried, frozen, tinned, cooked and processed fruits and vegetables; soups; juices in this class; jellies, jams, compotes, and sauces; all prepared food products in this class.
>
> **Class:** 31 Fresh fruits and vegetables.
>
> **Class;** 32 Non-alcoholic drinks; syrups and other preparations for making beverages.

In September 2008 a brand essence workshop, with representatives from the VVRP, VVMP, VVGP, defined the essence of the **vital**vegetables® brand (Figure 3). The brand essence then guided the development and management of the brand, logo and trademark registration (summarised in the Brand Usage Manual, version 3, September 2012).

With the marketing partners keen to explore the potential for exports of **vital**vegetables® products, it was agreed in April 2007 to develop an international commercialisation strategy. This also created the need for international protection of trademarks and IP. International registration of trademarks is cheaper if the country of the holder of the trademark is a signatory of the Madrid Protocol. As Australia had signed the Madrid protocol and New Zealand had not, it was agreed that all trademarks would be assigned to Horticulture Australia Limited and registered in Australia on behalf of VVRP. This facilitated cheaper international registration in a number of key territories. The assignment of trademarks to HAL was completed on April 30th 2008. The **vital**vegetables® trademarks and device are listed in the program trademark register (Trade Mark Register, October 2010).

3.7 Brand usage manual and policy on use of trademarks

Preparation of a Brand Usage Manual (and Style Guide) was necessitated by development of the new Vital Vegetables logo, associated trademarks and underlying brand essence. The manual has three main components:

- Information about the **vital**vegetables® brand;
- Criteria for appointment of a product as a **vital**vegetables® product including rules on making public nutritional claims;
- Use of the trademarks consistent with the brand style.

The use of trademarks has been defined in the Brand Usage Manual (version 3, September 2012) which sets out the criteria in the following format:

vitalvegetables®
In order to qualify for the **vital**vegetables® trademark, a product must satisfy the following criteria:

- A known content of nutrient (at least 25% greater than the industry standard) that delivers a specific health benefit to consumers based on current knowledge.
- Taste equal to or more acceptable to consumers than industry standard.
- Shelf life equal to or greater than the industry standard product.

vitalsalad™
To qualify for the **vital**salad™ trademark, a product that meets the three criteria required of a **vital**vegetables® product (see above) must also be composed primarily of raw leafy vegetables.

vitalslaw™
To qualify for the **vital**slaw™ trademark, a product that meets the three criteria required of a **vital**vegetables® product (see above) must also be composed of raw sliced or finely chopped vegetables.

vitalmedley™
To qualify for the **vital**medley™ trademark, a product that meets the three criteria required of a **vital**vegetables® product (see above) must also be composed of a diverse assortment of vegetables and be suitable for cooking by the consumer.

vitalimmunity™**, vital**heart™**, vital**bones™**, vital**fibre™, **vital**sight™
To qualify for these health sub-brand trademarks, a product that meets the three criteria to qualify for the **vital**vegetables® trademark (see above) must also contain key nutrient(s) that support the specific health halo. The **vital**vegetables® must also provide a benefit to consumers in a standard serving size (10%[15] or 25%[16] recommended dietary intake of key nutrient per serve).

3.7.1 Visual icons

The challenge to balance the need for strong claims that create a point of difference in the market but are still within the regulatory framework is also being addressed by registering visual icons for each health halo: **vital**heart™, **vital**sight™, **vital**bones™, **vital**fibre™, **vital**immunity™ (see section 3.3.4).

[15] source
[16] good source

3.8 Key performance indicators

Key performance indicators (KPIs) were identified in the Collaborative Research Agreement as targets to be achieved by the mid-term review. These targets are tabulated in Table 8. A refresh of the contracted milestones after the VV2 mid-term review identified new KPIs that were more closely aligned with product development and commercialisation to be completed by December 2012 (Table 8). The outputs are listed in Appendix 10: Commercial information releases, Confidential science reports, Confidential commercial reports, Scientific publications.

Table 8 Key Performance Indicators for the VV2 Contract.

Key Performance Indicators (to December 2010)		**Target**	**Achieved**
Products	Germplasm – proposals to PBR.	1	0
	Products to commercial agreement.	5	1
	Commercial information releases.	4	5
Science	Science publications, internal reports and presentations.	30	59
	Analytical and crop protocols.	9	20
	Staff exchanges and visitors.	4	4
Key Performance Indicators (to December 2012)			
	Key phytochemical data linked to consumer health benefits for products assembled.	1	1
	Develop robust claims and messages which comply with regulatory requirements in Australian and New Zealand.	5	5
	Hold Gate Keepers meetings.	*	10
	Prepare and present **vital**vegetables® category plans to the trade.	2	2**
	Quarterly reports completed.	8	8
	Business cases for **vital**vegetables® products for gate 4 (launch ready).	5	7
	Product manuals for **vital**vegetables® products for gate 4 (launch ready).	5	7
	HAL reports.	5	5

* as appropriate
**in six separate meetings

Achievement of KPIs was excellent for science publications, internal reports and presentations to December 2010. The development of analytical and crop protocols was also good. These protocols largely contain a body of material from earlier work (VV1) that we have consolidated into formal protocols as part of the product development process. KPIs between December 2010 and December 2012 have all been achieved (Table 8). During this period the team gained considerable experience in processes linked with product development and became extremely proficient in project management, achieving a successful launch of five products in New Zealand in October 2012.

Progress against the science plan was reported quarterly to the Operations Team and VVGG. All reports are circulated within VVRP and lodged on the research website. Research outputs were lodged on the research website and included literature reviews, seasonal production reports within each territory, health benefit dossiers, product information (e.g. production protocols, postharvest storage and handling protocols, processing requirements, quality

assurance procedures), travel reports, minutes of Project Team meetings, operations plan, quarterly reports and annual reports. In the latter part of VV2, project summaries (e.g. opportunity, status, critical path, risks, recommendations) were reported in the gate keepers minutes, updated business cases and power point presentations written for each Gate Keepers Meeting (Appendix 11). These documents were also held on the research website.

IP – proposals to patent

When the Collaborative Research Agreement was marked up at the commencement of VV2 it was recognised that patents would not be the primary form of intellectual property for Vital Vegetables. Formal protection of trademarks, logos and web domain names in Australia and New Zealand has been obtained. These are summarised in the Vital Vegetables trade mark registration summary lodged on the VVRP website.

Germplasm – proposals to PBR

Vital Vegetables research and development contributes value to germplasm owned by germplasm partners (e.g. HM Clause). Protection of germplasm was anticipated to be in the form of Plant Breeder's Rights, but trademark protection has been preferred by HM Clause, registering Calebrini™ in Australia in 2004. They also propose this form of protection for ACE capsicum.

- Booster® has been registered (2009) as a trademark by germplasm partner HM Clause in Australia (No. 1294386) and New Zealand (No. 802085).

Products to commercial agreement

Agreements were in place for the Booster® Broccoli launch in Australia in August 2009. Subsequent issues arising from the performance of the product in market meant that we had to revise numerous aspects of the commercialisation model before relaunch of high-glucosinolate broccoli and other **vital**vegetables®.

Under the Idea to Launch process that was implemented during VV2, product concepts passed through a series of phases and gates in order to reach the launch-ready stage with VVRP, VVMP and VVGP agreement for all aspects of the product. For the New Zealand Territory, the **vital**vegetables® portfolio is summarised in Table 4,;five products were launched in New Zealand in October 2012.

4 Discussion

The purpose of the Vital Vegetables 2 Program (VV2) was to grow the market for high-value vegetables that deliver scientifically verified benefits to the entire supply chain, health and well-being for consumers, and financial prosperity for all stakeholders.VV1 provided a significant body of material that was critical to the success of VV2, namely:

- Crop science and understanding of critical production processes;
- Germplasm screening and selection of elite cultivars;
- Analytical methods for key nutrients (e.g., vitamin A, C, E, lycopene, glucosinolates);
- Phytochemical content per serve for a range of vegetable crops (e.g. broccoli, cauliflower, tomato, capsicum, carrots, leafy salad vegetables);
- Vegetable nutrient databases that allowed the design of mixed products.

Research activity in VV2 saw the consolidation of this body of materials into formal protocols that were then integrated into product manuals for a range of **vital**vegetables® products. This activity resulted in the achievement of the first project outcome for VV2 – "*To develop a range of phytochemical-specific agronomy and postharvest protocols that can be applied to a wide range of vegetable crops".*

We anticipate the subsequent outcomes will be achieved through scientific research embodied in a new vegetable category, **vital**vegetables®. Development of a range of products in this new category will provide the New Zealand vegetable industry with the opportunity to market differentiated products in a global market. Realising the goal of "*increasing consumption of vegetables and decreasing the economic health burden on government and the community due to increased health of the population"* lies in consumer acceptance of specific health benefits that can be targeted with vegetable products. For the **vital**vegetables® products, they are heart health, healthy vision, bone health, digestive health and support of the immune system.

Successful delivery of VV2 has been dependent on a well-managed product development process. This is embodied in the ItL process that was purpose-built to develop vegetable products which, after rigorous testing, deliver a guaranteed minimum content of a signature nutrient that is superior to the industry standard The health benefit of these products augments the nutritional benefits that vegetables normally provide and it is delivered to the consumer in a standard serving size.

The purpose of ItL was to provide a transparent process to guide and facilitate rapid and successful development and commercialisation of new vegetable product ideas. The process was developed to address the following critical success factors for **vital**vegetables®:

- Continued commitment of senior management, including involvement at critical decision points in the process;
- Widespread adoption of the process across the **vital**vegetables® partnerships;
- 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;
- Use of skilled, competent project leaders trained in project management practices;
- Adequate resource allocation to projects and an optimal number of projects in the pipeline;
- Provision of ongoing training and support for the ItL process;
- Process metrics to evaluate the effectiveness of the ItL process;
- Continued evolution of the process to meet the changing needs of the **vital**vegetables® partnership.

The success of ItL (a phase and gate methodology) was in part due to the division of product development into discrete investment phases. A decision to commit the required investment for

the next phase was made at the gates between each phase. The decision was made by Gate Keepers, who were the senior managers of each partner organisation and responsible for critically assessing the projects put in front of them. ItL provided all stakeholders with:

- Clearly defined process;
- Objective decision-making;
- Consistent application;
- Streamlined execution;
- Alignment with currently recognised world "best practice".
- Transparency – a documented process that could be easily followed to ensure all aspects of product development were covered at the appropriate stage.

The second most significant aspect of the **vital**vegetables® approach to product development was the portfolio approach taken. A visual picture of what was on the table at any one time was drawn up at the end of each Gate Keepers meeting (Table 4, Appendix 11). Projects were essentially separated by project phase and projected launch date, and this allowed the Gate Keepers to see where there were gaps in the pipeline and where resources should be allocated in the future.

A number of improvements to the process may increase its success, namely:

- Training of more product leaders
- More regular consumer research to build on the limited knowledge base and identify further opportunities that could be addressed by developing new consumer value propositions in vegetables.

We were challenged in two main areas. Firstly, we had to understand the appropriate amount of research required to develop a concept to a stage suitable for presentation to the VVMP. Undertaking more work in order to reduce the risk of failure is a tendency of scientists, but assessment of risk and making decisions that accommodate commercial risk is a skill of the business leaders of VVMP. Deciding when products did not warrant any further investment, i.e. would not be progressed, is a commercial decision, and the scientists became better at putting the data on the table and trusting our commercial partners to interpret it in the context of what it was – preliminary, significant, supporting etc. The development of good working relationships with VVMP was essential to achieve this.

The second challenge was the lack of speed to market for new germplasm. The selection of elite cultivars based on their nutritional content was sometimes also accompanied by adoption of critical faults – e.g. low yield. The speed to market for new germplasm where these critical faults had been addressed was seriously underestimated. 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 (e.g. purple cauliflower) or less viable mainstream crops (e.g. high glucosinolate broccoli, ACE capsicum, high-lycopene tomato).

The **vital**vegetables® program has provided a path to market for functional fresh vegetable products that are a significant step above commodity vegetables.

5 Technology transfer

The stakeholder engagement and communications plan ensured that a regular and coordinated approach was taken for communications between partners. This meant that good working relationships were built and maintained, and the relationships increased the success of technology transfer in the latter stages of the VV2.

Technology transfer was built into product development through a phase-and-gate process that required formalised decision points to be taken at each gate. Key stakeholders were critical to the decision points – reviewing the status of the project and releasing resources for the next phase. In addition, the product portfolio was reviewed regularly by VVRP and VVMP to ensure the new products could be commercialised at the appropriate time (season) and in a timely manner (new releases planned every 6 months).

Knowledge was transferred between the partners using a number of mechanisms, for instance:

1. Scientific knowledge generated by the research partner organisations was shared quarterly through the reporting mechanisms and at face-to-face annual meetings. All data and outputs were maintained on a searchable password-protected website.
2. Phytochemical-specific agronomy and postharvest protocols were translated from science-heavy reports into end-user appropriate reports and procedures for VVMP.
3. Product development know-how was shared between key stakeholders at regularly scheduled gate keeper meetings (Appendix 11).
4. Product information was captured in business cases and product manuals that remain a trade secret within territory for the sole purpose of generating **vital**vegetable® branded products.
5. Market research was shared and debated between VVRP, VVMP and VVGP at focused face-to-face meetings to ensure the messages were understood and acted upon.
6. Nutrition and health benefit information was collated into scientific dossiers to support product health claims. The information was translated into product communications and developed into consumer-friendly messages with VVMP. Expert dietician and regulatory consultant opinion on the messages was sought to ensure they complied with FSANZ regulations.
7. Social media tools (website, facebook, Twitter) were used to build awareness of and generate interest in the **vital**vegetable® concept within primary audiences. This was achieved by telling the science and research story in a simple but compelling way.
8. A media relations campaign built awareness of the **vital**vegetable® concept in secondary audiences by providing science news stories that supported the launch of the new category of vegetable products.

Technology in the form of agronomy and postharvest 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 resulting in the development of product manuals for a suite of viable **vital**vegetable® products.

6 Recommendations

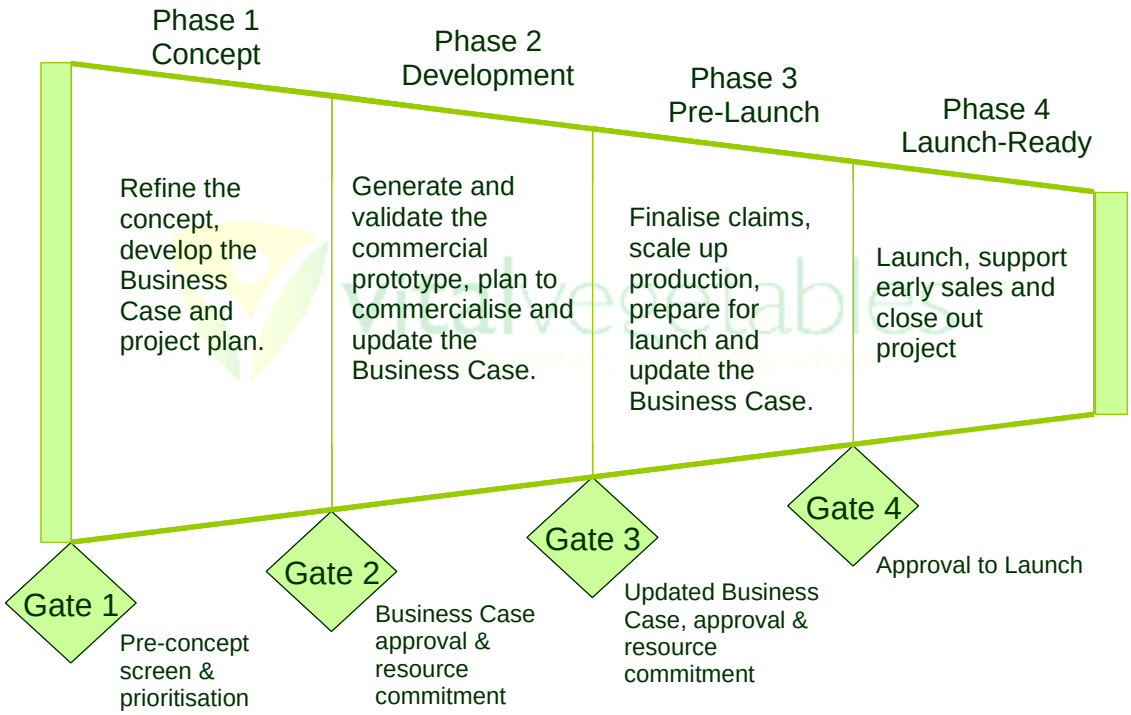
We recommend:

- That HAL accepts the Vital Vegetables 2 final report.
- That HAL monitors progress of Vital Vegetables commercialisation and provides support where specific research requirements are identified.
- That HAL participates in the ongoing commercialisation process for **vital**vegetables® intellectual property.
- That HAL continues to support the development of differentiated vegetable products to enable vegetable growers to add premium products to their offer.

7 Appendices

1. ItL Outputs
2. Roles and Responsibilities within ItL Process
3. Pre-Concept Template
4. ItL Gate 1 Score Card
5. **vital**vegetables® Product Manual Template
6. **vital**vegetables® Business Case Template
7. **vital**vegetables® Quarterly Report Template
8. Roles and responsibilities of Vital Vegetables Partners
9. Germplasm Check-list for High Lycopene Tomato
10. Vital Vegetables 2 Programme Outputs
11. Gate Keepers Meetings

Appendix 1 – ItL outputs



Outputs from Gate Keepers Meeting

1. Consensus decision which has the following potential outcomes:
   GO – commitment of resources enabling project to proceed through the next phase;
   CONDITIONAL GO – commence next phase but continued work is conditional on an agreed condition being met in a given timeframe;
   KILL – cease project work, review and archive the project;
   MODIFY – redo outputs to improve quality, resolve an issue or fill in gaps; or
   HOLD – project to Go but all work is delayed until it is given the green light, usually when waiting for resources to become available.
2. An approved work plan for the next phase leading to the next gate.
3. Project prioritisation and the commitment of resources.

Gate 1 is a soft screen that provides decision criteria for determining which pre-concepts merit the commitment of the resource to develop the business case in the next phase. This judgement decision is based on minimal information at this early stage:

- Strategic fit
- Strategic leverage *(leverages off the rest of portfolio, skill sets, strengths, resources, partner)*
- Market attractiveness *(channels and size)*
- Product advantage/impact *(health benefit, credibility to consumer, competition, differentiation)*
- Technical and commercial feasibility
- Potential financial reward *(small, medium, high)*

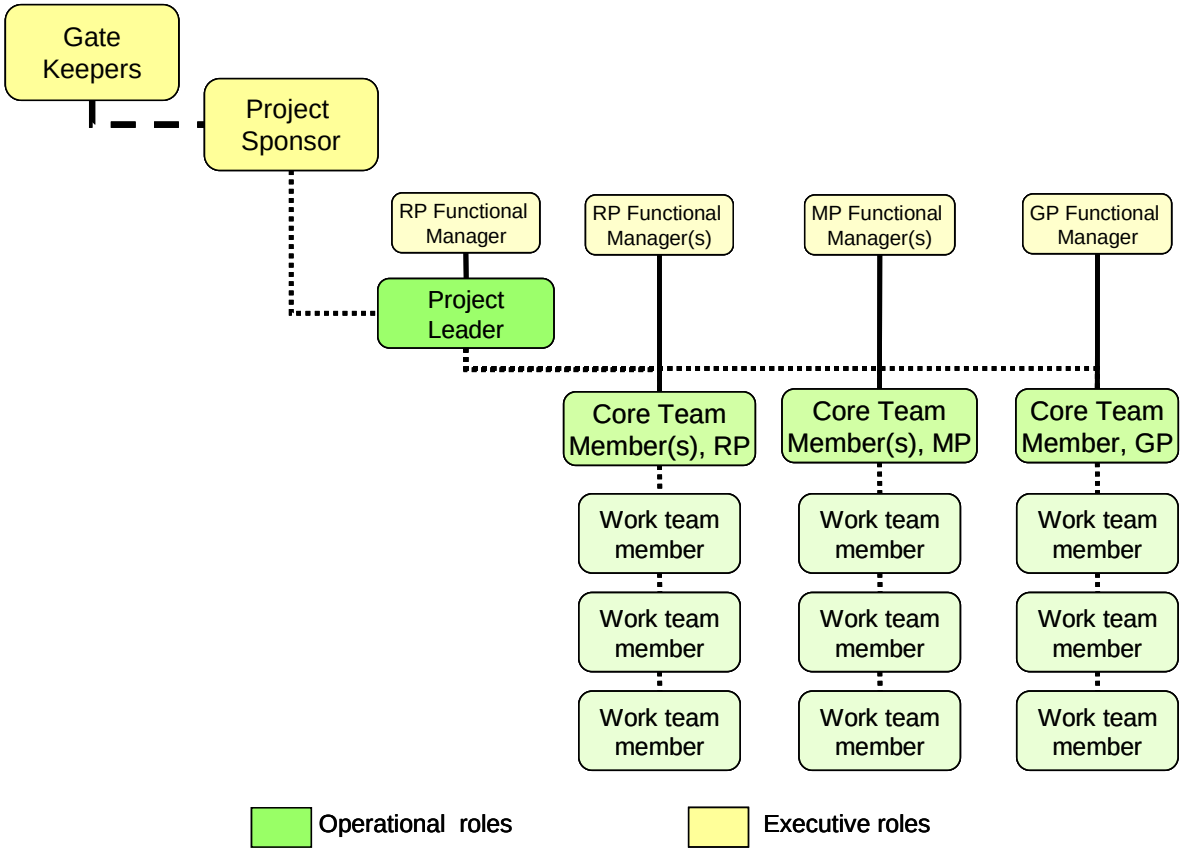
At each subsequent gate, the Project Leader with core team prepares a business case and project plan to be submitted to gate keepers prior to the gate keepers meeting. The following information is developed during the previous phase to support the project passing the gate:

- Integrated project timeline
- Phase budget and resource needs
- Cost benefit analysis
- Integrated risk analysis
- Updated business case

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 2 – Roles and responsibilities within ItL process

The following diagram illustrates the ItL project roles, their inter-relationships and reporting lines.



Idea to Launch Process Sponsor - The ItL Process Sponsor is an executive who has overall accountability for the ItL Process. This requires oversight of the implementation, use and maintenance of the ItL Process as well as the ongoing review and evolution of the process to ensure it continues to be relevant, efficient and effective.

Gate Keepers - Gate Keepers are executives representing the partner organizations who are equipped with the knowledge and experience, and have the authority to make sound gate decisions and who understand the strategic goals and overall portfolio. They are a multi-functional group representing the partners.

Project Sponsor - The Project Sponsor is an executive who has the ultimate authority and responsibility for a specific project on behalf of the research partners' Operations Team. The Project Sponsor is primarily responsible for providing guidance and mentorship to a specific project to ensure it delivers high-quality work in line with the agreed business case.

Project Leaders - These Project Leaders are held accountable for the planning, management and successful delivery of the project.

Core Project Team - The Core Team Members are primarily responsible for contributing high-quality work to the project and for actively contributing to a highly effective cross-functional team and/or multi-disciplinary team. They are ultimately accountable for any recommendations they make and for the quality of the work that they deliver.

Work Teams - Core team members need to manage small work teams outside the core project team structure to deliver their key tasks. These work teams are typically made up of a Core Team Member and "support persons" or "peripheral team members", who are not part of the Core Team. These teams are task orientated and are focused on the successful delivery of particular project activities, generally relating to a functional discipline or a particular project deliverable. They are a means of ensuring experts are contributing to a project as required, while avoiding tying up non-essential staff.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 3 – Pre-concept template

PRE-CONCEPT NAME:	
Author:	
Date:	
Approved:	**Score:**

PRE-CONCEPT DESCRIPTION:
Briefly describe the Pre-concept.

FIT WITH STRATEGY
In few words, describe how this concept fits with the **vital**vegetables® strategy.

STRATEGIC LEVERAGE
In few words, describe how this leverages off the rest of portfolio, skill sets, strengths, resources and partners.

MARKET ATTRACTIVENESS
In few words, describe the likely sales channels, target group and size of opportunity.

PRODUCT BENEFITS
In few words, describe what advantage the product will likely have over competing products. For example, consider health benefits, customer credibility and differentiation.

TECHNICAL AND COMMERCIAL FEASIBILITY
In few words, describe your initial assessment of the technical and commercial feasibility. Are you confident it can be achieved? Is it possible for science to substantiate it?

POTENTIAL FINANCIAL REWARD
Estimate the magnitude of the financial reward. At this early stage, this is ball park only.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 4 – ItL Gate 1 score card

Project name:		**Project Code:**	
Date:		**Evaluator name:**	

1. **vital**vegetables® STRATEGIC FIT

	Score = 0	Score = 5	Your score	Comments
1.1 Alignment with VV strategy	Outside scope or peripheral fit with current VV strategy	Strongly aligned with current VV strategy		
1.2 Strategic importance	Minimal impact on VV business strategy	Mission critical		
		Mean score:	0	

2. MARKET ATTRACTIVENESS

	Score = 0	Score = 5	Your score	Comments
2.1 Market channels & size	Limited: single channel/ region; niche market	Multiple channels, countries, common needs		
2.2 Margins in this market	Poor margins	Lucrative margins		
2.3 Market growth	Market showing no growth	Evidence of strong growth		
2.4 Competitor situation	Competition intense, market saturated, at best a follower	Scope to show leadership & dominate category		
		Mean score:	0	

3. NEW PRODUCT ADVANTAGE

	Score = 0	Score = 5	Your score	Comments
3.1 Unique consumer benefits	Proposed product is a copycat product only	Product has unique features not easily copied		
3.2 Meets consumer needs	Weak claim; Does not meet consumer needs well	Meets consumer needs & supported by strong claim		
3.3 Perceived value for money	Unlikely to be perceived to be worth price paid	Consumer will recognise value & pay a premium		
		Mean score:	0	

4. LEVERAGES CORE COMPETENCIES / RESOURCES

	Score = 0	Score = 5	Your score	Comments
4.1 Research/ technical synergies	Does not leverage current core competency / portfolio	Capitalises on existing core strengths in portfolio		
4.2 Marketing & Sales synergies	Does not leverage current partner core competency	Capitalises on existing partner core strengths		
4.3 Production/post harvest synergies	Does not leverage existing equipment & capabilities	Leverages current equipment & capabilities		
		Mean score:	0	

5. TECHNICAL AND COMMERCIAL FEASIBILITY

	Score = 0	Score = 5	Your score	Comments
5.1 Product development	Highly complex and significant uncertainty	Not complex and confident can produce robust product		
5.2 Commercial partnerships	Difficult partnership, poor track record, lack of confidence	Trusted partnership, good track record		
5.3 Regulatory /claims	Highly complex with significant uncertainty	Highly confident of substantiating claims /regulatory approval		
		Mean score:	0	

6. FINANCIAL REWARDS

	Score = 0	Score = 5	Your score	Comments
6.1 Estimated potential returns	Comparatively low <$	Comparatively high > $		
6.2 Estimated yield and royalty stream	Low <$	High > $		
		Mean score:	0	
		Total project score:	**0**	

Recommendation: (Go/Conditional Go/Kill/Redo/Hold)	Overall Comments:

Appendix 5 – **vital**vegetables® Product manual template

CONTENTS
EXECUTIVE SUMMARY
ABBREVIATIONS
PRODUCT DESCRIPTION
- FORMAT
- GERMPLASM

VEGETABLE PRODUCTION
- QUALITY ASSURANCE
- PRODUCTION LOCATION
- TRANSPLANTING / DIRECT SEEDING
- FERTILIZER
- PEST AND DISEASE CONTROL
- WEED MANAGEMENT
- IRRIGATION
- HARVEST

POSTHARVEST HANDLING AND PROCESSING
- TEMPERATURE MANAGEMENT
- WASHING AND WATER SANITATION
- RETAIL PACKAGING (PACKAGING MATERIALS, DATE STAMP)
- STORAGE AND DISTRIBUTION
- QUALITY ASSURANCE

RETAIL
- STORAGE
- DISPLAY
- INVENTORY
- IN-HOME CARE
- END-USE

QUALITY ASSURANCE
- QUALITY STANDARDS
- VALIDATION OF NUTRIENT CONTENT
- COLLECTING SAMPLES FOR NUTRIENT ANALYSIS
- APPROVED ANALYTICAL TESTING FACILITIES AND METHODS
- CHANGES TO PRODUCTION INITIATES ADDITIONAL TESTING
- OFF-SPECIFICATION PRODUCT

CONSUMER HEALTH BENEFIT LABELING
- NUTRITION INFORMATION PANEL (NIP)
- INGREDIENTS
- ICON AND CONSUMER MESSAGES
- RISKS ASSOCIATED WITH PACK LABELING

INTELLECTUAL PROPERTY
- TRADE SECRET
- USE OF TRADEMARKS

VITAL VEGETABLES LICENSEE RESPONSIBILITIES
REFERENCES
ACKNOWLEDGEMENTS

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 6 – **vital**vegetables® Business case template

SECTION 1 – APPROVAL
SECTION 2 - TABLE OF CONTENTS
SECTION 3 - EXECUTIVE SUMMARY
SECTION 4: PROJECT DESCRIPTION
- THE CONCEPT
- FIT WITH STRATEGY
- PROJECT OBJECTIVE
- PROJECT SCOPE

SECTION 5: MARKET ANALYSIS
- CONSUMER NEED
- MARKET & SALES CHANNEL(S) EVALUATION
- MARKET SIZE
- COMPETITOR ANALYSIS

SECTION 6: THE PRODUCT
- PRODUCT STRATEGY
- PRODUCT CLAIMS
- MARKET PARTNER(S) OPTIONS
- CONSUMER MARKETING STRATEGY

SECTION 7: LEGAL POSITION
- REGULATORY POSITION
- IP STRATEGY

SECTION 8: GERMPLASM AND PRODUCTION
- GERMPLASM OPTIONS
- GROWER STRATEGY AND AGRONOMY
- ANALYTICAL METHODS AND VALIDATION

SECTION 9: POST HARVEST PLANS
- POST HARVEST STRATEGY
- PROCESSING STRATEGY
- PACKAGING FORMATS
- STORAGE AND DISTRIBUTION

SECTION 10: SALES AND LAUNCH STRATEGY
- LAUNCH STRATEGY
- TRADE STRATEGY

SECTION 11: COST BENEFIT ANALYSIS
- FINANCIAL MODEL SUMMARY
- ASSUMPTIONS
- INTANGIBLE BENEFITS

SECTION 11: RISK ANALYSIS
- SUMMARY OF CRITICAL PROJECT RISKS

SECTION 10: PROJECT PLAN & RESOURCING
- KEY MILESTONES
- RESOURCE REQUIREMENTS FOR THE NEXT PHASE

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 7 – **vital**vegetables® Quarterly report template

PROJECT NAME: **PHASE:**
PROJECT LEADER:
DATE:

EXECUTIVE SUMMARY

PORTFOLIO STATUS

- PRODUCT SUMMARIES THAT CONSIDER PROGRESS ON:
    - CONSUMER & MARKETING
    - PRODUCTION & POSTHARVEST
    - COMMERCIAL & LOGISTICS

OUTPUTS

- SCIENTIFIC PUBLICATIONS
- CONFERENCE PRESENTATIONS
- CONFIDENTIAL **VITAL**VEGETABLES® REPORTS
- MEDIA RELEASES

STATUS OF RELATIONSHIPS

- VVMP
- VVGP
- INVESTORS

VITALVEGETABLES® **INTELLECTUAL PROPERTY**

- IP
- FREEDOM TO OPERATE
- TRADE SECRET

PROJECT ACTIVITIES

PROJECT *MILESTONES* *ACTIVITIES WITHIN REPORTING PERIOD*

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 8 – Roles and responsibilities of Vital Vegetables partners

Vital Vegetables Marketing Partner (Geographic)	**Vital Vegetables Research Partner (International)**	**Vital Vegetables Germplasm Partner (International)**

• Owns brand, upon achievement of agreed turnover targets (partners are shareholders).
• Pays royalties for use of IP
• Prepares, executes and finances an integrated marketing plan:
  o Advertising
  o Promotions
  o Public relations
• Acts as contact point with VVRP – prepares annual plan and manages all required processes and procedures.
	• Owns IP.
	• Passes ownership of the brand to VVMP in each geographic territory, upon achievement of agreed turnover targets.
	• Manages agreed science/R&D program and provides support required for health claims.
	• Has final approval for treatment and usage of the **vital**vegetables® brand, and all claims made in respect of any branded products.
	• Registers and has oversight of the website.
		• Develops elite germplasm – commercially viable and with functional attributes that deliver the brand proposition.
		• Works with the VVRP in the conduct of breeding efforts to maximise the potential for creation of new nutritionally enhanced or functional cultivars.
		• Supplies seeds exclusively to VVMP for cultivars identified as satisfying requirements for vitalvegetables®.

Joint Responsibilities • Agree Annual Plan, including products, commercial targets, support levels, R&D. • Provides senior level input at critical stages in the Idea to Launch Process. • Management of web site – consumer interface (marketing) and stakeholder management .		

Appendix 9 – Germplasm check-list for high-lycopene tomato

1. Crop name (or product identity). High-lycopene tomato

2. Fruit/Vegetable phenotype. Mainstream size and shape (medium, round)

3. Phytonutrient and target content (per gram FW). >15 mg lycopene/100 g fresh

4. **Growing conditions.** High-tech Dutch-style glasshouses. Fruit grown in fibre blocks, with liquid fertilisation. Temperatures are controlled, and natural lighting (no supplementary lighting) is used.

5. Length of growing season. Approx 49 weeks, August – July (harvest beginning Oct/Nov)

6. Climate during plant growth and vegetable production. At planting, temperatures are kept at 20°C both day and night. This is maintained until the first fruits are at least golf-ball sized or the third truss is setting. With crop registration determining how the plants are progressing the day/night delta is gradually increased and is be adjusted depending on average fruit weight, fruit load, stem thickness, leaf length and distance the flowers are setting from the head. Humidity is maintained below 85% (ideally). Temperatures of 15-25°C are normal for the entire crop.

7. Disease resistance. Normal resistances as per standard varieties (ToMV;Ff:1-5 ;Fol:0,1;For;Va;Vd ;Si) are required. Powdery mildew resistance if possible. Measures may be needed to eliminate incidence of blossom end rot (common to high-lycopene lines).

9. **Production characteristics:**

Time to harvest (seed/transplant to harvest) - Planting begins close to the shortest day (in New Zealand June 21). Grafted plants with two heads on one rootstock are used, at an initial plant spacing of 2.2 plants/m. When the light improves (approx week 30), an extra head is taken to make 2.75 heads/m. This is then reduced in fading light (approx week 10 of the new year). Under these conditions a standard cultivar (e.g. 'Clarence', a round fruit, 120-160g), is grown for up to 49 weeks.

Harvest season - Spring-autumn.

Between crop turn-around time - A 2-3 week turnaround (and back in production 11 weeks after pulling out old crop).

Yield - Standard tomatoes are generally required to produce 35-40 trusses/head. These are truss-pruned to five fruit and a truss arch inserted during low light periods to maintain average fruit weights. Yields of 55-60 kg/m/year are the goal.

9. Other. To date it appears the greatest challenge will be to secure germplasm that has the capacity to produce >15 mg/100 g lycopene with minimal impact on production factors (e.g., number of trusses, time to harvest, yield, absence of blossom end rot). This challenge is being addressed by monitoring of the breeding efforts of the VVGP over the next 1-2 years. This monitoring extends to grafting and growing a number of test plants at NZ Hothouse during a regular growing season, evaluating yield, disease susceptibility and lycopene content.

Completion Date: 31 December 2012. PFR SPTS No. 7778

Appendix 10 – Vital Vegetables 2 program outputs

Commercial Information Releases

Media Releases

1. Eason JR 2010. Jocelyn was interviewed about the health-promoting properties of fruit and vegetable skins for New Zealand Listener by Jennifer Bowden for information. http://www.listener.co.nz/issue/3665/columnists/15900/the_skinny_on_skins.html;jsessionid=5122EEC84503458786B838DDE0620A42
2. Heyes JA 2010. **vital**vegetables® – the science-business model behind new products. Food New Zealand, February 2010, p. 3.
3. Heyes JA 2009. National Radio interview, Vital Vegetables; September 2009.
4. Heyes J 2010. Radio interview: ThisWayUp, National Radio: black carrot concentrate as a food colorant, May 2010.
5. Heyes JA, West P, McKenzie MJ. 2009. Interview by New Zealand National Radio about the Vital Vegetables program.
6. Lister CE. 2010. Carolyn contributed information to a journalist from NutraIngredients for an article on super vegetables, www.nutaingredients-usa.com/Research/Super-veg-look-set-to-walk-the-antioxidant-red-carpet.
7. Lister CE, Said J. 2010. Carolyn and John were interviewed for New Nutrition Business by Richard Clarke. New Nutrition Business 15, 15-17: First failure teaches Booster® Broccoli how to differentiate: commercialisation case study.
8. McKenzie MJ. 2009. Research Programme, Booster® Broccoli and glucosinolate and selenium metabolism. The 15-minute clip was aired on Our Changing World on 22 September.
9. McKenzie MJ. 2009. Marian also spoke about her synchrotron research. The interview was aired on Our Changing World 23 September as part of a clip that featured Professor Ian Gentle, Head of Science at the Australian Synchrotron.
10. Alan Dick (2012) Super veg on the way. The Land. Retrieved 18 January 2012 from http://theland.farmonline.com.au/news/state/agribusiness-and-general/general/super-veg-on-the-way/2410874.aspx
11. Vegetable industry Annual Report 2011 (AusVeg, HAL). Vital Vegetables, Page 4. (85 pp).
12. Bob Hart, celebrity chef, highlighted ACE capsicum in a cooking program segment which will go to air on channel 9.

Media releases linked to the launch of Booster® Broccoli.

Media Update in August 2009 listed 5 international, 27 national and 28 State news items related to the launch of Booster® Broccoli. A selection of the popular articles is listed below:

1. 'Super' broccoli cancer hope. The Weekly Times, 9 April 2008.
2. Vital veggies boost the market. Vegetables Australia Mar/Apr 2008.
3. Aussie scientists develop super vegies. Herald Sun, 17 August 2009
4. Vital veggies on the fresh menu. Retail World, 17-28 August 2009.
5. Booster broccoli bursts onto domestic market. Hortlink, Winter 2009.
6. Broccoli: now better than ever for your health. Werribee Banner, 1 September 2009.
7. Look up in the sky! Is it a bird? Is it a plane? No, it's super broccoli. The Age, 20 September 2009
8. Vital Vegetables. Cover story: Vegetables Australia, Sept/Oct 2009.

Media releases linked with NZ VV category launch (October 2012)

To gain media interest, the Communications Team drafted press releases designed to provide science support for the **vital**vegetables® consumer health benefit messages. These have been released as part of the pre- and post-launch communication activities, including the following press releases and abstracts for magazine pitches:

- How to keep your vegetables fresh?
- If you are low in selenium, then make sure you eat your broccoli.
- Consumers confused about vegetables (Myths).

- What plants should I grow?
- Eat the Rainbow.
- All vegetables are created equal, aren't they?
- What 's so good about vegetables anyway?
- Vegetable Vitamins.

1. Michelle Robinson (23 September 2012) Super Veges Soar to the Rescue. Sunday Star Times. Retrieved from http://www.stuff.co.nz/life-style/wellbeing/7717865/Super-veges-soar-to-the-rescue.
2. Charlotte Shipman (23 September 2012) Super Veggies Hit Shelves. TV3. Retrieved from http://www.3news.co.nz/Super-veggies-hit-shelves/tabid/372/articleID/270284/Default.aspx
3. Anon (25 September 2012) NZ: 'Super veggies' hit shelves. Retrieved from http://www.freshplaza.com/news_detail.asp?id=101183#SlideFrame_1
4. Radio New Zealand Rural News (25/10/2012). Retrieved from http://www.radionz.co.nz/national/programmes/morningreport/20121025
5. Trans-Tasman study taps nutritional specifics for veggie marketing drive. http://www.freshfruitportal.com/2012/10/22/trans-tasman-study-taps-nutritional-specifics-for-veggie-marketing-drive/
6. Lisa Cork (2012) The Packaging Pitch: the art of the "need fulfilled". 3 October 2012. Retrieved from http://www.freshfruitportal.com/2012/10/03/the-packaging-pitch-the-art-of-providing-a-need-fulfilled/
7. Get more from your veges with vitalvegetables® (12 October 2012). Retrieved from http://www.foodworks.co.nz/3-4-1695/news/Get-more-from-your-veges-with-vitalvegetables%C2%AE
8. Get more from your veges with vitalvegetables® (15 October 2012). Retrieved from http://www.plantandfood.co.nz/page/news/media-release/story/get-more-from-your-veges-with-vitalvegetables/
9. Fuseworks (12 October 2012) Vitalvegetables to het supermarket shelves. Retrieved from http://nz.sports.yahoo.com/news/vitalvegetables-hit-supermarket-shelves-231444135.html
10. Case Study – Super Vegetables: Developing new vegetable cultivars with high levels of healthy compounds. Retrieved from http://www.plantandfood.co.nz/page/home/case-studies/super-vegetables/

Vital Vegetables Consumer Website

The New Zealand Communications Team has written and uploaded a full set of information onto the vitalvegetables® website that supports the five products going to launch under a range of headings (Our Story, Products, Health Benefits, Q&A). VVMP-NZ provided written information for 'Recipes', 'Where to buy' and act as the 'Contact' for the products (postal address, email and 0800 number). Each of the web pages has 'read more' tabs where the consumers can investigate and get more information as they feel the need. The **vital**vegetables® consumer website went live on 14/09/2012, http://www.vitalvegetables.co.nz/

Confidential Science Reports

Programme Status Reports (generated for HAL and VVGG)

1. VG08141 Vital Vegetables 2 New Zealand (Milestone 110) May 2012
2. VG08141 Vital Vegetables 2 New Zealand (Milestone 109) Nov 2011
3. VG08141 Vital Vegetables 2 New Zealand (Milestone 110) May 2012
4. VG08141 Vital Vegetables 2 New Zealand (Milestone 108) May 2011
5. VG08141 Vital Vegetables 2 New Zealand (Milestone 107) – Mid Term Review (see section below)
6. VV Quarterly Report Jul – Sep 2008
7. VV Quarterly Report Oct – Dec 2008
8. VV Quarterly Report Jan – Mar 2009
9. VV Quarterly Report Apr-Jun 2009
10. VV Quarterly Report Jul – Sep 2009
11. VV Quarterly Report Oct – Dec 2009
12. VV Quarterly Report Jan – Mar 2010
13. VV Quarterly Report Apr-Jun 2010
14. VV Quarterly Report Jul – Sep 2010
15. VV Quarterly Report Oct – Dec 2010
16. VV Quarterly Report Jan – Mar 2011
17. VV Quarterly Report Apr-Jun 2011
18. VV Quarterly Report Jul – Sep 2011
19. VV Quarterly Report Oct – Dec 2011
20. VV Quarterly Report Jan – Mar 2012
21. VV Quarterly Report Apr-Jun 2012
22. VV Quarterly Report Jul – Sep 2012
23. VV Quarterly Report Oct – Dec 2012

Vital Vegetables Mid-Term Review Papers

1. Booster Medial Update, August 2009
2. Business Cases: Mid-Term Review Supporting Document prepared for John Caradus and Chris Downs, 23 November 2010.
3. Crawford K (2010) Consumer responses to the Vital Vegetables Concept.
4. Eason J, O'Donoghue E, Lill R (2010) Vital Vegetables Program Mid-Term Review Briefing Paper: prepared for John Caradus and Chris Downs, 23 November 2010
5. Eason J, Tomkins B (2010) Development and commercialisation of high health vegetable products. The science behind the product. VitalVegetables Mid-Term Review, 1-2 December 2010.
6. Hughes D, Slater M (2010). Commercialisation Program, Mid Term Review, December 2010.
7. Sully R (2010). Program Overview, Mid Term Review. December 2010.
8. Terms of Reference: Mid Term Progress Review of Vitalvegetables, 10 November 2010.
9. Trade Mark Register, 18 October 2010.
10. Vital Vegetables Idea to Launch Process, Users Guide, version 0.5
11. Vital Vegetables Program Mid-Term Review – Report, 9 December 2010.
12. Vital Vegetables program Mid-Term Review – Research Partners Response, 14 February 2011.
13. Vital Vegetables Brand Essence. Di Marca Brand Performance Pty Ltd.
14. Vital Vegetables Quarterly Report April – June 2010.
15. Vital Vegetables Quarterly Report, July – September 2010.
16. Vital Vegetables Brand Usage Manual, version 2.0, June 2010.

Confidential Commercialisation Reports

In order to build a new **vital**vegetables® category that the range of products could be clearly identified within, generic cross-product work was carried out to achieve a brand proposition with consistent use of trademarks and health claims. Licensing arrangements were sought to ensure brand usage was agreed and consistent across different marketing partners in different territories.

1. Brand Proposition – post research (24th November 2011).
2. Confidentiality agreements with VVMP-NZ: VVNZ001, VVNZ002, VVNZ003.
3. Consumer Benefit Claims (18th July 2012). Uploaded onto VVRP website.
4. Eason J, Lister C (2012). Use of Vital Vegetables Trademarks. Confidential report prepared for VVRP, 2 July 2012.
5. Lister C (2012) Antioxidant Claims - Evidence Dossier. PFR Trade Secret Document SPTS No. 7573.
6. Slater (2011) VV Project Vital. Presentation of Key Findings of Market Research. August 2011.
7. Slater (2011) VV Project Vital. Qualitative Research Findings of Market Research. August 2011.
8. Trademark Registration Summary updated 19th September, 2012. Lodged on VVRP website.
9. Vital Vegetables Interim Licence Agreement, VVNZ004.
10. Vital Vegetables Master Licence Agreement (draft), VVNZ005.
11. **vital**vegetables® Brand Usage Manual, version 3, September 2012. Lodged on VVRP website.
12. Vital Vegetables Brand Usage Manual (21 March 2011). Lodged on VVRP website.
13. Vital Vegetables Style Guide (17 March 2011). Lodged on VVRP website.
14. Vital Vegetables Trademark registration summary (13 April 2012). VVRP website.
15. Vital Vegetables Trademark Registration Summary (21 June 2012). VVRP website.
16. Vital Vegetables Trademark Registrations Summary (19 September 2012). Lodged on VVRP website.
17. Willets J 2010. Vital Vegetables: product options research. Internal report for Vital Vegetables.

The protocols for crop production, handling and quality assurance along with the supporting analysis on health benefits provide the know-how package that underpins **vital**vegetables® products. These protocols have been developed from research information generated in both VV1 and VV2 as well as from public domain information but represent our development of that knowledge. The product manuals and business cases listed below are a collation of the protocols which have been recognised as IP in the IP register.

Product Manuals for New Zealand Territory

1. High Glucosinolate Broccoli Product Manual for NZ Territory. PFR Trade Secret Document SPTS No. 7541.
2. Selenium enriched sprouts Product Manual for NZ Territory. PFR Trade Secret Document SPTS No. 7547.
3. **vital**bones™ Salad Mix Product Manual for NZ Territory, September 2012. PFR Trade Secret Document SPTS No. 7543.
4. **vital**heart™ Salad Mix Product Manual for NZ Territory, September 2012. PFR Trade Secret Document SPTS No. 7542.
5. **vital**immunity™ Medley Product Manual for NZ Territory. PFR Trade Secret Document SPTS No. 7545.
6. **vital**immunity™ Slaw Product Manual for NZ Territory. PFR Trade Secret Document SPTS No. 7546.
7. **vital**sight™ Salad Mix Product Manual for NZ Territory, September 2012. PFR Trade Secret Document SPTS No. 7544.

Business Cases for New Zealand Territory

1. ACE Capsicum Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7553.
2. Baby Leaf Salad Mixes Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7549.
3. High-Glucosinolate Broccoli Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7548.
4. High-Lycopene Tomato Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7554.
5. Selenium-Enriched Sprouts Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7552.
6. Slaws (**vital**immunity™ slaw) Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7551.
7. Vegetable Medley Business Case for NZ Territory. PFR Trade Secret Document SPTS No. 7559.

Analytical Methods

1. Vital Vegetables Analytical Methods Summary. PFR Trade Secret Document SPTS No. 7555.
2. Vital Vegetables Analytical Methods Summary. PFR Trade Secret Document SPTS No. 7555
3. VVM001 – Protocol for ORAC analysis of salads and slaws (August 2012). PFR Trade Secret Document SPTS No. 7556
4. VVM002 – Protocol for total phenolics of salads and slaws (August 2012). PFR Trade Secret Document SPTS No. 7557
5. VVM003 – Protocol for glucosinolates in slaw (August 2012). PFR Trade Secret Document SPTS No. 7558
6. VVM004 – Protocol for glucosinolates in Medley (August 2012). PFR Trade Secret Document SPTS No. 7560
7. VVM005 – Protocol for glucosinolates in Broccoli (August 2012). PFR Trade Secret Document SPTS No. 7561
8. VVM006 – Protocol for vitamin A & E in Capsicum (July 2010). PFR Trade Secret Document SPTS No. 7562
9. VVM007 – Protocol for vitamin C in capsicum (July 2010). PFR Trade Secret Document SPTS No. 7563
10. VVM008 – Brix Method for Capsicum (July 2010). PFR Trade Secret Document SPTS No. 7564
11. VVM009 – Capsicum Sampling Protocol (July 2010). PFR Trade Secret Document SPTS No. 7565
12. VVM010 – Protocol for Total Carotenoids in Salads and Slaws (September 2012). PFR Trade Secret Document SPTS No. 7567
13. VVM011 – Protocol for ORAC analysis in Medley (September 2012). PFR Trade Secret Document SPTS No. 7568
14. VVM012 - Protocol for Total Phenolic analysis in Medley (September 2012). PFR Trade Secret Document SPTS No. 7569
15. VVM013 – Protocol for Vitamin C of Tomato (March 2010). PFR Trade Secret Document SPTS No. 7570
16. VVM014 – Protocol for Lycopene in Tomato (July 2010). PFR Trade Secret Document SPTS No. 7571
17. VVM015 – Protocol for Total Phenolics in Tomato (March 2010). PFR Trade Secret Document SPTS No. 7572

Trade presentations (pre-launch range discussions)

1. 19 May 2011 – Vital Vegetables Concept presented to Progressive (Woolworths, Countdown and Foodtown). D Hughes, A Bourhill, A Berrysmith, R Georgieff, L Dillon.
2. 15 June 2011 – Vital Vegetables Concept presented to Foodstuffs Auckland.
3. 4 August 2011 – Vital Vegetables Concept presented to Foodstuffs Wellington.

4. 14 May 2012 – Introduction to Vital Vegetables. Presentation to Foodstuffs, Christchurch South Island.
5. 1 June 2012. Product ranging meeting with Foodstuffs.
6. 8 June 2012. Product ranging meeting with Progressive, Auckland.

Scientific publications

Program science reports

1. Eason J, Brash D, Rippon P, Searle B, Andrews F, Feng L, Tomkins B, Jones R (2012) Field trials of high-glucosinolate broccoli in New Zealand and Australia**.** A confidential report prepared for Vital Vegetables Genetics Partner, Plant & Food Research SPTS No. 7035.
2. Eason J, Brash D, Rippon P, Searle B, Andrews F, Feng L, Tomkins B, Jones R (2012) Field trials of high-glucosinolate broccoli in New Zealand and Australia. A confidential report prepared for MG Marketing, Vital Vegetables Marketing Partner, Plant and Food Research SPTS No. 7035.
3. Eason J, Lister C (2012) Consumer health claims for **vital**vegetables® NZ October 2012 launch products. Confidential report prepared for VVRP, 1 July 2012.
4. Eason J, Lister C (2012) Use of Vital Vegetables Trademarks, 2 July 2012 (uploaded onto VVRP website 5/07/2012).
5. Eason J, West P, Sansom C, Perry N. 2010. Falcarinol and falcarindiol content in selected carrot lines. PFR SPTS No. 4686.
6. Eason JR, Rippon P, Lister C, Kerkhofs N, Andrews F, Gill K, Feng L. 2010. New Zealand-grown ACE capsicum. Summary for 2010 growing season. PFR SPTS No. 4435.
7. Eason JR, Zhou J, West P, Rippon P, Feng L, Joyce N, Braun R. 2010. Glucosinolate hydrolysis: Isolation and characterisation of BoESP and BoMyAP from *Brassica oleracea* and biochemical analysis of glucoraphanin hydrolysis derivatives. PFR SPTS No. 4677.
8. Eason JR. 2010. Overseas Travel Report prepared for Vital Vegetables Research Partners. PFR SPTS No. 3397.
9. Eason, J. 2008. Phytonutrients in carrots – Falcarinol. Crop & Food Research Confidential Report No. 2269
10. Eason, Lister, Berrill (1 July 2012). **vital**vegetables® Product Portfolio – Health Claims for October Launch Products (uploaded onto VVRP website 5/07/2012).
11. Evaluation of new **vital**vegetables® broccoli lines in NZ field trials: grower information (November 2010)
12. Heyes J, Brash D, Lister C, Rippon P 2009. Vital Vegetables New Zealand: pre-commercial trials. PFR SPTS No. 3070 for Vital Vegetables Marketing partnership.
13. Heyes J, Ding P, McGhie T (2012). High-vitamin carrots. A report prepared for Vital Vegetable Research Partners, Plant & Food Research SPTS No. 6543.
14. Heyes JA, Morrison SC, Lister CE (2012). Progress report, high-vitamin carrots. A report prepared for Vital Vegetables Research Partners, Plant & Food Research SPTS No. 7257.
15. Jones, R.B. 2009. Vital Vegetables - capsicum crop team report. VV Report #0911.
16. Jones, R.B. 2009. Vital Vegetables salad mix report. VV Report # 0910.
17. Jones, RB, Imsic M, Winkler S. 2009. Hazera High Vitamin ACE Capsicum Trial. **vital**vegetables® technical report No. 2902.
18. Lister C, Rippon P Dec 2010. **vital**vegetables®: New Zealand Salad Mix Summary 4.
19. Lister CE (2011) Developing **vital**vegetables® products - the health claim challenge. Presentation to Australian Marketing Partners, Melbourne, 8th December 2011.
20. Lister CE, Lill RE 2009. Booster® Broccoli: target sulforaphane level and recommended dietary intake. Internal report for VVMP.
21. Lister CE. (2011) Orange Cauliflower: Target phytonutrients, health benefits and suggested dietary intake. **vital**vegetables® Commercial in Confidence.
22. Lister CE. 2009: The health benefits of broccoli. PFR SPTS No. 2335.
23. Lister, Berrill and Eason (2012) Linking key vegetable and key nutrients to consumer health benefits (draft v12). Confidential Vital Vegetables Report. PFR SPTS No. 7682.
24. Lister, Berrill, Eason (2012) **vital**vegetables® Product Portfolio – Health Claims, 29 June 2012.
25. McKenzie, M.J., Matich, A.J., Lill, R.E., Brummell, D.A., McGhie, T.K., Chen, R.K-Y and Rowan, D.D. The identification of novel selenium-containing compounds in the Brassicaceae. ComBio2012, Adelaide, South Australia (23-27 September, 2012).
26. McKenzie, MJ, Chen R. 2009. Use of the ZFM beamline at the Australian Synchrotron to map selenium in broccoli tissue. Confidential Report prepared for The New Zealand Synchrotron Group, Royal Society of New Zealand. August 2009. PFR SPTS No. 3000.

27. O'Donoghue E, Somerfield S, Rippon R, Andrews F, Kerkhofs N (2010). Evaluation of high-lycopene tomatoes commercial trial, 2009-2010 season. December 2010, PFR SPTS Report No. 4858.
28. ODonoghue E, Rippon P, Somerfield S, Andrews F, Kerkhofs N. (2010) Maturity-related changes in high-lycopene tomatoes- developmental trial. December 2010. SPTS Report No. 4857
29. Paula Rippon and Limei Feng. 2011. Reassessment of glucoraphanin concentrations in **vital**vegetables® broccoli samples (New Zealand trials). A report prepared for Vital Vegetables Research Partners.
30. Perry N. 2010. Falcarinol and Falcarindiol content in selected carrot lines. PFR SPTS No. 4686.
31. Reid JB, Tan Y, Trolove SN. 2009. Further test of a new model of plant growth and nutrient uptake. PFR SPTS No. 2391
32. Rippon P, Andrews F, Feng L, Scheffer J, Hedderley D, Brash D. 2011. Shelf life trial of floretted Booster® Broccoli (TB185). A confidential report prepared for the research and marketing partners of **vital**vegetables®. PFR report SPTS 6313
33. Rippon P, Gill K, Andrews F, Hedderley D. 2010. Information sensory evaluation of ACE capsicums from New Zealand glasshouse trial. Confidential PFR report No. 4477.
34. Rippon P, Searle B, Feng L, Andrews F, Bycroft B, Lister C, Brash D, Lill R. 2011. VV Booster® Broccoli: Production of potential sulforaphane by TB185 in New Zealand. PFR report number 5430.
35. Rippon P, Searle B, Feng L, Andrews F, Eason J, Brash D.2012. New Zealand field trials of Vital Vegetables high glucosinolate broccoli selections TB3025, TB3055, TB3071 and Booster MS. PFR SPTS No. 7386.
36. Rippon PE, Searle B, Bycroft B, Andrews FA, Feng L, Lister CE and Brash D. 2010. **vital**vegetables® Booster® Broccoli New Zealand field trials: Progress to December 2009. PFR SPTS No. 3748
37. Trolove S. 2011. Effect of selenium on the germination of different plant species. Oct 2011
38. Trolove S, Tan T, Reid J, Shaw S, McKenzie M, Brummell D. 2010. Methods to produce high selenium broccoli. A report prepared for the Managers of the Future Vegetables Programme. PFR SPTS No. 3418.
39. **vital**vegetables® Booster® Broccoli field trial. Electronic Worksheet (November 2010)
40. VV Germplasm screening. Australia Update. R Jones. Oct 2011

Refereed publications

1. Brummell DA, Schroder, R. 2008. Xylan metabolism in primary cell walls. New Zealand Journal of Forestry Science 39: 125-143. (Underpinning science with links to VV2)
2. Imsic M, Winkler S, Tomkins RB, Jones RB. 2010. Effect of storage and cooking on β-Carotene isomers in carrots (*Daucus carota* L. 'Stefano'). Journal of Agricultural & Food Chemistry 58: 5109-5113.
3. Jones RB, Frisina CL, Winkler S, Imsic M, Tomkins R B. 2010. Cooking method significantly effects glucosinolate content and sulforaphane production in broccoli florets. Food Chemistry 123: 237-242.
4. Matich AJ, McKenzie MJ, Brummell DA, Rowan DD. 2009. Organoselenides from *Nicotiana tabacum* genetically modified to accumulate selenium. Phytochemistry 70: 1098-1106 (Underpinning science with links to VV2)
5. Matich AJ, McKenzie MJ, Lill R, Brummell D, McGhie TK, Chen R K-y, Rowan DD. 2012 Selenoglucosinolates and their metabolites produced in Brassica spp. fertilised with sodium selenate. Phytochemistry 75: 140-152
6. McKenzie MJ, Hunter DA, Pathirana R, Watson LM, Joyce N, Rowan D, Matich A, Brummell DA. 2009. Accumulation of an organic anticancer selenium compound in a transgenic Solanaceous species shows wider applicability of the selenocysteine methyltransferase transgene from selenium hyperaccumulators. Transgenic Research 18(3): 407- 424. (Underpinning science with links to VV2)
7. O'Donoghue EM, Somerfield SD. 2008. Biochemical and rheological properties of gelling pectic isolates from buttercup squash fruit. Food Hydrocolloids 22(7): 1326-1336. (Underpinning science with links to VV2)
8. O'Donoghue EM, Somerfield SD. 2009. Plant cell wall polysaccharides: a commentary on

their role as agents for food structure and for health. New Zealand Journal of Forestry Science. 39: 169-185. (Underpinning science with links to VV2)
9. O'Donoghue EM, Somerfield SD, Watson LM, Brummell DA, Hunter DA. 2009. Galactose metabolism in cell walls of opening and senescing petunia petals. Planta 229: 709-721 (Underpinning science with links to VV2)
10. Stefanelli D, Goodwin I, Jones R. 2010. Minimal nitrogen and water use in horticulture: effects on quality. Food Research International doi:10.1016/j.foodres.2010.04.022

Conference/seminar presentations

1. Biswas P, East AR, Hewett EH, Heyes JA. 2009. Harvest maturity and intermittent warming interactions on the physiology and quality of tomatoes. Postharvest Pacifica, Napier, New Zealand 16-19 November 2009.
2. Chen RK-Y, de Jonge MD, Paterson D, Howard DL, Henderson B, Freestone DJ, McKenzie MJ. 2009. Elemental mapping in broccoli tissue using the X-ray fluorescence microprobe at the Australian Synchrotron. Proceedings Combio2009, Christchurch Convention Centre, Christchurch, New Zealand 6-10 December.
3. Eason JR, West P, Brummell D, Somerfield S. 2008. Altering protease inhibitor activity impacts the development and senescence of broccoli. Chemistry and the Biosphere Conference, University of Otago, Dunedin, New Zealand. November 30th – December 4th, 2008. Oral presentation.
4. Eason JR, West P, Brummell D, Somerfield S, McLachlan A. 2009. Manipulating cysteine protease inhibitor expression in *Brassica oleracea* influences both plant development and harvest induced plant senescence. Combio2009 Abstract. Combio2009. Christchurch Convention Centre, Christchurch, New Zealand 6-10 December 2009.
5. Heyes JA 2009. Retaining the health benefits of vegetables after harvest. SE Asia Symposium on Quality Management, Bangkok, 2-5 August 2009.
6. Heyes JA 2009. Whole, fresh and good for you: Vegetables and children's health. Functional Foods Symposium, Auckland, New Zealand 23 November 2009
7. Imsic MI, Winkler S, Tomkins RB, Jones RB. 2009. Beta-carotene isomers in carrots: the effects of storage and cooking. Postharvest Pacifica, Napier, New Zealand, 16-19 November, 2009.
8. Jones RB 2009. The R&D Challenges involved in investigating the consumption of fruits and vegetables and prevention of serious diseases in humans. Postharvest Pacifica, Napier, NZ, 16-19 November, 2009.
9. Jones RB, Tomkins B. 2009. Why develop a better broccoli? ILSI Conference on Vegetable Nutrition. Melbourne, Australia, 12 November, 2009.
10. Jones RB, Winkler S, Imsic M, Frisina C, Tomkins B. 2009. Cooking significantly impacts on glucosinolate content and isothiocyanate production in broccoli florets. Postharvest Pacifica, Napier, New Zealand, 16-19 November, 2009.
11. Lister CE. 2010. Phytochemicals: more than just antioxidants. Dietitians Association of Australia 28th National Conference, Melbourne, Australia, 27-29 May 2010.
12. Lister CE. 2010. Superfoods – what is new? Dietitians Association of Australia 28th National Conference. Abstract published in Nutrition & Dietetics 67 (Suppl 1): 16. [invited International Keynote Speaker] Melbourne, Australia, 27-29 May 2010.
13. Lister CE, Lill RE, Tomkins B, Jones R, Heyes JA. 2009. The challenges in developing a functional whole vegetable. Proceedings Combio2009, Christchurch Convention Centre, Christchurch, New Zealand, 6-10 December.
14. Lister C, Yee Collinson J, Woods M, Adaim A, Dick J, Pollard S. 2009. NZFAVA: Increasing fruit and vegetable consumption for all New Zealanders. "Food elements: putting the pieces together" NZIFST Annual Food Conference, Christchurch, New Zealand, 23-25 June 2009
15. McKenzie MJ, Brummell DA, Chen R, Joyce NI, Hunter DA, Pathirana R, de Jonge MD, Howard DL, Paterson D. 2010. Maximising the uptake and metabolism of selenium into anticancer compounds in broccoli. Invited speaker to Queenstown Molecular Biology Plant Satellite Conference, Queenstown, New Zealand, 29-31 August, 2010.
16. McKenzie MJ, Brummell DA, Hunter DA, Pathirana R, Watson LM, Joyce NI, Matich A, Rowan D. 2008. Production of anti-cancer selenium compounds in plants. Conference proceedings: Chemistry and the Biosphere Conference. University of Otago, Dunedin, New Zealand, 30 November – 4 December 2008.

17. McKenzie MJ, Brummell DA, Matich AJ, Rowan DD, Joyce NI, Hunter DA, Pathirana R, Chen R K-Y, de Jonge MD, Howard DL, Paterson D. 2009. The production and metabolism of anti-cancer selenium compounds in plants. Proceedings Combio2009, Christchurch Convention Centre, Christchurch, New Zealand, 6-10 December.
18. Morrison SC, Joyce NI, Butts CA, Lister CE. 2008. Absorption and metabolism of red lettuce phenolics in rats. Nutrition Society Conference, Christchurch, New Zealand, 9-10 December 2008.
19. Olsson S, O'Donoghue EM, Brummell DA, Jameson L, McDonald R, Woolf A. 2009. Effect of high pressure water-washing and hot water drench on postharvest quality of capsicums. Postharvest Pacifica, Napier, New Zealand, 16-19 November 2009.
20. Pathirana R, West P and Eason JR. 2009. Proteomic examination of stress-induced cell death in Arabidopsis. Postharvest Pacifica, Napier, New Zealand, 16-19 November 2009.
21. Sowokinos JR, McKenzie MJ. 2009. Lowering acrylamide levels in processed potato products. Presentation at the 'Cooking qualities and methodology for healthier fries' workshop, 7th World Potato Congress, Christchurch, 23-25 March 2009.
22. Trivellini A, Zhou J, Zhang H, Ferrante A, Hunter D. 2008. Reciprocal regulation of a novel senescence-associated gene and its tandem duplicate in Arabidopsis. Chemistry and the Biosphere Conference, , University of Otago, Dunedin, New Zealand, 30 November - 4 December
23. West P, Eason JR, Pathirana R. 2008. Diploid arabidopsis cell cultures as model systems for cell death studies in plants. Oral presentation Chemistry and the Biosphere Conference, University of Otago, Dunedin, New Zealand. November 30th – December 4th, 2008.
24. Rippon P, Lister C, Lill R, Jones R, Heyes J, Eason J. 2010. Development of **vital**vegetables™ broccoli: Understanding the chemistry, biochemistry and health effects of the glucosinolates. Oral presentation to the 6th International Chemical Congress of Pacific Basin Societies symposium 'Understanding the Chemistry of Phytochemical Antioxidants and their Role in Human Health and Wellness', 15–20 December 2010, Honolulu, Hawaii.
25. O'Donoghue, E.M., Rippon, P., Somerfield, S., Andrews, F., Kerkhofs, N., Hedderley, D. 2011. Lycopene, vitamin C and total phenolics in new tomato lines. Poster 28 (Conference Proceedings p88). 'Horticulture for the Future' Joint APHC/AuSHS/NZIAHS Conference. September 18-22 2011, Lorne, Australia.
26. Winkler S, Frisina C, Jaeger J, Tomkins B, Jones R. 2011. Water loss effects on vitamin C content of lettuce leaves. 'Horticulture for the Future' Joint APHC/AuSHS/NZIAHS Conference. September 18-22 2011, Lorne, Australia.
27. Frisina C, Winkler S, Tregenza J, Henderson B, Stefanelli D, Jones R. 2011. Response of antioxidant levels to reduced nitrogen application in lettuce leaves. 'Horticulture for the Future' Joint APHC/AuSHS/NZIAHS Conference. September 18-22 2011, Lorne, Australia.
28. O'Donoghue E, Somerfield S, McLachlan A, Olsson S, Woolf A. 2011. High-pressure cold-water washing enables continuous high humidity storage for capsicum. 'Horticulture for the Future' Joint APHC/AuSHS/NZIAHS Conference. September 18-22 2011, Lorne, Australia.
29. Eason JR, West P, Brummell DA, Somerfield, S, McLachlan A. 2011. A cysteine protease inhibitor regulates harvest-induced broccoli senescence. 'Horticulture for the Future' Joint APHC/AuSHS/NZIAHS Conference. September 18-22 2011, Lorne, Australia.
30. MJ McKenzie, R K-Y Chen, MD de Jonge, D Paterson, DL Howard, B Henderson, DJ Freestone, B Ingham. 2011. Spatial imaging and quantification of microelements in the flowers of selenium-supplemented broccoli indicates elemental targeting to discrete tissues. Australian Synchrotron User meeting in Melbourne (8-9th December 2012), poster presentation.
31. MJ McKenzie, R K-Y Chen, MD de Jonge, D Paterson, DL Howard, B Henderson, DJ Freestone, B Ingham. 2011. Spatial imaging and quantification of microelements in the flowers of selenium-supplemented broccoli indicates elemental targeting to discrete tissues. GeoPIXE Workshop (6-7th December 2011) poster presentation.
32. Eason JR. 2009. Fresh food metabolism. Presentation to Shizouka University Delegation, Food Industry Science Centre, Palmerston North, 30th March 2009.
33. Eason JR, West P, Pathirana R. 2008. Modelling cell death in Arabidopsis cultures. Biology Meeting, Palmerston North, New Zealand 28 August 2008.
34. Heyes JA. 2009. Future Vegetables and Vital Vegetables. Address to HortNZ Research & Innovation Board meeting, Gisborne, New Zealand, 18 June 2009.

35. Heyes JA. 2009. Future Vegetables and Vital Vegetables. Briefing for Minister of Agriculture, David Carter, at HortNZ R&I Board meeting, Gisborne, New Zealand, 19 June 2009.
36. Heyes JA. 2009. Retaining phytochemical composition after harvest. Presentation at NZIFST workshop, Palmerston North, New Zealand, 20 November 2009.
37. McKenzie MJ and Chen R K-Y. 2010. Using the Australian Synchrotron to map microelements in plant tissue. Invited speaker at the Plant Biology Seminar Series, Biocommerce Centre, Palmerston North. 25th March 2010.
38. McKenzie M, S. Murray, S. Baldwin, G. Timmerman-Vaughan, A. Hardacre, I. Batey. 2008. Capillary Electrophoresis of Starch - FACE analysis. Presentation at Molecular Tools Meeting, Palmerston North, New Zealand, 24-25 September 2008.
39. Mullaney J, Heyes J, Sutherland J and Kelly B. 2010. Fighting cancer: the inside story from broccoli and bacteria. Poster presentation at the Riddet Institute Conference, 29 June 2010.
40. Pathirana R, West P, Eason JR. 2008. Establishment and use of a cell cycle synchronised diploid *Arabidopsis thaliana* cell culture to study programmed cell death. 4th September 2008. Laboratory of Tropical Crop Improvement, Division of Crop Biotechnics of Dept of Biosystems, Katholieke Universiteit Leuven, Leuven, Belgium, 4 September 2008.

Staff exchanges

1. Paula Rippon spent a week at DPI in May. This was a great opportunity to update each other on methodology and learn the methods DPI is using for tomato and capsicum analysis
2. Bruce Tomkins visited Gérard Simon of Vilmorin & Cie, France, October 2009.
3. Jocelyn Eason visited the vegetable breeding groups of Vilmorin & Cie in France 2010. While there she presented information from VV2 research and discussed collaboration on carrot and broccoli development.
    - Eason JR 2010. High Falcarinol Carrots. Presentation to Jacques-Yves Guéguen and Gérard Simon, Vilmorin, La Ménitré, France.
    - Eason JR 2010. High Sulforphane Broccoli. Presentation to Grégoire Marandel and Gaëlle le Navenec, Laboratoire de Biotechnologies Végétales, Harris Moran Clause. 10th May 2010, Beaucouzé, France.
4. Bruce Tomkins visited PFR, Palmerston North, 5 October 2012.
5. Joint DPI and PFR research meeting, September 2011.

Appendix 11 – Gate keepers meetings

Gate Keeper Meeting	Project (Gate)	Decision
December 2010	Baby leaf salad (G3)	Approved
February 2011	Floretted broccoli (G3)	Approved
	Purple potato (G3)	Approved
	High-lycopene tomato (G2)	Approved
	ACE capsicum (G3)	Approved
	Se-sprouts (concept)	Concept adopted
	Baby leaf salad (P3 progress)	Progress since G3 acceptable
June 2011	Cauliflower (G2)	Approved
	Vegetable medley (G3)	Approved
	Carrots (G3)	Approved
	Slaw (G1)	Approved
	Baby leaf salad (CBA tested)	CBA accepted
	Baby carrots (concept)	Concept adopted
September 2011[17]	Baby carrots (G2)	Stop
December 2011	High-Lycopene tomato (G3)	Hold
February 2012	Slaw (G3)	Approved
	Baby leaf salad (G4)	Approved
	Se-sprouts (P1 progress)	Acceptable progress
	Vegetable medley (G3)	Approved
	Purple potato (G3)	Approved
	Asian vegetable (concept)	No breeding programme, reconsider competitive advantage.
April 2012	Floretted broccoli (P4 progress)	Acceptable progress
	Cauliflower (P3, progress)	Limited progress, await Aus data.
	Purple potato (P3, progress)	Critical path adopted
	Carrots (G4)	Approved
	Slaw (G4)	Approved
	Se-sprouts (G3)	Approved
	High-lycopene tomato (P3)	Hold
	ACE capsicum	Stop, low yield

[17] Market research findings presented to VVMP, portfolio review

Gate Keeper Meeting	Project (Gate)	Decision
July 2012	Baby leaf salad (G4)	Approved
	Slaw (G4)	Approved
	Medley (G4)	Approved
	Broccoli heads	Hold, value proposition limited
	Sweet potato (G1)	Approved
	Purple potato (progress)	Stop existing line, test new line.
	Carrots (progress)	Current coloured carrots not viable, test high vitamin orange carrot against standard.
	High-lycopene tomato (P3)	Stop – outdoor production not viable.
August 2012[18]	Green light snacks (concept)	Concept adopted
	Cauliflower medley (concept)	Concept adopted
	Summer Mediterranean Grill (concept)	Concept adopted
	Winter Veg Roasties (concept)	Concept adopted
November 2012[18]	Se-sprouts (G4)	Approved
	Salad dressings (G2)	Stop – guidelines provided to VVMP to develop healthy dressings as components of other projects
	Slaw (vitalfibre™, G2)	On Hold – lower priority than heart, sight and bone slaws
	Green light snacks (G2)	Approved
	Stir-fry (G2)	Approved
	Cauliflower medley (G2)	Stop – limited value proposition and production/scheduling risks
	Summer Mediterranean Grill (G2)	Approved
	Winter Veg Roasties (G2)	Approved
	Slaw – **vital**heart™	New concept adopted
	Slaw – **vital**sight™	New concept adopted
	Slaw - **vital**bones™	New concept adopted

[18] Portfolio review