GROWING TOGETHER 2035

Aotearoa Horticulture Action Plan

THE HORTICULTURE STACK: BUILDING SCALE IN TIER 2 AND 3 CROPS

April 2026

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Horticulture industry-good organisations have a limited budget to invest in research and development each year. This project has taken the technology stack concept from the IT domain and applied it to horticulture, creating a framework that allows industry groups to systematically consider where to focus effort and resources to build scale.

The horticulture sector in New Zealand is made up of a mix of crops; some are well-established tier 1 crops grown at scale like kiwifruit and apples, others are tier 2 crops seeking to further build scale for example onions, cherries and avocadoes, and many are smaller or emerging tier 3 crops including persimmons, citrus, strawberries. All have the potential to grow, though research and technology needs differ depending on scale and the stage of development.

The horticulture stack is a framework to systematically consider different areas of specific crop(s) and to see what knowledge is present, and where the gaps are. The diagram below provides an example of a full, but not exhaustive, horticulture stack. It shows some of the 'features' for consideration in each layer of the stack and provides examples of the types of science and tools that underpin each feature.

Tier 1 crops are likely to have a full horticulture stack in place. A full stack is not a static position. Continually enhancing elements of the stack, for example implementing planar cordon orchard plantings in apples or the introduction of new cultivars in Kiwifruit, ensures differentiation and competitive advantage is maintained

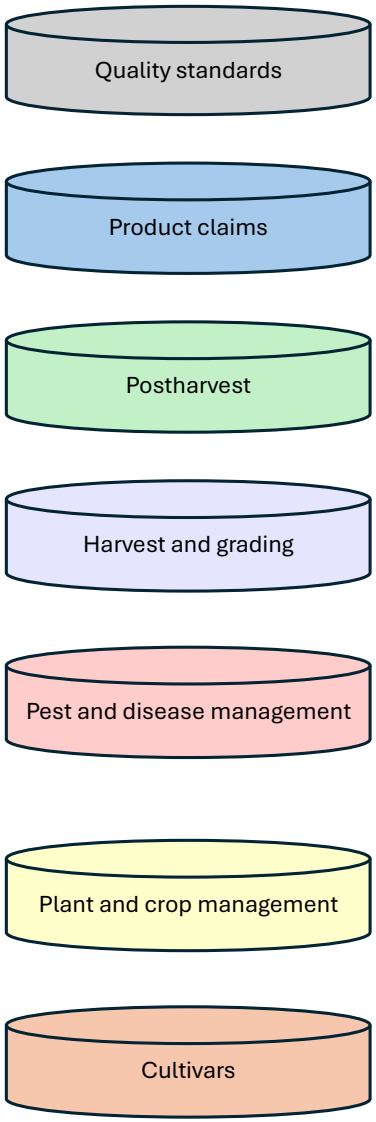
Tier 2 and 3 crops may have some elements of a horticulture stack in place but also have some gaps. The stack framework is a good starting point to see where R&D efforts have focused to date i.e. have most activities been in a few 'favored' layers? Or relatively evenly spread? How does this correlate with the layers that hold most significance for growth of the crop?

How will this work be used?

The horticulture stack analysis identifies the difference between the current state of knowledge, practices, or technologies and the desired or optimal state. By pinpointing these gaps, future research and innovations can be prioritised. The framework allows product groups to demonstrate a thorough approach to prioritisation (i.e. why this research project over another one?) and return on investment.

One of the benefits of a standardised approach is that it will surface challenges faced by multiple groups and opportunities for efficiency gains by working collaboratively on solutions.

The AHAP programme team have worked through the framework with the fresh tomato sector. As a result, the fresh tomato sector can review their research and development plan and ensure that the most impactful gaps are being prioritised. Support is available for other crop groups who would like to use the horticulture stack approach to shape their research and development portfolio.



Features of a 'complete' horticulture stack	Examples of underpinning science
• Current and future consumer preferences are known • Attribute/price/cost correlations have been determined • Quality standards and quality test methods are in place	• Sensory science • Food composition analysis • Consumer perception research
• Health or functional benefits are known and evidence-based • Production system certification allows for differentiation claims e.g. organic, sustainability	• Functional health evaluations • Nutrition and composition
• Optimised storage and ripening protocols are in place • Postharvest pest and disease management tools exist	• Time-temperature research • Controlled or modified atmosphere • Coatings • Pest and disease controls • Fumigation • Ethylene management
• Harvest tools and practices have been optimised • Grading technology can select for quality attributes • Systems are in place to meet market access requirements • Food safety practices are in place	• Harvest indexes • Robotic harvesters • Post harvest protocols and applicators • Screeners and sorters • Food safety technologies
• Integrated pest management tools and protocols are available • Traps, lures and sensors allow for proactive pest monitoring • Spray diaries, residue monitoring and resistance management are undertaken • Biosecurity readiness efforts have been made for priority threats	• Plant protection systems • Detection tools for pests and pathogens • IPM systems knowledge • Biological control tools • Technology for pest deterrence and control • Incursion impact analysis
• Growing and pollination systems are optimised • Tree architecture and pruning protocols maximise yield • Nutrient protocols and monitoring exist • Soil health management best practice is known	• Optimised growing system analysis • Soil function and health • Modelling and data science • Bioengineering technologies • Practice change and adoption • Pollination systems
• Cultivars have been selected to maximise consumer attributes, production traits, pest and disease resistance, soil tolerances (e.g. salinity) • Dwarfing rootstocks are available.	• Traditional breeding • Marker assisted selection • Genomic selection • New gene technologies

TomatoesNZ

CASE STUDY: FRESH TOMATOES

The Tomatoes NZ board worked through each layer of the horticulture stack and considered the below questions:

1. **What is the current state of fresh tomato sector knowledge or practices in this area?** Do we have the knowledge/tools we need? Have these been extended to growers? This captures work to date and let us know what is already available or in place for commercial fresh tomatoes.

2. **What is the fresh tomato sector missing in this area?** What is holding us back? These are the gaps. Knowledge, technology, policy and adoption gaps were captured.

3. **For each gap, who might know?** Who could the fresh tomato sector collaborate with? Can we get this knowledge from overseas? It may be more efficient to work with others. This could include innovative growers or researchers overseas but also growers of other covered crops in New Zealand.

4. **How important is each gap?** What cost, time/horizon, and resources would be required to address it? What is the cost of no change? Ranking the gaps reveals those most critical to achieving the biggest gains. The fresh tomato sector priortised gaps through two lenses: profitability (exports, production practices and energy) and risk mitigation.

5. **Whose wheelhouse does this sit in?** Who is responsible? The product group? Growers? Breeders? Regulators? A combination? The priorities need to be shared with those who have the mandate and ability to effect change. Product groups might only invest in things that most of their growers could adopt, not just the big ones.

Common types of gaps include:

Knowledge Gaps: Lack of research in certain areas (e.g. understudied pests, environmental impact of a new horticultural practice)

Technology Gaps: Lack of practical tools or efficient technologies or lack of access to these tools/technologies in New Zealand or for the crop.

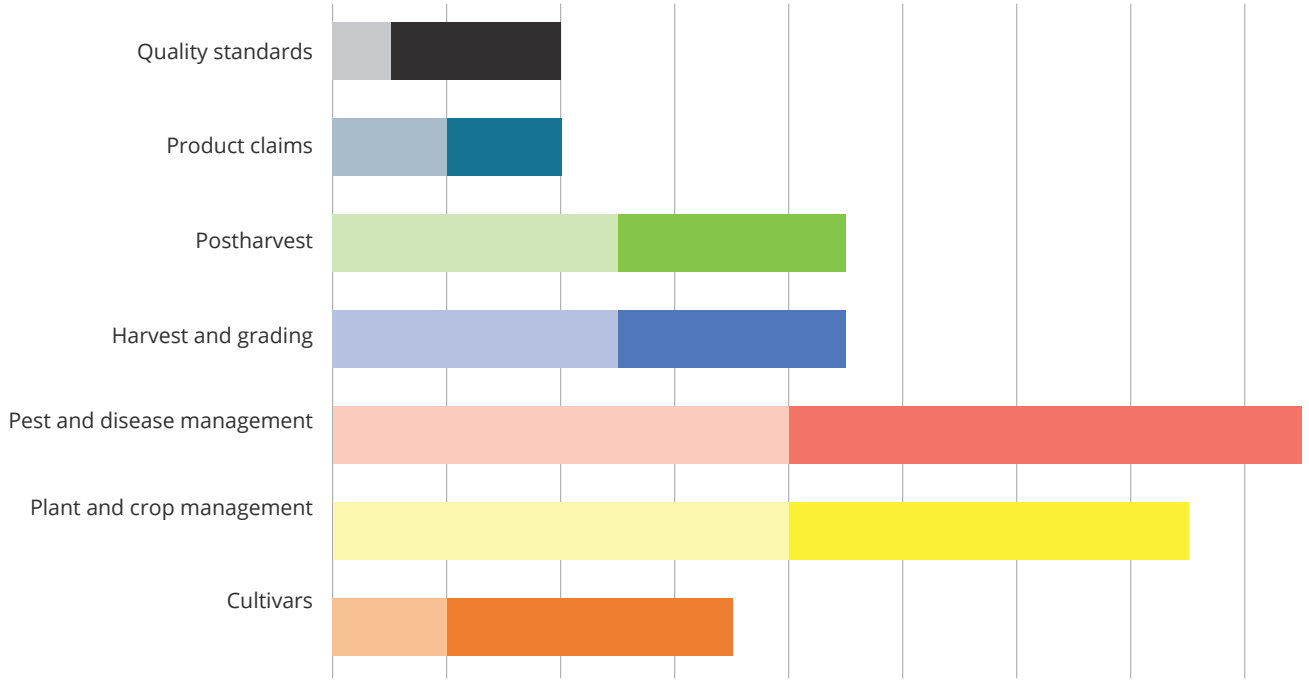
Policy Gaps: Gaps between research findings and policy or regulation that prevents broader application.

Adoption Gaps: Barriers preventing the adoption of new effective practices.

The horticulture stack project delivers on two AHAP actions:

- Use a technology stack approach to review the competitive position of Tier 2 sectors to ensure product quality standards, harvest and post-harvest protocols and techniques are in place (Key Priority 2.3).
- Develop a set of solutions (technology stack) for each Tier 2 crop to build the scale needed (Key Priority 4.1).

The horticulture stack analysis provides the basis for the fresh tomato sector to review their research and development plan.



Proportionality for fresh tomatoes: ratio of activities/knowledge/practices already completed or underway (light bars) vs gaps (dark bars).

Key findings:

- The fresh tomato sector has been active to varying degrees in all layers of the horticulture stack (illustrated by the light bars), but particularly in the pest and disease management and plant and crop management areas.
- The group determined that, despite significant research and development to date, there are still a number of gaps in the pest and disease management area that are holding the sector back.

Priority areas to a) maintain and b) build scale in the fresh tomato sector

Quality standards	• Current shopper demographics for fresh tomatoes. • Consumer values and preferences (e.g. environment, packaging, varieties available) and their impact on purchasing behaviour. • Promotion of the NZ story.
Product claims	• Value that could be captured from production efficiency claims e.g. efficient use of water and land.
Postharvest	• Maintaining sector knowledge about MRL's and MRL testing practices. • New technology for improving shelf life.
Harvest and grading	• Continuing to drive latest best practice into existing food safety protocols.
Pest and disease management	• Integrated pest management tools and protocols are available • Traps, lures and sensors allow for proactive pest monitoring • Spray diaries, residue monitoring and resistance management are undertaken • Biosecurity readiness efforts have been made for priority threats
Plant and crop management	• A demonstration glasshouse.
Cultivars	• Cultivars for longer shelf life. • Control options if leaf mould resistant varieties no longer work.

Of the 17 gaps that were considered high priority:

- Most priorities will support both export and domestic market growth aspirations.
- Some are 'low hanging fruit' and simply require a review of existing resources and knowledge to ensure they incorporate the latest information and practices.
- Some relate to industry-wide adoption – the knowledge is there, but a refresher is needed to keep adoption high.
- Some require new knowledge or technology if they are to be addressed.
- Some may drop down the priority list if further investigation determines that they are not going to move the sector far enough forward.
- Some R&D activities might go into the forward work programme to be kicked off in future years.

Next steps may include consideration of outcomes, research questions, project goals, timelines, funding needs, and collaboration opportunities.

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