



The Technological Kiwi:

**Technology activities to
support the use of
SOPi in schools**

Ministry for Primary Industries
Manatū Ahu Matua



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CONNECTIONS TO THE NEW ZEALAND CURRICULUM

CURRICULUM PRINCIPLES

The principles set out below embody beliefs about what is important and desirable in the school curriculum – nationally and locally. They should underpin all school decision making.

These principles put students at the centre of teaching and learning, asserting that they should experience a curriculum that engages and challenges them, is forward-looking and inclusive, and affirms New Zealand's unique identity.

The New Zealand Curriculum (2007) p. 9

The principles that relate to this resource are:

Community engagement: The curriculum has meaning for students, connects with their wider lives, and engages the support of their families, whānau, and communities.

Coherence: The curriculum offers all students a broad education that makes links within and across learning areas, provides for coherent transitions, and opens up pathways to further learning.

Future focus: The curriculum encourages students to look to the future by exploring such significant future-focused issues as sustainability, citizenship, enterprise, and globalisation.

KEY COMPETENCIES

The New Zealand Curriculum identifies five key competencies:

- thinking
- using language, symbols, and texts
- managing self
- relating to others
- participating and contributing.

People use the key competencies to live, learn, work, and contribute as active members of their communities. More complex than skills, the competencies draw also on knowledge, attitudes, and values in ways that lead to action. They are not separate or stand-alone. They are the key to learning in every learning area.

The New Zealand Curriculum (2007) p. 12

As students work on the activities in this resource they use and develop the key competencies in such ways as:

Participating and contributing: contributing to class discussion and participating in group tasks, particularly those that involve research or debating the positive and negative impacts of technological developments.

Thinking: both creative and critical: exploring technological innovations such as robotics and automation, the new possibilities they have opened up, where they might go in the future, and what the implications might be for individuals and the community; considering how technology both changes and responds to society; thinking about the different areas of specialist skills and knowledge required for technological developments.

Using language, symbols, and texts: students learn new specialist vocabulary (for example, brix, dry matter, NIR) and are introduced to new concepts (for example, supply chain, value-added); they will need to make sense of materials that have been written for adults working in the kiwifruit industry.

Relating to others: working collaboratively as part of a group to develop concepts and ideas about future value added products, the impact of robotics and automation.

Managing self: showing initiative, following up on commitments made to the group, contributing to research.

ACHIEVEMENT OBJECTIVES

Level 4: Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.

Level 5: Understand how people's perceptions and acceptance of technology impact on technological developments and how and why technological knowledge becomes codified.

KEY UNDERSTANDINGS

- The kiwifruit industry, and other primary industries, are very important to the New Zealand economy.
- Large-scale horticulture has been made possible by technological developments.
- Many of these technological developments have been pioneered in New Zealand.
- Technological developments draw on multiple areas of specialist knowledge and skills.
- How different people view a technological development can vary greatly.
- Continuing technological development is necessary for reasons of competitiveness but not everyone benefits.
- Customer (client) expectations/preferences are a major influence on technological developments in horticulture.
- Technology is making it possible for kiwifruit growers to reduce the adverse impacts of fertilisers and sprays on the environment.



BACKGROUND NOTES FOR TEACHERS

As other countries are limited by their arable land and water constraints, New Zealand is increasingly seen as having a comparative advantage to produce high-quality cost effective food for export. Some predict New Zealand will be a future food-producing powerhouse for Asia as our exports increasingly head in this direction. Certainly, kiwifruit exports support this prediction, with 54 percent of total exports in the year ending March 2016 going to Japan (21%), China (19%), Taiwan (10%) and South Korea (4%).

Kiwifruit growing in New Zealand has a history that goes back to 1904, when the first seeds were imported from the plant's native China. It was not however until the 1950s that the fruit became an export crop. In November 2010 the Psa-V bacteria was first detected in New Zealand in Te Puke, sending shockwaves through the industry. It is now present on over half the total area planted in kiwifruit.

Since 2010 the industry, supported by the Ministry for Primary Industries, has worked hard to control the spread of the disease and to find resistant cultivars. The Gold3 cultivar is a direct outcome of this research, with the new cultivar increasingly replacing its predecessor, Hort16A.

These efforts are now reaping a dividend, with New Zealand exporting 96 million trays of kiwifruit in the year ended 31 March 2015, and export values reaching over \$1 billion. The year ended March 2016 was even better:

Kiwifruit revenue is expected to be near \$1.7 billion on the back of record export volumes. Gold kiwifruit orchards are now reaching maturity after recovery from the Psa bacterial disease.

– Situational Outlook for Primary Industries 2016, page 13

Gold kiwifruit are very popular with domestic consumers, but even more crucially they are favoured by Asian consumers and have been a key factor in the rise of exports to that part of the world. In response to this demand, an increasing proportion of kiwifruit hectares are now planted in gold.

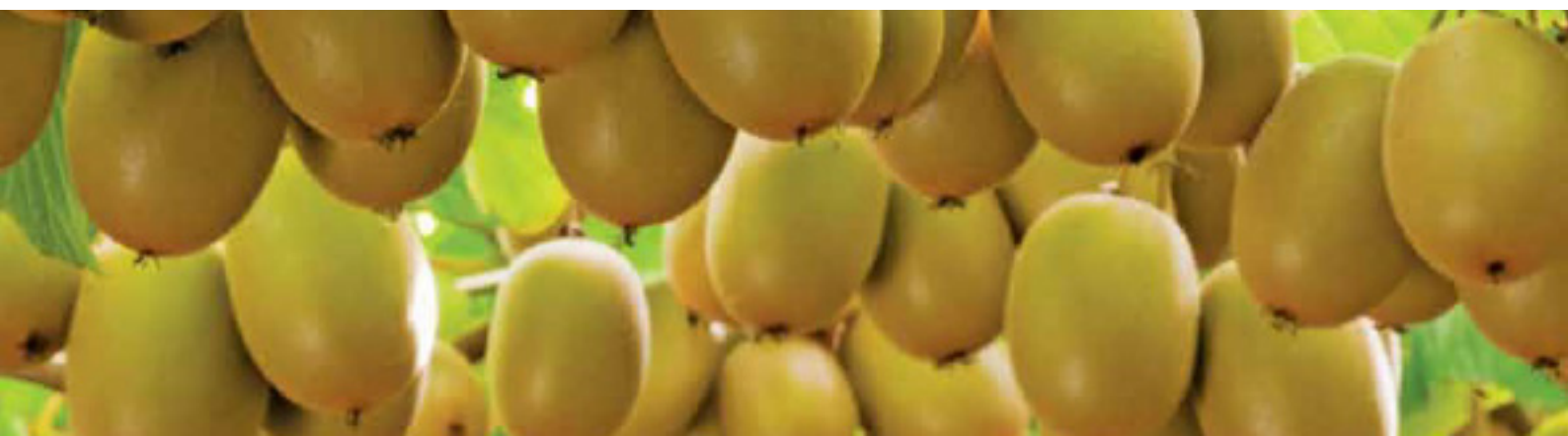
Zespri announced an additional 1600 hectares of gold kiwifruit licence would be released over the next four years, a significant addition to the 4800 hectares of gold kiwifruit in production in 2015.

Expansion of the high value and very productive Gold3 cultivar is expected to drive overall kiwifruit exports up 27 percent from current levels, to \$1.9 billion by 2020.

– Situational Outlook for Primary Industries 2016, pages 21 and 62

Technology makes a major contribution to every area of the kiwifruit industry, from developing new cultivars through to planting out through to delivery to foodmarkets. Technologies enable large-scale production – and provide the means to minimise negative impacts on the environment. New Zealand industries have been at the forefront of many of these developments and some provide innovative technologies to the world. These include sorting, grading and handling machinery, automated picking machinery, production of bioplastics from kiwifruit waste, production of kiwifruit purees ... Your students will have opportunities to research some of these technological developments in the activities that follow.

For an introduction to the kiwifruit industry in New Zealand, see Te Ara, the New Zealand encyclopedia.



TEACHING AND LEARNING PLAN

How these resources work

These resources comprise a snapshot and a set of activities for each of the following learning areas: maths, science, social studies and technology. The snapshot has been developed as an introduction to the context of the New Zealand kiwifruit industry and is suitable to be used with students in all learning areas. This can be shared using a variety of approaches (shared, guided or independently read) depending on what best suits the students you teach.

Each of the technology activities is designed to be taught over several sessions. An indicative timeframe for each is as follows:

- Activity one: 3 hours
- Activity two: 3–4 hours
- Activity three: 2–3 hours
- Activity four: 3 hours
- Activity five: 2 hours
- Activity six: 3 hours

The activities can be used in any order and with any number of students.

Possible tools for collecting information and presenting evidence

- Virtual communication (for example, Skype/Google hangouts, appear.in) for talking to experts
- Thinglink/Google for drawings
- Google Forms/Survey Monkey for obtaining and collating information and opinions
- Wicked problem type sites such as Innocentive, Make Better, Generator, OpenIDEO, Zooniverse, Worldometers
- Twitter for connecting with others online to learn more about an event or concept
- Google + communities
- Virtual field trips.

ACTIVITY 1:
IN THE BEGINNING

Students create a timeline of the New Zealand kiwifruit industry over the past 100 years, detailing how it has changed and contributed to the New Zealand economy.

Discussion questions to support and enhance the understanding of these historical events could include:

- How has the kiwifruit industry changed during this time?
- What are the main factors that have contributed to these changes?
- What did you learn about Isabel Fraser, Hayward Wright, and Jack Turner?
- How could you sequence these events – months, years, colour codes for economic and historical events, other ways?



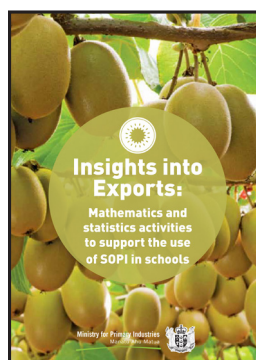
SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- SOPi 120118 Report pages 48–53
- SOPi 120144 Report pages 36–39
- SOPi 120133 Report pages 38–41
- SOPi 120123 Report pages 37–40

Links and tools for gathering ideas and presenting information

- Creating electronic timelines
- Isabel Fraser
- Hayward Wright
- Jack Turner
- Te Ara's history of kiwifruit
- Tuhono Whenua Horticulture Ltd
- Te Mānaki Whenua Kiwifruit Grower Toolkit
- The story of Zespri kiwifruit
- Sustainability the Zespri way
- Breeding Psa resistant kiwifruit – Video produced by Plant and Food Research



ACTIVITY 1:

ROBOTICS AND AUTOMATION



Students explore how and why robotics and automation are becoming ever more important in the kiwifruit industry. They also consider what impacts these technologies are having on job opportunities for people.

To support their understanding, students could:

1. Select a kiwifruit industry occupation from one of these three broad categories:

Growing: for example, grower, picker, pruner, orchard manager

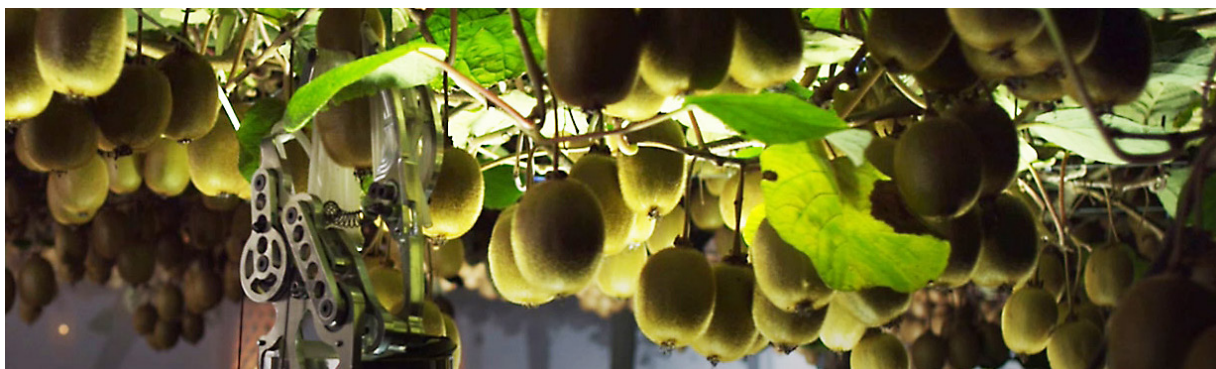
Adding value: for example, food technologist, processing plant manager, packhouse worker, international logistics specialist, marketer, coolstore worker

Support services: for example, soil scientist, geneticist, truck driver, biosecurity officer, conservationist, builder, equipment manufacturing company rep, IT specialist.



Compare and contrast the ways that robotics and automation have impacted on this role.

2. Invite someone who is involved in the kiwifruit industry to come in and talk to the class about robotics and automation innovations that are currently being explored for use in the industry. What are the likely impacts of these technological developments in terms of human possibilities, the kiwifruit industry, and the communities where kiwifruit growing is a major employer?
3. Try and identify the different areas of specialist knowledge that may be involved when developing, say, a robotic kiwifruit harvester or a kiwifruit grading machine. What would be the particular contribution of each specialist area?
4. Discuss how robotics and automation are important for the competitiveness of the New Zealand kiwifruit industry (and other industries too). Discuss who/what benefits/loses and why. They could debate whether saying 'no' to particular technological developments is an option.



SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
- [SOPI \(2014\) Report pages 36–39](#)
- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)

Links and tools for gathering ideas and presenting information

- [Leader of the pick](#) Development of an automated picker at Massey University
- [Roboticsplus](#) A company that works in the area of automation in the kiwifruit industry
- [Kiwifruit processing company](#) Various value-added products. What role is envisaged for automation and robotics in this part of the supply chain?
- [Fruit processing machines](#) This company specialises in handling fruit during processing.
- See also the industry links for Activity Three.
- [Futureintech Primary Industries Ambassadors.](#)



ACTIVITY 2:

VALUE-ADDED KIWIFRUIT PRODUCTS

Most New Zealand kiwifruit are exported as fresh, whole fruit. But technologists are working hard to expand the range of value-added kiwifruit products being brought to market.

To support their understanding, students could:

1. Research what value-added kiwifruit products are currently being made. They should consider not only products that use whole fruit, but also those that use parts of the fruit or byproducts of the industry, including waste.
2. Choose a value-added kiwifruit product that is commercially available and that interests them and then try to find out how the various constituents of the kiwifruit (e.g. seeds, skin, fruit, inner core) are managed in the processing line to create the end product.
3. Discuss what a business would need to consider before deciding to go ahead and manufacture an innovative kiwifruit product. They explore what the terms 'creative' and 'critical' thinking mean and identify examples of both types of thinking that would be involved when considering a new product for development and sale.
4. Work in small groups and form 'companies' to come up with creative and marketable ideas for new, value-added products that utilise kiwifruit. Each 'company' gives itself a suitable name, brainstorms and then agrees on a 'product'. The product must be brand new and not currently available. It doesn't matter if the technology to produce it is not yet in existence. Who will the target market for this product be? Think about the 'product' in terms of technical feasibility (what would be required to realise it?) and social acceptability. Each 'company' then prepares and presents a pitch for their future product. How is their idea received? Consider bringing in someone (or a small group of critics) to give feedback and critique, Dragon's Den-style.





SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
- [SOPI \(2014\) Report pages 36–39](#)
- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)

Links and tools for gathering ideas and presenting information

- [A Double Agent for Glycaemic Control and Nutrient Enhancement](#)
- Speakers at this [Kiwifruit symposium](#) present research confirming the nutritional value of kiwifruit.
- The [Kiwifruit processing company](#) makes a range of kiwifruit purees.
- Parrs Products Ltd makes [skincare products](#) that use kiwifruit extracts
- [Cendenco](#) makes kiwifruit paste, puree and quick frozen kiwifruit.
- [Kiwifruit extract for great health.](#)



ACTIVITY 3:

KIWIFRUIT PRODUCTION

Pushing the boundaries

Students explore ways in which the development of innovative technologies have enabled larger-scale production and processing within the kiwifruit industry.

To support their understanding, students could:

1. Collaborate to research innovative technologies that have been developed for use in growing, harvesting, sorting, packing, storing and transporting of kiwifruit.
2. Interview (face-to-face or virtually) one or more people who work in different areas of the kiwifruit industry (for example, a packhouse or coolstore manager, a Zespri representative, a soil or plant scientist) to gain an understanding of why some of these technologies were developed, and how they have enabled new possibilities.
3. Investigate the drivers (for example, economic, social, environmental) that led to the development and implementation of these technologies.
4. Investigate in what ways large scale kiwifruit production and distribution technologies are (a) similar to those used for other fruit, and (b) different from those used for other fruit. Can they account for the differences?

SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
- [SOPI \(2014\) Report pages 36–39](#)
- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)



Examples of innovative technologies, with some industry:

Frost protection and irrigation monitoring systems

- [Think Technology Group](#)
- [Frost monitoring technology](#)

Fruit sorting, cleaning and grading

- [Compac](#) (clients talk about their needs in short videos that show this New Zealand company's technologies in action)
- [Compac's InVision sorting system](#) is designed to detect external defects while [Inspectra](#) uses Near Infra-Red (NIR) technologies to check internal quality and condition.
- [Unitec sorting, grading and packing machines](#) (Italian technology)
- [Grading systems](#) (An excellent survey of New Zealand equipment being sold to the world)



Packing:

- [Compac's bin/volume/tray filling, bagging, punnet and tote technologies](#)

Carton handling:

- [Compac's carton handling and robotics technologies](#)

Data and analytics:

- [Compac's data and analytics technologies](#)



Cool store management:

- [Trevelyn's variable speed drivers, refrigerant leak detectors, non-flammable refrigerant, sustainability practices](#)

Reefer shipping, refrigerated container shipping:

- [Transport](#)
- [Delivery to markets](#)
- [Highly efficient reefer shipping](#)
- [Reefer ships the future](#)
- [Fruit boom brings shipping rethink](#)
- [TeAra – Kiwifruit exports](#)
- [Shipping Performance Analysis](#)
- [Is the supply chain fit for increased container traffic?](#)
- See also [Seeka kiwifruit grower services](#)



ACTIVITY 4:

IT TAKES ALL KINDS



Students explore how specialist technological knowledge and skills combined with knowledge and skills from other disciplines have enabled the development of a technological product or system.

To support their understanding, students could:

1. Select one of the innovative technological products or systems met in Activity Three and investigate how it was designed and developed.
2. Consider who would have been involved in developing this innovative technology, and the kinds of knowledge and skills that they would have needed. They could present this information in the form of a mind map, spider diagram, or other kind of graphic organiser.
3. Invite a project manager or someone else who has been directly involved in the development of a major local cool storage system or other primary industries system to come to class and answer prepared questions. Questions could relate to the person's particular role, and to the roles of the other specialist people involved in the project.
4. Work in small groups and each select and take on a specialist role. Keeping in their chosen roles, they plan the development of a technological system to be used in a new kiwifruit orchard or handling and sorting facility. Given their areas of expertise, what will their contribution be? What other expertise will they need to bring in to supplement their own?

SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
- [SOPI \(2014\) Report pages 36–39](#)
- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)

For examples of how particular knowledge and skills contribute to the development of kiwifruit technologies, see:

- [Zespri careers](#)
- [There is more to NZ's fresh supply chains than timely delivery to markets](#)
- [PickNZ careers in horticulture](#)



ACTIVITY 5:

MAKING AN IMPACT



Students explore some of the ways in which intensive kiwifruit production, made possible by advances in technology, has impacted on people and the environment.

Attached below is a list of some of these impacts. Students should be aware that the links are to resources that present a particular viewpoint and that this viewpoint is unlikely to be the only one.

To support their understanding, students could:

1. Group the listed impacts under the headings 'very positive' and 'very negative'. Are there any that don't fit either category?
2. Select one impact that different people are likely to experience in different ways and discuss some of the reasons why.
3. Is kiwifruit production important in your region? If so, think of all the ways it contributes to the local economy.
If your region is not a kiwifruit growing region, what is its biggest primary industry? Think of all the ways this industry contributes to your local economy.
4. What measures have been put in place to mitigate potential negative impacts (environmental, social and economic) of kiwifruit production in your area?
If your region is not a kiwifruit growing region, apply the same question to your region's biggest primary industry.



THE KIWIFRUIT INDUSTRY: Some impacts

Here are some of the impacts of the kiwifruit industry on New Zealand and New Zealanders, with one or more online references in each case:

Income from exports

- [SOPI \(2015\) Report pages 48–49, 52–53](#)

Job opportunities

- [Careers NZ](#)
- [New Zealand Kiwifruit Growers > Careers](#)
- [Futureintech Primary Industries](#)

Kiwifruit goes wild

- [Te Ara Encyclopedia](#)

Creation of monocultures

- [Biotechnology Learning Hub](#)
- [Kiwifruit a victim of monoculture farming](#)

Use of sprays

- [Kiwifruit spray season starts Spray drift concerns Te Puna resident](#)

Use of fertilisers

- [Sustainability and the environment](#)
- [The story of kiwifruit grower Darren](#)

Production of a nutritional fruit

- [The daily scoop of amazing](#)
- [Kiwifacts](#)

Visual impacts on landscape

- Frost fans, packhouses, windbreaks, etc.

Production of waste

- [Bay of Plenty guide to regional plans farming activity](#) (see page 41 for managing kiwifruit waste)
- [New kiwifruit spife uses compostable plastic made from kiwifruit waste](#)

SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
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- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)



ACTIVITY 6:

THE CUSTOMER GETS WHAT THEY WANT

Students consider how people's perceptions and what they want have influenced technological practices and decisions in the kiwifruit industry.

Attached below is a list of some factors that have been shown by research to influence consumer behaviour.

To support their understanding of how consumer preference influences technological developments, students could:



1. Carry out and then analyse a class survey to find which of the listed factors matter most to them.
2. Ask family/whānau members to rank the listed factors in terms of importance to them, and then collate and analyse class results.
3. Find out how new varieties of kiwifruit are developed and what varieties are currently being trialled. What are the attributes of these new varieties, and why have they been selected as important?
4. Find out how New Zealand transports its kiwifruit to overseas markets (consider, for example, transport to port, type of vessel, stowage methods, cooling/refrigeration, length of voyage, storage and handling at destination).
5. Put questions to the produce manager at a local supermarket, asking them about local kiwifruit buying habits (have they changed over time?) and the challenges of presenting kiwifruit for sale.
6. Discuss how changing consumer preferences and social attitudes present opportunities for new technological developments.
7. Discuss how preferences are often shaped as much by the way a product is produced (for example, sustainability, fair treatment of staff, cultural context) as by such practical considerations as taste, health benefits, convenience, or shelf life. Think of specific examples.

Some factors that influence the kiwifruit buying behaviour of consumers:

Consumers eat kiwifruit for their health and nutritional benefits.

'Global consumers have an increasing interest in foods that provide benefits beyond basic nutrition, with health benefits being one of the top drivers in consumer purchasing behaviour, along with taste and quality.' [Plant & Food Research](#)

Consumers want kiwifruit that look good (colour, size, quality) and taste good.

'Market research shows repeat purchase of kiwifruit is influenced mainly by taste and consistency, rather than by price. We have invested heavily in understanding how we can positively influence taste via growing techniques.' [Zespri Annual Review 2008/09](#)

Consumers want kiwifruit that have low chemical residues.

'By 1997, all kiwifruit was produced according to KiwiGreen or certified organic protocols, where biocontrol methods are favoured, and chemical sprays are used only when there are high numbers of pests.' [Te Ara Encyclopedia](#)

Consumers want to know that the kiwifruit they eat are produced in environmentally sustainable orchards.

'The Zespri® System is a unique orchard-to-retail delivery process that delivers consistently delicious fruit while using environmentally considerate methods to grow, cultivate, store and ship their fruit.' [Zespri](#)

Consumers like to try new types of fruit and to try variants of existing fruit.

'The growing interest in food and cooking – influenced by the availability of a wider variety of food and the emergence of celebrity chefs – has brought about a far greater desire for new and higher quality food products.' [Success and Failure in the NZ Kiwifruit Industry, p. 19](#)

Consumers like fruit that are convenient to eat.

'Barriers to consumption of kiwifruit often relate to convenience including how to judge when the fruit is ready to eat, and the need for utensils to cut and scoop out the flesh.' [Consumer Perceptions and Preferences for Kiwifruit](#)

Consumers want to know that the kiwifruit they eat has been stored and transported in ways that minimise environmental impact.

'Some initiatives underway include: Packhouse and Coolstore Waste utilisation – turning kiwifruit waste into bio-plastics which can be used for packaging. Slow-steaming ships – reducing a ship's speed by 2km/h to lower diesel use by 17 percent. The potential future use of SkySails – harnessing the wind's energy by flying a sail 100–300m off the front of cargo ships, reducing carbon emissions and lowering operating costs.' [Zespri](#)

SUPPORTING RESOURCES

Situation and Outlook for Primary Industries publications

- [SOPI \(2016\) Report pages 62–65](#)
- [SOPI \(2015\) Report pages 48–53](#)
- [SOPI \(2014\) Report pages 36–39](#)
- [SOPI \(2013\) Report pages 38–41](#)
- [SOPI \(2012\) Report pages 37–40](#)

Plant & Food Research case studies

- [Kiwifruit likeability](#)
- [Kiwifruit health benefits](#)

