Unlocking Orchard Opportunities

TEACHER GUIDE

New Zealand Edition

LESSON 1

YEAR 12-13

This resource has been developed by:

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Adapted for New Zealand use by:

Agribusiness in Schools
DELIVERING AGRIBUSINESS TO NZ SECONDARY SCHOOLS

Hort Innovation

LESSON 1

Unlocking Orchard Opportunities

LEARNING AREA

Agribusiness Standards (Year 12–13)

AGRIBUSINESS CURRICULUM CONTENT

Demonstrate understanding of future proofing that affect business viability. (**AS91865**)

Analyse future proofing strategies to ensure long term viability of a business. (**AS91869**)

Analyse how a product meets market needs through innovation in the value chain. (**AS91871**)

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Contents

LESSON OBJECTIVE

Students will learn about the significance of New Zealand's apple industry to producers, consumers, and the economy. Through collaborative tasks and guided research, they will learn how stakeholders in the industry are implementing innovations and technology to address social, economic, and environmental challenges to meet the needs of consumers while working towards global preferred futures.

LESSON OVERVIEW

Activity 1.1 – Introduction to New Zealand Apples
Activity 1.2 – Circle of Concern - Future Proofing
Activity 1.3 – An Innovative Industry
Activity 1.4 – Advancements in Apple Production

Resources and Equipment

ACTIVITY 1.1 – Introduction to New Zealand Apples

1. Growing the best apples in the world | ASB (1:42)
2. **Worksheet 1.1a – New Zealand Apples Fresh Facts**
3. Agribusiness | Fresh Facts 2024 - Sector Profile (Pg 12)
4. Access to computer/digital devices

Activity 1.2 – Circle of Concern - Future Proofing

1. Paper
2. Markers

Activity 1.3 – An Innovative Industry

1. Hawk Technology - Sunfruit Fully Automated Apple Packing Testimonial (2:45)
2. **Worksheet 1.3a – Apple Innovation Case Studies**
3. Access to computer/digital devices

Activity 1.4 – Advancements in Apple Production

1. Paper
2. **Worksheet 1.4a – Problem Solving Scenario Cards**
3. **Worksheet 1.4b – Advancements in the Apple Industry**
4. Materials for the design process (e.g. cardboard boxes, tin foil, straws, paper, scissors, glue, etc.)

Lesson Guide

ACTIVITY 1.1 – Introduction to New Zealand Apples

Students will learn about the significance of New Zealand's apple industry to both domestic and international stakeholders.

1. Facilitate a class discussion about apple production in New Zealand. Engage students by posing the following questions to tap into their understanding:
   - Where are apples produced in New Zealand?
   - Are all varieties of apples produced in the same locations? Why/why not?
   - What are the stages of the apple supply chain?
   - Is the New Zealand apple industry sustainable?
   - What are some of the challenges faced by New Zealand's apple industry?
2. View Growing the best apples in the world | ASB (1:42) to learn about the occupations and processes involved in apple production in New Zealand.
3. Facilitate a class discussion about the significance of the New Zealand apple industry to different stakeholders in New Zealand and abroad. Encourage students to identify the industry stakeholders observed throughout the video, recording their suggestions in a central area. Explain that the apple industry plays an important role in New Zealand's economy, food security, and the environment. It supports rural communities, contributes to international trade, and provides a nutritious and widely consumed food source to the population.
4. Distribute **Worksheet 1.1a – New Zealand Apples Fresh Facts** and provide students with access to computers or digital devices.
5. Students access the New Zealand apple industry statistics via the link Agribusiness | Fresh Facts 2024 - Sector Profile (Pg 12) and record answers to the questions on the worksheet.
6. Reconvene as a class and discuss what students have learned about the New Zealand apple industry.

ACTIVITY 1.2 – Circle of Concern - Future Proofing

Students will learn about environmental, economic, and social concerns faced by the New Zealand apple industry and will consider the different control measures implemented by the industry to manage these challenges.

1. Record the word 'flood' in a central area and ask students about the negative impacts of floods in New Zealand. Encourage them to think about the environmental, economic, and social impacts. Record their ideas as 'concerns'.

2. For each of the 'concerns', collaborate to record a possible 'control' or management strategy to prevent each problem from occurring or reduce the likelihood of them happening.

   For example:

   Concern: New Zealand's agricultural sector is vulnerable to flooding, causing damage to crops and livestock. This can disrupt the food supply chain and lead to food shortages and price increases.

   Control: Building flood barriers, levees, and embankments in vulnerable areas to prevent floodwaters from reaching farms.

3. Draw a circle of concern in a central area and divide students into groups of four. Distribute a piece of paper and markers to each group and ask them to draw a large circle and consider any 'concerns' that students know relating to apple production. Students record ideas in the outer 'concerns' circle.

   Suggested answers:

   Climate change, pests and diseases, changing consumer demand, labour shortages, etc.

4. Allow groups to share their 'concerns' with the class and then consider any possible 'controls' that could reduce or eliminate the concern using technology, innovation, or production methods, recording these controls in the inner circle.

   Suggested answers:

   Machinery automation, selective breeding of pest and disease resistant rootstocks, protected orchards, new apple varieties, etc.

5. Reconvene as a class and encourage groups to share the concerns and controls identified during the activity.

6. Explain that factors such as climate change, pests and diseases, changing consumer demand, and labour shortages can significantly impact New Zealand's apple industry. Building resilience within the sector involves effective management and adapting to changing conditions. Technology, innovation, and management practices can be implemented along the apple value supply chain to address challenges within the industry and ensure continued economic, environmental, and social sustainability for industry stakeholders.

ACTIVITY 1.3 – An Innovative Industry

Students will learn about the use of innovation and technology to address concerns in the apple industry. Students will engage with source materials to complete two case studies exploring robotics and genetic breeding in apple production.

1. Explain that students will investigate the use of innovation and digital technologies to address concerns and their controls in the apple industry. View the Hawk Technology - Sunfruit Fully Automated Apple Packing Testimonial (2:45) video about robotic production technology used in an New Zealand apple packing house to understand the current use of technology in the industry.
2. As a class, brainstorm the possible concerns that this technology may have addressed in the apple packing house.
3. Explain that automated production technology has been adopted in this New Zealand packing house to improve efficiency, product quality, and competitiveness while also addressing labour shortages and meeting the demands of modern consumers and global markets. The footage shows the machine visually grading and rotating apples to ensure consistency of colour and presentation when packaged. The apples are handled individually by the machine to prevent the fruit from bruising.
4. Provide students access to computers or digital devices, and distribute a copy of **Worksheet 1.3a – Apple Innovation Case Studies**.
5. Students access the source materials and complete the two case studies focused on robotics and specialised apple breeding.

   Answers

ACTIVITY 1.4 – Advancements in Apple Production

Students will collaborate to respond to concerns faced by New Zealand's apple industry. They will follow the Design Thinking process to design a solution to an industry challenge, applying their understanding of current innovations and technology being adopted in the sector to improve social, economic, and environmental sustainability.

1. Allocate students into groups of four or five and distribute a sheet of paper and a problem solving scenario card from **Worksheet 1.4a – Problem Solving Scenario Cards** to each group.
2. In their groups, students collaborate to read the information on their problem solving scenario card, recording their responses to the questions on the sheet of butchers paper.
3. Reconvene as a class and discuss the problems that groups were presented with. Facilitate a discussion about the technologies, innovations, and management practices that have been explored throughout the lesson. Encourage students to identify which problems could be addressed using existing technology or innovations. As a class, identify any advantages and disadvantages in adopting the innovations or technologies explored throughout the lesson.
4. Explain that in their groups, students will follow the Design Thinking process to create an innovation to solve the problem on their problem solving challenge card. Groups may wish to improve upon an existing technology or innovation or design a new management practice or device to solve the problem.
5. Distribute a copy of **Worksheet 1.4b – Advancements in the Apple Industry** to each group and present students with materials for the design process (e.g. cardboard boxes, tin foil, straws, paper, scissors, glue, etc.).
6. Groups follow the Design Thinking process to design an innovation or technology to solve the problem on their problem solving scenario cards.

Answers

ACTIVITY 1.1 – Introduction to New Zealand Apples

WORKSHEET 1.1a – New Zealand Apples Fresh Facts

Answers will vary annually, visit Fresh Facts 2024 to access current industry statistics.

ACTIVITY 1.3 – An Innovative Industry

WORKSHEET 1.3a – Apple Innovation Case Studies

Case Study One

1. Robotic apple harvester developed by Abundant Robotics.
2. The robotic apple harvester significantly improves harvesting operations by:

- Reducing dependence on seasonal labour – a major challenge in horticulture
- Increasing productivity by automating the picking of a large portion of apples, especially at the tops of trees, which are difficult and labour-intensive for human workers to reach.
- Maintaining fruit quality – the robot can identify and pick apples without bruising, ensuring that only fruit meeting quality standards is harvested.

Case Study Two

Joli

1. Joli™ – a new global premium apple variety. It is the product of over ten years of innovation through a collaborative breeding and commercialisation program involving Plant & Food Research, Prevar, and VentureFruit®

   The Joli™ apple variety improves several key areas of apple production:

2. Answers include:

- High productivity for growers: Joli™ trees are high-yielding, producing large quantities of fruit.'
- Enhanced fruit quality: The apples are large, full-flavoured, bright red, and juicy, with balanced sweetness that appeals to consumers.
- Optimised harvesting: Its mid to late March harvest fills a strategic gap between other premium varieties (JAZZ™ and Envy™), balancing labour and storage demands across the season.
- Climatic adaptability: The variety has been trialed to perform well in different environments and cope with varied climatic conditions.
- Strong post-harvest traits: It holds its quality and freshness well, crucial for New Zealand's export-focused horticulture.

3. Apple producers would choose to adopt the Joli™ variety because:

- Market differentiation & premium branding: premium branded varieties like Joli™ offer a competitive advantage and higher returns.

Answers (cont'd)

- Consumer appeal: Joli™ meets current and emerging consumer preferences with its size, taste, and appearance – critical for driving demand in global markets.
- Improved grower economics: Its high-yield and strong performance across climates reduce production risks and improve profitability.

Rockit

1. Rockit™ – a premium miniature apple variety and vertically integrated global brand.

Key innovations include:

- The Rockit tube packaging system (RTE – Rockit Tube Equivalent).
- Use of 2D planting structures in new orchards.
- A controlled global licensing model ensuring year-round supply.

2. Rockit's innovations improve multiple areas of apple production:

- Higher quality yields: 2025's harvest is noted as the cleanest and best in five years, with excellent size, taste, and colour.
- 2d orchard structures: New plantings using 2D structures improve tree training, sunlight exposure, ease of picking, and yield.
- Improved post-harvest and supply chain efficiency:
- Reduction in the number of pack presentations increases packing efficiency.
- Enhanced end-to-end visibility of the supply chain improves market responsiveness and reduces delays.
- Packaging innovation: The tube packaging creates a unique, snackable apple product with strong shelf appeal, tapping into snack food and gift markets.
- Premium returns: Growers can earn $1.80–$2 per RTE, significantly above standard returns due to premium branding and packaging.

3. Apple producers would adopt Rockit's model and technology because:

- Brand strength & global demand: Rockit is a globally recognised premium brand, selling in 28 countries, with controlled supply chains and high consumer demand—especially in Asia's gift market.
- Year-round sales opportunities: Through global licensed growers and cool storage, Rockit ensures continuous availability, smoothing out income and improving supply chain stability.
- Higher financial returns: The per-unit price of Rockit apples is up to three times higher than standard varieties, with better orchard gate returns.

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1.1a New Zealand Apple Fresh Facts

Click on the link to access New Zealand's apple and pear industry statistics. Record your answers to the questions below.

Industry stats: Fresh Facts 2024 New Zealand Apples (Pg 12)

	Question	Answer
1.	What was the most recent annual value of the New Zealand apple industry?	
2.	What percentage of New Zealand's apples are exported annually?	
3.	How many commercial apple and/or pear growers are there in New Zealand?	
4.	Which New Zealand region produced the greatest percentage of apples in the last twelve months?	
5.	List the five most common varieties of apples produced in New Zealand	1. _____ 2. _____ 3. _____ 4, _____ 5. _____
6.	Which variety of apple was purchased the most by New Zealand households in the last twelve months?	
7.	Identify a possible reason that some varieties of apples decreased in purchase value in the last twelve months.	_____ _____ _____ _____ _____ _____

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1.3a Apple Innovation Case Studies

Technology and innovation in agriculture improve productivity, profitability, and sustainability, addressing challenges along the value supply chain of food and fibre products. In New Zealand's apple industry, innovations and technology allow growers to produce higher-quality apples, reduce environmental impacts, and adapt to changing consumer demands.

Image source: T&G Global

Case Study 1:
Robotic apple-picker

READ

1.

- **World's first commercial robotic apple harvest at T&G's Hawkes Bay orchards.**
  https://tandg.global/worlds-first-commercial-robotic-apple-harvest-at-tgs-hawkes-bay-orchards-with-abundant-robotics/
- **Could robot harvesters be the way forward for New Zealand's apple industry?**
  https://www.massey.ac.nz/about/news/could-robot-harvesters-be-the-way-forward-for-new-zealands-apple-industry/

WATCH

2.

World-first apple-picking robot boots up in Hawke's Bay.
https://www.youtube.com/watch?v=OhswzqyVuLw

RESPOND

3.

Answer the questions on the following page about the focus innovation.

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Apple Innovation Case Studies – Case Study 1 (cont'd)

Answer the following questions after researching Case Study 1.

1. Identify the name of the technology/innovation.

2. Describe how the technology/innovation improves an area of apple production.

3. Justify why apple producers would incorporate technology/innovation in their production systems.

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Apple Innovation Case Studies (cont'd)

Case Study 2:
Apple varieties, Joli and Rockit

JOLI

1.

- **T&G launches new global premium apple variety**
  https://tandg.global/tg-launches-new-global-premium-apple-variety/
- **New apple variety to be planted in Canterbury**
  https://www.odt.co.nz/rural-life/horticulture/joli-good-new-apple-variety-be-planted-canterbury

ROCKIT

2.

- **Rockit apples poised to catch a rebound season**
  https://www.farmersweekly.co.nz/markets/rockit-apples-poised-to-catch-a-rebound-season/

WATCH

3.

Rockit Apples
https://www.youtube.com/watch?v=yPl3uAuAWmQ
https://vimeo.com/337946602?fl=pl&fe=vl

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Apple Innovation Case Studies – Case Study 2 (cont'd)

Answer the following questions after researching Case Study 2.

1. Identify the name of the technology/innovation.

2. Describe how the technology/innovation improves an area of apple production.

3. Justify why apple producers would incorporate technology/innovation in their production systems.

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Problem Solving Scenario Cards

Read the problem solving scenario card and collaborate with your group to record your answers to the challenge questions. Your responses may involve using current management practices and technologies or creating innovative new solutions for addressing these problems.

1 Scenario One: **Climate Crunch**

Problem: Over the past few years, you have noticed significant climate changes in the region where your apple farm is located. More extreme weather events, such as droughts and heat waves, affect your apple production. The fruit is not maturing properly, and you are struggling to meet consumer demands.

Challenge:

How could you modify your orchard to cope with the changing climate?

- What technology or innovations could you implement to protect your apple trees from extreme weather conditions?
- How could you educate consumers about the challenges faced by apple growers due to climate change?

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Problem Solving Scenario Cards (cont'd)

2. Scenario Two: **The Harvest Helper Crisis**

Problem: You manage an apple orchard, and every year you rely on a team of seasonal workers to help with the apple harvest. This year, many of your regular workers cannot make it due to travel restrictions and other issues, and you are struggling to find enough workers to pick the apples in time.

Challenge:

- What management practices could you implement on your orchard to address the challenge of labour shortages during harvest?
- What technologies or machinery could you implement to streamline the harvest process and reduce the need for manual labour?
- How could engaging with the local community help to address this concern?

3. Scenario Three: **The Pest Threat**

Problem: A new invasive pest species that damages apples on trees and reduces crop yields has recently been identified at a nearby apple orchard. You need to develop a strategy to protect your orchard and the local apple industry from this threat.

Challenge:

- How could you manage your production system so that the apples were more resistant to this threat?
- What biosecurity measures can you implement to safeguard your apple trees without harming the environment?
- What technology or innovations could you implement to protect your apple trees from the invasive pest species?

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Problem Solving Scenario Cards (cont'd)

4. Scenario Four: **Taste Trend Transformation**

Problem: You have noticed a shift in consumer preferences. People are now looking for unique and exotic apple varieties, and demand for traditional varieties is declining. You have an orchard full of traditional apple trees and worry about staying competitive in the changing market.

Challenge:

- How could you modify your orchard to meet changing consumer demands for unique apple varieties?
- What marketing strategies could you use to promote your traditional apple varieties?
- How could you diversify your production (e.g. value-added products such as apple-based snacks or beverages) to diversify your income?

5. Scenario Five: **The Sustainable Orchard Challenge**

Problem: You manage an apple orchard and would like to improve the environmental sustainability of your production system to ensure the long-term health of your orchard and meet consumer demand for environmentally responsible products.

Challenge:

- How could you transition your orchard to more sustainable farming practices while maintaining or increasing apple production?
- What steps could you take to reduce the use of chemical pesticides and fertilisers and promote biodiversity?
- How could you communicate your commitment to sustainability to consumers?

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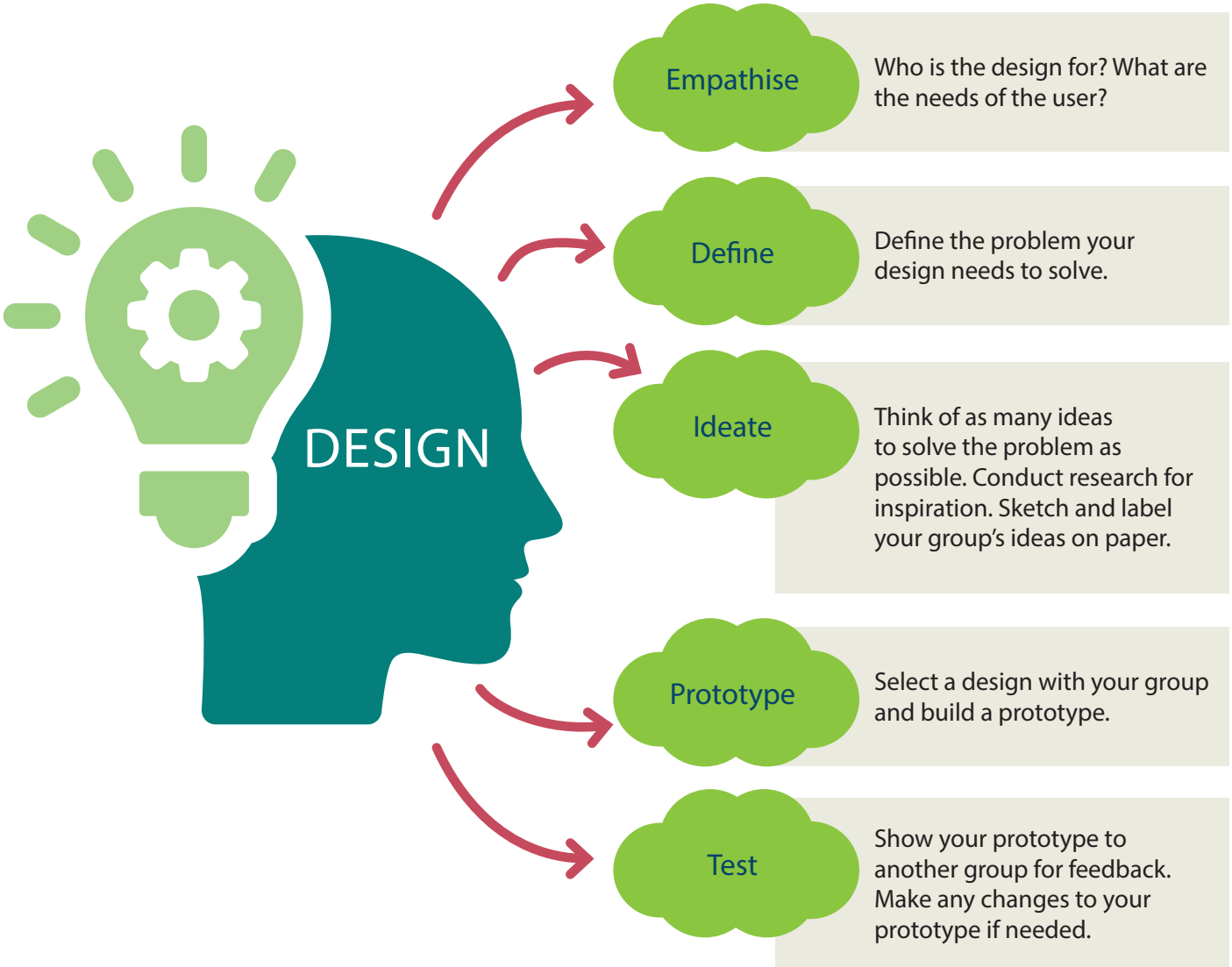
Advancements in the Apple Industry

Image source: Montague Orchards

Follow the Design Thinking process below and use the provided materials to empathise, define, ideate, and create a prototype to solve a concern in New Zealand's apple industry. Your innovation may be an original concept or improve an existing product or management practice.

Collaborate with your group to record your responses to the Design Thinking prompts on a piece of butchers paper.



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Advancements in the Apple Industry (cont'd)

Feedback plays an important role in the Design Thinking process as it helps identify the design's effective aspects and those needing modification to meet the design criteria.

Use the feedback form below to provide feedback on another group's design.

Group name: _____

1. Identify the problem in New Zealand's apple industry that this design is solving.

_____

_____

2. Describe how the design meets the design criteria.

_____

_____

_____

_____

3. Identify one aspect of the design that could be improved. Provide your reasons why.

_____

_____

_____

_____

_____

_____

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