Apples Along the Supply Chain

TEACHER GUIDE

New Zealand Edition

LESSON 2

YEAR 12-13

This resource has been developed by:

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Agribusiness in Schools
DELIVERING AGRIBUSINESS TO NZ SECONDARY SCHOOLS

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LESSON 2

Apples Along the Supply Chain

LEARNING AREA

Agribusiness Standards (Year 12–13)

NEW ZEALAND 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 features of New Zealand apples and value-added products and their function in addressing food security challenges. Students will explore the stages of the value supply chain for New Zealand apples and the occupations relating to apple production.

LESSON OVERVIEW

Activity 2.1 – New Zealand Apple Supply Chain
Activity 2.2 – What If...?
Activity 2.3 – Value-Added Apples
Activity 2.4 – Rootstocks for Resilience

Resources and Equipment

ACTIVITY 2.1 – New Zealand Apple Supply Chain

1. Resources
   - Taylor Corporation - Apples growing and exporter (6:49)
   - ENZA website
   - Journey of a Jazz™Apple
   - Loading Apples in Nelson
2. **PIEFA Food and Fibre Card Game | Australian Apple Supply Chain Game Cards**
3. **Instructions PIEFA Food and Fibre Card Game | Australian Apple Supply Chain**
4. **Worksheet 2.1a – Supply Chain Additional Game Cards**
5. Access to computer/digital devices

Activity 2.2 – What If...?

1. **Worksheet 2.2a – What If...?**
2. New Zealand - cold storage - The Coolstore (2:57)
3. Access to computer/digital devices

Activity 2.3 – Value-Added Apples

1. **Worksheet 2.3a – All-Purpose Apples**
2. **Worksheet 2.3b – Value-Added Apples Case Studies**
3. Case Study 1: Growth in diversification - value added products
   - Read - Apple press - 20 minutes with Sally Gallagher
   - Watch - Introducing "The Apple Press" (1:33)
4. Case Study 2: Converting waste into ingredients
   - T&G GLOBAL HITS THE SPOT WITH FERMENTED APPLE FLOUR

5. Access to computer/digital devices

Activity 2.4 – Rootstocks for Resilience

1. **Worksheet 2.4a – Rootstocks for Resilience**
2. Get Grafting (6:11)
3. Optional: Lesson 2 – Growing and Grafting
4. Optional: Grafting practical task materials or grafting modelling task materials
5. **Worksheet 2.4b – Grafting and Budding Sentence Sort**

Lesson Guide

ACTIVITY 2.1 – New Zealand Apple Supply Chain

Students will play a card game ordering the marketing and supply chain of apples.
They will research sustainable practices and technologies relevant to the marketing and supply chain of apples and design cards using either digital technology and design software, or paper and markers to complement the supply chain.

1. Facilitate a class discussion to review what students have learned about the New Zealand apple industry. Encourage students to share the innovations and occupations involved in apple production learned in **Lesson One: Apples – Unlocking Orchard Opportunities**.
2. View:
   - Taylor Corporation - Apples growing and exporter (6:49)
   - ENZA website
   - Journey of a Jazz™ Apple
   - Loading Apples in Nelson

   to observe the different processes and technologies involved in the supply chain of New Zealand apples
3. Print and distribute **PIEFA Food and Fibre Card Game | New Zealand Apple Supply Chain Game Cards**, cut into individual cards and preferably laminated.
4. Students follow the instructions from the **Instructions PIEFA Food and Fibre Card Game | New Zealand Apples Supply Chain**:
   - Place all the step and arrow cards face up and sort them into two piles:
     – Step cards, and arrow cards
   - Remove and reserve the careers and technology.
   - Collaborate and organise the cards into a supply chain by placing the step cards in their sequential order and arranging the arrow cards between each step to create a supply chain flowchart.

   Answers
5. Students place the provided technology card (Robotic Harvester) adjacent to the relevant step in the completed supply chain flowchart.
6. Distribute **Worksheet 2.1a – Supply Chain Additional Game Cards**.
7. Students design two new cards (**Instructions PIEFA Food and Fibre Card Game | New Zealand Apple Supply Chain** Extension 1 and 2) to add to the deck (two technology cards).

   Students may use digital technology and design software (e.g. Canva) or design cards on paper (similar to the cards used in the supply chain flowchart) using pencils, markers, etc.

ACTIVITY 2.2 – What If...?

Students will participate in a thought experiment to consider the role of apple production in global food security. They will conduct research to learn about methods of storage used by the New Zealand apple industry to ensure year-round product availability and meet consumer needs.

1. Record the question: "What if… we needed to sustain the world's population solely on apples?" in a central area.

2. Allocate students into pairs and encourage them to discuss and record various perspectives by categorising them as Plus, Minus, and Interesting.

   Suggested questions for students to consider:

   - How could we increase production to produce enough apples to feed the world?
   - Could apples be grown all year round to ensure a constant supply?
   - Where in the world could apples be grown? Would this impact the availability of the food source globally?
   - What methods could be used to preserve apples?
   - How would a diet of only apples meet people's nutritional needs?

4. As a class, allow students to share the ideas they have discussed with their partner. Record the advantages and disadvantages this scenario could pose in a central area. (Note: there are no right or wrong answers for this activity).

5. Distribute a copy of **Worksheet 2.2a – What If...?** and provide students with access to computers/digital devices.

6. Students read and view the information about the availability, selection, and storage of apples and respond to the questions on the worksheet.

7. Reconvene as a class and facilitate a discussion about storage methods used by the apple industry to meet year-round consumer demand for apples. Ask students to consider the information they have learned in the context of the question: "What if we needed to sustain the world's population solely on apples?" Discuss the impacts of storage methods on food security and how these might play a role in the What if...? scenario.

ACTIVITY 2.3 – Value-Added Apples

Students will learn about value-added products produced from apples and how these products contribute to economic, environmental, and social sustainability in the industry.

1. Display **Worksheet 2.3a – All-Purpose Apples**.
2. Students observe the features of each product and consider the following questions:
   - Which of these products would be most appealing to consumers? Why?
   - Which products would have a longer shelf life than a fresh apple?
   - Why might producers want to use their apples to create products such as these?
3. Explain that value-added products in the apple industry refer to apples that have been processed or changed from their original, fresh form. The value-adding process creates uses for apples that do not meet market specifications in their fresh form. There are a diverse range of value-added products. Benefits such as extended shelf life, altered taste/texture, or consumer convenience can contribute to the appeal of these products for consumers.
4. View Introducing the Apple Press (1:33) to gain an understanding of the role of value-added products in reducing food waste and providing additional revenue to apple producers.
5. As a class, identify the benefits of this value-added product for producers and consumers.

   Suggested answers:

   Producers: reducing food and financial waste, providing an additional source of revenue, building resilience to changes in consumer demand, etc.

   Consumers: Offers a convenient and nutritious choice, providing more options for consuming the daily recommended servings of fruit, etc.
6. Distribute **Worksheet 2.3b – Value-Added Apples Case Studies** and provide students with access to computer/digital devices.
7. Students access the source materials and complete the case studies focused on value-added products in the apple industry.

   Answers

(Activity 2.3 continued following page...)

8. Reconvene as a class and facilitate a discussion about the role of value-added products in the apple industry. Encourage students to consider how value-added products contribute to addressing the challenge of food insecurity posed by a growing population.

   Suggested answers:

   Reduced seasonal vulnerability if climatic conditions impact the annual yield of apples, increased shelf life could make some value-added apple products a valuable emergency food supply, value-added products provide a diversification of food sources in case the supply of fresh apples is impacted, etc.

ACTIVITY 2.4 – Rootstocks for Resilience

Students will learn about the significance of rootstock selection in New Zealand apple production and understand how the choice of rootstock contributes to sustainability and food security in the apple industry.

1. Distribute a copy of **Worksheet 2.4a – Rootstocks for Resilience** and read the information as a class.
2. Facilitate a class discussion about the role of rootstock selection in improving sustainability in the apple industry. Brainstorm how rootstock selection contributes to the sector's environmental, economic, and social sustainability. Record students' ideas in a central area.
3. Students complete the questions on **Worksheet 2.4a – Rootstocks for Resilience**.

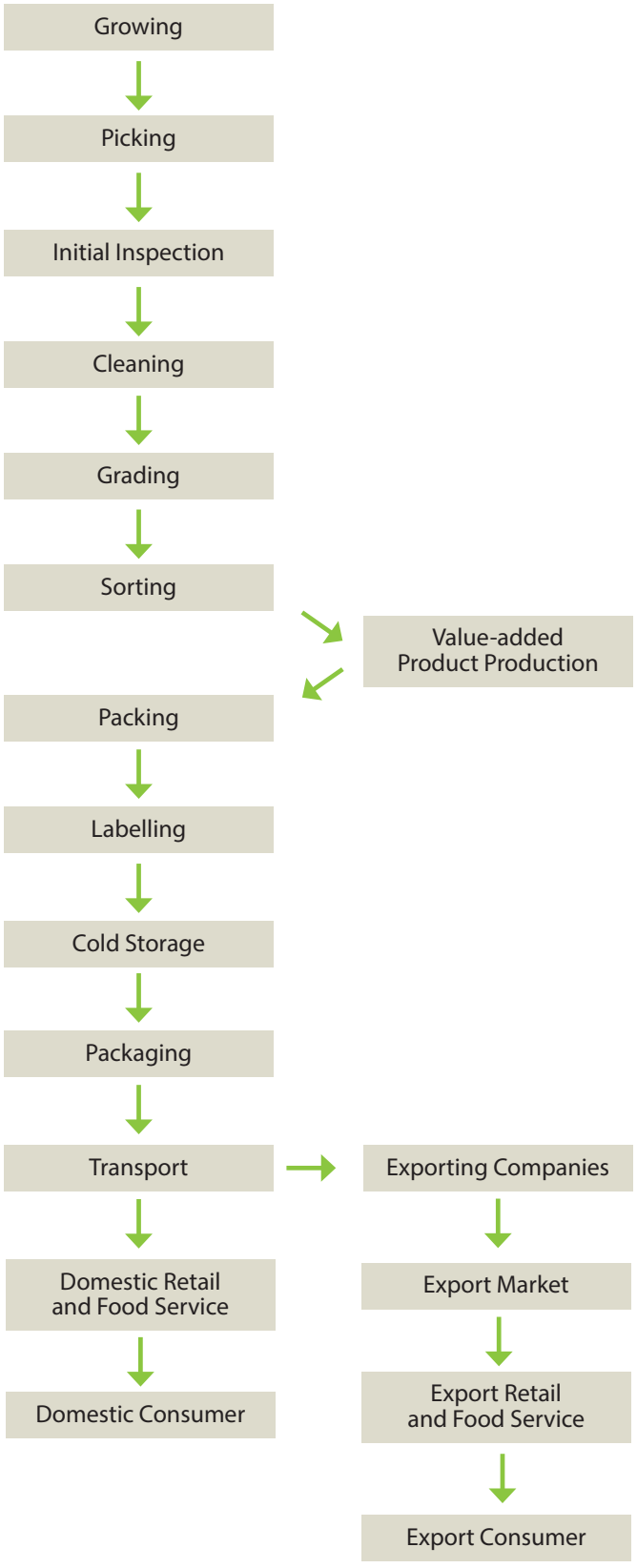
   Answers
4. Reconvene as a class and view the Get Grafting (6:11) video to observe different methods of grafting and budding.
5. Optional: Access Activity 2.4 – Grafting Practical or Modelling Task from Lesson Two – Growing and Grafting learning resource and follow the steps to complete the grafting modelling task or grafting practical activity with students (see the Resources and Equipment section of Lesson Two – Growing and Grafting for required materials).
6. Distribute a copy of **Worksheet 2.4b – Grafting and Budding Sentence Sort** and allow students to cut out and sequence the sentences correctly to show the method for grafting and budding.

   Answers

Answers

ACTIVITY 2.1 – New Zealand Apple Supply Chain

The New Zealand Apple Supply Chain card game stages:



ACTIVITY 2.2 – What If...?

WORKSHEET 2.2a – What If...?

1. February - May
2. To ensure year-round availability
3. Cold storage – A sophisticated refrigeration system that controls the temperature and humidity of the cool store.

   Controlled atmosphere storage – Controls the temperature and humidity of the cool store while reducing oxygen levels and increasing carbon dioxide levels to reduce the rate of apple ripening.

ACTIVITY 2.3 – Value-Added Apples

WORKSHEET 2.3a – Value-Added Apples Case Studies

Case Study One: Growth in diversification – value-added products

1. The Apple Press apple juice. Made from imperfect or blemished apples that don't meet export standards. Apples are selected based on specific varieties (Jazz, Braeburn, Royal Gala). The apples are processed using 'super clean' filling technology, which ensures hygiene and gives the juice an extended chilled shelf life.
2. Student answers will vary. Possible answers include: a premium juice that tastes like the actual fruit variety it is made from; it appeals to sustainability-conscious consumers because it uses fruit that would otherwise go to waste.
3. Student answers will vary. Possible answers include: creating juice from blemished apples adds value to what would otherwise be waste, improving profitability, allows producers to capture more of the supply chain, from raw fruit to finished product, meet growing consumer demand for sustainable, traceable, and high-quality food products.
4. Student answers will vary. Possible answers include: Economic: Converts waste apples into a profitable product, increasing returns for growers. Environmental: Reduces food waste by using imperfect apples that would typically be discarded. Social: Provides local jobs.

(Answers for Activity 2.3 continued following page...)

Case Study Two: Converting apple waste into ingredients

1. Apple pomace is an edible, highly nutritious byproduct produced when making apple juice. Apple pomace has been stabilised to create a versatile ingredient that can be used in various applications.
2. Student answers will vary. Possible answers include: The stabilised apple pomace ingredient is highly nutritious and versatile, adding nutritional value to diverse dishes.
3. Student answers will vary. To provide them with an additional source of revenue. To reduce waste of apples that do not meet market specifications, etc.
4. Student answers will vary. Possible answers include: Environmental – Reducing food waste in the industry. Social – Providing greater food and nutrition security for consumers. Economic – Providing an additional source of revenue for producers.

ACTIVITY 2.4 – Rootstocks for Resilience

WORKSHEET 2.4a – Rootstocks for Resilience

1. Selecting disease-resistant rootstock can reduce the need for chemical application to treat pests and diseases in an orchard, improving the environmental sustainability of the production system.
2. Selecting appropriate rootstocks can improve orchard productivity, increasing annual revenue. Pest and disease-resistant rootstocks can reduce the need for chemical application to treat pests and diseases in an orchard, lowering the cost of farm inputs. The use of dwarf rootstocks can make orchard maintenance easier, reducing labour costs.
3. Selection of rootstocks that are compatible with climate and soil conditions can build orchard resilience to extreme weather events. Selection of pest and disease-resistant rootstock can build resilience to threats from pests and diseases that may have a resistance to chemical treatments, allowing the continued production of fruit.
4. Selection of rootstocks that are compatible with climate and soil conditions can build orchard resilience to climate change, reducing supply chain impacts from extreme weather events and providing greater food security for consumers. Pest and disease-resistant rootstocks provide greater resilience against biosecurity threats that could impact apple production and the availability of apples to consumers.

WORKSHEET 2.4b – Grafting and Budding Sentence Sort

1. Slice the top of the rootstock into a V-shape by making two 2.5–3cm sloping cuts.
2. Slice the scion to make two corresponding cuts of the same length, creating a pointed end.
3. Fit the sliced end of the scion into the V-shaped wedge of the rootstock. Use grafting tape to secure the two pieces together.
4. Prune back the scion, leaving only 2–3 buds on the plant.
5. When your scion begins to shoot, remove the grafting tape.

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Supply Chain Additional Game Cards

Research technologies relevant to the marketing and supply chain of apples. Design two additional cards using either digital technology and design software, or paper and markers to complement the supply chain.

Name of technology/innovation:

Description:

Picture or drawing:

Considerations:

Name of technology/innovation:

Description:

Picture or drawing:

Considerations:

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What If...?

Read the information and view the videos to learn about the storage of apples

- **The Coolstore**
  https://vimeo.com/337477713?fl=pl&fe=vl

Image source: Taylor New Zealand

Record your findings below:

1. Identify months of the year when New Zealand apples are harvested.

2. Explain why apples are stored throughout the year.

3. Describe how apples are stored and how this technology affects their quality.

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All-Purpose Apples

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Value-Added Apples Case Studies

Value-added products in the apple industry refer to items made from fresh apples that have been processed or transformed to create a new marketable product. This process enhances the features of the apples, extends their shelf life, or creates new uses for them. Value-added products come in different forms and aim to provide additional sources of revenue for producers while offering greater choice to consumers.

READ

1.

- **Growth in diversification - value - added products**
  https://theapplepress.co.nz/20-minutes-with-sally-gallagher/

WATCH

2.

- **The Apple Press (1:33)**
  https://www.youtube.com/watch?v=fiykAcfdilo
- **Converting food waste into ingredients**
  Adding Value; T&G GLOBAL HITS THE SPOT WITH FERMENTED APPLE FLOUR
  https://tandg.global/tg-global-hits-the-spot-with-fermented-apple-flour/

RESPOND

3. **Divide the class into groups and give half the groups case study one and the other case study two. Discuss findings with the whole class.**

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Value-Added Apples Case Studies (cont'd)

Case Study 1: **Growth in diversification – value-added products**

Answer the following questions after researching Case Study 1.

1. Identify the name of the value-added product and describe how it is made.

2. Justify why consumers would purchase this product.

3. Justify why apple producers would diversify their production system to produce this value-added product.

4. Describe how this product improves economic, environmental, or social sustainability in the apple industry.

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Value-Added Apples Case Studies (cont'd)

Case Study 2: Converting Food Waste

Answer the following questions after researching Case Study 2.

1. Identify the name of the value-added product and describe how it is made.

2. Justify why consumers would purchase this product.

3. Justify why apple producers would diversify their production system to produce this value-added product.

4. Describe how this product improves economic, environmental, or social sustainability in the apple industry.

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Rootstocks for Resilience

Read the information below to learn about the role of rootstock selection in orchard management and apple production. Use the information to answer the questions on the following page.

In apple production, grafting occurs when the stem (scion) of one apple tree variety is joined with the lower portion of a different variety of apple tree that has roots or has the capacity to develop roots (rootstock). Grafting allows the positive characteristics of two apple tree varieties to work together to create a specialised tree.

Apple growers in New Zealand consider various factors, such as climate, soil type, pest and disease risks, and desired tree size, when selecting rootstocks to plant. This selection process enables them to tailor their production systems to different conditions and consistently yield top-quality apples across various regions of the country.

Pest and disease resistance:

Pest and disease resistance plays an important role in rootstock selection in apple production. To address changing consumer attitudes about the use of chemicals in production and to lower the cost of their orchard inputs, apple growers can reduce the need for chemical treatments to manage pests and diseases and improve the overall health of the orchard by selecting rootstocks that have pest and disease-resistant traits.

Improved productivity:

Different rootstocks can affect fruit size, flavour, and colour. By grafting, growers can combine the desirable traits of two varieties to create consistent, high-quality apples. Using dwarf rootstock can also improve productivity by allowing more trees to be planted in smaller blocks, increasing the overall yield of apples.

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Rootstocks for Resilience (cont'd)

Adaptation to soil and environmental conditions:

Selecting rootstocks that are compatible with the climate and soil type of the growing region is an important factor in apple production. By choosing rootstocks that are resistant to harsh weather conditions such as heatwaves or frosts, growers can enhance the resilience of their orchards to better manage the challenges of a changing climate.

Orchard management:

Using dwarf rootstocks that reduce the overall height and width of the trees can make orchard maintenance tasks such as pruning, spraying, and harvesting easier and reduce labour costs.

Answer the following questions.

1. Explain how selecting appropriate rootstocks can improve the environmental sustainability of the New Zealand apple industry.

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Rootstocks for Resilience (cont'd)

2. Explain how selecting appropriate rootstocks can improve the economic sustainability of the New Zealand apple industry.

3. Explain how selecting appropriate rootstocks can improve the resilience of apple production systems.

4. Explain how selecting appropriate rootstocks can contribute to greater food security in New Zealand.

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Grafting and Budding Sentence Sort

After completing the grafting practical task, cut the sentences and glue them into a workbook in the correct sequence to show the grafting procedure. Draw a diagram to accompany each of the stages of the process.

Fit the sliced end of the scion into the V-shaped wedge of the rootstock. Use grafting tape to secure the two pieces together.

When your scion begins to shoot, remove the grafting tape.

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Grafting and Budding Sentence Sort (cont'd)

Slice the scion to make two corresponding cuts of the same length, creating a pointed end.

Slice the top of the rootstock into a V-shape by making two 2.5–3 cm sloping cuts.

Prune back the scion leaving only 2–3 buds on the plant.

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