Teacher Guide
Year 10 - 12

Sustainable Food and Fibre Production

Supporting students to learn about New Zealand agriculture's role in sustainability

Sustainable Food and Fibre Data

This resource has been developed by:

Primary Industries Education Foundation Australia | primezone Food and fibre classroom educational resources.

Nutrien Ag Solutions™

Adapted for New Zealand use by:

Agribusiness in Schools
DELIVERING AGRIBUSINESS TO NZ SECONDARY SCHOOLS

Contents

Learning Areas & New Zealand Curriculum Content

Mathematics and Statistics.

Statistical Literacy

Students will:

- Evaluate statistical investigations or probability activities undertaken by others, including data collection methods, choice of measures, and validity of findings.
- Evaluate statistical reports in the media by relating the displays, statistics, processes, and probabilities used to the claims made.

Science

Nature of Science

Students will:

- Use a wider range of science vocabulary, symbols, and conventions .
- Apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy).

Participating and contributing

Students will:

- Develop an understanding of socio-scientific issues by gathering relevant information in order to draw evidence based conclusions and to take action where appropriate.

Social Studies

Students will gain knowledge, skills and experience to:

- Understand how people's management of resources impacts environmental and social sustainability.

Lesson Overview

- **Activity 4.1** - Guess the Set! (15 mins)
- **Activity 4.2** - Understanding Agricultural Data (65 mins)
- **Activity 4.3** - Using Data to Solve Problems and Find Solutions (15 mins)

Resources and Equipment

Activity 4.1 - Guess the Set!

1. **Worksheet 4.1a - Guess the Set!**
2. Timer

Activity 4.2 - Understanding Agricultural Data

1. New Zealand Horticulture Story (2:09)
2. Dairy Holdings CropX (2:02)
3. Farm Mangament Systems With Waikawa Farms (4:17)
4. Precision Agriculture and IoT (2:12)
5. Digital Agriculture and Big Data Analytics (0:56)
6. Digital Agriculture | Digital Farming | Smart Farming | Digital Farming Technology (5:42)
7. Worksheet 4.2a - Understanding Agricultural Data
8. Worksheet 4.2b - The Future of Using Data in Agriculture
9. Highlighters

Activity 4.3 - Using Data to Solve Problems and Find Solutions

1. **Worksheet 4.3a - Using Data to Solve Problems and Find Solutions: Emissions Data**

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Lesson Guide

Activity 4.1 - Guess the Set!

Students observe mystery data with missing information and collaborate to assign meaning to the food and fibre data sets. They will discuss why data is essential in the agricultural sector and understand the benefits it provides to stakeholders.

a) Divide students into small, collaborative groups. Distribute the five data sets on **Worksheet 4.1a - Guess the Set!** to each group.

b) Groups observe the data and are provided ten minutes on a timer to identify and think about the following information:

- The potential meaning of the data (what is being measured?)
- The production system the data relates to (crop yield, rainfall, animal weight, etc.)
- The importance and implications of the data. Consider various aspects of efficiency, sustainability, and environmental impact (why does the data need to be collected?)
- The technology used to measure the data (how would the information be collected/recorded? Past and present)

c) After the ten minutes, encourage groups to share their information as a class and identify what each data set could represent. Provide students with answers. Answers page 7-8

d) As a class, discuss the following questions to understand what students know about collecting data focused on food and fibre production.

i) How can producers use the data that is collected about their farms?

ii) How can producers benefit from collecting and analysing data about their farms/production systems? Provide some examples where data collection and analysis could be helpful in other areas of life.

iii) Why is collecting accurate data important in food and fibre production? Answers page 7-8

Activity 4.2 - Understanding Agricultural Data

Students learn about data collection in food and fibre, understanding the types of data that can be collected and how this relates to production. They will also learn from a case study about a farming app used for data collection and analysis and answer questions related to the activity. Finally, students will design a series of positive social media posts about data use in food and fibre.

a) Explain to students the importance of collecting data to manage and improve agricultural practices. Highlight that quantifiable data helps people make informed decisions about sustainable food and fibre production and can help address challenges such as climate change and food security.

b) As a class, view a range of secondary source videos (one to six) focused on the use and application of research, technologies, and data in agriculture, including:

Secondary Source 1: New Zealand Horticulture Story (2:09)
Secondary Source 2: Dairy Holdings CropX (2:02)
Secondary Source 3: Farm Mangament Systems With Waikawa Farms (4:17)
Secondary Source 4: Precision Agriculture and IoT (2:12)
Secondary Source 5: Digital Agriculture and Big Data Analytics (0:56)
Secondary Source 6: Digital Agriculture | Digital Farming | Smart Farming | Digital Farming Technology (5:42)

c) Encourage students to create a personal mind map/notes about the research and data that is being collected and the technology being used to collect the data featured in the videos.

d) Distribute, read, and highlight the information on **Worksheet 4.2a - Understanding Agricultural Data** as a class and answer the questions in the spaces provided. Answers page 9

e) Distribute **Worksheet 4.2b -The Future of Using Data in Agriculture** to students. Either as a class or individually, read the information and complete the multiple-choice questions focused on drones, artificial intelligence (AI), and blockchain traceability. Answers page 11

f) Provide students with time to design and complete two positive social media posts about data use in food and fibre and then share them with their peers.

Activity 4.3 - Using Data to Solve Problems and Find Solutions

Students will observe data to understand its relevance to producers. They will focus on emissions data and its analysis, understanding how this tool can be used to make sustainable decisions during the production of food and fibre.

a) Briefly introduce the concept of emissions analytics and its importance in reducing the environmental impact of food and fibre production. Explain how analysing emission data helps producers make more sustainable choices. Explain to students that:

- Producers use advanced tools, such as the Greenhouse Gas Accounting Framework (G-GAF) and Sustainable Bioenergy Greenhouse Gas Accounting Framework (SB-GAF), to measure the greenhouse gas emissions from their operations.
- These tools help identify how much pollution their farming or production activities contribute to the environment, enabling them to make smarter decisions to reduce their footprint.
- This not only helps in meeting government regulations but also aligns with the growing demand for eco-friendly products.
- This practical application of technology and data analysis addresses sustainability goals and demonstrates how agriculture is adapting to become more sustainable for the future.

b) Distribute Worksheet 4.3a - Using **Data to Solve Problems and Find Solutions: Emissions Data**, and as a class, complete the provided questions. Answers page 11

Answers

Activity 4.1 - Guess the Data Set

Worksheet 4.1a - Guess the Set!

1. **Marketing report for slaughter prices for cattle, sheep, and venison.**

   a) A sales report on slaughter prices for cattle, sheep, and venison, showing economic trends and the positive outlook for the agriculture sector showing a positive upwards trend on the 5-year average.

   b) This data relates to sheep, beef and venison production systems, indirectly reflecting the impact of factors rainfall, pasture growth and availability and market demand.

   c) This sales data is crucial for economic efficiency, guiding producers in market trends and what price they would receive for livestock in weight bands and what is happening in the market so they can make informed decision on buying and selling livestock.

   d) Modern technology, such as electronic identification tags and digital weighing and scanning, has replaced manual recording, enhancing the accuracy and efficiency of sales data collection and analysis.

2. **Expected weather conditions on a given day**

   a) Data showing expected weather conditions in New Zealand on a given day. Weather forecasts are critical for planning the time of management practices such as cultivation, planting, harvesting, irrigation, frost protection etc as well as preparing for extreme weather events.

   b) This data is important to crop and livestock production systems, as weather affects irrigation needs, pasture growth, and overall farm management strategies.

   c) Accurate weather forecasts is vital in New Zealand's agriculture and horticulture industries because it enables producers to make informed decisions that maximise productivity, reduce losses, and manage risks associated with unpredictable weather patterns. This includes timing of sheep farming operations and optimising resources such as water, mitigating frost or drought impacts.

   d) Advanced meteorological technologies, including satellite observations, radar systems, and weather models, provide accurate and timely precipitation forecasts. These tools have evolved from traditional rain gauges to sophisticated digital platforms offering real-time data and predictive analytics.

3. **62 years of rainfall trend data for 30 sites in New Zealand**

   a) A series of maps displaying 62 years rainfall trends for 30 sites in New Zealand, colour-coded with red triangles for likely or very likely increasing rainfall and blue triangles for likely or very likely decreasing rainfall, and grey dots for indeterminate rainfall trends.

   b) This historical rainfall data is critical for understanding the impact of climate variability and climate change on agriculture and horticulture. It informs future decision making that will help minimise risk to primary production systems by providing insights into drought and flood risk.

   c) Visualising long-term rainfall trends is essential for developing agricultural resilience and sustainability strategies. Recognising patterns associated with El Niño and La Niña helps in anticipating water availability, informing water management policies, and preparing for extreme weather events, thus mitigating their impacts on food and fibre production.

d) The evolution from manual rainfall recording to advanced climate technologies has enabled the comprehensive mapping of rainfall trends over more than 60 years. Modern Geographic Information Systems (GIS), remote sensing, and climate modelling are pivotal in analysing and presenting this data, creating a deeper understanding of climate dynamics and their effects on food and fibre production.

4. **Export revenue from primary industries and percentage contribution from each industry.**

a) A pie graph showing the export revenue from dairy, meat and wool, horticulture, forestry, seafood, arable and processed food and other products for a financial year visually represents each sector's economic contribution. By showing the percentage breakdown, it highlights the relative importance of each sector allowing stakeholders to gauge which sectors drive the most value.

b) This data is important to understanding the diverse components of the primary industry respectively, indicating their roles in food supply, environmental sustainability, and economic activity.

c) Analysing the value of export revenue is crucial for strategic planning, policy development, and investment decisions within the primary sector. This breakdown helps identify trends, strengths, and areas needing support or regulation. For instance, a high value in crops might prompt investments in technology for precision agriculture. At the same time, significant contributions from fisheries and forestry highlight the need for sustainable management practices to protect these resources.

d) The collection and analysis of economic data across these diverse sectors employ a range of technologies and methodologies. Satellite imagery and precision agriculture tools offer insights into production volumes and crop and livestock health. In fisheries and forestry, remote sensing and GIS technologies map and monitor resources, aiding in sustainable management. Data analytics platforms integrate these varied data sources, enabling comprehensive economic analysis across the sectors.

5. **Seasonal variation in price for a product e.g. Broccoli**

a) The line graph measures the changes in wholesale prices of a primary product like broccoli, reflecting the dynamics of supply and demand, weather conditions, production costs, and other external factors influencing the agricultural sector. It illustrates the economic significance of these price movements over time.

b) The data relates to the horticultural production systems, highlighting the impact of factors such as crop yield, environmental conditions, and management practices on prices of crops like broccoli. This system is integral to understanding the impact of a range of factors and practices behind pricing trends.

c) The collection of price data is critical for both producers and stakeholders in the agricultural and horticulture industry to make informed decisions about production, marketing, and risk management. It aids in economic analysis, supply chain optimisation, and the implementation of strategies to mitigate extremes in price fluctuations.

d) Historically, price data collection relied on manual methods, but modern technologies enable real-time tracking through digital platforms and electronic trading systems.

Activity 4.2 - Understanding Agricultural Data

Worksheet 4.2a - Understanding Agricultural Data

1. Farmers collected agricultural data through more traditional methods before the widespread availability and access to computers, mobile phones, and IoT (Internet of Things) technology. They would have relied more heavily on physical observation and manual record-keeping to track weather patterns, crop growth, soil conditions, and livestock health. Information such as weather changes was noted from personal experience or local reports, soil quality was assessed through hands-on testing, and crop and livestock health was monitored by visual inspections and personal expertise. Data analysis was performed manually, with decisions based on accumulated knowledge, historical records kept in notebooks, and an intuitive understanding of the land and climate.

2. An individual at home

Data Type	Why do you think this data is collected?
Internet usage	To monitor how much time you spend online and ensure you're visiting safe websites.
Health and fitness	If you use a smartwatch or fitness app, it tracks your physical activity, sleep patterns, and sometimes even what you eat to help maintain a healthy lifestyle.
Streaming preferences	Services like Netflix or Stan might track what shows or movies you like to watch so they can recommend others you might enjoy.

Teachers at school

Data Type	Why do you think this data is collected?
Attendance records	To make sure you're attending school regularly and to track any patterns in absences that might need attention.
Grades and assessments	To understand how well you're doing in your classes, what areas you excel in, and where you might need extra help or resources.
Library loans	To keep track of which books you've borrowed, help you discover new books you might like, and ensure books are returned on time.

Someone in your community

Data Type	Why do you think this data is collected?
Participation in community events	Local councils or community groups might track participation to plan better events in the future that more people will enjoy.
Public transport usage	Data on how and when you use buses, trains, or trams can help plan better routes and schedules to match when people need them the most.
Health information during outbreaks	During health crises like the COVID-19 pandemic, tracking who has been vaccinated or sick can help keep everyone safe by controlling the spread of illness.

3.

c) Suggested terms

Term	Definition
Comprehensive data management	A thorough approach to organising, storing, and analysing data collected from various sources.
Crop tracking	Monitoring the growth, health, and yield of crops over time.
Interactive scouting	Using technology to examine crops in the field, identifying issues like pest infestations or nutrient deficiencies.
Expert recommendations	Advice given by specialists based on data analysis to improve farming practices.
Application data	Information related to farm inputs like fertilisers, pesticides, and water.
Paddock-specific weather updates	Weather forecasts and conditions are provided for individual fields or paddocks.
Rainfall totals	The amount of rain that has fallen over a specific period, measured in millimetres or inches.
Yield and logged data	Information on the amount of crop harvested (yield) and recorded observations or measurements from farming activities.
Seeding, spreading, and spraying applications	Farming practices involve planting seeds, distributing fertilisers or soil amendments, and applying pesticides or herbicides.
Fully spatial	Data that includes geographic coordinates allows it to be mapped and analysed in relation to specific locations.
In-app	Within a mobile application, features or functions can be accessed directly through the app.
Yield, application, and crop imagery data	Visual representations (like maps or photographs) of crop yields, the areas where inputs have been applied, and the condition of the crops.
Pre-season input and rotation planning	The process of deciding which crops to plant and where, along with the necessary fertilisers and amendments, before the planting season begins.
NDVI biomass imagery	Images that use the Normalised Difference Vegetation Index to measure and visualise the amount and health of plant life in an area, indicating biomass.
Per hectare annual subscription	A subscription model in which users pay yearly for services or data access based on the amount of land (in hectares) they manage.

Worksheet 4.2b - The Future of Using Data in Agriculture

2. B) To support decision-making processes that increase productivity, sustainability, and profitability in agriculture.
3. C) By providing a secure and transparent record of all transactions, enhancing food safety and traceability.
4. B) They are used to monitor crop health, assess damage, and apply treatments, contributing to more precise and efficient farming practices.
5. Artificial intelligence (AI) and machine learning enhance the precision and efficiency of agricultural practices by analysing diverse data sources, including satellite imagery, weather forecasts, and soil nutrient levels. These technologies enable producers to predict future crop yields based on historical and current data, facilitating optimal harvesting times, storage needs, and market strategies. Farmers can streamline operations, reduce waste, and maximise profits by making informed decisions. AI supports sustainable resource use, ultimately contributing to smarter, more productive farming.

Activity 4.3 - Using Data to Solve Problems and Find Solutions

Worksheet 4.3a - Using Data to Solve Problems and Find Solutions: Emissions Data

1.

Factor	Production system 1 (%)	Production system 2 (%)
Fuel	10	12
Fertiliser and urea	15	12
Burning	7	8
Crop residues	27	29
Indirect N_2O	0	0
Electricity	1	2
Pre-farm	40	37
Carbon sequestration in trees (t CO_2-e/t crop)	0	-50.6
Net Farm Emissions (t CO_2-e/t crop)	134	58

2. **Costs and investment:** The initial cost of adopting variable rate fertiliser technology and the expenses related to planting mixed species in 20 hectares.

Technical knowledge: Understanding how to implement variable rate fertilisation and manage mixed species plantings effectively.

Soil health and crop suitability: Assessing the suitability of the soil for mixed species plantings and the impact of reduced fertilisers on crop yield.

Market demand: Evaluating the demand for crops that might be affected by reduced planting areas and potential market interest in sustainably produced crops.

Long-term sustainability: The impact of these changes on long-term farm sustainability, including soil health, biodiversity, and ecosystem services.

Economic impact: Projected economic returns from reduced input costs against potential changes in yield and the value of carbon sequestration benefits.

Climate impact: The overall reduction in greenhouse gas emissions and contribution to climate change mitigation efforts.

Labour and time requirements: Additional labour and time might be required for the new planting and fertilisation techniques.

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Student Activities
Year 10 -12

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Guess the Data Set!

1. **Observe the data and answer the questions in the space provided:**

North Island

Cattle	Weight	Last Week	Year ago vs	5 yr ave
P2 Steer	300kg	7.35	5.85	+33%
M2 Bull	300kg	7.40	5.85	+35%
M Cow	190kg	5.65	4.00	+48%
Sheep	**Weight**	**Last Week**	**Year ago vs**	**5 yr ave**
P/Y Lamb	16-23kg	8.30	6.10	+19%
MX Mutton	20-30kg	4.35	2.70	-2%
Venison	**Weight**	**Last Week**	**Year ago vs**	**5 yr ave**
AP Stag	60kg	9.20	8.70	+20%

South Island

Cattle	Weight	Last Week	Year ago vs	5 yr ave
P2 Steer	300kg	7.15	5.35	+39%
M2 Bull	300kg	7.10	5.40	+39%
M Cow	190kg	5.45	3.75	+53%
Sheep	**Weight**	**Last Week**	**Year ago vs**	**5 yr ave**
P/Y Lamb	16-23kg	8.10	5.95	+19%
MX Mutton	20-30kg	4.10	2.50	-2%
Venison	**Weight**	**Last Week**	**Year ago vs**	**5 yr ave**
AP Stag	60kg	9.15	8.65	+19%

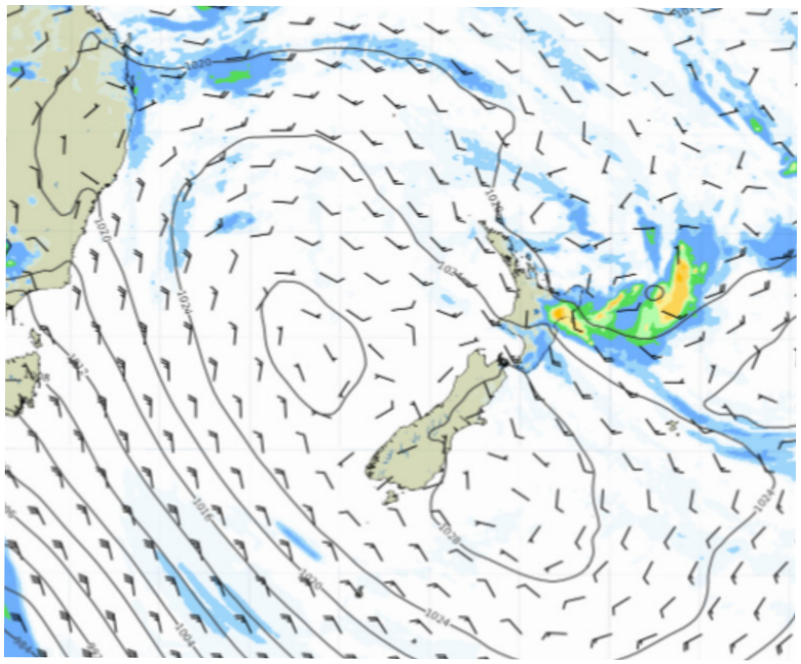
a) **What is the meaning of the data?** (what is being measured?)

b) **What production system do you think it relates to?** (crop yield, rainfall, animal weight, etc.)

c) **What is the importance and implication of the data?** (why does the data need to be collected?)

d) **What technology might be used to measure the data?**
(how would the information be collected/recorded in the past and present?)

2. **Observe the data and answer the questions in the space provided:**



MetService, 2024

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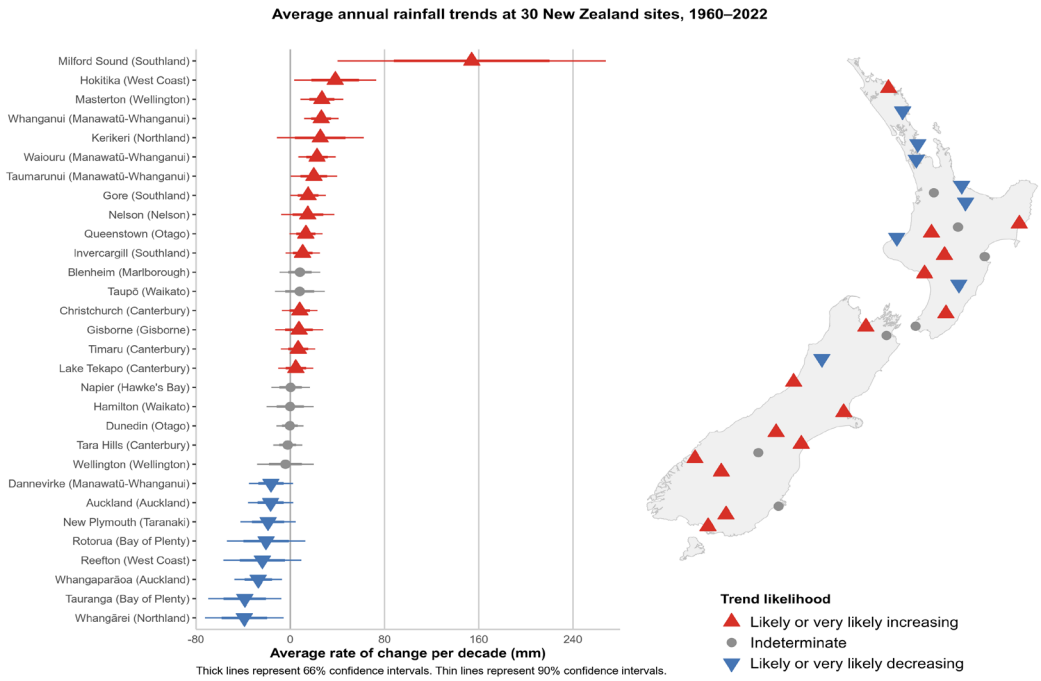

NIWA, 2025

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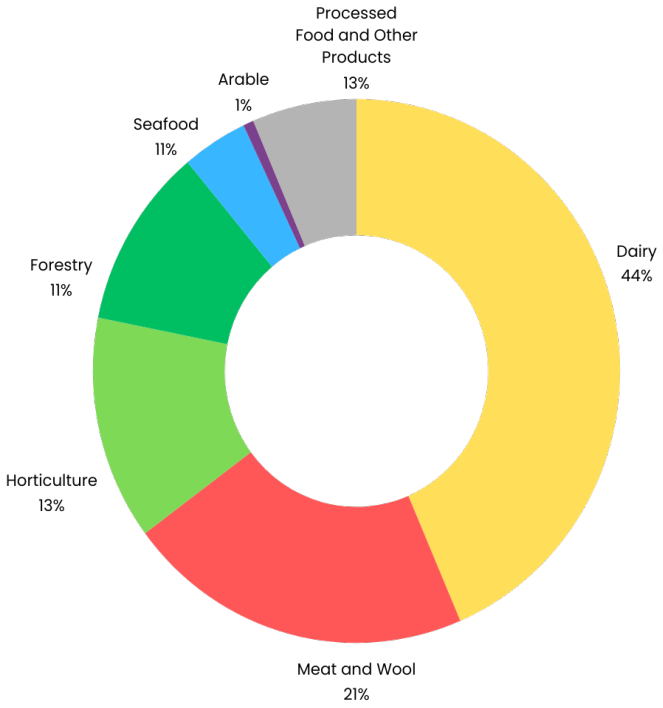

Stats NZ, 2025

a) **What is the meaning of the data?** (what is being measured?)

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c) **What is the importance and implication of the data?** (why does the data need to be collected?)

d) **What technology might be used to measure the data?**
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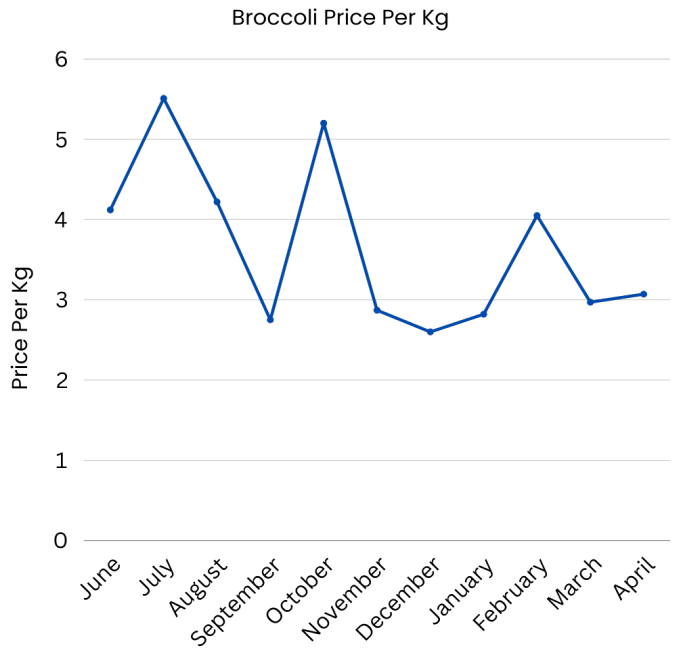

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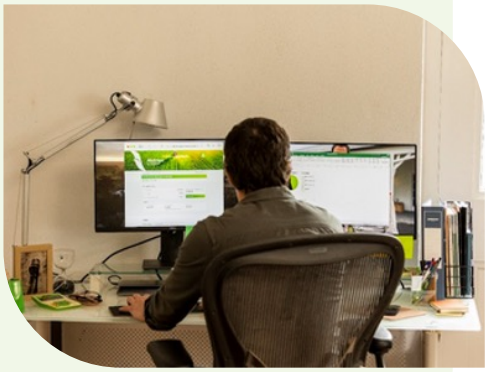
Understanding Agricultural Data



What is agricultural data?

Agricultural data collection is an important process that helps gather information about food and fibre production. It includes everything related to crops, livestock, soil, climate, and whole supply chain practices. This data helps people to make informed decisions to increase food and fibre productivity, sustainability, and profitability. For example, data analysing soil moisture levels helps producers decide when to plant or irrigate crops, ensuring water is used efficiently.

What agricultural data is collected?

Data collection is vital in agriculture and can include:

- **Weather and climate data:** Temperature, rainfall, and wind speed to assist in making informed planting and harvesting decisions.
- **Soil analytics data:** Composition (sand, silt, and clay), nutrient availability, and moisture content are used to determine the best crops to plant.
- **Cropping data:** Yield rates, growth patterns, and disease susceptibility are used to improve crop management over time.
- **Livestock data:** Tracking growth rates and keeping breeding records helps producers enhance livestock management.
- **Market and sales data:** Product prices and supply and demand trends are used to strategise selling and distribution.
- **Emissions data:** Greenhouse gas emissions from different farming practices are essential for understanding and reducing agriculture's environmental impact. For example, tracking livestock emissions can help implement practices that reduce methane production.
- **Financial data and risk management data:** Records of production costs, revenue, and market trends are vital for financial planning. Risk management data, including insurance information and strategies to mitigate adverse weather or market conditions, supports making informed decisions to protect investments

data collection (noun) Definition: the process of gathering and recording information
Example: The scientist conducted extensive data collection to support their research findings.

How is agricultural data collected?

Collecting accurate data is crucial for ensuring its quality. Measurement errors can occur during data collection, so it's important to design methods to minimise them.

Data collection in the primary sector employs various technologies. Examples include:

- **Sensors:** Deployed in fields to monitor soil moisture and nutrients.
- **Drones and satellites:** Provide aerial images to assess crop health and yield potential.
- **Farm management software:** Integrates various data types for comprehensive analysis and decision-making.
- **Apps:** Play a crucial role in collecting and analysing data, leading to optimised crop production, resource management, and enhanced decision-making capabilities.

1. **As a class, consider how this data would have been collected and analysed before computer, mobile phone, and IoT technology were available to producers.**

The collection of this type of agricultural data serves many purposes:

- **To optimise production:** Data helps to make smart choices. Think of it as using a smart map for a road trip; it shows you the best route and tells you where traffic jams are. By using advanced tools, we can ensure that resources are used efficiently and when necessary. Data also helps us spot parts of the process that are not working well, so we can improve them and ensure everything runs smoothly and quickly.
- **Sustainable practices:** Data supports the adoption of sustainable agricultural practices by allowing the monitoring of environmental impacts.
- **Enhance profitability:** Producers can make better financial decisions by understanding trends and production costs. They can assess the plants and animals generating the most income on their farms.

2. **Think about the types of data that are collected about yourself and why this data is collected about you. Record the information in the table below.**

Data Type	Who is collecting the data?	Why do you think this data is collected?
	An individual at home	
	Teachers at school	
	Someone in your community	

Case Study: Echelon®

Echelon is a farming management app that provides producers with a way of collecting, managing, and assessing data about their farms. (This is an Australian example, but also applicable to New Zealand)

3. a) **Read the information about the app.**
   b) **Use one colour to highlight any words you are unfamiliar with and research the meaning of the word.**
   c) **Annotate the key meanings in the margins.**
   d) **Circle any data that can be collected by the app.**

Echelon®

Using special technology like sensors and satellite images, Echelon helps producers get detailed information about their farms. This data, combined with details about soil quality, plant growth, farm inputs, and crop health, allows experts to give producers advice on how to make their farms more productive and efficient. Echelon uses cloud-based data (which means the data is stored online), and producers can access it through an easy-to-use app that works even when offline. This gives them all the tools they need to make the most of every paddock on their farm.

Echelon Manage

Echelon Manage helps producers track everything on their farms and manage their crops with:

- The Echelon® app for expert advice and tracking farm activities like planting and spraying crops.
- Updates on the climate and weather and how much rain has fallen on specific fields.
- Data from planting, fertilising, and spraying machines will help producers understand how their crops perform.
- Maps that show yields (how much crop was produced) and images of crops at different stages.
- Tools for planning what to plant and what farm inputs to use before the growing season starts.
- A yearly subscription to images that can be analysed to track crop growth.
- An annual subscription fee per hectare.

(adapted from Nutrien Ag Solutions, 2023)

(Nutrien Ag Solutions, 2023a)

Extension: Research the app and view the screenshots showing the types of data that can be collected and read about the app features.

The Future of Using Data in Agriculture

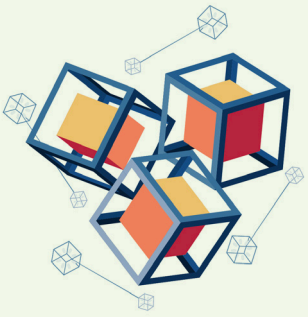
The future of food and fibre production lies in precision farming, where data-driven decisions will lead to even more efficient and sustainable practices.

1. **Read the following information to learn more about food and fibre data collection**

Data collection is vital in agriculture and can include:

- **Drones:** Drones have revolutionised farming by changing how data is collected. They are used to check crop health, evaluate damage from disasters, and apply pesticides and fertilisers. The detailed images drones capture help producers decide exactly when and where to water, plant, and care for their crops, making farming more efficient and environmentally sustainable. In the future, drones will be even more advanced.

- **Artificial intelligence** (AI) and machine learning will improve producers' understanding of farming data. AI collects many different types of information, like data from pictures from space, weather reports, and soil nutrient content, to make good predictions about food and fibre production. This is helpful for producers because it supports their planning and assists them in using their resources wisely. For instance, AI can use old data about how crops performed in the past and what's happening now to predict future crop yields. Producers can make smart choices about when to harvest their crops, how much storage they will need, and the best time to sell, making operations run smoother, cutting down on waste, and helping them earn income.



- **Blockchain traceability:** Blockchain technology will securely record every transaction, such as the journey of produce from the farm to the consumer, guaranteeing the authenticity and safety of food products. This traceability will enhance consumer trust by making the entire process visible and verifiable. In the event of a food safety concern, blockchain will enable quick identification of the contamination source, facilitating swift resolution and minimising health risks. Blockchain will ensure fairer transactions by providing transparent records of produce

Select the best answers.

2. **What is the primary purpose of collecting agricultural data?**

- [ ] A) To maintain the amount of information available to producers.
- [ ] B) To support decision-making processes that increase agriculture productivity, sustainability, and profitability.
- [ ] C) To comply with regulations only.
- [ ] D) To create complex reports.

3. **How does blockchain technology benefit the agricultural supply chain?**

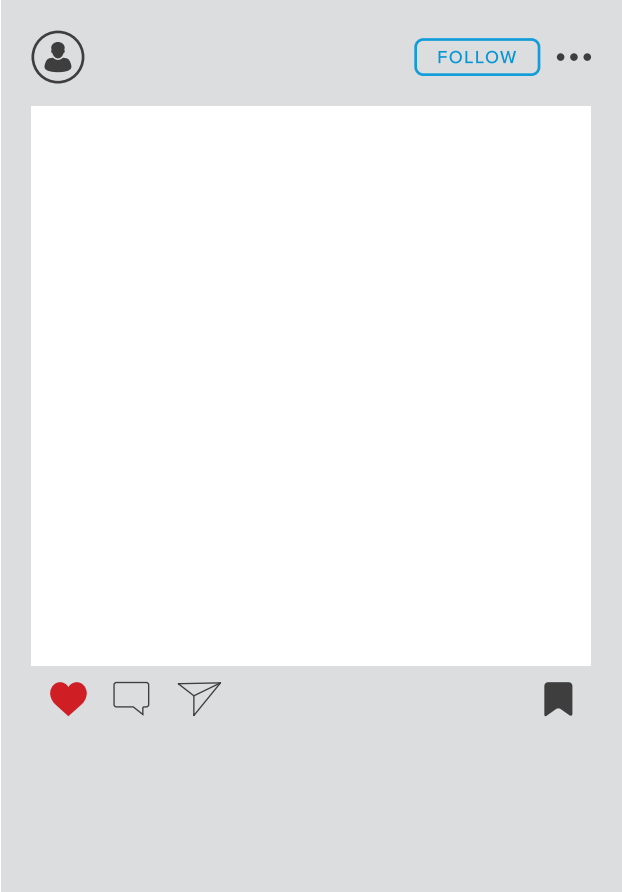
- [ ] A) By increasing information for producers.
- [ ] B) By reducing the transparency of transactions between producers and consumers.
- [ ] C) By providing a secure and transparent record of all transactions to enhance food safety and traceability.
- [ ] D) By making it easier to trace the origin of food prices.

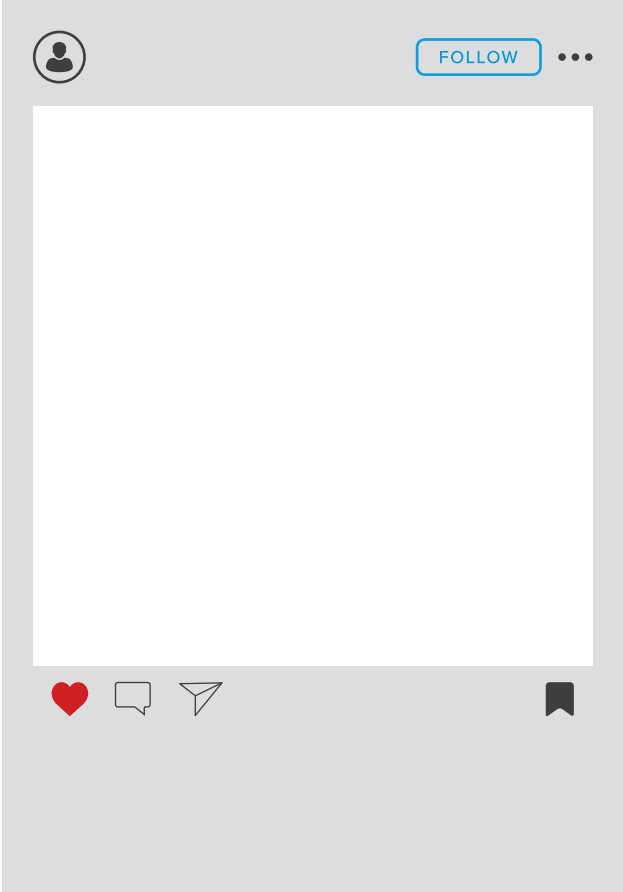
4. **What role do drones play in modern agriculture?**

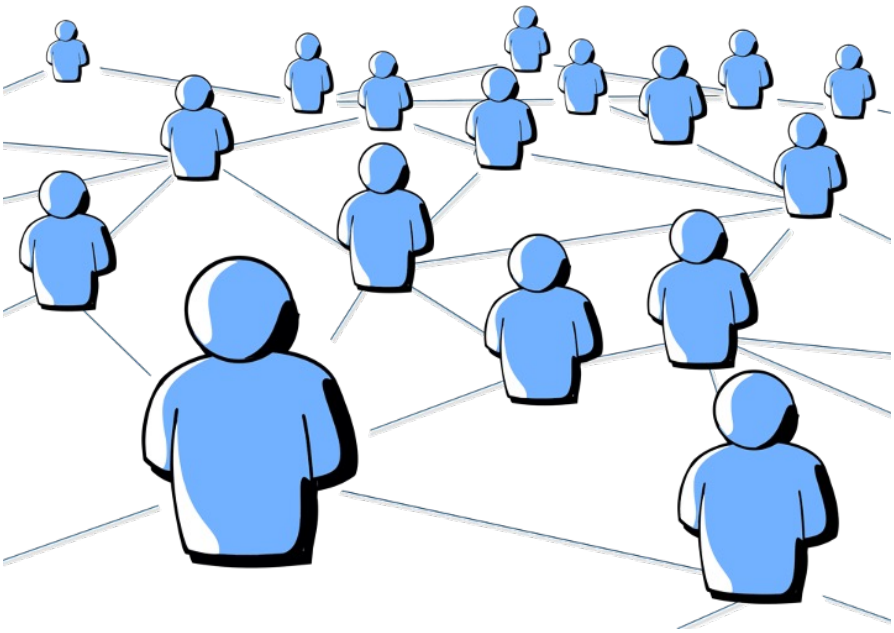
- [ ] A) Drones capture images of producers and keep them safe.
- [ ] B) They are used to monitor crop health, assess damage, and apply treatments, contributing to more precise and efficient farming practices.
- [ ] C) Drones replace the need for human labour on the farm.
- [ ] D) They are used to analyse financial data to manage risk on the farm.

5. **Describe how artificial intelligence (AI) can benefit producers in agriculture.**

6. **Create two positive social media posts about the importance of data use in food and fibre.**







Using Data to Solve Problems and Find Solutions: Emissions Data

Producers use advanced tools, such as the Greenhouse Gas Accounting Framework (G-GAF) and Sustainable Bioenergy Greenhouse Gas Accounting Framework (SB-GAF), to measure the greenhouse gas emissions from their operations.

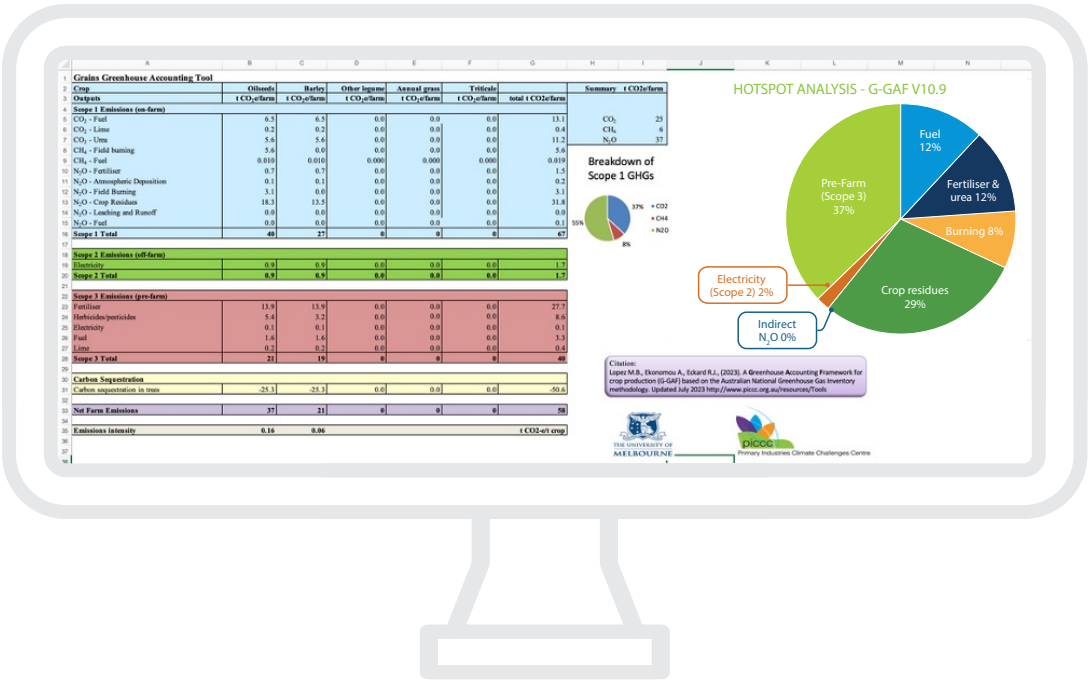
These tools help identify how much pollution their farming or production activities contribute to the environment, enabling them to make smarter decisions to reduce their footprint.

Production data is entered into the tool and analysed in order to target areas where sustainable improvements can be made. These improvements may be economic (lowered input costs or improved yields) or environmental (reduced chemical usage or lowered GHG emissions).

The **Greenhouse Accounting Tool** spreadsheet analyses a significant amount of data, including metrics related to the production systems. The types of data that can be analysed include:

- On-farm Emissions CO_2 - Fuel, lime, urea
- On-farm Emissions CH_4 - Field burning, fuel
- On-farm Emissions N_2O - Fertiliser, atmospheric deposition, filed burning, crop residues leaching and runoff, fuel
- Off-farm Emissions - Electricity
- Pre-farm Emissions - Fertiliser, herbicides/pesticides, electricity, fuel, lime
- Carbon sequestration

Production data is entered into the spreadsheet and analysed. An assessment of emissions is produced.



Scenario:

Five years ago, an arable farmer sought the services of a consultant to address production system emissions on their farm. The consultant recommended two interventions be made:

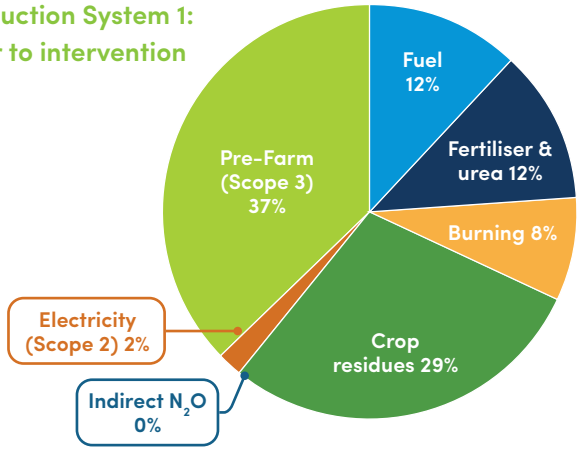
- Intervention 1: The arable farmer should introduce the use of variable rate fertiliser application technology, reducing urea application by 25% in all crop types.
- Intervention 2: The arable farmer plants 10% of the total cropping area with mixed species plantings.

To account for intervention 2, the following actions were needed:

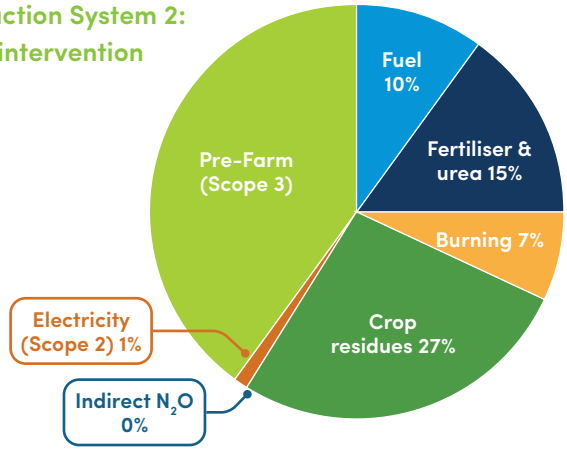
- Reduce the area planted to wheat and barley by 10%.
- Add 20 hectares of planting area for vegetation.

1. Consider the two graphs and complete the table below to highlight some of the key differences and changes to greenhouse gas emissions that occurred as a result of the changes to production.

Production System 1: Prior to intervention



Production System 2: After intervention



	Production System 1	Production System 2
Fuel		
Fertiliser and urea		
Burning		
Crop residues		
Indirect N_2O		
Electricity		
Pre-farm		
Carbon sequestration in trees (t CO_2-e/t crop)	0	-50.6
Net Farm Emissions (t CO_2-e/t crop)	134	58

In summary, the producer analysed their production system and changed the following aspects.

The first intervention was to introduce the use of variable rate fertiliser application technology, which meant a reduction of urea application by 25% in all crop types.

They also changed their production and planted 10% of the total cropping area with mixed species plantings. This intervention meant that there was a reduction in the amount of area planted to wheat and barley by 10% and a 20-hectare area of vegetation added, which resulted in carbon sequestration.

The changes resulted in Net Farm Emissions in the production system changing from 134 t CO_2e/farm to 58 t CO_2e/farm.

As a class, identify the factors a producer would need to consider before making these changes on their farm (reducing the area of cropping, variable application of fertiliser, and using 20 hectares to plant mixed species).

2. **List the ideas below.**