Wonder Project

Plant Challenge Lab Book

Rōpū name:	
Rōpū members:	

Contents

Lab 1.1: Carbon footprint champions

Everyone has their own carbon footprint. You can shrink your footprint and help slow down climate change with your food choices.

Do you have what it takes to be a carbon footprint champion?

- Take the quiz, then tally up your points to find out how footprint-friendly your lunch is.
  - Score 1 point for every "A"
  - Score 2 points for every "B"
  - Score 3 points for every "C"
- Add up your rōpū members' scores and write down the total in the circle at the end of the quiz.

What's your lunch made of?

1. What's your favourite part of today's lunch?

a. Last night's leftovers.

b. Fresh fruits and veggies.

c. Pre-packaged snacks like a muesli bar or bag of chips.

2. From zero to carnivore, how meaty is your lunch?

a. Zero! There's no meat in my lunch.

b. I have chicken or fish in my lunch, but no red meat (like beef, bacon or ham).

c. I love my red meat and have some in my lunch today!

What's your lunch stored in?

3. You brought your lunch to school in...

a. My trusty lunch box/bag. I'll use the same one all year.

b. A reusable box/bag. I replace it every few weeks.

c. A plastic bag. We're using up the ones we have at home.

4. What do you use to quench your thirst?

a. A reusable water bottle. I'll use the same one all year.

b. A plastic bottle that I might use a few times.

c. One time use bottle, juice box or pouch.

Where did your lunch come from?

5. Where was the food in your lunch bought?

a. At least two items were grown or made at home. The rest comes from the market/local store.

b. Mostly from the market, my local dairy or the tuck shop.

c. I've got no idea. Probably the supermarket.

6. How much of the food in your lunch comes from local sources?

This means where your food was made. Check any packaging or stickers to see where these items were made if you're not sure.

a. At least two things were made locally, or in Aotearoa.

b. Hmm, maybe some of it is made locally or in Aotearoa? I'm not sure. The packaging is probably in the rubbish at home!

c. Not much – we love trying food from across the world.

What will be left when you're finished?

7. What will you do with the leftovers from your lunch?

a. There won't be any leftovers – I only pack what I know I'm going to eat!

b. If I don't finish it, it will go in the fridge or I'll eat it tomorrow.

c. Meh, it will probably get thrown out at the end of the day.

8. How were most of your snacks packaged?

a. We made the snacks ourselves out of stuff we have at home. There isn't much extra packaging.

b. Some of my snacks (like chips and nuts) come in a big bag or box. We make individual portions for my lunchbox.

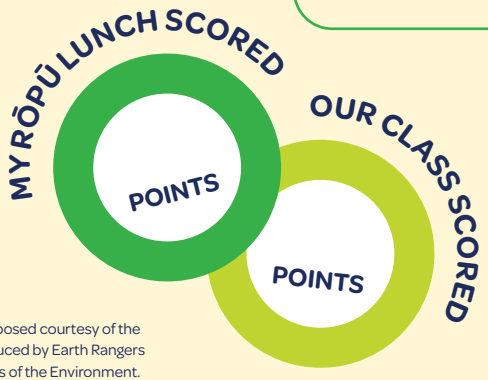
c. Everything is individually wrapped when we buy it at the supermarket.

9. How many pieces of rubbish will your lunch produce?

a. None – I try and bring litter-free lunches.

b. Just one.

c. Two or more.



Lab 1.2: Sensor time trial

It's time to test your environmental observation skills against the clock.

The challenge: Race against time and try and get a higher reading on your sensor than your opponent rōpū by measuring different environmental conditions.

Let's begin!

Step 1

Pair up with another rōpū – you will be challenge opponents.

Step 2

Your teacher will allocate you and your opponent rōpū a sensor. Circle the sensor you were given:

- Temperature
- Light
- Humidity
- Conductivity

Step 3

Brainstorm the best locations to find a high reading with your rōpū. Think about the environmental conditions you could consider looking for.

Tip: If you were given the **conductivity** sensor, you'll do things a bit differently. Your challenge will be to find a higher number of conductive objects than your opponents.

Step 4

Decide as a team who will go first, second, third and last. Line up outside in that order.

Step 5

When the timer starts, race to the locations your rōpū came up with and take a reading with your sensor. Write down your readings in the table. Be quick, you only have one minute!

Tip: It will take some time for your sensor to reach its final reading. Make sure the number is steady before you write it down!

Step 6

When your time is up, race back to your team and tag the next person in. Keep going until everyone has had a turn.

Write down your readings here:

Sensor	

What did you measure?	Reading:
What did you measure?	Reading:
What did you measure?	Reading:
What did you measure?	Reading:

Crown the winner

Take a look at all of the readings your rōpū collected, find the highest number and circle it.

If you measured conductivity, tally up the total number of conductive objects you measured.

Compare your final numbers with your opponent rōpū. Whoever has the highest number is the winner!

Lab 2.1: **Microgreen trial one**

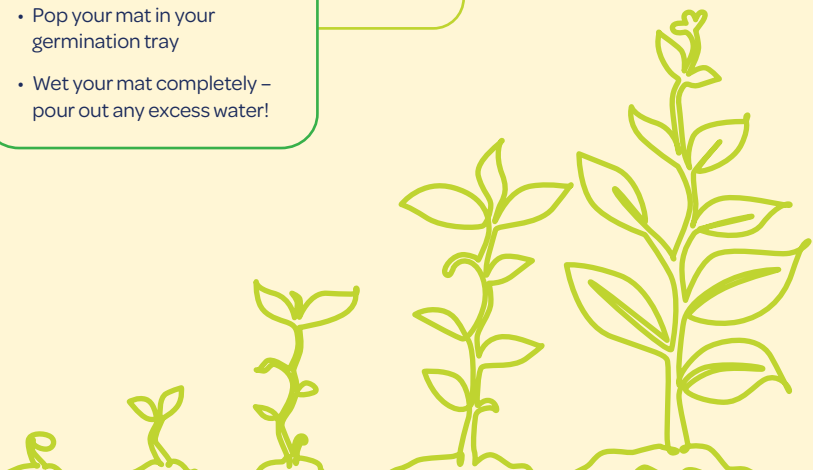
Task: It's time to sow the seeds of your first trial. Follow the steps in the video and use the refresher below!

Step 1: Container

- Collect your container
- Prepare your germination tray:
  - Make sure it's clean
  - Add a label with the date
  - Punch a hole for airflow

Step 2: Grow mat

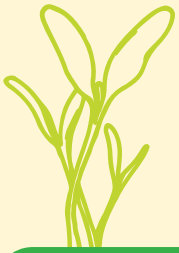
- Cut your grow mat to the right size
- Pop your mat in your germination tray
- Wet your mat completely – pour out any excess water!



Step 3: Seeds

- Choose one type of seed and take 1 teaspoon – some seeds will grow faster than others!
- Soak your seeds in cool water for at least 5 minutes
- Spread evenly across your mat
- Then spritz with water

Tip: Remember to mist your microgreens with water every day!



Step 4: Cover it up

- Cover everything with a lid
- Wait for the magic to happen!
- Once they've sprouted, remove the lid to expose to light

Tip: Putting a lid on the top makes it cosy and dark and tricks the seeds into thinking they are in soil. This helps with germination and encourages the shoots to grow upwards and find the light.

Lab 2.2: **Daily data**

You need to check your trials every day to make sure they have everything they need to thrive!

You'll use the skills of **observation, recording** and **analysing** to monitor the growth and progress of your plants. Try to be careful and accurate as you'll use this information later in the challenge.

Task: Use your senses and your sensors to check plant growth and conditions every day.

Tip: Check your plants at the same time each day for the most accurate recordings.

Use your sensors to record the **temperature, light** and **humidity** levels, and whether your growing environment is **conductive.**

Tip: You can capture your observations by recording information in the tables provided but also by taking videos, photos and sketches!

Use your **five senses** to make some observations about your plants' progress. You only need to do this once every 2 or 3 days.

Record your results in the table.

Trial one

Record your data for trial one

Seed variety:

Date	Quantitative data				Qualitative data (eg. number of leaves, leaf colour, number of shoots)
	Temperature	Humidity	Light	Conductivity	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	

Trial two

Record your data for trial two

Seed variety:

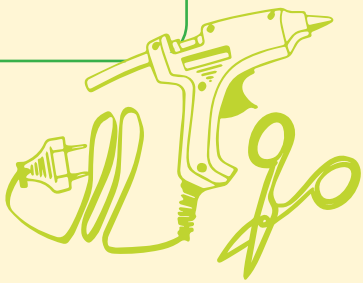
Date	Quantitative data				Qualitative data (eg. number of leaves, leaf colour, number of shoots)
	Temperature	Humidity	Light	Conductivity	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	

Lab 3.1: **Build your grow house**

Task: Build a basic grow house to help your microgreens flourish.

You need:

- 1 container with a lid – this will be your frame
- Large clear plastic bag/sheets or 2.25/3 litre clear bottles – these will be your windows
- Scissors
- Glue



Step 1: Develop an action plan

Think about the features of your grow house that will help your plants to grow.

For example, plants like a warm environment and 8–10 hours of sunlight a day. You also need to be able to see and access your plants easily.

Discuss potential features with your team and fill in the action plan on the next page.

Where will you put your grow house, and why?

What materials will you use, and why?

What else do you need to make sure your grow house works?

Step 2: Create your frame

- Choose your container.
- Cut holes in the sides for your ‘windows’. Leave the base of your container intact.
- Cut the middle out of your container lid.

Step 3: Add windows and a roof

Using a transparent material will help let in the light.

- Take out the material you’ve chosen for your windows.
- Trace the shape of each window onto your material.
- Cut out each of your windows. Make sure each window is slightly bigger than the hole it needs to cover.
- Cut out your roof.
- Glue your windows and roof inside your frame.
- Make a 1cm hole in the side of your grow house for air flow.

Voila! A basic grow house

Step 4: Move in your greens

- Pick up your grow mats and carefully transfer your plants into your grow house. You might need a few pairs of hands!
- Use your temperature sensor to check the temperature is between 18–25°C.

Ka pai!

Lab 3.2: **Microgreen trial two**

Task: Plant your second microgreen trial.

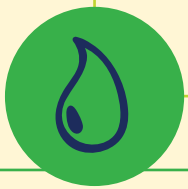
Put what you've learned from trial one into practice. In your second trial, test different ways of growing and see if it improves your microgreen crop.

Brainstorm

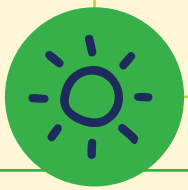
Discuss the changes you can make to improve your crop with your rōpū.
Review your data from Lab 2.2. Can you see any trends or patterns?

Making changes

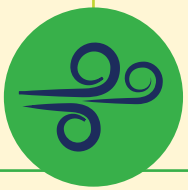
What would happen if you...



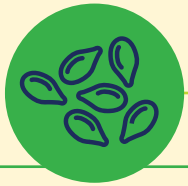
Change how often you water your microgreens.



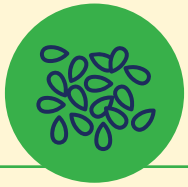
Move your microgreens so they get more light.



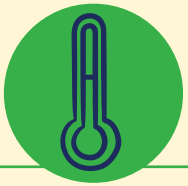
Improve the airflow with a larger hole, or multiple holes in your grow house.



Change seed density by planting more, or less seeds.



Chose a different type of microgreen seed to plant.



Create a more stable environment where the temperature stays the same.

Let's get growing

Plant your second trial.

Follow instructions from **Lab 2.1** and start recording data in **Lab 2.2.**

Lab 3.3: Making nutrients

Task: Create a nutrient solution and add to your second microgreen trial.

Why nutrients?

All plants need a balance of minerals for their overall health and strength.

Plants usually get these minerals from the nutrients in soil. So, when you grow them hydroponically, you need to add them yourself.

Let's make a nutrient solution or compost tea to add to your microgreens!

Step 1

Pick your ingredients.

You could try:

- Banana skin – a superfood, packed with potassium, phosphorus and calcium
- A few used green tea bags – contains tannic acid and nutrients which are natural fertilisers
- A pinch of epsom salt or baking soda – stimulates growth and helps maintain healthy leaves
- Any fruit or vegetable scraps you have – keep in mind some of these might be harmful to your microgreens so it pays to do your research first!

Step 2

Fill a bowl or large bottle ¾ with water.

Step 3

Add your ingredient(s) to your water. You can choose more than one!

Step 4

Give your solution a good stir and cover.

Step 5

Set aside and leave to soak for a week, before it's ready to use.

Lab 4.1: **Data dig**

Task: Dig into your data to see what went well in trial one, and what could be improved for trial two.

Data dig one: Range

Microgreens do best when they live in a controlled environment. You can find out how well you controlled your environmental conditions by calculating the range of your quantitative data sets.

- Choose a data set from your first trial (humidity, temperature, light)
- Write down the lowest and the highest reading
- Use the calculation below to calculate your data range

highest reading – lowest reading = range

Reminder!

Qualitative data is information you observe by using your five senses.

Quantitative data is information in the form of numbers, or quantities.

Now do the calculation for each data set.

Trial one range

Temperature range:

highest reading	–	lowest reading	=	range

Humidity range:

highest reading	–	lowest reading	=	range

Light range:

highest reading	–	lowest reading	=	range

Analyse:

What do your calculations mean?
What can they tell you about plant growth?

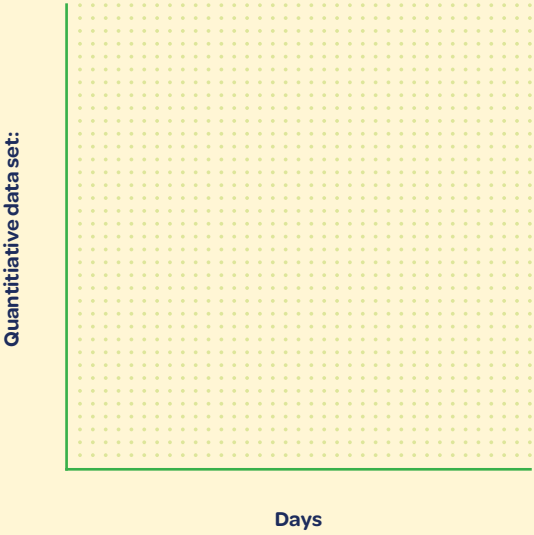
A low range means:

A high range means:

Data dig two: Plot a graph

Plotting a graph can help you see your data visually and spot patterns more easily.

- Choose a quantitative data set (temperature, humidity, or light) to plot
- Mark the horizontal x axis with the number of days
- Mark the vertical y axis with the numbers from your chosen data set
- Plot your results by carefully marking an **x** in the right place for each day
- Draw a line to connect each **x**



Analyse:

What does your line graph look like? Is it a straight line or is it wonky? What do you think this means?

Discuss your results in your teams and write down your observations and analysis.

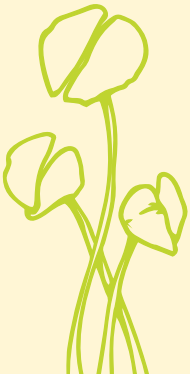
Data dig three: Correlation

Looking at the **correlation** between your quantitative and qualitative data can help you form conclusions on what worked well for your microgreens. Correlation means the **relationship** between two or more things.

Example: Yellow leaves can be a sign of an unhappy plant. Was there a time when you saw leaves turning yellow? What does your quantitative data show when that happened? Did your light levels drop? Were the humidity levels low?

Correlation 1

Correlation 2



Lab 4.2: Feeding nutrients

Your compost tea has now been brewing for at least a week! It's time to finish what you started and feed your microgreens a tasty compost treat.

Grab your tea and block your nose!

Strain the liquid so there are no peels or grains in the water.

Dilute your compost tea, so it's half water half compost.

Pour into your spray bottle using your funnel.

Feed your greens

Spray your nutrients onto your microgreens.

Tip: Continue to mist your microgreens every day with your compost/water solution to keep the mat damp.

Lab 4.3: **Grow house glow-up**

Task: Level up your grow house for trial two to unlock your microgreens' ultimate growing potential.

But first...

We need to think about what we learnt from our first grow house. What went well? What could you have done differently?

Circle yes or no for each question. If your answer is no, discuss how to improve this for your second grow house with your rōpū. Write your ideas in the boxes.

Did your grow house keep your microgreens at a consistent and warm temperature?	**Yes!** / **No**	**We'll improve by:**
Did your grow house provide a good level of air flow?	**Yes!** / **No**	**We'll improve by:**
Did your grow house let enough light in?	**Yes!** / **No**	**We'll improve by:**
Did your grow house keep the water in?	**Yes!** / **No**	**We'll improve by:**

Glow up your grow house

You'll need:

- Material for your grow house structure/ frame. This could be cardboard rolled into tubes, recyclable plastic, wood or something else you can recycle. Make sure it's sturdy enough to stay standing!
- Material for your walls – think about what material will work best for trial two.
- Glue to stick it together.
- Paint or markers to make it your own.

Step 1

Make your grow house structure. This time, get creative! What structure will help your greens grow best?

Tip: You might want to think about the angle of your roof and how it will get the most sunlight.

Step 2

Trace the walls and roof of your new structure onto your new material. Cut them out!

Step 3

Stick your new walls onto your new structure.

Step 4

Add some character to one of your walls with a marker. You might want to add a team logo or even a face.

Lab 4.4: **Design your farm of the future**

Task: It's time to design your very own farm of the future.

Before we begin...

Think about how your farm of the future is going to solve the challenge question and help feed our communities.

Brainstorm with your team and write your answers in the boxes below.

I wonder how my farm of the future will grow food sustainably?

Who will my farm of the future feed?

Where will my farm of the future be located?

What will my farm of the future grow?

Draw your farm of the future

A great design is easy to understand and has unique features that make it special. Make sure to label your farm's unique features.

Your farm name

Lab 5.1: **Data dig 2.0**

Task: Gather insights from your trial two data and compare it to your insights from trial one.

To accurately analyse the difference between your trial one and trial two data, you need to compare 'like' with 'like'. So, you'll need to analyse your trial two data the same way you analysed trial one.

Data dig one: Range

Remember to use this equation to calculate range:

Highest reading - lowest reading = range

Trial two range

Temperature range:

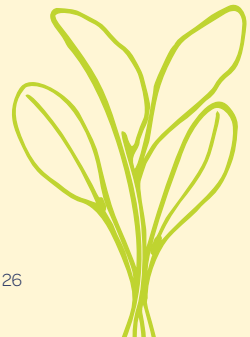
	–		=	
highest reading		lowest reading		range

Humidity range:

	–		=	
highest reading		lowest reading		range

Light range:

	–		=	
highest reading		lowest reading		range



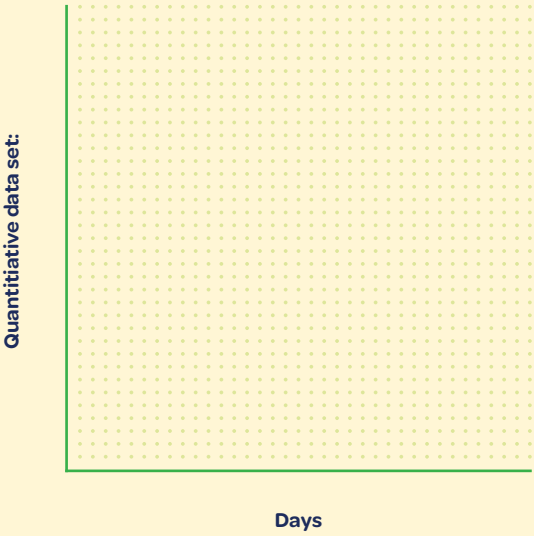
Analyse:

Compare your trial two range data to trial one. Which was your more successful trial? Why? Discuss with your rōpū and write your analysis here:

Data dig two: Plot a graph

Plot a line graph for trial two. Use the same data set that you used in **Lab 4.1.**

- Choose a quantitative data set (temperature, humidity, or light) to plot
- Mark the horizontal x axis with the number of days
- Mark the vertical y axis with the numbers from your chosen data set
- Plot your results by carefully marking an **x** in the right place for each day
- Draw a line to connect each **x**



Analyse:

Is your line straighter or wonkier than your first trial? What does this mean? Write down your analysis.

Data dig three: Correlation

Are there any new data correlations?
Jot a couple of correlations down:

Correlation 1

Correlation 2

Let's form a conclusion!

Now that you've compared your two data sets, which of your trials do you think was more successful and why?

Circle the trial number that was more successful.

1 or 2

The temperature was

The light was

The humidity was

It was/wasn't conductive

Make a list of what you did to make your microgreens grow better in this trial.

Our microgreens grew better because:

How will I use this information to help me develop my farm of the future?

Lab 5.2: Develop your farm of the future

Task: Get ready to sprout your farm of the future. In your rōpū, develop a model that shows off what you've learnt about growing food sustainably.

A model is a visual representation of your farm of the future idea. This can be a digital representation, or a physical model made from recycled/reusable materials.

Gather your resources

Discuss with your rōpū the best way to create your farm of the future and the resources you'll need.

If you're making a physical model, these could be:

- Cardboard
- Kitchen rolls
- Coloured paper
- Pipe cleaners
- Recyclable plastic

You can choose whatever you want!

It is also helpful to have:

- Scissors
- Glue
- Tape
- Ruler

Write down your ideas here:

Tip: Keep notes of your future farm's features and how they solve the challenge question. You'll need these when you present your idea to your class.

Ready?

Channel your STEM smarts, unleash your creativity and build your farm of the future!

Make sure you collaborate with your rōpū. Your combined forces will make your future farm fantastic!

Lab 6.1: **Deliver**

Task: Your farm of the future deserves to be shown off. Create a 5-minute presentation to deliver your team's design to the class.

Use the boxes below to help structure your presentation and make sure you get all your points across. Feel free to be as creative as you want but always keep the challenge question in mind.

'I wonder how to grow food sustainably?'

Our presentation

Our farm of the future's name is:	
Our farm is located in:	
Our farm will feed:	
Our farm helps to grow food sustainably by:	

The 4 Ds

A few simple steps that STEM superstars use to solve problems in a creative way.

Tip: It's ok to go backwards and forwards between the steps to find the best solution.

Step 1: Discover

I wonder what the problem is?

Step 2: Design

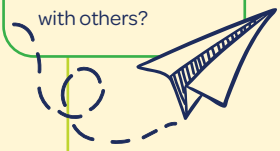
I wonder what the solution is?

Step 3: Develop

I wonder how to bring the solution to life?

Step 4: Deliver

I wonder how we can share our solution with others?



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