SESSION 3

How can more sustainable growing techniques innovate how we grow plants for food?

Farms of the future

Which is the odd one out?
What have they all got in common?

Image credits: Bio tech Vertical farming/YesHealth/PlantsPests&Diseases/Growing Underground

What are hydroponics?

Using **Hydroponics** is an effective method for growing plants that instead of using soil places the plants in a **water solution** that's rich in **nutrients** so the roots are able to take in everything they need.

The plants will also have access to large amounts of oxygen, which helps to facilitate growth. The advantage of using hydroponics to grow plants is that it allows for a much quicker growth rate which can be up to **30% faster** than soil-based planting methods.

What do the experts say about hydroponics?

Hydroponic systems use 10 times less water that soil-based growing methods.

Microbes in the soil are beneficial for plant growth.

Hydroponic systems can produce year round crops.

Hydroponic systems can produce higher yields that soil-based alternatives.

Hydroponic systems that use artificial lighting can use lots of electricity.

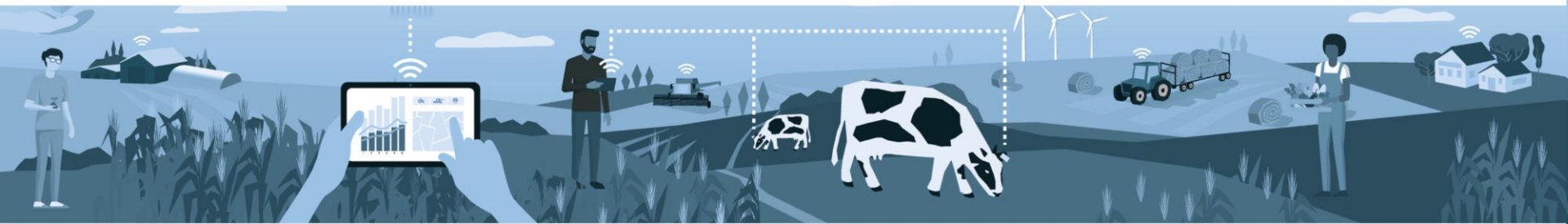
Hydroponic systems can be located close to where the food is needed reducing travel distance and time from the farm to the table.

Hydroponic systems can be stacked high and don't need as much land as conventional soil-based farming.

Hydroponic equipment including pumps, pipes, lights, air filters, lights, fans can all be expensive.

Weeds are not an issue with hydroponic methods because they need soil to grow.

Systems are made of materials which require resources to build and maintain.



What foods can be grown with hydroponics?

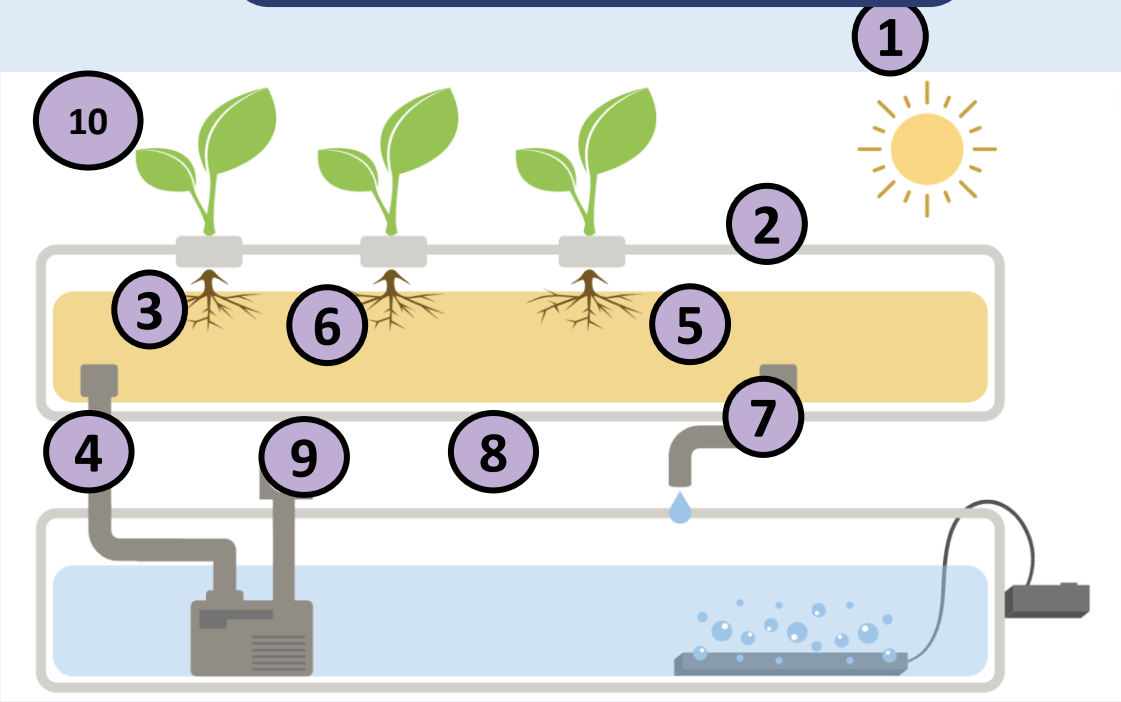
Image credits: Jorge Zapico/mhaithaca/Didriks/Stacey Spensley/Muffet/The Ewan/16:9clue/Scott 97006/CAIT/Suzie's Farm/ilovebutter

What foods can be grown with hydroponics?

Image credits: Jorge Zapico/mhaithaca/Didriks/Stacey Spensley/Muffet/The Ewan/16:9clue/Scott 97006/CAIT/Suzie's Farm/ilovebutter

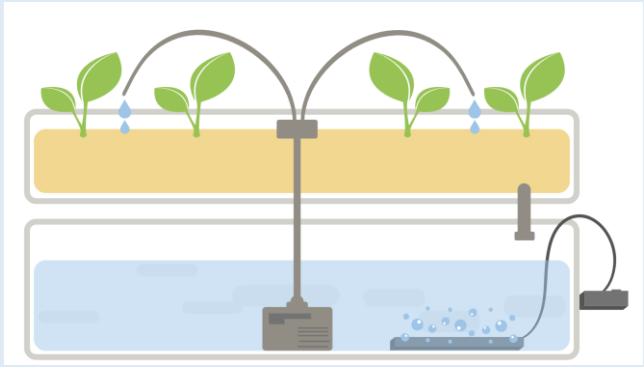
Systems Thinking

Identify the parts that make up a typical hydroponic system.

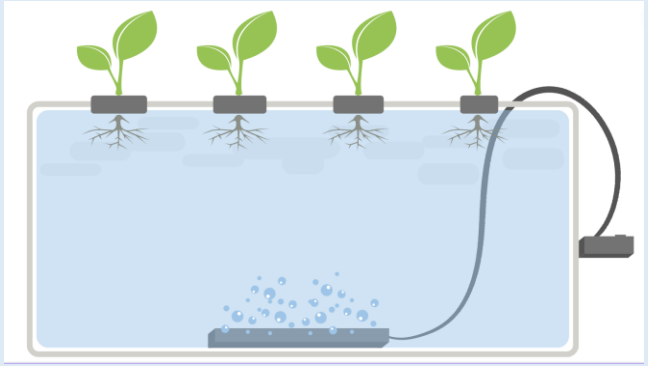


Reservoir	Watertight container to hold nutrient solution
Growing chamber	Container with drain holes that holds the plant
Growing medium	Non-soil substance that plants grow in
Nutrient solution	A solution of the 16 elements essential for plant growth
Submersible pump	Moves nutrient solution from reservoir to plant chamber
Delivery system	Tubing or wick that carries nutrient solution from the reservoir to the plant chamber
Simple timer	Controls when the pump and or lights come on
Return pipe	Unused nutrient solution returned to the reservoir tank
Light	8-10 hours of daily light
Air pump	To oxygenate the nutrient solution as roots use oxygen for aerobic respiration

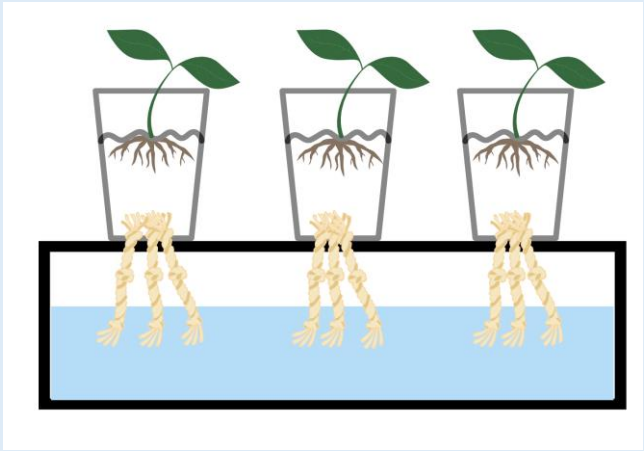
Some different types of hydroponic system for inspiration



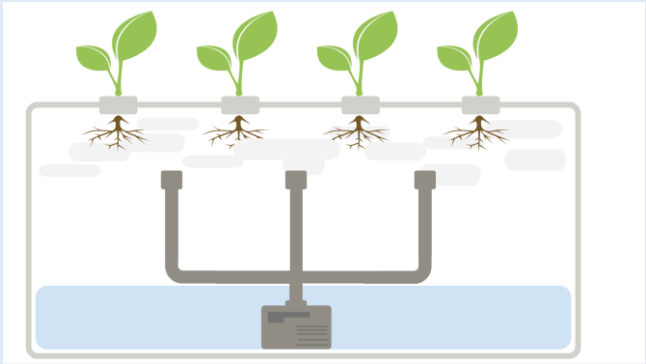
Drip System



Water Culture System

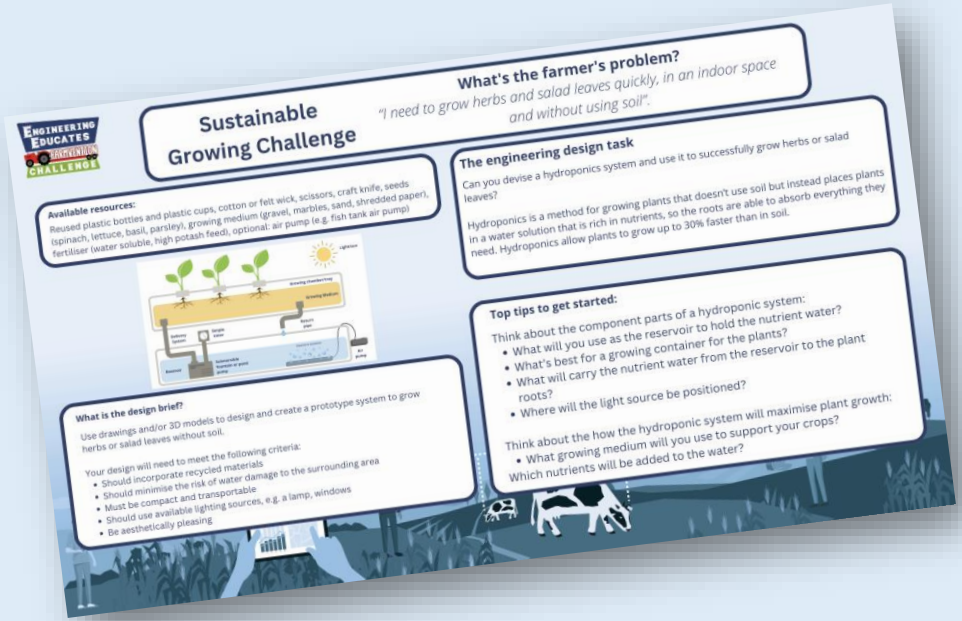


Wick System



Aeroponics System

Sustainable Growing Challenge



Sustainable Growing Challenge

What's the farmer's problem?

"I need to grow herbs and salad leaves quickly, in an indoor space and without using soil".

Available resources:

Reused plastic bottles and plastic cups, cotton or felt wick, scissors, craft knife, seeds (spinach, lettuce, basil, parsley), growing medium (gravel, marbles, sand, shredded paper), fertiliser (water soluble, high potash feed); optional: air pump (e.g. fish tank air pump)

The engineering design task

Can you devise a hydroponics system and use it to successfully grow herbs or salad leaves?

Hydroponics is a method for growing plants that doesn't use soil but instead places plants in a water solution that is rich in nutrients, so the roots are able to absorb everything they need. Hydroponics allow plants to grow up to 30% faster than in soil.

What is the design brief?

Use drawings and/or 3D models to design and create a prototype system to grow herbs or salad leaves without soil.

Your design will need to meet the following criteria:

- Should incorporate recycled materials
- Should minimise the risk of water damage to the surrounding area
- Must be compact and transportable
- Should use available lighting sources, e.g. a lamp, windows
- Be aesthetically pleasing

Top tips to get started:

Think about the component parts of a hydroponic system:

- What will you use as the reservoir to hold the nutrient water?
- What's best for a growing container for the plants?
- What will carry the nutrient water from the reservoir to the plant roots?
- Where will the light source be positioned?

Think about the how the hydroponic system will maximise plant growth:

- What growing medium will you use to support your crops?

Which nutrients will be added to the water?

Work collaboratively to create a working hydroponic system prototype

Image credit: Spark CBC

In this challenge we have worked like agricultural engineers by **imagining**, **planning** and **creating** a prototype hydroponic system to grow crops indoors.

SUSTAINABLE FARMS