

Soil Defenders - Session 4

How could we sow seeds without compacting the soil?



Context:

Pupils continue to work within the engineering design cycle, with a focus on creating prototypes for a machine for seed sowing that avoids soil being damaged and compacted. In their design, they consider the different steps within the seed sowing process and how to respond to the farmers' need to make sure that seeds are dispersed evenly and in a straight line.

They learn about how the Small Robot Company engineers are innovating robots to support farmers in becoming more sustainable in the way they work on arable farms.

Engineering Focus: Working like engineers by creating a simple machine to sow seeds, thinking about the parts of a system and how they work together.

Learning time:

2 hours

Suggested age group:

7-9 years old

Curriculum for Excellence links:

First Level:

I explore and discover engineering disciplines and can create solutions.

TCH 1-12a

I can use exploration and imagination to solve design problems related to real-life situations. EXA 1-06a

I can explore and experiment with sketching, manually or digitally, to represent ideas in different learning contexts. TCH 1-11a

Second Level:

I can extend my knowledge and understanding of engineering disciplines to create solutions. TCH 2-12a

I can develop and communicate my ideas, demonstrating imagination and presenting at least one possible solution to a design problem. EXA 2-06a

I can use a range of graphic techniques, manually and digitally, to communicate ideas, concepts or products, experimenting with the use of shape, colour and texture to enhance my work. TCH 2-11a

Keywords

ploughing
planting
fertilising
harvesting
transporting
soil compaction
sowing
seed drill
hopper
pipe
coulters
tines
prototype
system

Resources:

- Soil defenders Session 4 PPT
- 5mm thick strong corrugated card (from a recycled box)
- 3mm skewers/dowel/straws
- Seeds/beads/marbles
- PVA glue/Glue gun/Masking tape
- Scissors/craft knife/cutting mat
- cardboard tubes
- recycled boxes
- A4 sheet of light card to make templates
- Problem on a Page: Soil Saver Challenge handout

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Step-by-step plan

1

Recap what we know about the processes that take place on an arable farm over the year.

Support pupils in matching photos of processes on the arable farms to their place in the cycle of 'a year on a farm'. Begin by checking their understanding of each key word in the cycle (Slide 2) and then ask children to talk in pairs about what they can see the heavy machinery is being used to do and what process this might be. Key questions:

- From the photos - What have all these processes got in common? (All use heavy machinery)
- What problems do heavy machinery cause? (Soil compaction, pollution)

2

How are agricultural engineers inventing solutions to common problems on arable farms? A case study.

Watch the NFU 'Agricultural Video' through the link on our website.

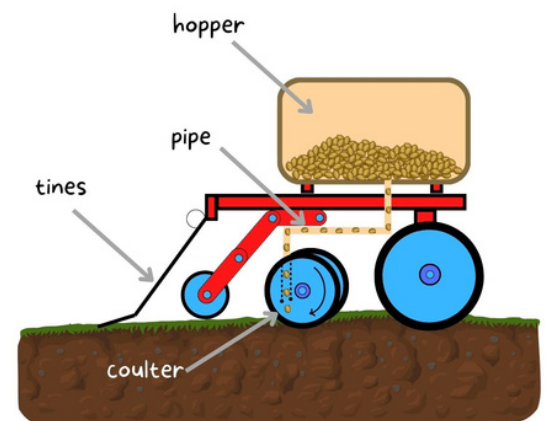
In addition, you can watch the video about how an engineering company called the **Small Robot Company** have developed **three small robots Tom, Dick and Harry** to solve some of the problems with arable farming. This introduces the pupils to how agricultural engineers are finding creative solutions to avoid using heavy machines that cause soil compaction and making the most of modern technology. Encourage pupils to discuss how the small robots solve some of the problems they have learnt about.

3

Innovating sowing seeds

Support pupils in looking at how seeds are planted today using larger machinery by watching a **video of a seed drill in action** and then taking a closer look at the parts of the system and their jobs (Slides 3 and 4).

Explain that engineers are experts at making things and making things work better by reducing or solving problems. Explain that in this session the pupils will be thinking as engineers to come up with ways that seeds could be sown without the use of heavy machinery.



2



Step-by-step plan

Creating prototypes for a seed dropping device

Pupils work in pairs to create a prototype seed dropping device. Provide them with the 'Problem on a page' handout that clearly outlines their challenge and design brief (slide 5).

4

Provide materials listed in the resources section of these teacher notes and challenge your pupils to develop a small prototype device that drops seeds/beads/marbles as it rolls along.

Try to limit guidance to that provided on the 'Problem on a page' to encourage your pupils to think creatively and come up with their own unique solution to the problem.

Evaluate as an engineer

Once pupils have made, tested and tinkered with their prototype they should evaluate how well they have met the design brief.

Encourage them to explain:

5

- What are the essential parts of the system in their seed dropper?
- How well their seed dropper meets the design criteria?
- How their seed dropper might help solve the problem of soil compaction?

If the opportunity arises pupils can share their prototype with a farmer, engineer or a family member to practice communicating their ideas with an audience.

Revisit the Engineering Design Cycle for learners to reflect on how they have been working as an engineer through the Soil Save Challenge (slide 6).

Take it further

Adapting a design to match the needs of the farmer (Slide 7)

Should you want to allocate more classroom time for pupils to work on their prototypes you could challenge them to **adapt** their designs to meet the specific needs of a particular farmer:

- I need the drill to hold bigger seeds.
- I need the seeds to be dropped further apart.
- I need the seed drill to carry more seeds for larger fields.

3

Soil Saver Challenge

What's the farmer's problem?

"I need to sow my seeds evenly without compacting the soil too much, as this can mean the plants don't grow as well."



Available resources:

For wheels & axles – cardboard, straws, dowel, skewers;
For the body and hopper – tissue box, cardboard tubes, plastic bottles/box;
For the seeds – seeds/rice/marbles/beads.
Other useful materials:
corrugated cardboard, craft sticks, paper cups, masking tape, glue, scissors, rubber bands.

What is the design brief?

Use drawings and/or 3D models to create a prototype of a seed dropping device that reduces the chance of soil compaction.

Your design will need to meet the following criteria:

- Seeds should be dropped automatically (not by hand)
- It should touch the ground when seeds are being dropped
- Should be operated by only one person
- Seeds should be dropped or 'planted' in a straight line
- Seeds should be a similar distance apart

The engineering design task

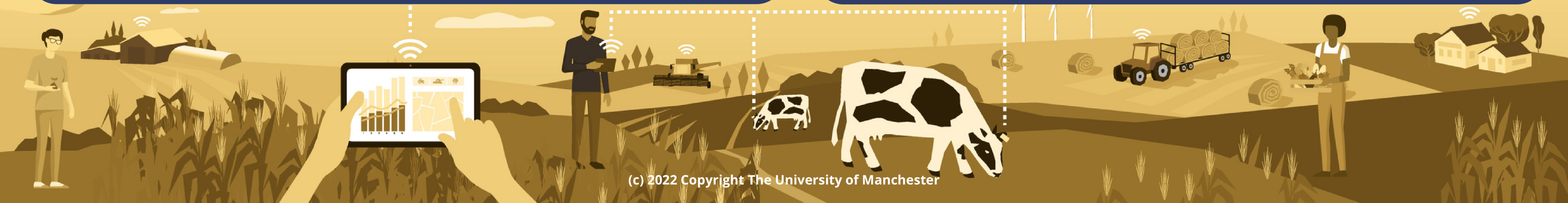
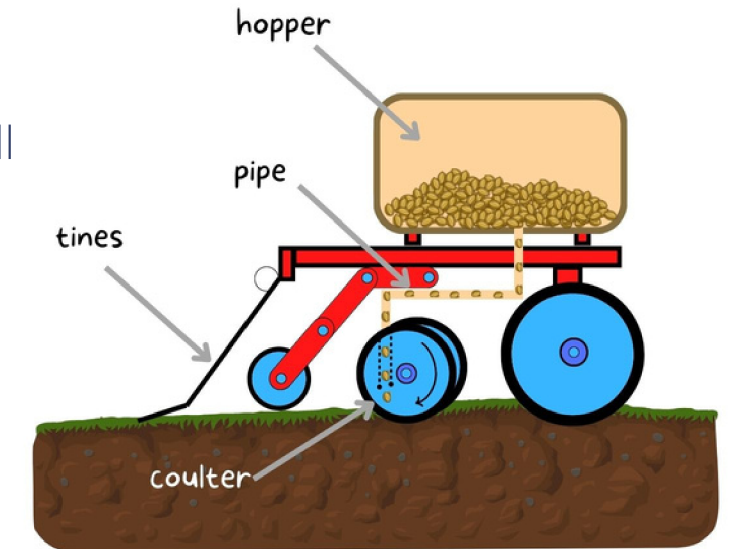
Can you find a way to make a simple seed dropping device which helps the farmer to solve his compaction problem?

Farmers use special machines called seed drills to make sure that the seeds are planted evenly. These machines can be very heavy and cause the soil to become compacted which can make it hard for a plant's roots to reach enough oxygen and water. The heavier the machinery the more likely that compaction will happen. Your challenge is to come up with an idea for a lightweight alternative.

Top tips to get started:

Think about the component parts of a seed drill system:

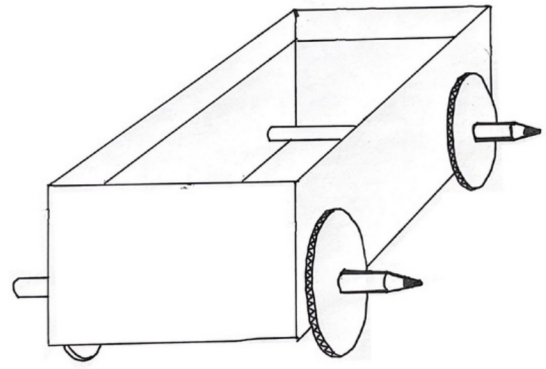
- What does the hopper and pipe do?
- What could you use for these parts of the system?
- Where will you have seed storage?
- What will stop seeds falling out?



Background Information:

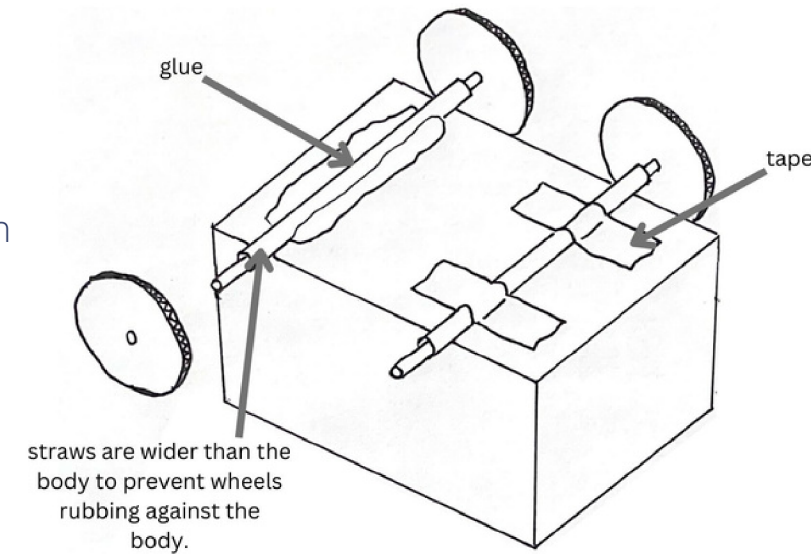
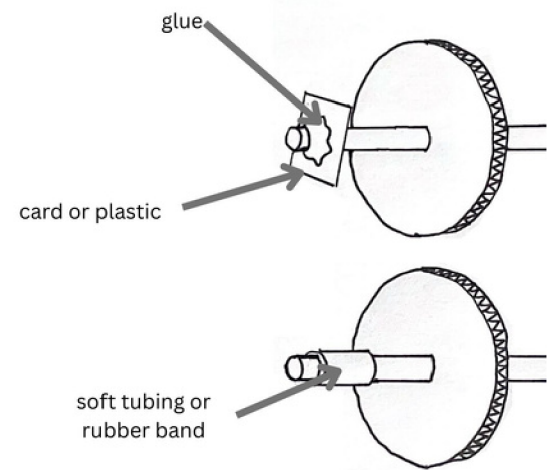
How will you make a moving vehicle?

There are different ways to fix wheels.



You could use pencils, chopsticks, doweling or skewers as axles.

Placing your axles through a straw can help stop the wheels rubbing.



Wheels can be attached to the axle with card, plastic, tubing, glue or rubber bands.

Think about the system used in a seed drill. How could you adapt your vehicle so that it drops seeds as it moves along?

If you are stuck for ideas take a look at the **Soil Saver Challenge Get Yourself Unstuck Guide**.

Glossary:

Seed Drill - a device used to sow seeds for crops by positioning them in the soil and burying them to a specific depth while being dragged by a tractor.

Hopper - stores the seeds to be planted above the rest of the machine so that the force of gravity helps them fall through to be planted.

Pipe - a shoot for the seeds to travel through, from the hopper to the soil.

System - a set of related parts or components that work together to produce an outcome.

Axle - a rod on which one or more wheels can rotate, either freely or be fixed to and turn with the axle.

Axle holder - the component through which an axle fits and rotates.

More information and inspiration!

Take a look at these videos of other people's solutions to the problem to get some ideas:

- [Loo Roll Roller](#)
- [Tissue Box Triumph](#)

Want to take it further?

Can you consider how you can improve your machine to:

- hold more seeds?
- drop seeds further apart?
- plant larger seeds?

How well did you do?

Use the problem-solving score card to evaluate how well you performed in this design and make/create task?

Success Criteria	Score /5
Device drops seeds	
Seeds are evenly spread	
Easily operated by one person	
Made from recycled materials	
Seeds fall in a straight line	