Pre-excursion resource

Wonderful Water

Level 3 – Level 6

Year

Grade 3 – Grade 6

Level

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Activity description

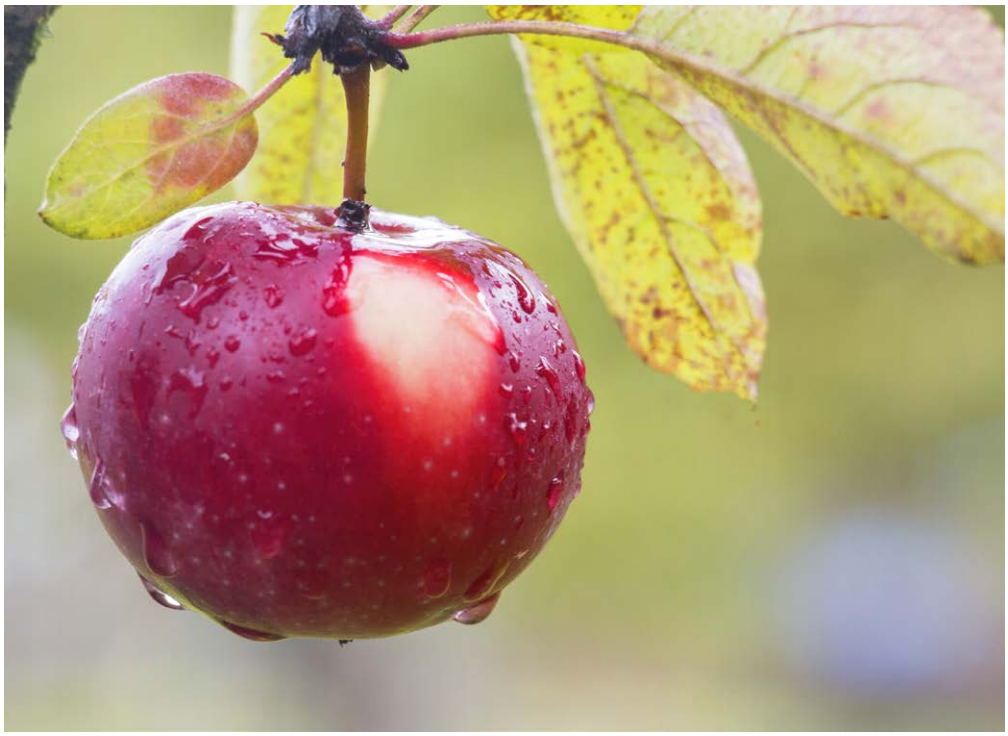
Students learn about the importance of water to the horticulture industry. In a hands-on activity they become design engineers and investigate different water filtration systems for removing pollutants. Working in teams they design, build and test their own filters and discover that plants are the most efficient and amazing natural water filters.

Materials required

- 2 x plastic 2-litre bottle, empty and clean with the lids (2 per group)
- Scissors
- Filters: cheesecloth, coffee filter, old sock or paper towel
- Rubber bands
- Materials to put in the filter (e.g. gravel, sand, cottonwool)
- Dirty water (make your own with any of the following: coffee grounds, dirt, crunched-up old leaves, cooking oil, tiny pieces of foam)
- Writing materials
- Worksheet: Wonderful Water

Key Topics

- Design and technology
- Water filtration



Instructions

Introduce the topic of water to students by discussing the following questions:

- Why do you think water is so important to the horticulture industry?
- What do plants rely on to grow?
- In a drought, if there is not a lot of rain and the dams are empty, where does the water come from to grow fruit trees?
- What does irrigation mean?
- What happens when the water in the channel, creek, river or reservoir becomes polluted?
- Can you clean water?
- Is it safe to drink?
- What does a design engineer do at work?

Did you know that plants also play a part in cleaning our water? As with air, plants that live on and in the water absorb carbon dioxide and expel oxygen. In aquatic environments, this is helpful to fish and improves water quality. Plants in aquatic systems also absorb nutrients, bacteria, metals and chemicals.

A plant's xylem, which transports water from the roots to the leaves, mimics a filter, and the small pores in xylem are just the right size to remove harmful bacteria.

THE TASK: Students are working as design engineers for an orchard and have been asked to design a new water filtration system because the orchard's channels and dams have become so polluted from upstream rivers that the company doesn't want to use the water to wash the apples and pears unless it is safe. The company is looking at different types of filter material to determine which ones work well and is seeking your advice about which you think is the best filtration method.

1. Divide the class into small design engineer groups of two or three and distribute the worksheets.
2. Ask students to write down a prediction for what they think their particular filter materials will do.
3. Get two clean plastic bottles.
4. Cut both the bottles in half, set the bottom half of the bottles to one side.
5. Put some holes in the lid using a nail or scissors so the dirty water can drain through the holes.
6. Students set up their filters by placing the filter material into the inverted 2-litre bottle top. Place the filter in the end of the bottle with the neck, so it functions like a funnel.
7. Cover the small opening on the top half of the bottle with their chosen material (cheesecloth, coffee filter, old sock, paper towel). Wrap a rubber band around it to keep it on. This is going to be the filter cartridge.
8. Fill the filter cartridges with two different materials, one in each bottle, that they think will best clean the water (gravel, sand or cottonwool). Students think about how they intend to mix or layer the materials to gain the best results.
9. Put the bottom half of the bottle underneath the filter to catch the water.
10. Test the filter by pouring a small amount of dirty water into the filter cartridge. Look at the water that comes out into the bottom of the bottle.
11. Gently stir the dirty water and then slowly pour it into the filter. Make sure the liquid doesn't go above the top of the filter.
12. Direct students to observe what happens during the filtration. Expect some filtrations to take longer than others. Remind students to record on their worksheets their observations and draw pictures of the filtered water.
13. After all groups have collected data, share the results as a class. Have students record all team results in the class data section on the worksheets.
14. Discuss and record results. Students write a summary for the orchard on their recommended filtration system.
15. Collect all supplies and dispose of used items properly. Rinse and save the bottles.

Suggestions for assessment

Have students answer the worksheet discussion questions, comparing answers with a team member. Collect and review student worksheets to assess their engagement, comprehension and mastery of the subject matter.

Engineering presentations: Ask each team to present their filter system design to the class, explaining their logic. Examine the filtered solutions. Conclude with a class vote and discussion about which water is the cleanest and why.

Curriculum links

The Victorian Curriculum

Design and Technologies

Level 3–4

Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques (VCDSCD029).

Select and use materials, components, tools and equipment using safe work practices to produce designed solutions (VCDSCD030).

Evaluate design ideas, processes and solutions based on criteria for success developed with guidance and including care for the environment and communities (VCDSCD031).

Plan a sequence of production steps when making designed solutions (VCDSCD032).

Level 5–6

Critique needs or opportunities for designing, and investigate materials, components, tools, equipment and processes to achieve intended designed solutions (VCDSCD038).

Generate, develop, communicate and document design ideas and processes for audiences using appropriate technical terms and graphical representation techniques (VCDSCD039).

Science

Level 3–4

With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (VCSIS065).

Suggest ways to plan and conduct investigations to find answers to questions including consideration of the elements of fair tests (VCSIS066).

Safely use appropriate materials, tools, equipment and technologies (VCSIS067).

Compare results with predictions, suggesting possible reasons for findings (VCSIS070).

Represent and communicate observations, ideas and findings to show patterns and relationships using formal and informal scientific language (VCSIS072).

Level 5–6

With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be based on previous experiences or general rules (VCSIS082).

Worksheet: Wonderful Water

Work in your engineering groups to design the best water filter system using the filter material options and your choice of dirty water. Record and explain all your choices on the worksheet.

Draw and label your dirty water. What does it look like? What does it smell like?

(Note: Never taste the water in a science experiment!)

Draw a sketch of your filter setup. Write down the materials you used in the filter. A diagram might help if you used layers.

Make a prediction

Our filter is

I predict that the (filter type) will remove

when we pour the dirty water through it because

Write down your observations from filtering the water. Write down any ideas for how to improve the filter cartridge in your second bottle.

Describe the filtered water after treatment.

Draw the filtered water (what I see and smell).

Draw your engineering group's best water filter setup.

Describe the filtered water after treatment.

Questions

Did your filter work as you expected it to? Explain why or why not.

Do you think the filtered water is clean enough to drink? Explain why or why not.

Do you think the filtered water is clean enough to put into a dam? Explain why or why not.

List some ideas for ways you might get the “polluted” water cleaner.

Write a recommendation for the orchard about how they should go about filtering their polluted water.

Background information

Plants need nutrients, sunlight, air and water to grow. Where does the water come from? When the weather is right, it can come from rain. But that's not always the case.

Irrigation is any method that people use to apply water to land so plants can grow. Most farms in Australia use some form of irrigation. Examples include drip systems that release water to the ground, and sprinkler systems that spray water over crops.

Innovations are improving how we use irrigation. Sensors and smart systems are used to look for leaks in the pipes, and to only water plants when needed. By checking weather forecasts and measuring the moisture in the soil, farmers can make the most of water – a valuable resource

What's going on in the filtration experiment?

The slower, the better! The longer it takes for water to move through a filter, the cleaner it gets. Water slips easily through the filter materials, but bigger particles, like dirt, get trapped. The filter materials usually get finer and finer, so they can catch whatever was missed earlier.

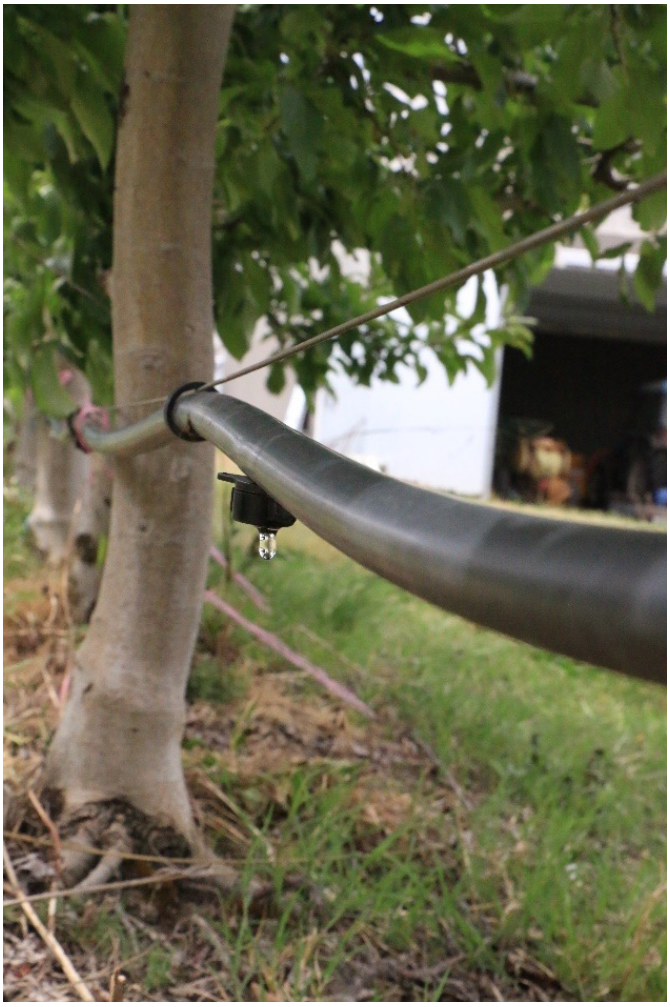
Growing apples during a drought

Irrigation water supply can often be less than what the crop needs during a drought. This leads to tree water stress and the trees produce fewer apples that are also smaller in size.

Growers must choose between buying scarce water, if available, at high cost; removing the entire crop and 'parking' trees on minimum irrigation to keep them alive; or using a combination of thinning and deficit irrigation to prioritise fruit size/quality over yield (quantity).

Understanding the relationship between water deficits, yield, fruit size, fruit quality and crop load is critical for water budgeting and growing fruit to market specifications in drought conditions.

Reference: Goodwin I, O'Connell M and McClymont L, "Water deficits and apple productivity", AFG Spring 2019, https://apal.org.au/water-deficits-apple-productivity/



Drip irrigation system in an orchard.