Health | Science | Social Studies | Technology

3: Food – Levels 3 & 4

Our food, feeding the world

CORE EDUCATION Tātai Aho Rau

Ministry for Primary Industries
Manatū Ahu Matua

Regional to national/international markets

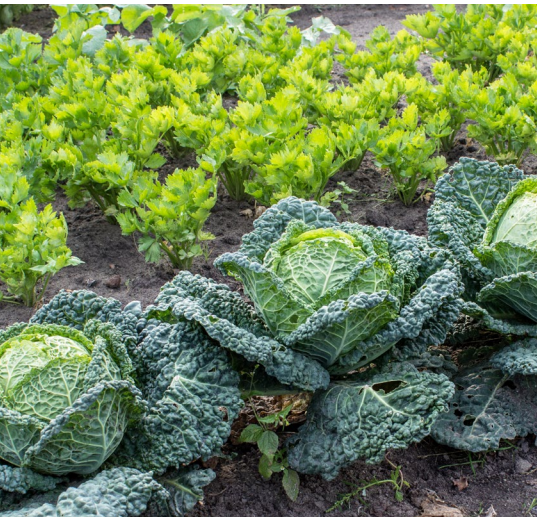
Students explore the foods grown in their local area. How much of this is eaten locally? Where else does it go nationally/internationally?

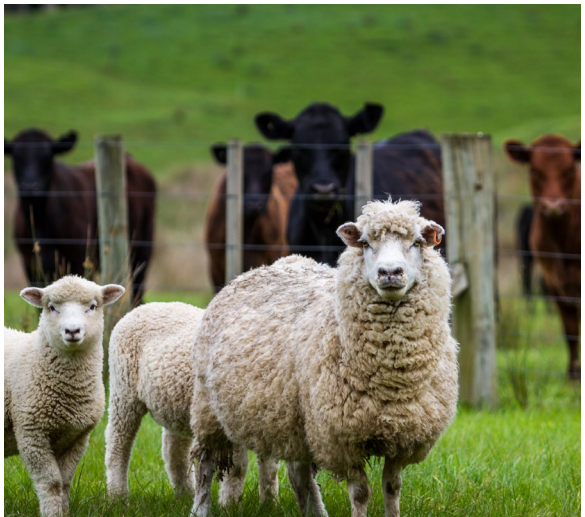
It is recommended that students investigate food that is locally produced if possible so that they gain first hand experiences and information. The amount of learning that can take place outside the classroom will depend on the food system you choose to investigate. Visits or virtual online connections with local farms, orchards, cool stores, ports, and processing or packaging operations are useful to give glimpses into the broader context of food production. Opportunities may be limited due to the community's location or health and safety requirements. However digital representations such as videos and advice from visiting experts can take the place of field trips.

- If appropriate to your region, you may choose to look at the production of fibre, either from plants, such as timber, hemp products, or flax products; or animals, such as wool or hair.

Key understandings:

- Food is produced all over New Zealand, for local, regional, national and international consumption.
- People and technology interact to keep food systems functioning and safe.





Food in our town and food for the world

- Trace the history of land in your area, and create timelines charting the guardianship, ownership and use of land and waterways. Maps are a visual way to capture moments in history. **Archives New Zealand** and local councils hold historical maps, many of which are available online. They may show the resources and livelihoods of particular groups of people at specific times. Have the students investigate what their local area looked like 70 or 170 years ago. Discuss the reciprocal relationships of people and the primary industries – How have the people looked after the land, and the land looked after the people? What might it look like in another 70 or 170 years?
- Students can visit local markets to talk to growers about who they sell their products to.
- Students can cultivate their own (cultivated) environment by creating a school garden, and investigating who they could supply produce to.
- Students can develop some case studies about local primary industries and their links to the local, regional and international food systems and contributions to animal welfare and biosecurity practices. Encourage them to look beyond the obvious – what is happening in local waterways? Who are some of the local, boutique producers and what are they growing or making? What kinds of iwi-run programmes, such the **Ngai Tahu fisheries** or the **Awhiwhenua Land Based Training Farm School** in Whanganui, operate in their area? What do you need to think about if transporting to the rest of NZ, or exporting to other parts of the world?
- Hold a school market day or encourage students to have a stall at a local farmers' market. Challenge the students to produce and sell products that are sourced only from their local primary industries. This does not mean that they have to grow them themselves, only that they have to produce something to sell that is 100% local. Proceeds could go towards local sustainability projects or a school gardening or farming project[1].

From producer to national and international consumer

Follow a New Zealand processing system (local if possible) from production to international table. Inquire into the processes, pathways, technologies and people involved. Revisit simple food supply chains (see the L3-4 resource for more information). How does the supply chain change when the product is being exported overseas? How many more steps are required to get a food product onto someone's table?

Students can complete one of the following in small groups and add to a class report or display:

- The importance of the food system locally, nationally, and globally.
- The effects of the food system on the local community and the environment.
- How each step contributes to creating a marketable product.

[1] Schools should ensure they comply with Food Act 2014 provisions when producing and selling food. Information can also be found on the MPI website www.mpi.govt.nz and in the following information sources: What does the Food Act mean for me? Schools: **http://www.mpi.govt.nz/document-vault/5260** and What does the Food Act mean for me? Fundraising: **http://www.mpi.govt.nz/document-vault/12864**

- Areas where innovation is taking place in the food system.
- The impact of New Zealand's reputation for high animal welfare standards and food quality and safety on international markets.
- The impact of pest and disease management and eradication methods on markets.
- Biosecurity risks and hazards (those that are here now, and those who could be a threat in the future).
- The importance of matching consumer expectations, for the local and international markets.

Investigate the roles people play in the food system

- Ask each student to choose a food item from the supermarket. Ask the students to research all the people and process required in the food system for that food, then collate the results as a class. When interpreting the results, ask students to make statements about the common roles, organisations and processes.
- Assign each student a career in a food industry job from the roles identified above (such as cheese maker or apple packer). Using a web tool like **Vocational Pathways**, students can find out what skills are required for that job and create a profile or job description for that role.
- Students can take on the role of different workers and discuss or debate food system issues from their place in the food system. Ideas for discussion and debate:
  - one step in the process chain is more important than all the others;
  - people will soon be unnecessary in a food system;
  - consumers should be allowed to buy only what is grown in their local area.

Investigate the role of animal welfare in the food system

- Many of the food systems studied will involve animals. Students can interview someone who works with animals in animal welfare, such as a farmer or vet, an SPCA staff member or MPI staff member, and get information on why animal welfare is important in the food supply chain.

Related resources

For information specific to New Zealand industry and animal welfare systems:

- Beef and Lamb New Zealand
- Dairy NZ
- Deer Industry New Zealand
- New Zealand Pork
- Egg Producers Federation of New Zealand
- Poultry Industry Association of New Zealand (PIANZ)
- Ministry for Primary Industries

Risk and Hazards in the food system

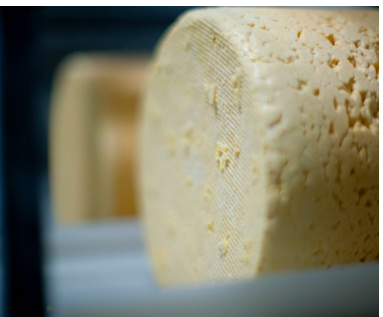
Any number of things can put our food system at risk. Students investigate how pathogenic microbes occur in, or can get into the food system. These pathogens can lead to spoilage or foodborne illness. Once the students have a basic understanding of how pathogens get onto food, they can explore ways this can be avoided or minimized during food production, processing, transport and storage. Keeping our food safe when moving it from one region to another or sending it to other countries adds more complexity to the food supply chain.

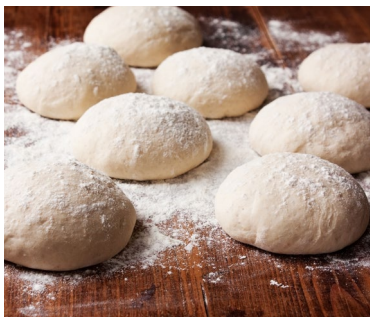
Teacher notes

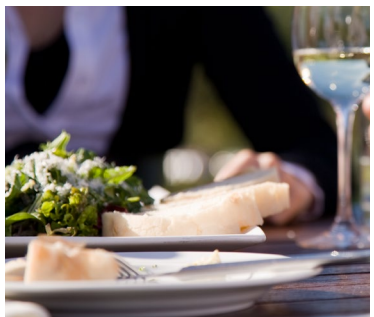
All food systems can be affected by pathogens such as viruses, fungi, and bacteria. They may be naturally on the raw food items or may be due to cross-contamination from direct human contact or a lack of cleanliness within the food system pathways.

The presence of pathogens or **spoilage organisms** can tip the balance of a food system. Food may not last through the food system when procedures that preserve and prevent contamination are not followed. Although often they cannot be seen, pathogenic microbes make people sick and we need to take precautions against them.

Students may be more familiar with the colloquial term “germs”. Encourage them to use the correct scientific terms to avoid confusion.







Some simple definitions:

Pathogens – any organism that can cause disease. Bacteria, viruses and fungi are all pathogens.

Bacteria – single cell microorganisms found everywhere, including on and in animals, plants, the air, soil and waters. They can reproduce on their own. Examples include *Campylobacter* and *Salmonella*.

Viruses – smaller than bacteria, viruses can’t reproduce themselves and need to get inside a host cell to be copied. Influenza and the common cold are caused by viruses. Examples from food include *Norovirus* and *Hepatitis*.

Fungi – there are many different types of fungi. Only some can be seen with the naked eye. Fungi feed on other organic matter. Examples include *Aspergillus* (the blue mould in bread and cheese), mushrooms and yeast. Some moulds produce aflatoxins that cause foodborne illness.

Pathogenic microbes

Help students investigate how pathogenic microbes occur in, or can get into the food system.

- Examine microbes that we cannot see with the naked eye. You can find examples online, such as: **Huffington Post article on viruses, Discover Magazine gallery of pathogens, National Geographic gallery of pathogens and Live Science gallery of fungi**. You could ask the students if they think the virus cells truly look like this, or if these are theoretical models.
- This activity on the website **Steve Spangler Science** encourages students to take samples of bacteria from their immediate environment (hands, phones, food, benches, dishcloths, and so on) and investigate which ones will grow and how quickly they grow in an agar-filled petri dish. (If you don’t have equipment such petri dishes available, try making your own sampling dish. For instructions, see **KaylaPins.com: DIY surface bacteria sampling dish**.) Please note: Before growing microorganisms in the classroom, you should refer to Section 3.2 of **Safety and Science in Schools**, produced by the New Zealand School Trustees Association.
- Make a simple yeast bread as a class to investigate how yeast, a single celled fungus, **makes bread rise**. Discuss with the class the **scientific processes** involved – how yeast requires sugar for its ‘food’ and releases carbon dioxide gas through respiration to make the food rise. You could also discuss the role that yeast and fermentation plays in relation to gluten.

Factors that affect bacterial growth

Students can investigate some of the conditions required for the growth of microbes – both pathogens and **spoilage organisms** – on food:

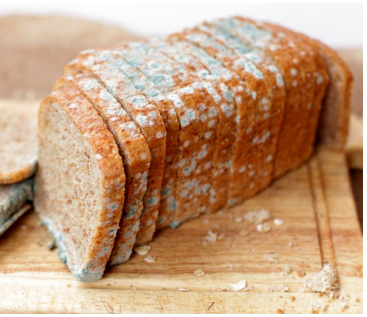
1. **Food:** Pathogens require food to survive. For this reason, moist, protein-rich foods are good potential sources of pathogenic bacterial growth. Create a class list of protein-rich foods and highlight those involved in any of the food systems you have studied. Then brainstorm how other, non-protein foods like leafy vegetables can carry pathogens.

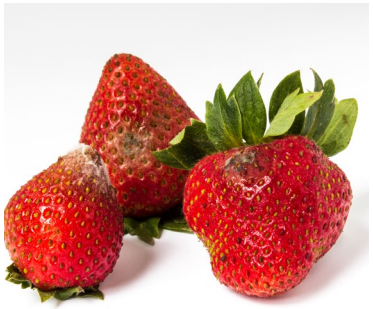
2. **pH levels in food:** Higher levels of acidity, i.e. a lower pH in a food, may make it less likely to promote the growth of pathogens. Students can test pH levels in a variety of foods and categorise them from most-likely to least-likely to be prone to growth of spoilage organisms or pathogens.

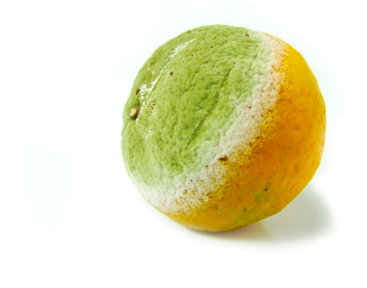
3. **Time and temperature:** Bacteria require temperature and time to grow. This **thermometer image** gives students an indication temperatures that will prevent food spoilage and/or prevent it from becoming unsafe. Ask students to create a **Quizlet** that will test the food spoilage and safety knowledge of friends and family.

4. **Oxygen:** Most spoilage bacteria, moulds, and yeast require oxygen to grow. Often this kind of food spoilage can be seen or smelt. Students can experiment with different foods and investigate how they spoil when left out in the air. They could then design packaging that minimises oxygen exposure.

5. **Moisture:** Moisture and humidity on the surface of food can encourage the growth of fungi, such as mould, and pathogenic bacteria. In addition, foods like lettuce that have



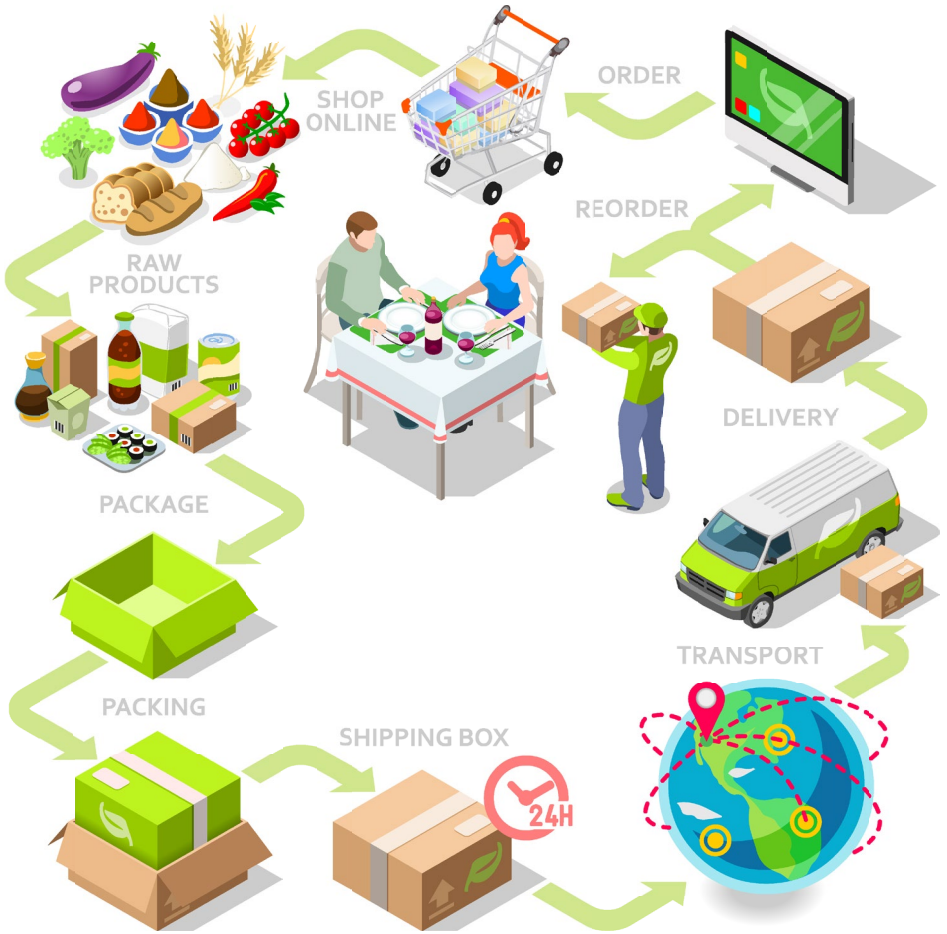




a high moisture content are also vulnerable to bacterial growth. Microorganisms use the water to dissolve the food they need, and then reuse the water to help the food get into bacterial, yeast and mould cells where it is used for energy and growth. Investigate the effects of moisture with a test of **how mould grows**.

Reducing risk in the national/international food supply chain

Encourage students to explore how food contamination (for example the presence of pathogenic microbes) is prevented when sending local produce to other regions and countries.



1. Choose some common but high-risk foods foods, for example, chicken, hummus, and salad. Using the list of favourable micro-organism growth conditions, examine each of these foods and have students predict the conditions, which increase the bacterial pathogens in these foods. Identify the point/s in each food's processing when contamination could occur.

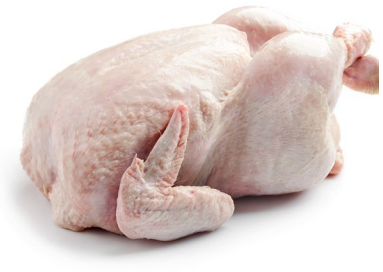
2. Selecting a New Zealand food system that involves exporting to other countries as a context, students examine all or part of it in more detail. Explore how risks are addressed and problems solved in the food supply chain. Examine how technologists and scientists use research and evidence to improve on and innovate on existing systems to enhance food safety and productivity. Guiding questions:

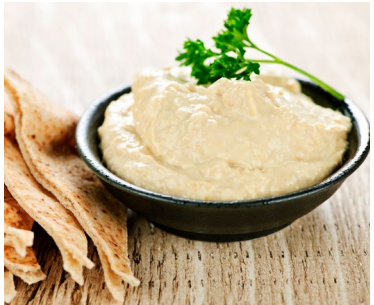
    - What kind of cleaning and sanitation happens on the farm or orchard that is the focus of your study?
    - What kinds of bacteria do producers and growers look out for? How could they affect their crops or be passed on to humans?
    - How do producers and growers reduce the potential for a spread of bacteria into the environment?

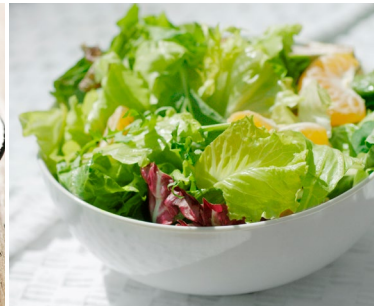
3. What methods are used to keep food fresher and safer for longer in the food system (for example, pasteurisation, irradiation, high pressure processing)?

4. Why are foods processed differently?

5. Are food safety precautions in the production of plants and the production of animals vastly different or are the principles the same?







Food preservation and production techniques

The reproduction rate of many bacterial pathogens means that the food we eat requires preservation. To keep the food fresh and safe between harvest and consumption, several techniques are used to keep bacteria and other microorganisms from growing.

1. Students investigate preservation methods including:
    - Changing the amount of moisture that is available in a food – Bacteria and other microorganisms need foods with a high moisture content to grow. Students can find foods at home or at the supermarket that are dried and/or packaged to keep out moisture. (Potato chips are one example.) They can experiment with fruit, making **fruit leather** through a dehydration process. They can then compare how well the fruit leathers are preserved compared with fresh fruit.

    - Adding preservatives – Preservatives are chemicals that prevent bacteria and other microorganisms growing. They can also act to improve the appearance, moisture content, and texture of food. Others, such as vinegar, are used to lower the pH of foods such as pickles, to make them last longer. To add a community connection to their learning, students could harvest fruit from their gardens or ask orchards, supermarkets or fruiterers for donated food to make chutneys, jams or pickles to donate to local food banks[1].

    - Controlling food temperatures – During processing, foods can be heat treated (pasteurisation, canning, boiling) to kill any microorganisms that are present in the raw ingredients. The foods may then be stored at cold temperatures (refrigeration or freezing) to control any further growth.

        - New Zealand has a strong history in refrigerated transport for food, and the development of what became known as freezing works. For more information, see **Tech History.co.nz**.

        - Investigate the work of scientists Louis Pasteur and Alice Catherine Evans, who developed the process of pasteurisation. Explore why the pasteurisation process was necessary and changes to food technology that have taken place in recent years. (Brief overview – **History of Pasteurisation**). For a chance to debate and write persuasively, students investigate arguments against pasteurisation and how it is used (or not used) in other countries, including New Zealand, where there is debate and **regulations** around the sale of raw milk.

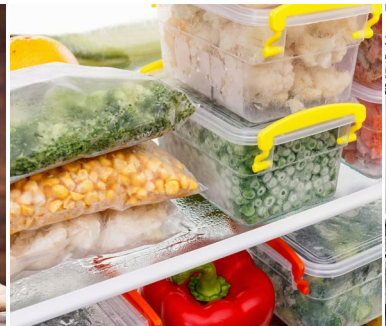
[1] Schools should ensure they comply with Food Act 2014 provisions when producing and selling food. Information can also be found on the MPI website www.mpi.govt.nz and in the following information source: What does the Food Act mean for me? Schools: http://www.mpi.govt.nz/document-vault/5260.

2. Use the multiple cultural perspectives of students in your class to explore traditional knowledge about safe food practices. Look at preparation, harvesting, storage and presentation.

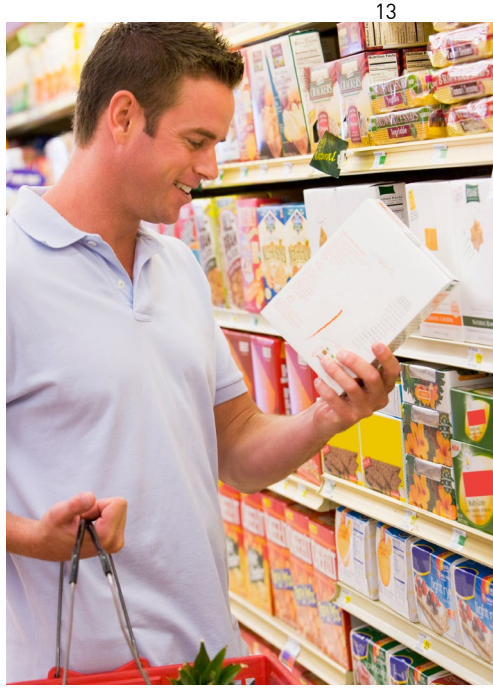
3. Compare and contrast different experiences and kinds of technologies used, and examine how traditional knowledge is still practised today. Include a Māori perspective.

4. Create an instant classroom display by posing these questions on your wall or whiteboard:
   - What does food mean to people?
   - What part does food play in sustaining cultural traditions and practices?
   - What tikanga are observed in relation to food?

5. Encourage students to add ideas when they are ready, discuss them at home, and ask anyone who visits your classroom to share their thinking.



Food retailing



When a trip to a local producer or processor is not possible, take the class to a supermarket to investigate how different foods are kept safe. What difference do you notice between local, national and international products? Students can design a supermarket department that is food safe:

1. Give each group of students a fresh food department of a supermarket. Challenge them to design a food-safe programme for their department.

2. Visit the local supermarket to interview department managers to get tips for keeping food safe.

3. Support each group to design their food-safe programme. Have them present it to the class.

4. After each group has presented their findings and ideas, appoint two store managers to work with the teams to develop a supermarket protocol for the whole store.

5. Remind students to think about how many hands the food may have passed through before it gets to the consumer, and what (if any) action needs to be taken to keep the food safe.

Food labelling

There are regulations for labelling food. Create a resource in the classroom by collecting food labels.

1. Explore why some food labelling is mandatory and how misunderstanding of food labelling could lead to increased food wastage.

2. Students design food packaging from natural or found materials to criteria co-constructed by the class. **A sample class activity** is available here. Packaging criteria could specify:
   - the food or group of foods to be packaged;
   - packaging that must be fit for purpose (transporting, preserving, storing and presenting);

- packaging that includes the mandatory labelling for that food.

4. Students investigate the international requirements for labelling products. Are there additional requirements for labelling of New Zealand products that are going to be sold in other countries?

5. Look again at the food labels you have collected. Is there any mention of the way animals were cared for listed on the product label?

For more information, see: **Ministry for Primary Industries: Food labelling**.

Food safety at home

Help students understand that all the precautions taken in the food production system will not help if food safety rules are not followed in the home. Introduce or remind students of the 3 Cs – clean, cook and chill. These are outlined in the Level 1-2 part of this resource and on **Ministry for Primary Industries: Tips for food safety**. Information can be integrated into home learning projects to spread the food safety message to whānau and have students follow good food handling practices in authentic contexts. Projects could include:

- Design take home packs to inform whānau about food safety.
- Make a TV Show – for example Master Chef, where the judges vote on the contestants' food safety choices, rather than their cooking; a documentary that follows one kind of food from the producer to your plate; or a Mythbusters show, where food safety myths are debunked by the presenters.
- Have a market stall at school or in the community. Accompany the food with written descriptions or drawn diagrams that show how safe the food is.

Related resource

Book 23: Fresh Food: How Food Keeps and Loses Its Freshness