# The Price of Bread

## LESSON PLAN

### Learning objectives strands 2–5
- Organisms affect, and are affected by, their environment
- Factors in the reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation, and dispersal.

### Learning objectives: strand 1 (HSW)
- Analyse data from a wide range of secondary sources, and use findings to provide evidence for scientific explanations.

### PLTS
- Team workers: carry out practical activities cooperatively.
- Independent enquirers: support conclusions using reasoned arguments and evidence.

### APP
- AF 2 – understanding the applications and implications of science.
- AF 3 – Communicating and collaborating in science.

## Starter

- **Farming** What do farmers need to grow successful crops? Students play a card-game ranking exercise.

- **Seed packet exercise** Look at the instructions on the packet, and begin to appreciate the weather conditions indicated on the packet for seed germination and growth.

## Differentiation

### Help
- Remove some words from the list.

### Extension
- Students add words to the list.

## Resources
- Teacher and technician notes
- Activity sheet 1
- Activity sheet 2

## Main

### April shower for wheat flour
- Students carry out a practical to investigate germination rates with different amounts of water. The experiment will need to run for about 4 days.
- Students analyse results by calculating germination rate and plotting a graph of the results.
- Students use books or the Internet to research germination (if time allows).

### Differentiation

#### Help
- Count out the seeds as this can be tricky. Provide a table template and a formula to calculate the percentage germination. Tell students to draw line graph; provide axes.

#### Extension
- Students plan their own volumes and a range of volumes. Provide little guidance about table layout, or how to calculate percentage germination. Ask students to justify choice of graph.

#### Help
- Direct students to a particular book or website; they produce labeled diagram of germination.

#### Extension
- Students produce a written report of the process of germination, using own research sites. Students should be able to indicate why water is needed for germination.

### Resources
- Teacher and Technician Notes
- Activity sheet 3
# The Price of Bread

## LESSON PLAN

### Plenary
- **The price of bread** Students calculate the cost of wheat under different conditions, and then the cost of bread.

### Differentiation
- **Help**
  - Take the students through the stages of each calculation.
- **Extension:**
  - Do not provide any guidance about method and do not allow use of calculators.

### Resources
- Teacher and Technician Notes
- Activity sheet 4

### Homework
- **Crop consequences** Students complete Activity sheet 5. They can discuss positive or negative, or both, changes in the weather conditions and the impacts these changes will have on the food industry.

### Learning outcomes

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make observations and measurements and vary one factor while keeping others the same. Record data using tables and bar charts.</td>
<td>Relate conclusions to patterns in data, including graphs and scientific knowledge and understanding. Describe some processes and phenomena related to organisms.</td>
<td>Use line graphs to present data, interpret numerical data and draw conclusions. Analyse findings to draw scientific conclusions consistent with the evidence. Apply and use knowledge and understanding in familiar contexts.</td>
<td>Communicate qualitative and quantitative data effectively, using scientific conventions and terminology. Draw conclusions using scientific knowledge and understanding and account for any inconsistencies in the evidence.</td>
<td>Use quantitative relationships between variables. Describe a wide range of processes and phenomena related to organisms. Make links between different areas of science in explanations. Apply and use more abstract knowledge and understanding in a range of contexts.</td>
</tr>
</tbody>
</table>
The Price of Bread

In this lesson students consider the conditions needed to germinate and successfully grow a crop. They will begin to link this to the weather conditions in the seasons when seeds germinate.

Students will then investigate the best rainfall conditions needed for successful germination. They will extend their thinking to consider the effects of droughts and floods on the productivity and ultimately the cost of some foods.

<table>
<thead>
<tr>
<th>Equipment required per group:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter</strong></td>
</tr>
<tr>
<td>• <strong>Activity sheet 1</strong> One per group, cut into packs of cards.</td>
</tr>
<tr>
<td>• <strong>Activity sheet 2</strong> One per group, or a selection of empty seed packets.</td>
</tr>
<tr>
<td><strong>Main</strong></td>
</tr>
<tr>
<td>• <strong>Activity sheet 3</strong></td>
</tr>
<tr>
<td>• Seven 150 ml beakers</td>
</tr>
<tr>
<td>• Seven cotton wool pads</td>
</tr>
<tr>
<td>• At least 140 cress seeds</td>
</tr>
<tr>
<td>• Cling film</td>
</tr>
<tr>
<td>• Labels/label pens</td>
</tr>
<tr>
<td>• 10 ml measuring cylinder</td>
</tr>
</tbody>
</table>

Different brands of cotton wool pads absorb different amounts of water, thus affecting the range of germination rates. The aim is that the largest water volume should flood the pad, and no germination should occur.

<table>
<thead>
<tr>
<th>Health and Safety notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Students should take care not to spill the water.</td>
</tr>
</tbody>
</table>

**Starter**

1. **Old MacDonald’s successful farm** Students use a card game to discover what farmers need to grow successful crops. Copy **Activity sheet 1** and cut into sets of playing cards. Issue the packs of cards to groups of 3 or 4 students.
   a. Students discuss the ideas on the cards, in terms of importance to growing crops.
   b. Sort the cards into two groups – those that are needed for successful crop growth, and those that are not needed.
   c. Now take the cards needed for growing crops, and rank them in order of most important to least important.
   d. Ask the groups to name one or two of their top cards, and to justify their decisions.

2. **Seed packet exercise** Students look at the instructions on the packet, and begin to appreciate the weather conditions indicated on the packet for seed germination and growth. They consider the following questions:
   a. Why do you have the instructions on this packet of seeds?
   b. Why don't the seeds grow in the packet?
   c. What would be the best weather for successful germination of the seeds?
   d. Why does it indicate what months to sow the seeds?
Main

**Practical – investigating the best world climate for growing crops**

Students work in small groups to carry out the investigation, planting cress seeds in a variety of different water levels. Students follow the method on *Activity sheet 3*.

- The low water levels will all be absorbed by the cotton wool pad, and produce zero germination.
- The middle values will produce high germination rates approaching 100%.
- The high levels of water will more than cover the cotton wool pad, and the seeds, or they will float. There will probably be low or zero germination.

The experiment will take 2–4 days to run; you may wish to prepare a set in advance.

Students record the results in a table of their own design. This may need some direction, depending on the class ability; see guidance in the lesson plan.

Finally students work through the questions on *Activity sheet 3*.

**Answers to practical questions**

1. Suitable graph.
2. Low levels of water result in low germination rates; medium water levels have good germination rates; high water levels have low germination again. Thus moderate water levels of water are best for germination.
3. The water represents rainfall.
4. The best condition for germination is a moderate rainfall; not too little, not too high.
5. Spring, because the rainfall is appropriate.
6. Good locations: temperate climate countries, for example, Europe, North America.
   Bad locations: areas with a dry climate, for example, desert regions, Africa, or tundra where water freezes, for example, Russian steps, Canadian wastes.
7. It would not show that the middle values of water are highest and then you could not draw a conclusion.
8. Yes; 20 seeds give a good range of germination figures with plenty of repeats.
   No; not enough of a range in the data – more seeds would generate a range.
9. Cannot test two variables at the same time, as we need to tell the effect of one variable independent of the second. Also difficult to have a range of temperatures.

**Plenary**

Students complete *Activity sheet 4*, calculating the cost of wheat under different conditions and then the cost of bread. This could be extended by discussing the link between the weather and crops; at most times of the year there will be some issue, for example, cold winters increase the cost of winter vegetables; dry summers reduce the supply of wheat or summer fruit and vegetables.

**Answers**

1. £211.33
2. £240.00
3. 11p
4. 12p
5. Factors include transport cost of wheat from different countries, fuel costs increasing, increase in wages, more intermediates, each making a profit as the grain is sold.
ACTIVITY SHEET 1

The Price of Bread

What do you need to grow successful crops?

1. Each group in the class gets a set of playing cards.
2. Cut out the cards below.
3. Discuss the ideas on the cards, thinking about their importance to growing crops.
4. Sort the cards into two groups – those that contain things that are needed for successful crop growth, and those that are not needed.
5. Now take the cards that contain things needed for growing crops, and rank the cards in order from the most important to the less important.

<table>
<thead>
<tr>
<th>Warm temperature</th>
<th>Cold temperature</th>
<th>Hot temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vet</td>
<td>Tractors</td>
<td>Hedges</td>
</tr>
<tr>
<td>High rainfall</td>
<td>Low rainfall</td>
<td>Medium rainfall</td>
</tr>
<tr>
<td>Sandy soils</td>
<td>Electric fences</td>
<td>Mineral-rich soil</td>
</tr>
<tr>
<td>Earthworms</td>
<td>Sheep dog</td>
<td>Quad bike</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>Large work force</td>
<td>Air-conditioned barn</td>
</tr>
</tbody>
</table>
Instructions on a seed packet

1. Why do you have the instructions on this packet of seeds?
2. Why don’t the seeds grow in the packet?
3. What would be the best weather conditions for successful germination of the seeds?
4. Why does it indicate the months in which to sow the seeds?

SOWING AND GROWING
Sow the seeds Jan-Apr in trays indoors or in a greenhouse at approx. 15-20°C (60-68°F) onto firmed quality compost and cober lightly. Transplant resulting seedling 5cm (2”) apart in trays and grow on prior to planting 15-20 cm (6-8”) apart in mid-late May. Alternatively sow direct into finely raked, moist, warm soil 6mm (1/4”) deep in Apr-May. Suitable for dry and well drained soil mixed with sand and stones. Final outcome will vary.
Investigating the best world climate for growing crops

The weather is a key factor in growing crops successfully. There are some areas in the world with climates that do not favour seed growth. The aim of this investigation is to find out whether the amount of rainfall in an area will affect successful germination of the seeds in a crop.

Equipment

Per group:
- 7 beakers
- cotton wool pads
- measuring cylinder
- cress seeds
- cling film

Method

1. Label 7 beakers with your group name, the date, and the volume of water; the volumes are 0 cm³, 1 cm³, 2 cm³, 4 cm³, 8 cm³, 16 cm³, 32 cm³
2. Place a cotton wool pad in each beaker.
3. Measure the correct volume of water with a measuring cylinder, and pour over the cotton wool pad in the beaker.
4. Carefully count out 20 cress seeds, and sprinkle them over the pad (ensure they are reasonably spaced out).
5. Repeat for each beaker.
6. Cover the top of the beaker with a piece of cling film.
7. Leave all the beakers on a window sill for up to four days.
8. Observe and count the number of seeds that have germinated.
9. Calculate the percentage germination rates.
10. Record your observations and results in a table.

Analysing your findings

1. Plot a suitable graph of your percentage germination rates.

Once you have recorded your results, consider the following points in your groups:

2. Describe the relationship you have recorded between amount of water and germination rates.
3. What does the water content model in this experiment?
4. What does this experiment tell you about the best weather for planting crops?
5. What time of year would be best for planting?
6. Can you suggest good locations and bad locations in the world for planting crops?
7. Why would a straight line of best fit not be appropriate on your graph?
8. Looking at your results, do you think that 20 seeds have provided enough data? Give a reason for your answer.
9. Why did you not test temperature at the same time?
The Price of Bread

The cost of bread is affected by the yield of wheat. This is affected by how successful germination is with the farmers.

Wheat yield

The weather affects the germination rates, which affects the wheat yield.

1. In a good year, the germination rate can be as high as 90%, which will yield an average of 6 tonnes of wheat per hectare. The sale of the wheat harvest will give the farmer an income of £1268.00 per hectare.

   What would be the sale cost of one ton of wheat?

   Cost = £________

2. In a bad year, the yield might fall as low as 3.5 tonnes per hectare. There is now less wheat, which will result in a higher cost per ton. The farmer will sell the wheat for £840.00 per hectare.

   What is the cost of a ton of wheat?

   Cost = £________

Price of bread

1 tonne of wheat will produce 2000 loaves of bread.

3. In a good year what would be the cost of the wheat in one loaf of bread?

   Cost = _______p

4. In a bad year what would be the cost of the wheat in one loaf of bread?

   Cost = _______p

5. In 2010 the Daily Telegraph reported that bread prices were set to increase by up to 10 p per loaf due to grain shortages. This increase cannot be due to the change in the cost of wheat. Can you suggest any reason that there might have been such a sharp rise in the price of bread?

   ____________________________________________
   ____________________________________________
   ____________________________________________
Crop consequences

1. In the first row insert in each box a weather factor you think is important for successful crop growth.
2. In the second row write a statement to describe the consequence of a change in that factor (positive or negative), and explain the reason(s) for that consequence.
3. In the final box describe and explain what the impact of these changes would be on the food production industry.