**ACTIVITY: Pollination – three-level reading guide**

**Activity idea**

In this activity, students read about the pollination using a three-level reading guide and use their ability to locate information to interpret the scientific information. Students apply their understanding of this information to its implications for the horticulture industry.

By the end of this activity, students should be able to:

* locate information in the text
* interpret what the author means
* apply the information.

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**Introduction**

A three-level reading guide supports students to locate information in a text, interpret what the author means and then apply the information.

* Using a three-level reading guide leads students to first focus on the actual information in the text (level 1).
* Next, they think through the information, making links between ideas and interpreting the author’s intent and thoughts (level 2).
* Finally, they consider the implications of the ideas, making generalisations and critically evaluating the arguments (level 3).

An effective approach to this strategy is for students to consider the three levels individually and then to discuss their responses with a partner so that they can discuss and check closely with the text.

A three-level reading guide should be used as an activity to generate discussion among your students. It provides a structured strategy for students to give their views and justify what they say by referring back to the text. For this reason, this strategy is not appropriate for use as a homework exercise or test.

**What you need**

* Copies of the student handout [Reading about pollination](#Handout)

**What to do**

1. Hand out copies the student handout [Reading about pollination](#Handout)
2. Give students the opportunity to answer the questions.
3. Have students compare and discuss their responses with a partner.
4. As a class, discuss student responses to question 7 to develop a well reasoned scientifically based argument on the importance of knowledge of pollination to the horticulture industry. Students could be encouraged to prepare a response using: “I think knowledge of pollination is important to a grower because….”

**Student handout: Reading about pollination**

Read the article Pollination and answer the following questions.

***Reading on the lines***

When reading ‘on’ the lines, you use/select factual statements from the text.

1. List two ways male pollen cells are moved to the female part of flowers.
2. List some important human foods that are seeds.
3. What fruit crops are not getting pollinated enough?

***Reading between the lines***

When reading ‘between’ the lines, you use ideas that are suggested by the text.

1. What is the difference between self-pollination and cross-pollination?
2. Why does pollination have to happen before seeds can be made?
3. Why are flowers all sorts of different shapes, styles, scents and colours?

***Reading beyond the lines***

When reading ‘beyond’ the lines, you link ideas that are either suggested in the text and/or from your own understanding of the topic.

1. Why is knowing about the pollination process important for the New Zealand horticulture industry?

**Pollination**

Flowers are not on plants just to make them look pretty. They are there as a vital part of a flowering plant’s life cycle. Not all plants have flowers, and you can find out what flowering plants are and how they are different to other plants.

Flowering plants create seeds, which get spread away from the parents and grow into new plants in new places. These seeds are part of the sexual reproduction of flowering plants. In this process, male cells combine with female cells, either on the same plant, leading to self-pollination, or between two plants of the same species, called cross-pollination.

Flowers have male and female structures, and it is the process of pollination that transfers [pollen](http://sciencelearn.org.nz/About-this-site/Glossary/pollen) from the male part to the female part. After pollination, pollen releases a male [gamete](http://sciencelearn.org.nz/About-this-site/Glossary/gamete) that fertilises a female gamete in the [ovule](http://sciencelearn.org.nz/About-this-site/Glossary/ovule) and mixes their [genetic](http://sciencelearn.org.nz/About-this-site/Glossary/genetic) material. After this [fertilisation](http://sciencelearn.org.nz/About-this-site/Glossary/fertilisation), the ovule grows to form a [seed](http://sciencelearn.org.nz/About-this-site/Glossary/seed).

Pollination has to happen before seeds can be made, so flowers have a range of ways to make sure it does. The male pollen cannot move to the female part of a flower on its own, so wind and animals are used to carry it instead. All the colours, shapes, sizes and smells of flowers are their ways of making it easy for the wind or animals to pick up and carry the pollen to the right female flower part.

**Pollination in New Zealand ecosystems**

Some flowers have such specialised structures that they can only be pollinated by a certain species of insect, bird or mammal. This is fine when an ecosystem is healthy, but if numbers of pollinators decline, this can have a knock-on effect on the plants and the ecosystem. Some of the research New Zealand scientists are doing is to investigate the effect the decline of native birds has on flowers that rely on them for pollination.

**Fruit crops and pollination**

Seeds are an important human food. Beans, lentils, peas, rice, nuts, sweetcorn, wheat, soybean and many other foods are all seeds. Many flowers also produce fruit to protect their seeds, and we eat these too. Apples, oranges, apricots, grapes, cucumbers, tomatoes and pumpkins and many more are fruit. As eaters, we call some of them vegetables, but to a botanist, they are all fruit.

A flower must be pollinated before it can make these seeds and fruit, and in some cases, more pollination means more seeds, which means bigger fruit. It seems that some fruit crops, such as kiwifruit and avocados, are not getting pollinated enough. Find out more by reading [Kiwifruit pollination problems](https://www.sciencelearn.org.nz/resources/72-kiwifruit-pollination-problems) and [Avocado pollination](https://www.sciencelearn.org.nz/resources/73-avocado-pollination).

You’ll also need to find out about honey bees – the main pollinators of many cultivated food crops. In the case of kiwifruit, artificial pollination is often used to ensure good crops. Find out about the RoboBee that is being developed to improve artificial pollination in the video [RoboBee](https://www.sciencelearn.org.nz/videos/17-robobee).

Adapted from [Pollination – introduction](https://www.sciencelearn.org.nz/resources/1156-pollination-introduction).

**Reading about pollination – answers**

1. List two ways male pollen cells are moved to the female part of flowers.

*By wind and by animals.*

1. List some important human foods that are seeds.

*Beans, rice, wheat, nuts, apples, pumpkins, tomatoes.*

1. What fruit crops are not getting pollinated enough?

*Kiwifruit and avocado.*

1. What is the difference between self-pollination and cross-pollination?

*Self-pollination is where male and female cells on the same plant pollinate each other. Cross-pollination is where male cells of the same species pollinate the female cells of the same plant species but on a different individual plant.*

1. Why does pollination have to happen before seeds can be made?

*Pollination brings the male cell to the female cell of the flower and leads to fertilisation of the female gamete or ovule by the male gamete released from the pollen grain. If this does not occur, the female gamete will not be fertilised, so no seed will be produced*

1. Why are flowers all sorts of different shapes, styles and colours?

*Flowers are different shapes sizes and colours to assist in the spread of pollen from one plant to another by wind or animals. Some insects are attracted to white flowers or specific scents. Wind-pollinated flowers have different shapes of male and female parts to make sure they can release and catch the pollen efficiently.*

1. Why is knowing about the pollination process important for the New Zealand horticulture industry?

*A sample response might include the following ideas:*

*The horticulture industry is dependent on seeds and fruits for many of the crops and products. If the flowers are not pollinated, the fruits will not be produced. Understanding whether a plant is dependent on animals such as bees for pollination or is dependent on wind for pollination will mean a grower can assist the pollination process by using a technological approach. A grower might bring beehives into the crop when it is flowering to ensure there are plenty of bees around to pollinate the flowers – this is sometimes used in greenhouses. A grower could also use mechanical devices to blow pollen around.*