

Australian cotton plant adaptations

For year 5 stage 3

Teacher lesson plan



Curriculum links

Science / Year 5 / Science Understanding / Biological sciences / ACSSU043

Living things have structural features and adaptations that help them to survive in their environment (ACSSU043)

Elaborations

- explaining how particular adaptations help survival such as nocturnal behaviour, silvery coloured leaves of dune plants
- describing and listing adaptations of living things suited for particular Australian environments
- exploring general adaptations for particular environments such as adaptations that aid water conservation in deserts

Students will

- explore what makes a cotton plant suited to a particular environment;
- explore a cotton plant to investigate adaptations that improve their chance of survival and what makes it suitable to particular environments;
- explore strategies that cotton plants have developed to deal with temporary or seasonal changes to physical conditions of their habitat; and
- explore structural and internal/behavioural adaptations cotton plants make.

Resources required

- 1 copy per student of the 'Australian cotton plant adaptations' student text and 'Australian cotton plant adaptations' student worksheet
- Interactive white board (IWB)
- IWB cotton plant adaptations sorting activity Notebook file (<http://tinyurl.com/lk5zvjt>).
 - Also available in PowerPoint (<http://tinyurl.com/mtzmu2k>)

Timing

This lesson will take 40-50 mins. The lesson sequence and timing is on page 3.



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Assessment

Teachers may choose to use this activity to contribute to an assessment. If assessment is used, these activities will set the students up well to be evaluated on the extent to which they:

- describe ways in which a plant has adapted that make it suited to its environment
- describe adaptations as a structural feature, internal function or behaviour in response to coping with an extreme environment
- link an adaptation to its function (purpose)

Literacy considerations

This lesson could involve technical vocabulary that may not form part of student prior knowledge.

The key in the student worksheet is designed to scaffold learners' comprehension skills by being explicit about the strategies required to decode the text. An explanation of the key is below.



Here questions (sometimes referred to as literal comprehension questions) can be answered directly and explicitly from the text.



Hidden questions require students to hunt through the text looking for clues to give you information that may be 'hidden'.



Head questions require students to take the information in the text, add it to what you already know and come up with new information! These questions require students to make inferences which require more than a literal understanding. Students may initially have a difficult time answering inference questions because the answers are based on material that is in the text but not explicitly stated. An inference involves students combining their literal understanding of the text with their own knowledge and intuitions.



Heart questions require students to identify feelings that can be found in the text and make inferences as to why they are experiencing those feelings. These types of questions may also require students to make a personal response. They require them to respond with their own feelings for the text and the subject which are not found in the text. Although responses cannot be incorrect, they must relate to the content of the text and reflect a literal understanding of the material.

you may consider ways of scaffolding learners such as appropriate partnering, think/pair/share or cooperative learning.




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Suggested lesson timing

	Grouping	Activity
2 mins	WG	Ask students what they know about cotton. Explain that in today's lesson they will explore the adaptations of a cotton plant that have occurred to enable it to survive and grow in the Australian climate.
3 mins	WG	Pre-teach vocabulary from the 'Australian Cotton Plant Adaptations' student text.
20 mins	WG then I or CLG	Ask students to read the 'Australian cotton plant adaptations' text and follow the instructions to complete the 'Australian Cotton Plant Adaptations student worksheet'. Explain the key on the student's worksheet.
10 mins	WG or CLG	Allow time to discuss answers from the group.
10 mins	WG	To consolidate learning, complete the IWB cotton adaptations sorting activity.
5 mins	WG or CLG	Reflect on what makes the cotton plant suitable for the Australian climate and environment.
Total time required: 40 minutes		

Key

WG = whole Group

I = Independent

CLG = consider strategies to scaffold learners including think-pair-share, appropriate scaffolding or collaborative learning groups.



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Background information

Structural adaptations

Structural adaptations refer to the special body parts of an organism that help it to survive in its natural habitat; for example, its skin colour, shape and body covering. Plants also have structural adaptations that help them to survive in a habitat. They may have fuzzy or hairy leaf surfaces to reduce moisture loss, deep or shallow roots or waxy or shiny, reflective leaves.

Behavioural adaptations

Behavioural adaptations are ways in which a particular organism behaves in order to survive in its natural habitat. Behavioural adaptations can be instinctive or they can be learned. Instinctive behaviour is a behaviour pattern that the organism naturally follows. A plant living for more than one season (perennial) or living for just one season (annual) is a type of plant behaviour. A plant may also keep its leaf pores closed during the heat of the day and open them at night when the air temperature is cool and the evaporation rate is low.

Internal adaptations

Internal (or physiological or functional adaptations) refer to the working of an organism's body. These adaptations relate to the general functioning of the body. The way a plant processes food or the performance of certain biochemical reactions such as being able to keep a constant body temperature are examples of adaptations that help an organism to survive in their particular habitat. Plants may also have physiological features such as accumulating water and self-pruning in order to survive in a particular habitat.

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AUSTRALIAN COTTON PLANT ADAPTATIONS

STUDENT TEXT

BY SOPHIE DAVIDSON



Jump on board and explore the fascinating adaptations of the Australian cotton plant. We will look specifically at its structural and internal/ behavioural adaptations and become familiar with the plant physiology.

Gossypium is the word used to describe the 40 different species of cotton plants. Species of Gossypium have adapted to live in countries all over the world including, Australia, Africa and Mexico.

Their differences are a result of adaptations they have made over a long period of time in order to be able to live in their diverse environments be that cold, hot, arid or tropical.

There is much diversity in the cotton plant family much like there is among humans. Like us, cotton plant varieties have different appearance, what's going on inside of them varies and they behave differently in the same circumstances.

There are structural adaptations which are the physical changes that occur over many generations to help it survive in its habitat. They comprise anything that relates to its physical appearance such as the colour and shape and covering of its parts like the leaves, flowers and roots.

The variations in Gossypium also include internal adaptations and behavioural adaptations – ones we can't necessarily see but they are changes the plant has been able to make to how it functions internally which affect its ability to process food, to grow and develop, cope with extreme temperatures and weather events for example.

In Australia, cotton is grown by around 1,200 cotton families stretching from Emerald in the north of Queensland to the Victorian/NSW border. Australian farmers proudly grow the highest yielding, finest quality cottons in the world with less water, less chemicals and healthier soils than ever before. The varieties of cotton grown in Australia are especially bred for Australian conditions.



AUSTRALIAN COTTON PLANT ADAPTATIONS

STUDENT TEXT



Compared with most plants grown as commercial crops, cotton adapts quite well to adverse climatic and environmental challenges like drought, heat, inadequate sunlight, salinity (salt), or too much water. Its hardiness is one of the reasons it can be grown in Australia. It first grew in the desert.

One of the adaptations of the cotton plant that allow it to live in Australia is the seed. The cotton seed has evolved to contain just enough carbohydrates to produce the first root and the first two leaves (called the cotyledons). It is quite self-sufficient needing then only moisture, warmth and sunlight to germinate.

The leaves are one of the most fascinating parts of the cotton plant and they have many functions. They regulate the plant's temperature, convert sunlight to food and protect the plant from insects. Cotton leaves have a shiny, waxy surface area. This helps to regulate water loss. Throughout the 160 days from planting to harvest, the cotton plant constantly grows new leaves.

This is because the new leaves are more efficient than the old ones. Cotton plant leaves have a large surface area which allows the plant to maximise its exposure to light.

The cotton plant has evolved to be able to protect itself, somewhat, from pest insects. Cotton leaves have evolved to have hairy surfaces. The hair protects the plants from insects as some don't like laying their eggs in uncomfortably stubbly places! Another adaptation to the leaf and

also the stem is that they contain a chemical called gossypol which is unpleasant for the insects to eat and deters them from feasting on the plant

The leaves of the cotton plant also help it to adapt to temperature extremes. The hair on the leaf creates a microclimate which protects the plant from extremes of heat and cold. If the plant gets too hot, the leaf allows the plant to sweat. The cells on the plant surface, called a stomata, open and draw up water from the soil via the roots.



AUSTRALIAN COTTON PLANT ADAPTATIONS

STUDENT TEXT



This water is then released through the leaves to cool the plant. The leaves will also droop when the plant is hot and water stressed to try to minimise exposure to the sun.

In Australia scientists even found a way to speed up the cotton plant's evolution to respond to challenges. A soil borne bacterium called *Bacillus Thuringiensis* (BT) was identified and a process was used to transfer the BT gene into the cotton seed. The BT gene manifests itself in the cotton leaf so when a caterpillar named *helicoverpa* eats the cotton leaf, there is a reaction in the *helicoverpa*'s guts and it dies. This is a man-engineered adaptation.



This cotton is referred to as transgenic or genetically modified cotton.

The roots on a cotton plant can grow very deep and wide to access water.

If the climate is too extreme, the plant's survival behaviours kick in. The plant will drop or 'shed' the flowers or small bolls during and after periods of stress if it has inadequate resources like moisture, light, nutrients or carbohydrates or after weather events like flood and water logging. It can bounce back after difficult events by shedding flowers or bolls. The cotton plant will redirect its energy from producing more new babies (bolls and seeds) to conserving its current babies.

The energy it saves from shedding the flowers and small bolls is redirected to supporting the remaining leaves, branches, roots and fruit. Also as the reproductive structures develop, the vegetative and root growth slows so that the plant can supply resources to the developing fruit.

Finally the plant has lots of ways to look after its babies. If it needs to, the plant can move nutrients around from one area to another to support developing fruit.





What is the function of the cotton lint you might ask? For the cotton plant, the lint is the least important structural feature. It exists to cushion the seeds for when they fall off to allow them to regrow (which we don't allow them to do when we farm cotton in Australia). Farmers have many techniques to 'trick' the cotton into producing lint. We also have a scientific breeding program developing seed varieties with high lint yields. This combination of management practices and breeding of seed varieties mean that we have cotton yields that are three times the world average.



Australian cotton plant adaptations



Student worksheet


Worksheet Purpose

To be better able to meet the outcomes of your lesson or unit and improve student engagement with the Australian cotton story video content.


Key  = here  = hidden  = head  = head



1 In your own words, describe a structural adaptation  

2 In your own words, describe what is an internal and behavioural adaptation  

3 What is the botanical name of the family to which the cotton plant belongs? 

4 Circle the most correct response. Pest insects are:

- A Insects that occur in the cotton crop in enough numbers to damage the crop and reduce the yield
- B Irritating bugs 
- C Any insect found in a cotton crop

5 Complete this table  

cotton plant structural adaptations

Australian cotton plant adaptations

Student worksheet

Key



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6

Complete this table



cotton plant internal & behavioural adaptations

7

What would be your response to the comment 'Cotton is not suitable to Australian conditions'. Justify your response.



8

Complete one of these sentences:

A. Information that was familiar to me already in this text was

B. In my opinion, the most clever adaptation of the cotton plant is

C. What surprised me about this text is

