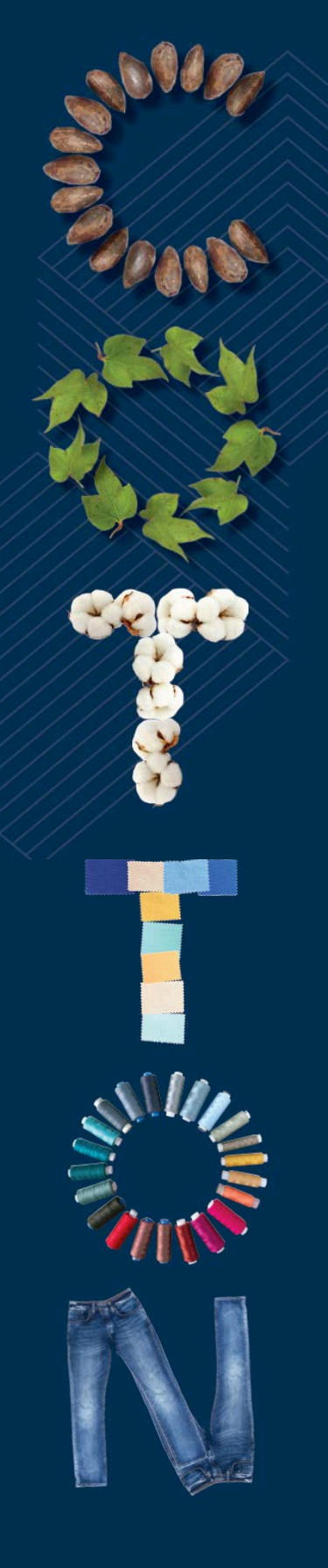


Growing Cotton

in the Classroom



Practical Investigation
Years F - 6
Design and Technologies,
Science & Science Inquiry



COTTON
AUSTRALIA

Primary Industries Education
Foundation Australia



Growing Cotton in the Classroom

Overview

Lesson Objective

Students observe the characteristics of cotton seeds and conduct an investigation over a number of weeks, enabling them to pose questions, make predictions and observations, record measurements, communicate findings, and reflect on the development of cotton seeds into plants. This lesson is differentiated to allow students of varying abilities and different year bands to conduct appropriate investigations.

Lesson Overview

Activity 3.1 – Cotton Seeds (30 mins)

Activity 3.2 – Planning an Investigation (30 mins)

Activity 3.3 – **Observing, Recording, and Summarising Results** (30 mins + 15 mins per observation session)

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ATTRIBUTION, CREDIT & SHARING



This resource was produced by Primary Industries Education Foundation Australia (PIEFA) in collaboration with Cotton Australia. Primary Industries Education Foundation Australia's resources support and facilitate effective teaching and learning about Australia's food and fibre industries. We are grateful for the support of our industry and member organisations for assisting in our research efforts and providing industry-specific information and imagery to benefit the development and accuracy of this educational resource.



While reasonable efforts have been made to ensure that the contents of this educational resource are factually correct, PIEFA, and Cotton Australia do not accept responsibility for the accuracy or completeness of the contents and shall not be liable for any loss or damage that may be occasioned directly or indirectly from using, or reliance on, the contents of this educational resource.



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Growing Cotton in the Classroom

Overview



Australian Curriculum Content Year F – 6

Design and Technologies

- Explore how plants and animals are grown for food, clothing and shelter. (AC9TDE2K03)
- Describe the ways of producing food and fibre (AC9TDE4K03)
- Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments (AC9TDE6K01)
- Explain how and why food and fibre are produced in managed environments (AC9TDE6K03)

Science

- Observe external features of plants and animals and describe ways they can be grouped based on these features (AC9SFU01)
- Identify the basic needs of plants and animals, including air, water, food or shelter, and describe how the places they live meet those needs. (AC9S1U01)
- Compare the observable properties of soils, rocks and minerals and investigate why they are important Earth resource (AC9S3U02)
- Examine how particular structural features and behaviours of living things enable their survival in specific habitats (AC9S5U01)
- Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01)

Science inquiry

- Pose questions and make predictions based on experiences (AC9SFI01)
- Engage in investigations safely and make observations using their senses. (AC9SFI02)
- Represent observations in provided templates and identify patterns with guidance (AC9SFI03)
- Compare observations with predictions with guidance (AC9SFI04)
- Share questions, predictions, observations and ideas with others (AC9SFI05)
- Pose questions to explore observed simple patterns and relationships and make predictions based on experiences (AC9SII01)
- Suggest and follow safe procedures to investigate questions and test predictions. (AC9SII02)
- Make and record observations, including informal measurements, using digital tools as appropriate. (AC9SII03)
- Sort and order data and information and represent patterns, including with provided tables and visual or physical models (AC9SII04)
- Compare observations with predictions and others' observations, consider if investigations are fair and identify further questions with guidance (AC9SII05)
- Write and create texts to communicate observations, findings and ideas, using everyday and scientific vocabulary (AC9SII06)

Growing Cotton in the Classroom

Overview

Science inquiry (cont.)

- Pose questions to explore observed simple patterns and relationships and make predictions based on experiences (AC9S2I01)
- Make and record observations, including informal measurements, using digital tools as appropriate (AC9S2I03)
- Sort and order data and information and represent patterns, including with provided tables and visual or physical models (AC9S2I04)
- Compare observations with predictions and others' observations, consider if investigations are fair and identify further questions with guidance (AC9S2I05)
- Write and create texts to communicate observations, findings and ideas, using everyday and scientific vocabulary (AC9S2I06)
- Pose questions to explore observed patterns and relationships and make predictions based on observations (AC9S3I01)
- Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment (AC9S3I02)
- Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (AC9S3I03)
- Construct and use representations, including tables, simple column graphs and visual or physical models, to organise data and information, show simple relationships and identify patterns (AC9S3I04)
- Compare findings with those of others, consider if investigations were fair, identify questions for further investigation and draw conclusions (AC9S3I05)
- Write and create texts to communicate findings and ideas for identified purposes and audiences, using scientific vocabulary and digital tools as appropriate (AC9S3I06)
- Pose questions to explore observed patterns and relationships and make predictions based on observations (AC9S4I01)
- Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment (AC9S4I02)
- Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (AC9S4I03)
- Construct and use representations, including tables, simple column graphs and visual or physical models, to organise data and information, show simple relationships and identify patterns (AC9S4I04)
- Compare findings with those of others, consider if investigations were fair, identify questions for further investigation and draw conclusions (AC9S4I05)
- Write and create texts to communicate findings and ideas for identified purposes and audiences, using scientific vocabulary and digital tools as appropriate (AC9S4I06)



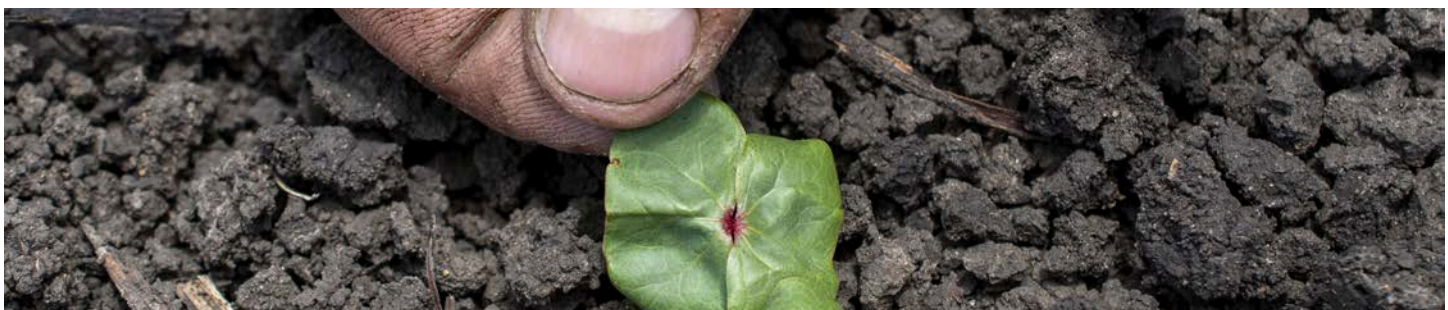
Growing Cotton in the Classroom

Overview



Science inquiry (cont.)

- Pose investigable questions to identify patterns and test relationships and make reasoned predictions (AC9S5I01)
 - Plan and conduct repeatable investigations to answer questions, including, as appropriate, deciding the variables to be changed, measured and controlled in fair tests; describing potential risks; planning for the safe use of equipment and materials; and identifying required permissions to conduct investigations on Country/Place (AC9S5I02)
 - Use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate (AC9S5I03)
 - Construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships (AC9S5I04)
 - Compare methods and findings with those of others, recognise possible sources of error, pose questions for further investigation and select evidence to draw reasoned conclusions (AC9S5I05)
 - Write and create texts to communicate ideas and findings for specific purposes and audiences, including selection of language features, using digital tools as appropriate (AC9S5I06)
- Pose investigable questions to identify patterns and test relationships and make reasoned predictions (AC9S6I01)
 - Plan and conduct repeatable investigations to answer questions including, as appropriate, deciding the variables to be changed, measured and controlled in fair tests; describing potential risks; planning for the safe use of equipment and materials; and identifying required permissions to conduct investigations on Country/Place (AC9S6I02)
 - Use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate (AC9S6I03)
 - Construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships (AC9S6I04)
 - Compare methods and findings with those of others, recognise possible sources of error, pose questions for further investigation and select evidence to draw reasoned conclusions (AC9S6I05)
 - Write and create texts to communicate ideas and findings for specific purposes and audiences, including selection of language features, using digital tools as appropriate (AC9S6I06)



Growing Cotton in the Classroom

Resources & Equipment

ACTIVITY 3.1 – Cotton Seeds and What They Need to Grow

1. Cotton seeds (one per student). You can request ONE free Cotton Sample Kit per school annually:
<https://cottonaustralia.com.au/education-kit>
2. Ruler (one per group)
3. Magnifying glass (optional)
4. **Worksheet 3.1a – Cotton Seeds** (Observation Activity)
5. **Worksheet 3.1b – What Do Plants Need?** (Brainstorm Activity)
6. [Kids in the Garden, Ep 2: How seeds become plants – ABC Education](#) (5:19)

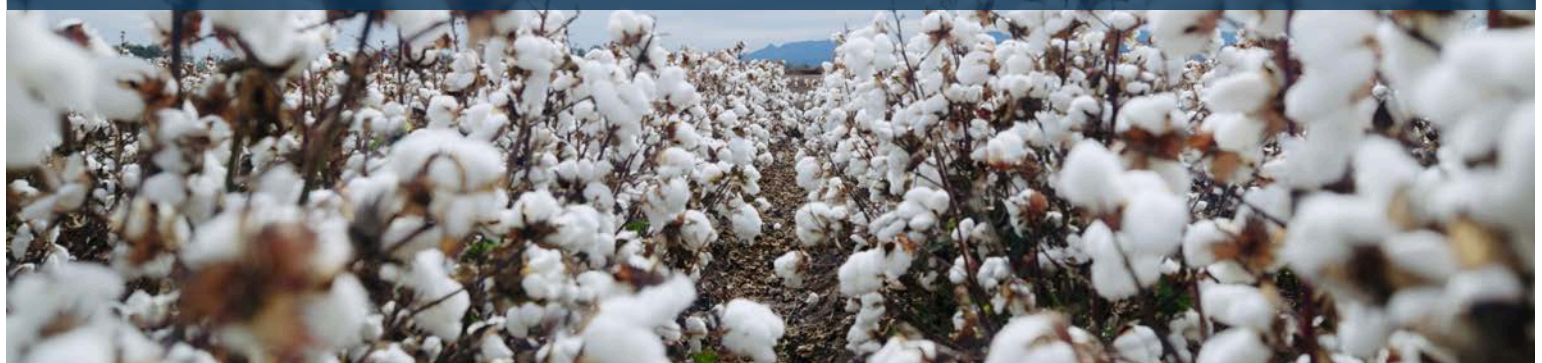
ACTIVITY 3.2 – Planning an Investigation

1. Foundation – Year 2: **Worksheet 3.2a – Planning an Investigation** (Discussion Activity)
2. Year 3 – Year 6: **Worksheet 3.2b – Planning an Investigation** (Question & Answer Activity)

ACTIVITY 3.3 – Observing, Recording, and Summarising Results

1. **Worksheet 3.3a – Planting Cotton Seeds** (Procedural Activity)
2. Cotton seeds (minimum one per student) You can request ONE free Cotton Sample Kit per school annually:
<https://cottonaustralia.com.au/education-kit>
3. Soil (potting mix or from garden bed)
4. Plastic cups or takeaway containers (minimum one per student)
5. Spoons (minimum one per group)
6. Watering can or water spray
7. Gardening gloves (minimum one pair per group)
8. Rulers (minimum one per group)
9. Markers (minimum one per group)
10. Access to soap and water for hand washing
11. [Manutec Soil pH Test Kit Story](#) (3:54)
12. Soil pH test kit (available from gardening and hardware shops)
13. **Worksheet 3.3b – Observing and Recording Results** (Template Activity)
14. **Worksheet 3.3c – Displaying and Summarising Results** (Graphing Activity)
15. Pencils (one per student)

Note: Schools are responsible for generating their own risk assessments for activities.



Growing Cotton in the Classroom

Cotton Seeds - Germination Needs

Lesson Guide for Activity 3.1

Students will explore the features of cotton seeds. They will revise the needs of plants as living things and make predictions about the changes they expect to see throughout the investigation.

a) Allocate students into groups and provide each group with five cotton seeds to handle and observe. Ask them to measure their length and width using a ruler, then describe and sketch each seed, recording their observations on **Worksheet 3.1a - Cotton Seeds** (Observation activity). Allow students to share their observations.

b) Explain to students that they will be planting these seeds and observing how they grow into cotton plants over a period of time. Ask students to brainstorm the needs of plants. Students may draw, annotate, or write sentences about the needs of plants around the image of the cotton plants on **Worksheet 3.1b - What Do Plants Need?** (Brainstorm activity). (Answers page 11).

c) View the video [Kids in the Garden, Ep 2: How seeds become plants - ABC Education](#) (5:19) and allow students time to add to their brainstorm.

d) Encourage a class discussion to make predictions about what they expect to observe as the cotton seeds grow into cotton plants using a series of questions. Students may record their individual responses, or the teacher may record class predictions to refer back to at the end of the investigation.

Questions may include:

- How long do you predict it will take for a seed to germinate (get its first leaf)?
- Do you predict they will all germinate at the same time?
- How tall do you predict a cotton plant will have grown after five weeks?
- How many leaves do you predict will grow each week?
- What do you predict each plant will look like after five weeks (students may draw answers)? etc.





Growing Cotton in the Classroom

Planning an Investigation

Lesson Guide for Activity 3.2

Students will plan an investigation to monitor the growth and development of cotton seeds into plants over a number of weeks. They will plan a fair and reliable scientific test, make predictions, and plan to use equipment safely.

a) Foundation – Year 2: Project or distribute **Worksheet 3.2a – Planning an Investigation** (Discussion activity) OR

Year 3 – Year 6: Distribute **Worksheet 3.2b – Planning an Investigation** (Question & answer activity)

b) Discuss the things necessary to consider when planning a scientific investigation.

c) Assist students in considering a question they would like to investigate about the growth of cotton plants. Refer students to consider the brainstorming task on the things that plants need.

A variety of suggested research questions and information for planning for different year bands and abilities are provided on Answers (pages 11–12).

d) Discuss the need to repeat an experiment to ensure that the results from the investigation are reliable (the results are consistent, dependable, can be trusted, can be relied upon). Students can satisfy the need for repetition in their investigation by planting multiple seeds (e.g. planting five cotton seeds). Students may also combine their results with others, provided that the variables (changed and controlled) are the same.

e) Discuss the need to plan to use equipment safely and what students should do to mitigate any risks. For example, soil contains microorganisms that might be harmful if they get into your body (skin/nose/mouth) so students should wear gloves and wash their hands with soap and water after handling soil.





Students will carry out the planned scientific investigation using cotton seeds. Over a number of weeks, they will record data from their observations, make measurements, and present data using tables and a graph.

a) Project or distribute **Worksheet 3.3a - Planting Cotton Seeds** (Procedural activity) and provide students with the equipment listed.

b) In a suitable working area, assist students in following the procedure (steps 1 - 4) to plant the cotton seeds in plastic cups or takeaway containers, marking the checklist boxes as tasks are completed. If planting more than one seed in a cup or container, ensure students are spacing seeds at least 2 cm apart.

Step 5 is left blank, as this will vary based on the research question chosen. Students either write their own method for step 5 or copy the method written and displayed by the teacher. (Answers page 19).

c) Leave the containers in a secure area and ensure they have enough sunlight and are watered regularly (unless these are the variables being tested/changed) over the coming weeks. When watering, the soil should be damp to the touch, not saturated.

d) Optional: Test the soil to determine its pH which is a measure of its acidity or alkalinity. A pH of 7 is neutral, higher than pH 7 is alkaline, and below pH 7 is acidic. The ideal soil pH for growing cotton plants is pH 5.5 - 8.2. Outside these limits, certain plant nutrients become unavailable to the plant (e.g. zinc at high pH) or are released in toxic quantities (e.g. aluminium at low pH).

View the video [Manutec Soil pH Test Kit Story](#) (3:54) to see how soil pH can be tested.

e) Over a five-week period, allocate time for students to observe and record measurements and data about the growth and development of the cotton seeds into plants. Encourage students to share and compare observations.

f) Foundation - Year 2: Distribute Worksheet 3.3b - Observing and Recording Results (Template activity) for students to complete.

Year 3 - Year 6: Students record their observations and measurements using either **Worksheet 3.3b - Observing and Recording Results** (Template activity), or draw a table in their workbooks/use a spreadsheet on a digital device to record the relevant data (height of plant/number of leaves/day of germination).

g) Ask students to reflect on the data collected. If suitable for students' abilities, assist them in graphing the results from their investigation using a pencil and **Worksheet 3.3b - Displaying and Summarising Results** (Graphing activity). Students should give the graph a title, label the axes (time (days), and height of plants (cm)), and plot a suitable graph.

.NOTE- continued on next page.



h) Assist students in summarising the patterns or trends in the graph using one or two sentences.

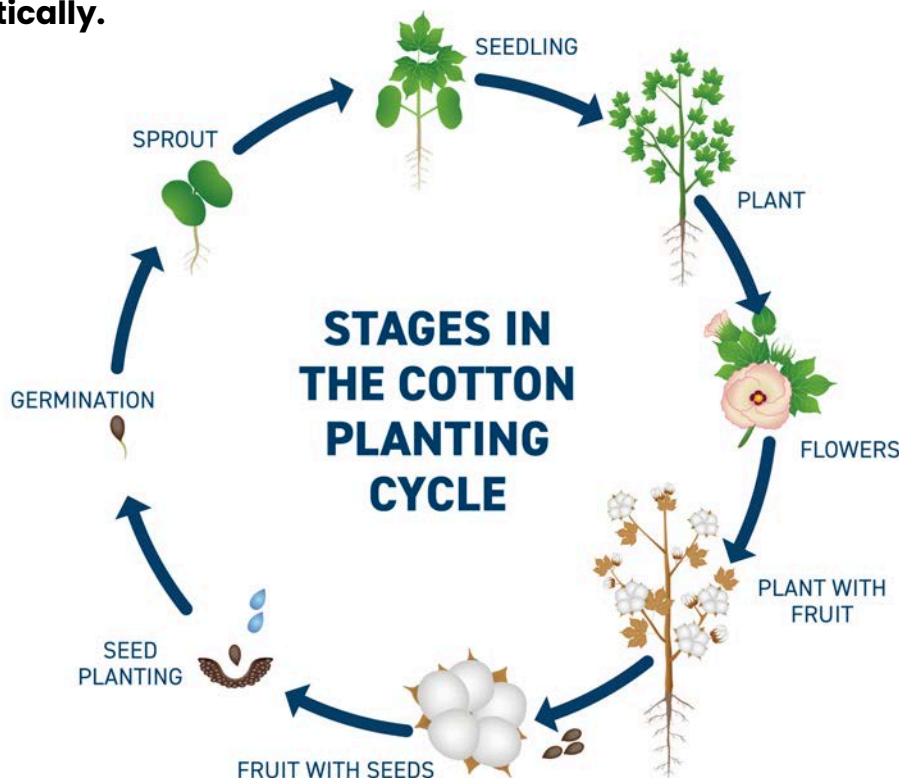
i) Discuss with students the original research question and assist them in drawing conclusions based on their results from the investigation. Record on page 2 of **Worksheet 3.3b - Displaying and Summarising Results** (Graphing activity).

j) At the conclusion of the investigation, discuss

- Whether their hypothesis (what they thought would happen) was correct
- Were there any anomalies in the results? (Unusual or unexpected results)
- Did some seeds fail to germinate? Why might that be the case?
- Would you expect the same results if you repeated the experiment again? Do you think your results are reliable?
- What would you change if you did the experiment again to improve your results? (For example, plant 100 seeds).

k) Seedlings may be planted into larger pots and observed over a number of months to see the complete life cycle of a cotton plant.

NOTE: After the experiment concludes, students may like to transplant the seedlings into a larger 10cm pot to grow indoors or into the school garden bed (depending on the season and location). Continue to keep the soil moist, in full sun and check for pests which you can remove by hand or use store-bought remedies as you would for other food and fibre grown domestically.





Growing Cotton in the Classroom

Answers



ACTIVITY 3.1 – Cotton Seeds – Germination Needs

Worksheet 3.1b – What Do Plants Need? (Brainstorm activity).

Answers will vary depending on ability and year band.

Plants need light, air (carbon dioxide), water, nutrients in the soil, and a warm temperature to survive and grow.

Plants make their own food by photosynthesis. To perform photosynthesis, plants need carbon dioxide, water, and sunlight. Carbon dioxide from the air enters through a plant's leaves and stems. Water is absorbed from the soil and is taken up through the roots, through the stem and leaves. Light is provided by the sun.

Plants also need nutrients such as nitrogen, potassium, and phosphorus to grow. They obtain these nutrients from the soil. Soil pH is a measure of how acidic or basic the soil is, and it influences the availability of nutrients in the soil to the plant. Soil pH varies depending on local conditions and is optimal for cotton growth at pH 5.5–8.2.

ACTIVITY 3.2 – Planning an Investigation

Worksheet 3.2b – Planning an Investigation (Question and answer activity).

Student answers will vary.

c) Students may wish to test research questions not listed in the table.

Suggested research questions and planning information for different year bands and abilities

Year Band	Research Question	Variables to Change	Variables to keep the same	Measure
F – 2	Do cotton plants need sunlight to grow?	Sunlight/no sunlight	Amount of water Temperature Soil type Planting depth Spacing of seeds	Height of plant in centimetres using a ruler OR Number of leaves
F – 2	Do cotton plants need water to grow?	Water/no water or reduced water	Amount of light Temperature Soil type Planting depth Spacing of seeds	Height of plant in centimetres using a ruler OR Number of leaves



Growing Cotton in the Classroom

Answers



Year Band	Research Question	Variables • to change	Variables • to keep the same	Measure
3 - 4	Do cotton plants grow better in soil A or soil B?	Soil A/Soil B	Amount of water Temperature Amount of light Planting depth Spacing of seeds	Height of plant in centimetres using a ruler AND Number of leaves
3 - 4	Do cotton seeds need sunlight to germinate?	Sunlight/no sunlight	Amount of water Temperature Soil type Planting depth Spacing of seeds	Number of seeds that germinate by a certain date (e.g. two weeks)
3 - 4	Do cotton seeds need water to germinate?	Water/no water or reduced water	Temperature Amount of light Soil type Planting depth Spacing of seeds	Number of seeds that germinate by a certain date (e.g. two weeks)
5 - 6	Does the planting depth of cotton seeds affect germination time?	Depth of seed planting	Amount of water Temperature Amount of light Soil type Spacing of seeds	Number of seeds that germinate each day/two days
5 - 6	Do cotton seeds germinate more rapidly in the dark?	Sunlight/no sunlight (dark)	Amount of water Temperature Soil type Planting depth Spacing of seeds	Number of seeds that germinate each day/two days
5 - 6	Does the spacing of cotton seeds when planting affect the growth of a cotton plant?	Spacing of seeds	Amount of water Amount of light Temperature Soil type Planting depth	Height of plant in centimetres using a ruler AND Number of leaves
5 - 6	Do cotton plants grow differently in soils with differing pH?	pH of soil	Amount of water Temperature Amount of light Planting depth Spacing of seeds	Height of plant in centimetres using a ruler AND Number of leaves



Growing Cotton in the Classroom

Answers



Page 3 of 3



ACTIVITY 3.3 – Observing, Recording, and Summarising Results

b) Step 5 will vary depending on the research question chosen.

For example, if the research question chosen is – Do plants need sunlight to grow?

Step 5: Lightly wet the soil using a watering can and place one container on the windowsill and another container in a dark cupboard. Observe and take measurements of the cotton plant every two days.



Growing Cotton in the Classroom

References



ABC Education. (2023). Kids in the Garden, Ep 2: How seeds become plants – ABC Education. In abc.net.au. <https://www.abc.net.au/education/kids-in-the-garden-ep-2-how-seeds-become-plants/13633088>

Manutec. (2023). Manutec Soil pH Test Kit Story. [www.youtube.com. https://www.youtube.com/watch?v=f4CuQndxyVY](https://www.youtube.com/watch?v=f4CuQndxyVY)





Growing Cotton in the Classroom

Cotton Seeds

Student Worksheet 3.1a



Look at a cotton seed. Record your observations in the table below.

You will need:



- cotton seeds
- ruler
- pencil
- magnifying glass (optional)



Observations	Cotton Seed
Length and width (mm) Measure with a ruler	
Appearance (colour, shape, markings)	
Sketch	



Growing Cotton in the Classroom

What do Plants Need?

Student Worksheet 3.1b



Brainstorm the things that plants need to survive and grow.





Growing Cotton in the Classroom

Planning an Investigation

Student Worksheet 3.2a



When planning a scientific investigation, there are a number of things you need to think about.

1



Ask a question.

2



Research to find out more about your question.

3



Make a prediction.
A hypothesis is what you think might happen.

4



Decide what you will change and what you will keep the same.

To have a fair test, you must only change one thing (variable) and keep the other things (variables) the same.

5



Decide what you will measure and how you will measure it.



Growing Cotton in the Classroom
Planning an Investigation
 Student Worksheet 3.2b



When planning a scientific investigation, there are a number of things you need to think about.

1



Ask a question.

What would you like to find out about the needs of plants?

2



Research and learning about what other people have discovered helps you discover more about your research question.

What do you already know about this topic?

3



Make a prediction.

A hypothesis is what you think might happen.
 I predict that



Growing Cotton in the Classroom
Planning an Investigation
 Student Worksheet 3.2b



When planning a scientific investigation, there are a number of things you need to think about.

4



Decide what you will **change** (and what you will keep the same): The variables are the things that can change in an experiment. To have a 'fair' test, you must only change one variable and keep the others the same.

What will you change?

What will you keep the same?

Will this be a fair test? -----

Decide what you will **measure** in the investigation.

5



You could measure:

- the number of leaves on the plant.
- the height of the plant.
- how long it takes for the plant to germinate (get its first shoot).

What will you measure, and how will you measure it?

Growing Cotton in the Classroom

Planting Cotton Seeds

Student Worksheet 3.3a

Follow the instructions below to plant five cotton seeds. Tick each step in the box when completed.

You will need:

Five cotton seeds



Soil



Plastic cup or container



Spoon



Water



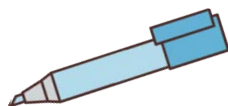
Gloves



Ruler



Marker



Step 1

Label a plastic cup or container with your initials. Using the ruler, measure 2 cm from the top of the cup. Draw a line with the marker.

Step 2

Put on gloves. Add soil into the cup/container using a spoon and fill to the marker line.

Step 3

Using the ruler, measure 2 cm down from the top of the soil. Draw a line with a marker.

Step 4

Make a small hole in the soil with your finger down to the 2 cm marker line. Gently press a cotton seed into the hole and cover it with soil.

Step 5



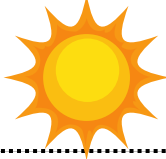

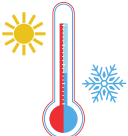



Observe the growth and development of the seeds over a number of weeks.

Record your observations using the Plant Growth Chart below.

Research question:

Tick the box to show which variables are the same (controlled) and which variables are different in your investigation.

Tip: You should only have one box ticked in the 'changed' column.

Variable		Changed	Kept the same (controlled)
sunlight		<input type="checkbox"/>	<input type="checkbox"/>
water		<input type="checkbox"/>	<input type="checkbox"/>
temperature		<input type="checkbox"/>	<input type="checkbox"/>
soil		<input type="checkbox"/>	<input type="checkbox"/>
depth of planting		<input type="checkbox"/>	<input type="checkbox"/>
spacing of planting		<input type="checkbox"/>	<input type="checkbox"/>



Growing Cotton in the Classroom

Observing and Recording Results

Student Worksheet 3.3b



Page 2 of 2

Days since planting: _____

Height (cm)

Number of leaves

Sketch

Notes:

Days since planting: _____

Height (cm)

Number of leaves

Sketch

Notes:

Days since planting: _____

Height (cm)

Number of leaves

Sketch

Notes:

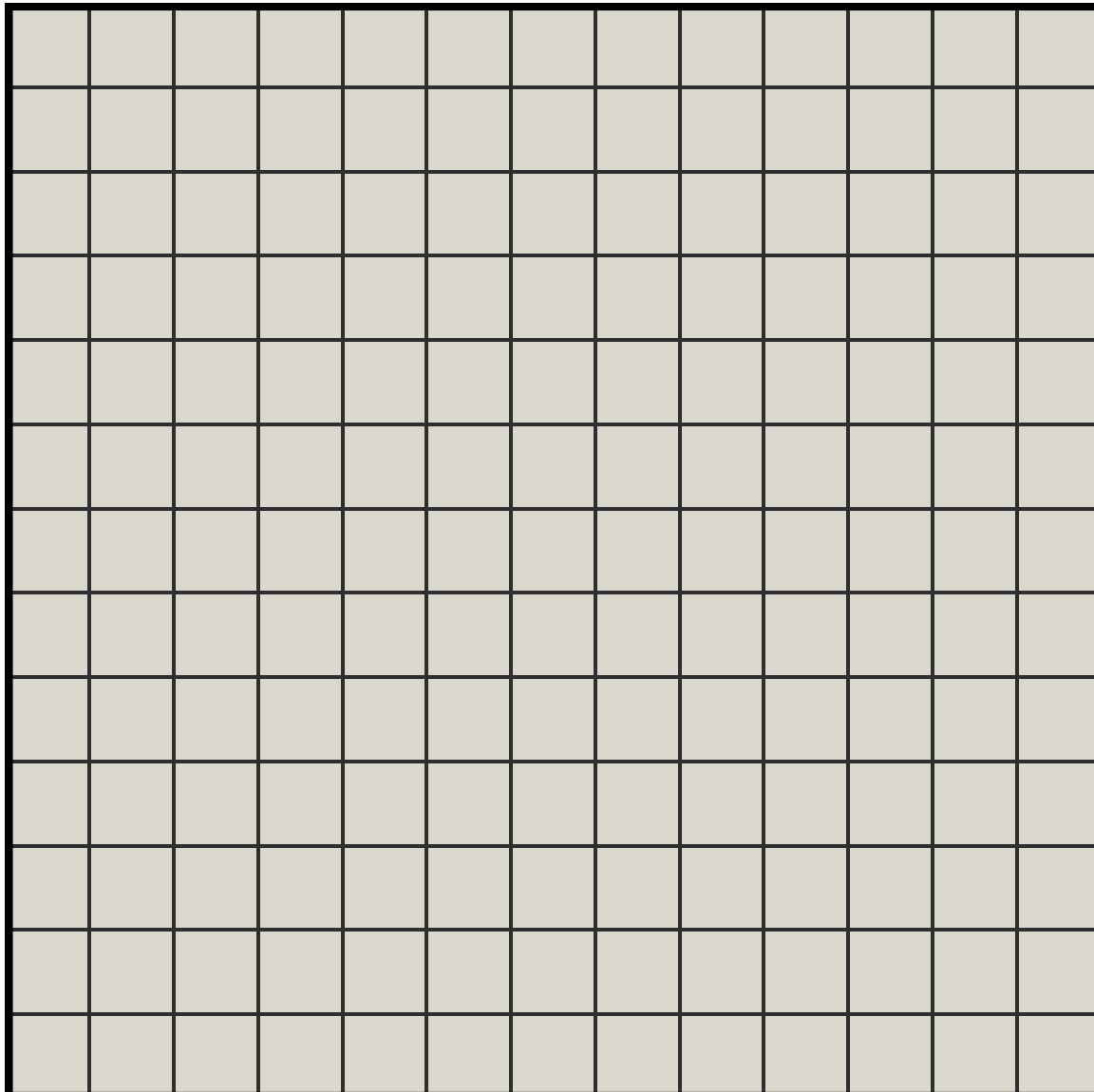


Use the data from your investigation to display your results as a graph.

Reminder: make sure your graph has the following:

- A title that explains the data plotted
- Two labelled axes, including units
- Points plotted neatly

Title: _____





Results

Summarise the patterns or trends in the graph. Hint: How did the plants change over time? Describe the differences between the treatment groups.

Conclusion

Write a conclusion to the investigation in the space below.

