COTTON AUSTRALIA

THE COTTON PLANT

The story of a modern, sustainable agricultural industry that's helping to clothe the world. Cotton Australia's Cotton Education Kit provides current, authoritative information for all teachers and students, and includes:

- Targeted Australian Curriculum outcomes for Years 7-12, and outcomes for Years 11-12 from NSW, QLD, SA, WA, NT & ACT syllabi in each of its 10 chapters.
- Case studies and multimedia that are embedded in the Kit. Additional school resources, lessons and worksheets are found online in the Cotton Classroom.

Cotton Classroom

THE COTTON PLANT

Cotton is a natural fibre that grows on a plant. It is both a food and fibre crop, and the plant is a leafy, green shrub related to the Hibiscus family and is botanically known as Gossypium hirsutum or Gossypium barbadense. By nature, it is a perennial shrub that reaches a height of 3.5 metres.

COTTON PLANT CHARACTERISTICS

Commercially, cotton is grown as an annual plant and reaches a height of 1.2 metres. Its leaves are broad and heart-shaped with coarse veins and three to five lobes. The plant has many branches, with a main central stem. The cotton plant's taproot reaches a depth of 1.5 metres.

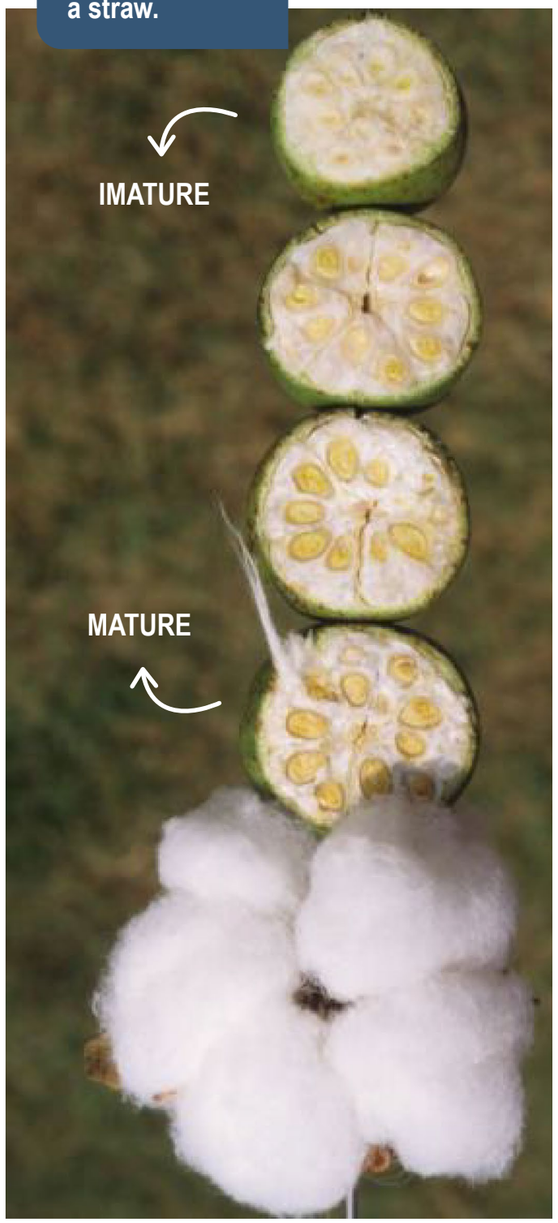
Squares (flower buds) develop several weeks after the plant starts to grow, with flowers appearing a few weeks later. The flowers then drop, leaving a ripening seed pod that becomes the cotton boll (the fruit) after pollination. The flower of the cotton plant is a self-pollinating type that does not need insects to assist with pollination.

The plant also produces seeds that are contained in small capsules (called locks) surrounded by fibre in the cotton bolls. Each cotton boll usually contains 27 - 45 seeds, and attached to each seed is between 10,000 – 20,000 tiny fibres about 28mm in length.

Fact Sheet: The Cotton Plant in Australia.

Boll growth stages.

Cotton fibre is made from cellulose, has a slim coating of wax and is thin and hollow like a straw.



CAN YOU SEE SIMILAR TRAITS TO COTTON PLANTS? THERE ARE 17 NATIVE GOSSYPIUM SPECIES THAT ARE ALL MEMBERS OF A DISTINCT GROUP FOUND EXCLUSIVELY IN AUSTRALIA, INCLUDING THE STURT'S DESERT ROSE (GOSSYPIUM STURTIANUM) WHICH IS THE NORTHERN TERRITORY'S STATE EMBLEM.

HOW COTTON GROWS

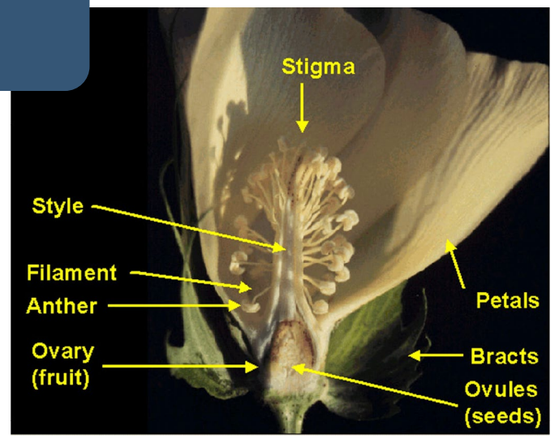
It takes about four to 14 days for cotton seedlings to appear after seeds are planted, depending on temperature and moisture levels. The cotton seedling grows into a young plant, sending down a long 1.5 metre taproot to find water and nutrients.

The first two leaves that are visible on the young cotton plant are seedling leaves called cotyledons. They are useful for absorbing sunlight into the plant. The sunlight is then converted through a process known as photosynthesis into nourishing carbohydrates that will help the plant grow. In about two to four weeks, they turn over the photosynthetic task to true leaves (leaves produced after the cotyledons), which continue the feeding process for the duration of the plant's life.

The first flower buds (called squares) appear within about 35 days. As the squares develop, the bud swells and begins to push through the bracts until it opens into an attractive flower. This happens after a further 25 days, when the first creamy-white, hibiscus-like flowers appear. The cotton plant continues to produce squares and flowers for about half the growing season. The last productive flower opens about three to four months after planting.

Cotton flowers only stay open for 24 hours. During this short time, the flower must be fertilised to produce the seed that has the cotton fibre or lint attached. Fertilisation takes place when pollen from the anther (male part) is transferred to the stigma (female part) of the flower. Over the one-to-two days after pollination, the flowers change colour from white to pink to red, mauve or purple and then fall off.

Labelled cross-section of a cotton flower



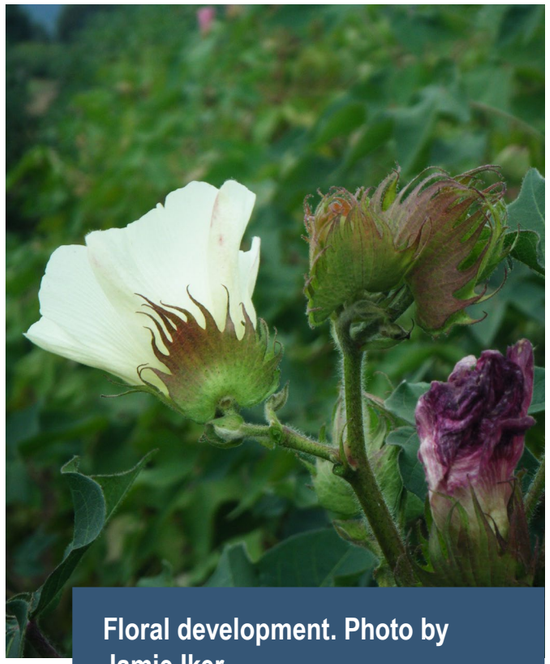
The fruit, called bolls, then begin to develop. These green, immature bolls are a segmented pod containing approximately 32 immature seeds from which the cotton fibres will grow. Each segment is called a lock and there are typically 3-5 locks in each boll.

The boll is considered a fruit because it contains seeds.

Individual cells on the surface of the seeds start to elongate the day the pink flower falls off (abscission). The fibres grow, mature and thicken for the next month, forming a hollow cotton fibre inside the boll, which becomes approximately the size of a table tennis ball.

Bolls reach full size about 25 days after the petals fall. After a further 35 to 55 days, the bolls naturally burst open along the boll's segments, or carpels, and dry out, exposing the underlying cotton segments called locks. These dried carpels are known as the bur, and it's the bur that will hold the locks of cotton in place when fully dried and fluffed, ready for picking.

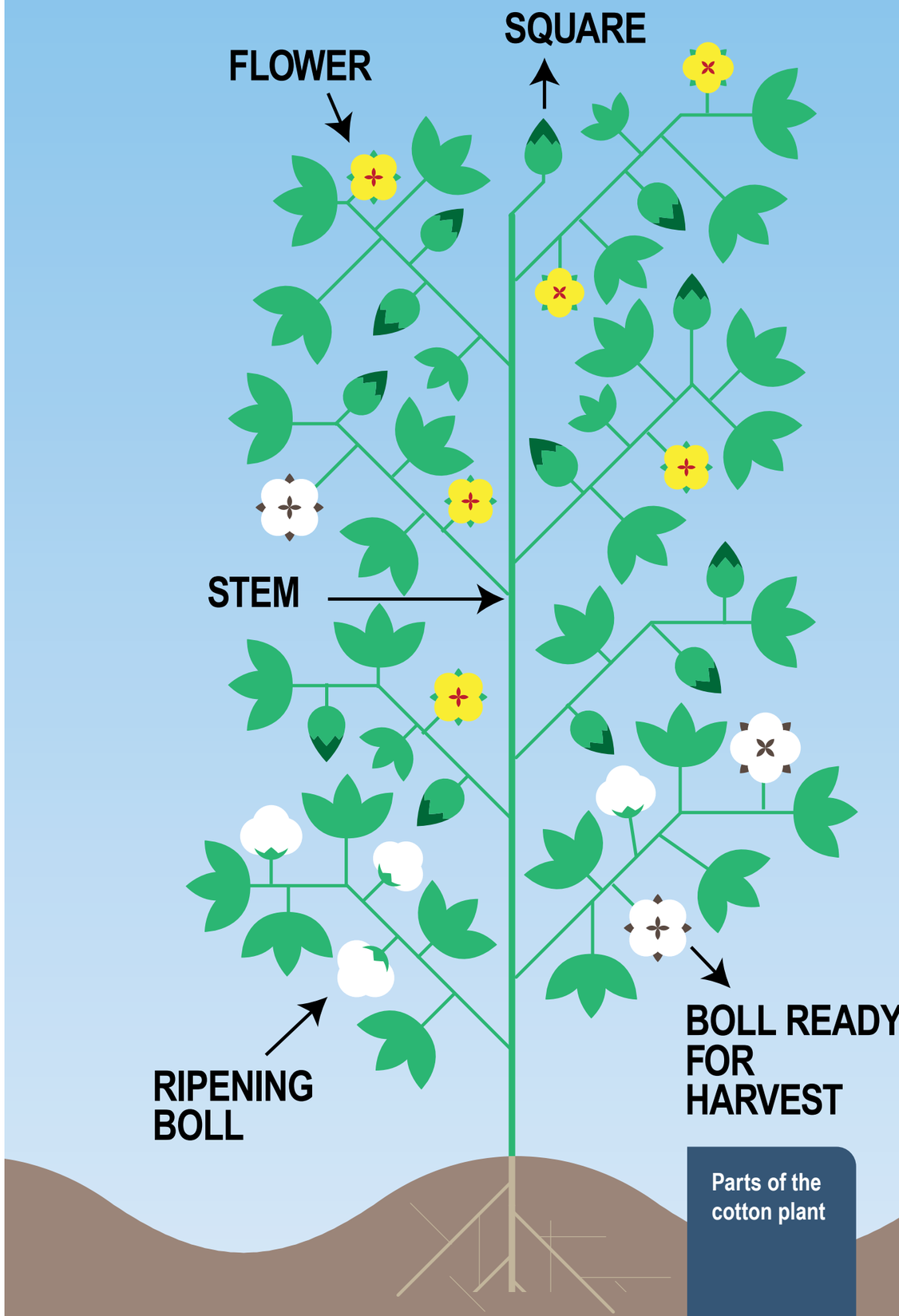
When most of the bolls are open, the crop is ready to pick. An average boll will contain nearly 500,000 fibres of cotton and each plant may bear 15-20 bolls. The growing season from emergence to picking is about 180 days. Variations to this timing can differ in each cotton growing region due to seasonal conditions.



Floral development. Photo by Jamie Iker.

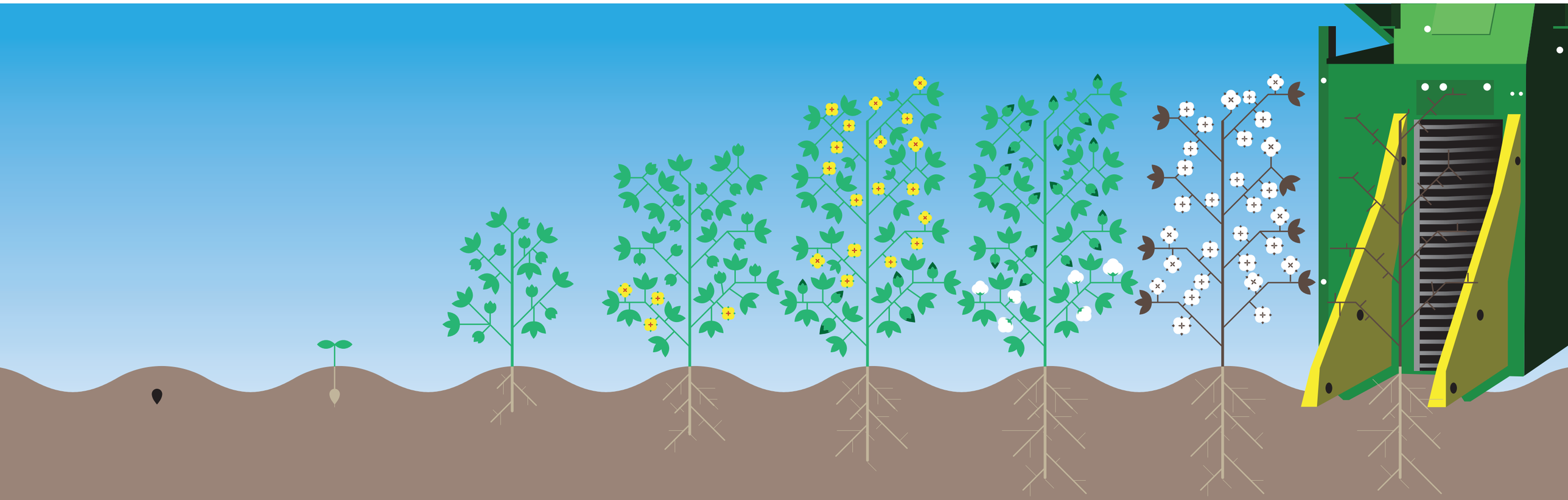
A series of photos depicting a cotton plant's growth over a whole season

CASE STUDY: The Growth and Development of Cotton from The University of Georgia



Parts of the cotton plant

STAGES IN **THE COTTON PLANT CYCLE**



1ST DAY

SEED PLANTED

5-10 DAYS

SEEDLING EMERGES

40-50 DAYS

FLOWER BUDS FORM

70-80 DAYS

FLOWERING COMMENCES

100-105 DAYS

COTTON BOLLS BEGIN TO FILL

120-130 DAYS

COTTON BOLLS START TO OPEN

150-160 DAYS

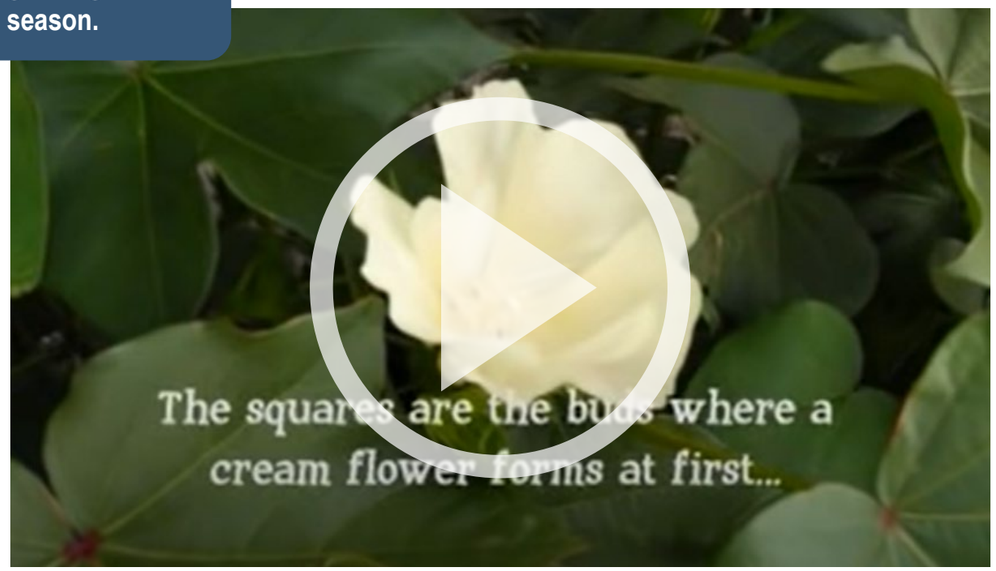
COTTON BOLLS FULLY OPEN AND READY FOR PICKING

AFTER PICKING, COTTON PLANTS ARE MULCHED BACK INTO THE SOIL READY FOR THE NEXT CROP

COTTON'S **GROWTH CYCLE**

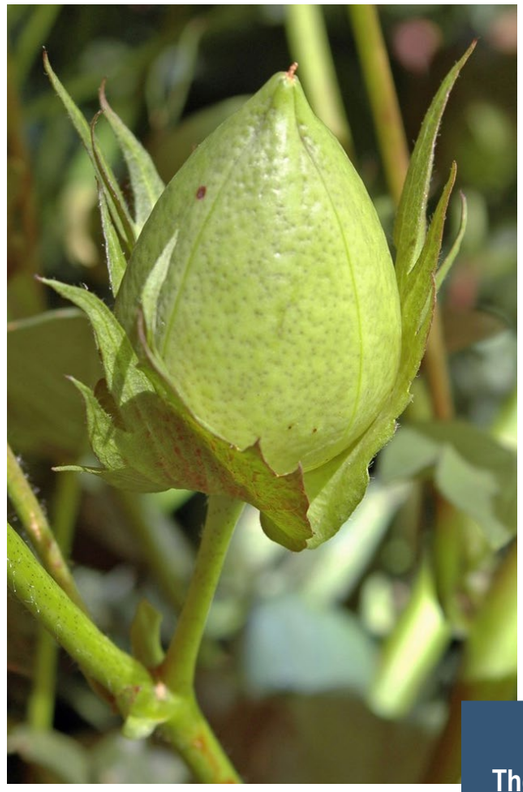
Fact Sheet: How Cotton is Grown

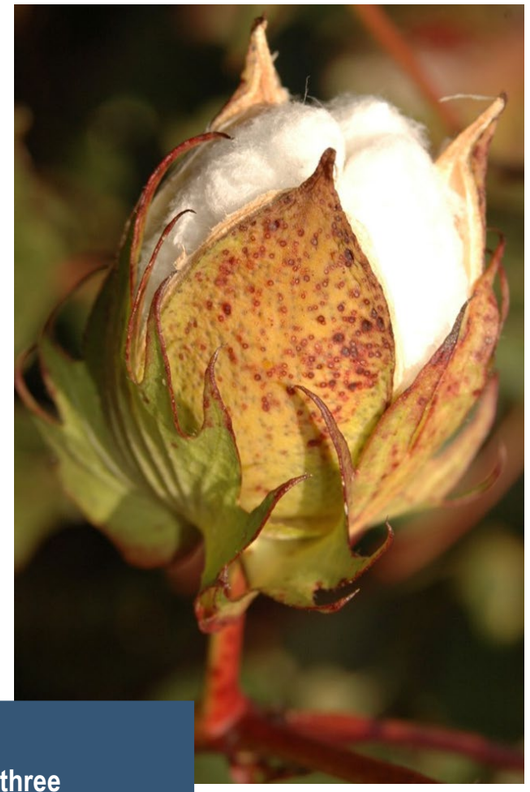
Cotton is a perennial summer crop, but in Australia is grown and managed as an annual crop. It prefers hot summers with low humidity and long hours of sunshine. In general, cotton grows quicker as the average temperature rises and the longer and hotter the season, the greater the yield.

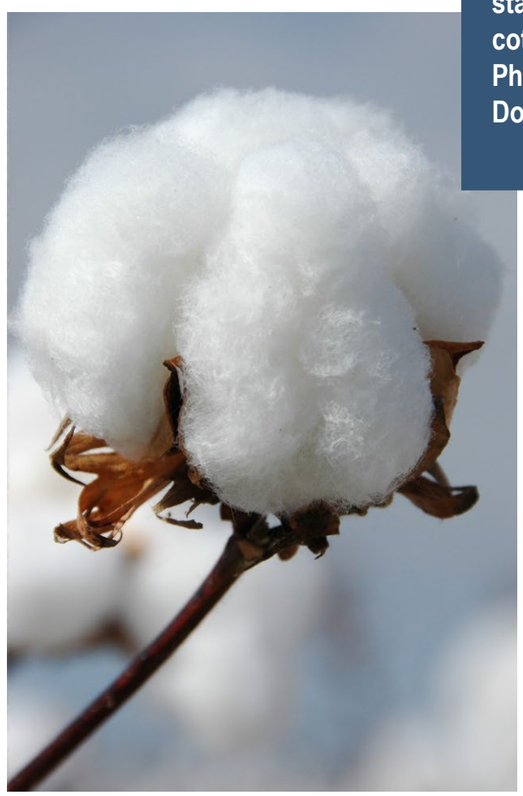


A typical Australian cotton growing season.

Time-lapse footage of cotton bolls.







The three stages of cotton. Photo by Carly Donnelly.

Australia's cotton growing season lasts approximately six months with variation in planting to picking time across the regions. Generally starting in September/October/November (planting) and ending in March/April/May (picking). However, in Northern Australia planting is December/January and in the Central Highlands in Queensland planting is from August to December.

Several environmental factors affect the growth of cotton, particularly in the early stages, including heat shock, cold shock, sand blasting, hail damage and water logging.

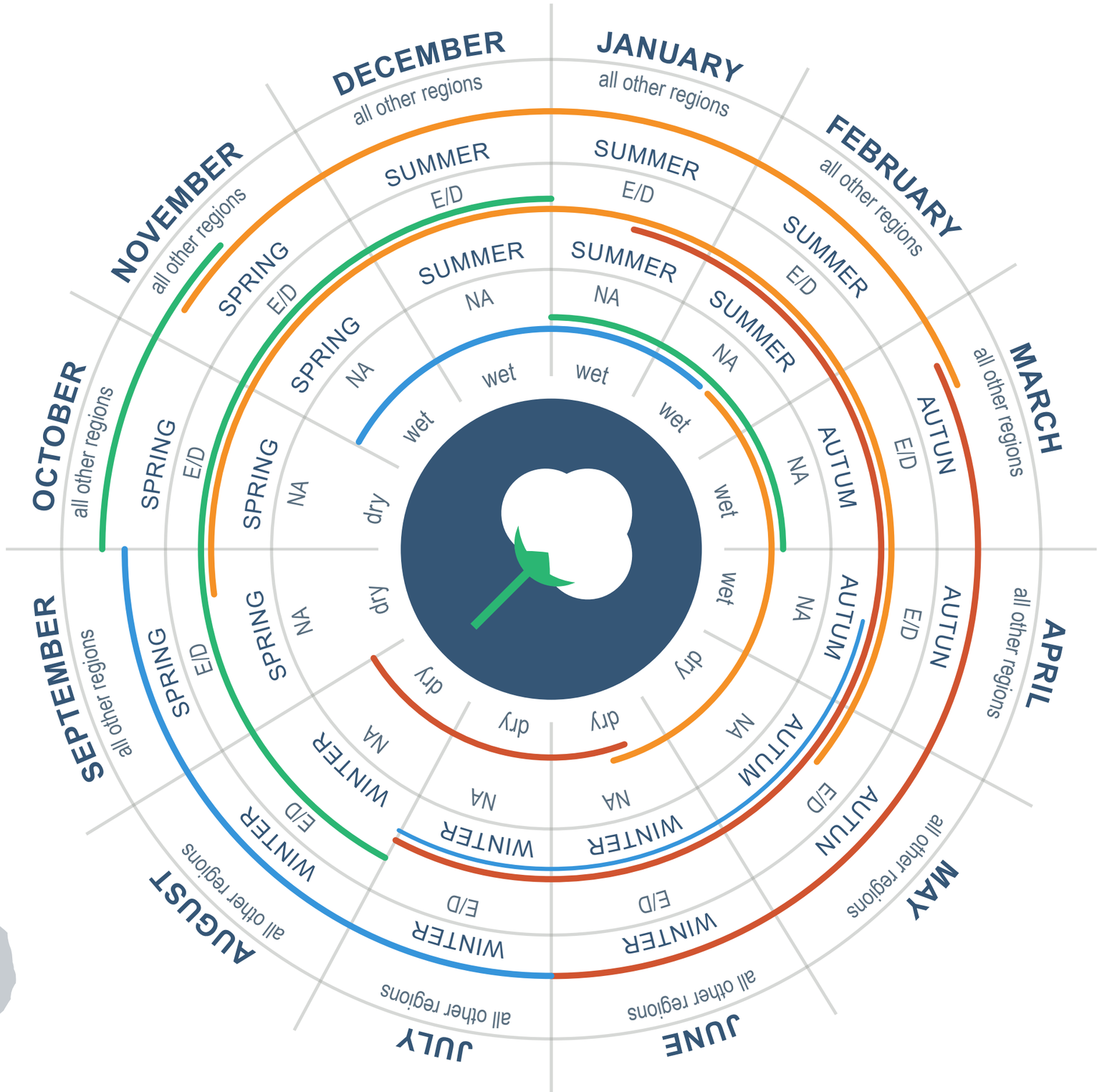
AUSTRALIAN COTTON **GROWING CALENDAR**

COLOUR KEY

- Soil preparation
- Planting
- Growing
- Picking

GROWING REGIONS KEY

- Northern Australia
- Emerald/Dawson Valleys
- All other regions (NSW, Southern QLD, Northen VIC)



COTTON GROWER'S **SEASONAL TASKS**

Australia's cotton growing season lasts approximately six months, however when cotton is planted and picked differs depending on the region.

SOIL PREPARATION

→ Soil prepared for planting, weeds removed, nutrients added if necessary.

→ Soil moisture levels checked, pre-watering if necessary.

PLANTING

→ Soil temperature checked.

→ Cotton seed planted when soil is warm enough for satisfactory seed germination and crop. establishment (i.e. soil temperature reaches 14°C at a depth of 10cm and is rising in temperature for at least three successive days).

→ Cotton seedlings emerge one to two weeks after planting.

GROWING SEASON

→ Flower buds develop a few weeks after the plant starts to grow, then flowers appear a few weeks later. The flowers then fall off, leaving a ripening seed pod that becomes the cotton boll (the fruit).

→ Ongoing checks for pests, soil moisture level tests and weed removal.

→ On irrigated cotton farms, the initial irrigation (watering) is usually followed by a further four to five irrigations, at two to three-week intervals, from mid-December to late February. This can differ greatly depending on the region, temperature, soil type and on natural rainfall levels.

→ Approximately four months of growing is needed for the cotton bolls to ripen and split open.

→ Cotton growers use a range of natural and soft chemical options to control the pests that attack cotton (a process called Integrated Pest Management, or IPM).

DEFOLIATION, PICKING AND TRANSPORTATION TO GINS

→ Crop checked by agronomists to make sure it is ready to pick.

→ To speed up the plant maturity process towards picking, cotton growers apply products to both open the cotton bolls and so the plant will drop its leaves. This defoliation of the leaves will enable a much cleaner picking process to happen.

→ Large mechanical cotton pickers are used to pick the crop.

→ Growers usually choose to pick the cotton crop once most bolls have opened and fully matured. It is extremely important that cotton is picked dry, or discoloration may occur and reduce quality.

→ Cotton is loaded onto trucks and sent to the gin where it is ginned – a process seperating lint (raw cotton fibre), cottonseed and trash.

→ The cotton lint is tightly pressed into bales, each weighing 227kg – these are then sent to ports for shipping to overseas markets.

→ The cotton seed is utilised locally as stockfeed. The cottonseed oil can also be extracted and used as cooking oil or for a number of other purposes.

→ The trash is composted locally and reapplied to the soil as a fantastic source of organic matter.

SOIL PREPERATION (OFF-SEASON)

→ Classing and marketing activities undertaken.

→ Growers plant winter crops and/or graze sheep and cattle.

→ Growers make improvements on-farm for next season.

→ Farm maintenance undertaken.

The cotton plant's taproot reaches a depth of 1.5 metres.

Southern Cotton 2016 Season – Grower Guide. A year round on-farm production overview with a discussion about conditions and timing variations for southern NSW growing regions.

CASE **STUDY**

A change of fortunes in Jan-Feb 2020 resulted in the best start to a winter cropping season in years. Join CottonInfo's Climate Risk Technical Lead Jon Welsh and AgEcon Research Economist Janine Powell to sort through the major influences in this year's growing season, scenario management, a strategy for planting rains, and a review of the latest decision support and tools/useful climate-related apps.

THEMES AND AUSTRALIAN CURRICULUM
OUTCOMES FOR SECONDARY SCHOOL

The Cotton Education Kit has been linked to the Australian Curriculum for Years 7-10, and targeted outcomes for Years 11 -12 from all state & territory curriculums across Australia. A list of themes is provided for teachers as a quick guide to assist linking the content to their unit of work or syllabi in their state or territory.

A full list of the individual syllabuses that have been mapped against the Cotton Education Kit can be found in the Cotton Classroom.

Cotton Classroom

CHAPTER FOUR THEMES

- Parts of the Cotton Plant
- How Cotton Grows
- Cotton's Growth Cycle
- Cotton Grower's Calendar

CHAPTER FOUR
CURRICULUM OUTCOMES

Australian Curriculum	Course	Chapter 4: The Cotton Plant
Australian Curriculum	Year 8 Science	ACSSU149 (Cells) ACSSU150 (Multi-cellular organisms)
State / Territory	**Senior Secondary Course**	
New South Wales (HSC)	Agriculture (2013)	P1.1 P1.2 P2.1 P2.3 P4.1 H1.1 H2.1 H4.1
	Biology (2017)	BIO11-9
	Geography (2009)	H5 H6
	Primary Industries (VET) (2020)	AHCBAC201 AHCBAC202
Victoria (VCE)	Biology (2016)	Unit 1: AoS 1 How do organism's function?
Queensland (QCE)	Biology (General) (2017)	Unit 1: Topic 2
Western Australia (WACE)	Biology (General) (2017)	Unit 2: The functioning organism
	Plant Production Systems (General) (2017)	Unit 1: Plant structure and function
	Plant Production Systems (ATAR) (2017)	Unit 1: Plant structure and function
South Australia / Northern Territory (SACE)	Biology Stage 1 (2021)	Topic 3: Multicellular organisms
Tasmania (TCE)	Biology (2016)	Organisms (Criterion 7)
ACT (ACT SSC)	Biology A/T (2014)	Cells and Organisms

KEY **LINKS**

- Cotton Australia.
- 360-degree digital film of a cotton farm, the latest addition to Cotton Australia's suite of educational resources informing city and country residents about the Australian cotton industry.
- Google Arts & Culture
- Australian Cotton
- Cotton Research and Development Corporation
- Cotton Seed Distributers
- CottonInfo
- Primezone: Primezone provides teachers and students with access to the latest quality primary industries education resources

COTTON AUSTRALIA