

CHAPTER 5

How Cotton is Grown



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GROWING CONDITIONS



Cotton is grown by farming families and enjoys long, hot summers

WATER AVAILABILITY AND LOCAL CLIMATE ARE THE MOST SIGNIFICANT CONTRIBUTING FACTORS TO THE DISTRIBUTION AND TYPE OF COTTON GROWN IN AUSTRALIA AND THE REST OF THE WORLD.

Cotton can be grown either as dryland (reliant on rainfall) or as irrigated cotton (requiring supplemented water supply).

Dryland cotton requires:

- Full soil moisture profile at the start of the season
- Rainfall during the summer months
- Long periods of heat with low humidity

Irrigated cotton requires:

- A reliable water supply
- Irrigation water from rivers or underground
- Long periods of heat with low humidity

The higher the average temperature and amount of direct sunlight during the growing season, the faster the crop will grow and develop. The longer and hotter the growing season, the higher the potential yield.

Irrigated cotton is better suited to low rainfall environments because the farmer has more control over the level of moisture in the soil. The quality of the cotton is also less likely to be affected by rainfall when the bolls open (rain on open cotton bolls can cause discolouration).

Dryland cotton can be grown profitably in some areas. Growers will make the decision about planting a dryland cotton crop based on stored subsoil moisture and the current price being offered for cotton.

PREPARING THE LAND

The first step in growing any crop is to prepare the land. Cotton, particularly irrigated cotton, requires a great deal of land preparation. It takes time to get the soil and the general lay of the land ready for cotton growing.

Soil preparation starts immediately following the last cotton crop. Most farmers now leave their cotton stubble standing in the field and mulch it back into the soil to add valuable nutrients. This also helps the soil retain moisture by reducing evaporation.

On an irrigated cotton farm, fields are levelled and graded such that they have a precise slope or grade. This is done to enable water to flow from the top of the field to the bottom of the field in a controlled way. If the field isn't sloped enough or is uneven, then water can lie around and waterlog the soil or if too steep, the water will run off too quickly and not soak into the soil profile. It is important that the slope enables the water to flow slowly down the field watering all the plants evenly. A tail drain is constructed at the end of the field to recycle the excess run-off water.



Cotton is planted directly into wheat stubble to help conserve moisture for healthier soils

SOIL TYPES AND ACHIEVING HEALTHY SOILS

Cotton is predominantly grown on cracking self-mulching clay soils found on flood plains adjacent to rivers. These soil types expand and contract depending upon the water content of the clay.

Growers test the soil a few months prior to planting to check nutrient levels and how much fertiliser may be required. Nitrogen is the main nutrient needed by cotton plants, and it can be applied in the form of anhydrous ammonia, a liquid that when directly applied to the soil, changes back into a gas and clings to soil particles for the plants to use later. Nitrogen can also be applied in granular form. Nitrogen can be added to the soil three months before planting. Cotton also needs many other nutrients such as phosphorus, potassium, sulphur and zinc.

Growing only one type of crop in a field can lead to a deficiency of nutrients and the build-up of soil diseases and pests. Most growers rotate crops to avoid these problems. For example, a grower might decide to plant cotton in a field for three years, wheat the next year, and then plant a legume crop or leave the field crop-free (fallow). This process is called crop rotation. Irrigated cotton growers usually rotate their cotton crop every three or four years.



Cotton is grown on self mulching, cracking clay soils
photo by Jack Hawkins

PLANTING

Cotton seed is planted in the spring as soon as the soil is warm enough to be sure of satisfactory seed germination and crop establishment. The soil is warm enough when the temperature reaches 14 degrees Celsius at a depth of 10 cm for at least three days in a row.

In northern NSW, the right soil temperature is usually reached in late September or early October. In Central Queensland, it is likely to occur up to a month earlier and in Southern NSW, up to a month later.

On irrigated crops, cotton is sown with 6, 8, 10 or 12 row precision planters that place the seed at a uniform depth and interval along rows generally one metre apart (rows planted one metre apart are known as a 'solid' configuration). Seeds are planted about 10 -12 seeds per metre, four centimetres deep, into the soil on top of the rows (mounds) which are typically spaced one metre apart.

Another way that Australia's cotton farmers maximise yields and fibre quality and save water and fertiliser is to reduce the number of plants by planting in "skip rows".

This is achieved by leaving a configuration of rows of cotton bare of seed or 'skipped'.

There are three common options for skip row planting, and these have become more common and easier due to the flexibility of modern harvesting equipment;

- Single Skip - every third row is skipped (therefore the field has 66% plant population)
- Double Skip - two adjacent rows are planted and then 2 are skipped (50% plant population)
- Super Single - every third row is planted alone (33% plant population)

A recent variation of solid and skip row planting configurations in irrigated cotton systems is to plant evenly spaced rows 1.5 metres apart (creating a plant population of 66% of a standard solid planting).



Super single skip row cotton early in the season



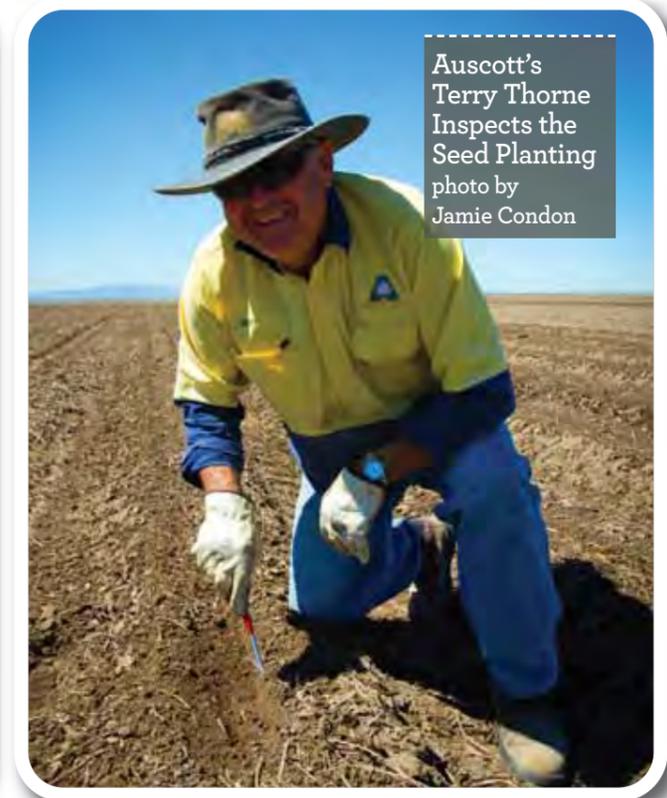
Double skip row cotton early in the season



Skip row cotton late in the season photo by Steve Burke



Planting Cotton on Dusk with precision planters at "South Callandoon" Goondiwindi, QLD photo by Andrew Hughes



Auscott's Terry Thorne Inspects the Seed Planting photo by Jamie Condon

ROW CONFIGURATION GUIDE

SINGLE SKIP (66% OF PLANTED AREA)



80 INCH OR 1 IN 1 OUT (50% OF PLANTED AREA)



DOUBLE SKIP (50% OF PLANTED AREA)



SUPER SINGLE (33% OF PLANTED AREA)



(Source: CSD Getting the most out of skip irrigated cotton)

MANAGING THE CROP

PRODUCING A HIGH QUALITY, HIGH YIELDING, WATER EFFICIENT COTTON CROP REQUIRES CAREFUL MANAGEMENT THROUGHOUT THE SEASON. THE FOLLOWING SECTION OUTLINES SOME OF THE MOST IMPORTANT THINGS TO MANAGE THROUGHOUT THE GROWING SEASON.

WATERING BY IRRIGATION

While not all cotton crops rely on irrigation water, this is a major component of growing a cotton crop.



Irrigating cotton is an all-hands-on-deck job!
photo by Holli Holmes

WHAT IS IRRIGATION

Irrigation means moving water mechanically from one place to another for agriculture. Irrigation generally occurs in Australia where the rain falls at a different time to when the crops need it. Water for irrigation comes from rivers or underground supplies (huge underground lakes from which water is pumped via bores).

State Governments construct dams to hold water and then stringently control the allocation of and access to water. Irrigation farmers are issued a licence to access a defined volume of water each year. They pump the water from rivers or underground water supplies onto their farms where it is usually held in on-farm storages until it's needed.

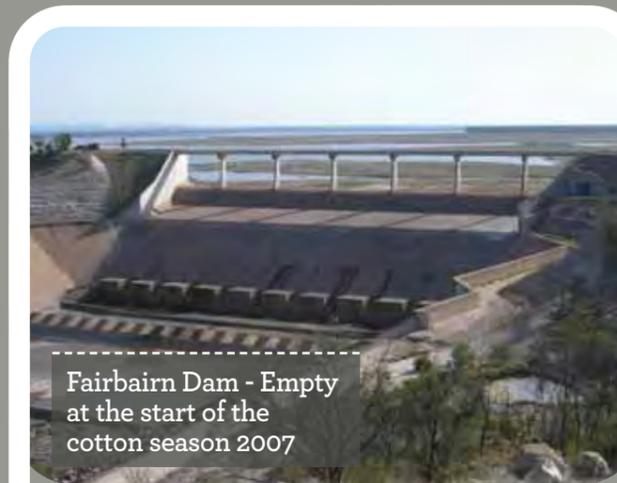
In the case of cotton growers (who plant a crop each year), the available water supply for irrigation changes each year depending on how much rain there's been and how much water is in the dams. Water distribution for domestic use,

stock, the environment and permanently planted crops (such as fruit trees) always have priority over cotton farms.

Cotton growing therefore requires careful water management. Well-designed and well-built systems combined with careful application ensure that a minimum amount of water is used, and that there are many safeguards against wastage. Usually the land in an area that uses irrigation is flat (often on a flood plain) allowing the water to be easily moved from the natural source to the irrigated area.

Careful design of irrigation systems is important to ensure:

- water travels down a field at just the right speed to water, but not waterlog, the plants
- that all run-off water is collected and recycled for re-use in the next irrigation
- maximum water savings



Fairbairn Dam - Empty at the start of the cotton season 2007



Fairbairn Dam busting its banks in January 2008



Irrigation water is often stored on-farm in large dams like this one
photo by Annette Coward

Australia's variable climate sees droughts and flooding rains. That's why governments have built public dams to store water so that there can be a greater security of supply

TIMING OF IRRIGATIONS

To really get the crop growing well from the early stages, there needs to be adequate moisture in the soil before the crop is even planted. If there isn't enough water in the soil from recent rains, growers can either add a little extra water before cottonseed is planted or they can add the water just after the seed is planted. This is called 'watering up' the crop. This initial irrigation is usually followed by a further four to five irrigations at two to three week intervals, from mid- December to late February.

The time the crop really needs water the most is during January and February. This is when the temperatures are highest and the fruit on the plants is starting to mature and fill. The timing of these irrigations is crucial to achieve high yields (quantity) and high quality cotton fibres.



Blog: Read this blog to hear from cotton farmer Bess Gairns about how to use probes on the farm

MEASURE TO MANAGE: WATER USE EFFICIENCY

Water is a cotton grower's most precious resource, and so everything is done to conserve moisture to get the most out of every drop. Australia's cotton industry is now considered the most water-efficient in the world.

One of the key ways for growers to save water is to only water the cotton plants when they need it. Fields are equipped with soil moisture probes (called capacitance probes) at regular intervals that electronically measure how much moisture is in the soil. This data is sent back to the farmer's computer system in the office, where an assessment is made about whether or not that particular field needs watering. It's a very measured, scientific approach that has made a huge difference to the way cotton farmers manage their water.



This is a probe to measure soil moisture. It contains a telemetry unit, data logger and solar panel. The moisture probe is in the ground below and generally has sensors at specific intervals in the soil profile, every 10cm for about 120cm

TYPES OF IRRIGATION

MOST OF AUSTRALIA'S COTTON IS GROWN UNDER FLOOD IRRIGATION SYSTEMS, SYSTEMS THAT HAVE IMPROVED THEIR WATER SAVING CAPACITY DRAMATICALLY IN THE LAST 20 YEARS USING A RANGE OF TECHNIQUES.

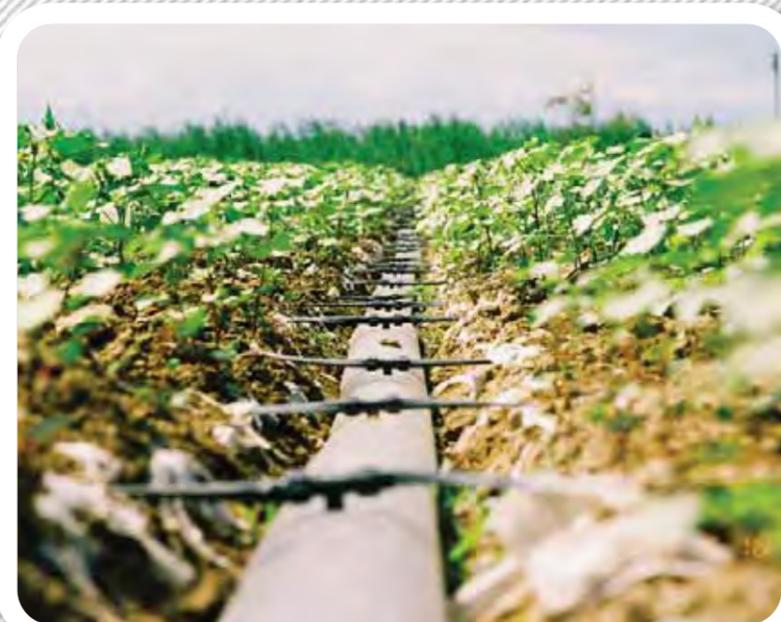
COTTON GROWERS ARE MORE AND MORE USING OTHER FORMS OF IRRIGATION THAT OFFER EVEN GREATER WATER SAVINGS. IN SOME AREAS, ON SOME SOIL TYPES, THESE METHODS ARE NOT SUITABLE – COTTON FARMERS USE THE BEST COMBINATION OF IRRIGATION TOOLS AND TECHNIQUES THAT SUIT THEIR LOCAL CONDITIONS. SOME OF THE NEWER FORMS OF IRRIGATION ARE DRIP, BANKLESS CHANNELS AND THROUGH THE BANK.



Flood irrigation – a birds eye view

DRIP IRRIGATION

Drip irrigation is an option for use particularly in sandy soils (where water disappears quickly) and extremely hot regions (where evaporation occurs quickly). Drip infrastructure (pipes and dripper mechanisms) is laid beneath the surface, deep enough to not be disturbed by cultivation machinery, but at a level enabling the delivery of water directly to the plant roots. Drip irrigation ensures maximum efficiency of water allocation, although the cost is much greater.



BANKLESS CHANNELS

Bankless irrigation is a system of overflowing the head ditch into a paddock with the grade running in the opposite direction to a typical raised bed irrigation and syphon system.

The excess water then drains back into the head ditch and on to the next bay.



Bullamon Plains in St George QLD has a bankless channel irrigation system to conserve water



Case Study: An innovative “bankless channels” approach to irrigation by Cotton Growers of the Year “Bullamon Plains” in St George Queensland

THROUGH THE BANK

This is a syphon-less irrigation system, one of a number that's been extensively trialed in the Australian cotton industry. Pipes are inserted through the channel banks, with “gates” to better control water flow into the furrows.



The Saunders' at St George Queensland have designed and constructed an automated surface irrigation system that added a variable-rates-of-flow function into a syphon-less watering set up



Case Study: The Saunders family are cotton growers who've embraced a new form of irrigation technology, “through the bank”