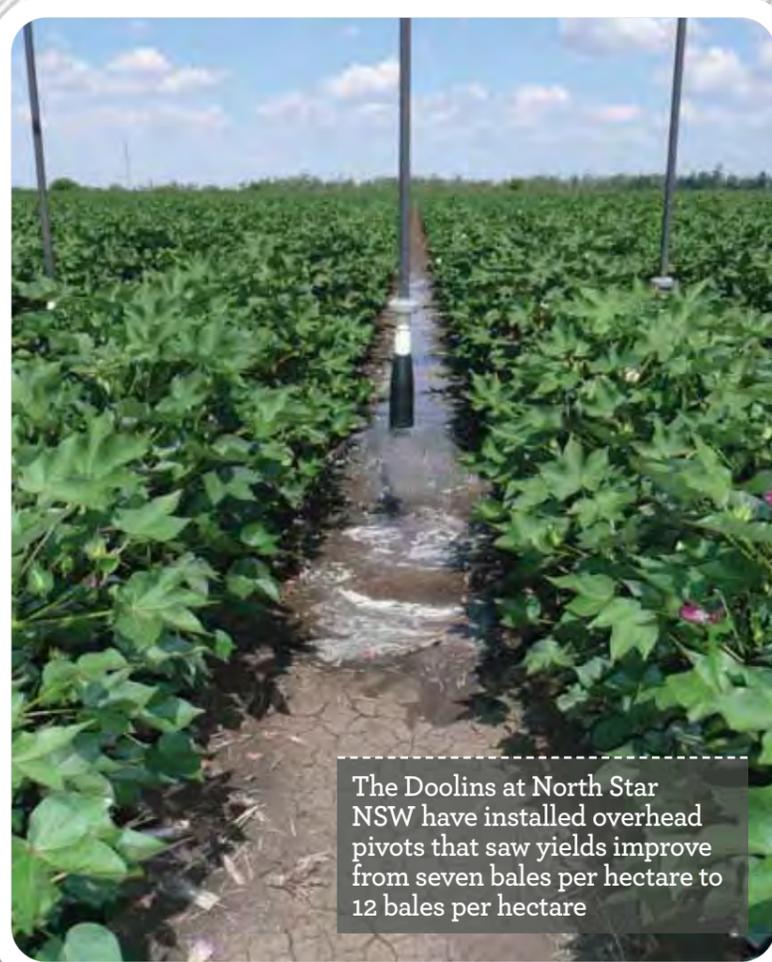




Irrigation efficiencies in action

OVERHEAD PIVOTS OR LATERAL MOVE IRRIGATORS

Overhead pivots, also called lateral move irrigators are large sprinkler-like irrigation systems that water the cotton plants from above, rather than below. The plants are 'sprayed' with water that is released along the arms of the pivot or lateral move. They require a lot less water than flood irrigation, providing great water efficiencies.



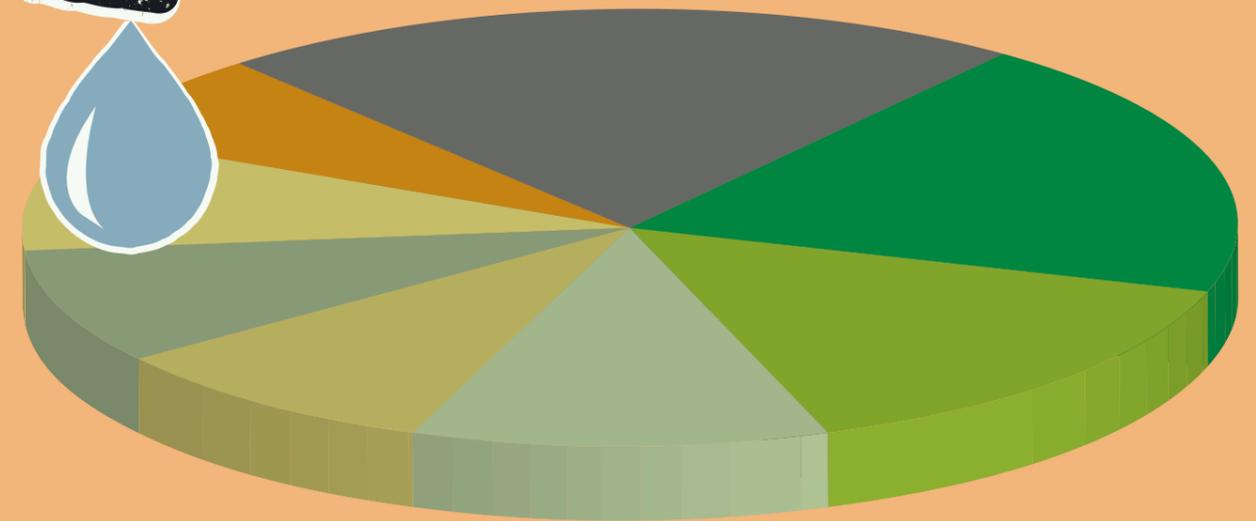
The Doolins at North Star NSW have installed overhead pivots that saw yields improve from seven bales per hectare to 12 bales per hectare



Case Study: Young cotton farming couple Simon and Sandy Doolin have dramatically increased yields with their overhead irrigation system



CROP WATER REQUIREMENTS



Cotton uses about the same amount of water as other summer crops, is drought and heat tolerant and uses less water than rice, maize, soybeans and many vegetable crops. Cotton's average irrigation requirement is 5.2 megalitres per hectare (5.2 ML/ha), compared to rice (10.1ML/ha), nurseries, cut flowers and turf (4.2 ML/ha) and fruit and nut trees. (4 ML/ha).

AVERAGE IRRIGATION REQUIREMENT (MEGALITRES/HECTARE)

● RICE	10.1
● MAIZE	8-9
● SOY BEANS	6-8
● COTTON	5.2
● NURSERIES, CUT FLOWERS, TURF	4.2
● MUNGBEANS	4
● JAPAN	3.5-4.5
● SUNFLOWERS	2-5



Fact Sheet: Cotton and Water

NUTRITION

Just like any living thing, cotton plants need “food” to grow well. It’s important to find the right balance of delivering nutrients to the plant at various stages of its growth, without overdoing it.

To do this, cotton growers need a sound knowledge about plant nutrient requirements and demands and an understanding about soils. Decisions about application of fertilisers are made with consideration of a large range of other factors including crop rotations, stubble management and irrigation practices.

Cotton growers develop a fertiliser program but before that can happen, a grower needs to:

- Determine soil nutrient status through soil sampling
- Calculate expected crop nutrient requirement
- Implement a fertiliser use plan considering – type, rate, application, frequency, timing
- Monitor crop nutrient status via leaf (and petiole) analysis
- Develop a long-term crop nutrition and soil health management plan

The main nutrients that a cotton crop requires are:

- Nitrogen
- Phosphorous
- Legumes
- Potassium
- Zinc
- Iron

The above information was extracted from the Australian Cotton Production Manual 2011-2012, CRDC.



CONTROLLING WEEDS

The cotton farm can be home to a wide range of weed species. Many of these weeds are native and were present before cotton was first grown in these areas. Many more weed species, however, are introduced and have successfully established on cotton farms.

Some of these weeds are of little importance, but most compete with cotton and are routinely controlled on cotton farms. Over 200 weed species are currently considered to be weeds of significance on cotton farms.

Weeds reduce the productivity of the cotton plants by competing for food (nutrients), water and sometimes light. If the weeds put too much pressure on the cotton plants, the quality and yield of the cotton is reduced.

Weeds may also provide a haven for pests and diseases, attracting them to the crop. During harvesting, weeds can choke up the machinery and contaminate the crop, and a contaminated crop means extra time spent in cleaning and processing and additional ginning costs to the growers. Weeds can also cause contamination of the cotton and discolouration of the cotton lint.

There are many different types of weeds found in cotton areas, and they vary between the regions. Some of the common ones are noogoora burr, nutgrass, anoda weed, sesbania and cowvine.

Growers spend a lot of time and effort controlling weeds, using several methods including:

- **Cultivation** – digging up weeds between the rows of cotton using a machine called a cultivator
- **Herbicides** – sprayed to kill weeds before planting and during the season
- **Chipping** – weeding by hand using a hoe-like tool, which is time consuming and labour intensive. This is a much less common practice in the modern cotton industry

MANAGING DISEASES

Diseases affect the quality of the cotton lint as well as the productivity of the cotton plant. Different diseases attack different parts of the cotton plant — the leaves, stem, bolls and roots. Disease may even cause the plant to lose its flower buds and bolls, resulting in no cotton being produced at all.

Cotton can be affected by a range of diseases. The most serious ones in Australia are:

- **Bacterial Blight**, a bacterial disease that causes dark green angular spots on the underside of the leaf. It may also affect young developing bolls
- **Fusarium Wilt**, a common fungus that infects plants via the root system. It blocks the plant’s ability to take up water
- **Verticillium Wilt**, a common fungus that infects plants via the root system. It blocks the plant’s ability to take up water

There are three main ways to combat disease:

1. Rotation and Fallow

Since diseases can build up in the soil when the same crop is grown year after year, crop rotation is a common method of prevention. Rotating or changing the crops in a field every few years means diseases don’t get a chance to settle in, breaking their cycle. Growers may also let a field lay ‘fallow’. A fallow field is a field that is being rested, with no crops in it at all.

2. Plant Breeding

Cotton scientists have also developed resistant or tolerant cotton varieties that are able to fend off certain diseases. By introducing these new stronger varieties growers can get rid of diseases without having to use other methods.

3. Fungicides

A fungicide is a chemical that kills fungi. Most planting seed sold in Australia has been coated with a fungicide to protect it during its early days in the soil.



For all there is to know about the weeds that affect cotton production in Australia, WeedPak, developed by our very own researchers



A comprehensive summary of the diseases that affect cotton plants in Australia, as well as how to manage them

CONTROLLING INSECTS

HEALTHY COTTON CROPS ARE UNFORTUNATELY VERY ATTRACTIVE TO INSECTS THROUGHOUT THEIR WHOLE GROWING PERIOD. AS COTTON IS A LUSH GREEN AND BUSHY PLANT, MANY INSECTS LOVE TO ATTACK IT.

OVER 100 DIFFERENT TYPES OF PESTS ATTACK COTTON WHICH MAKES CROP PROTECTION AN IMPORTANT PART OF A COTTON GROWER'S JOB. IF THESE "BAD" BUGS ARE LEFT UNMANAGED, THE CROP IS BADLY DAMAGED AND MAJOR YIELD AND QUALITY LOSSES ARE THE RESULT.

The following are the main insects that affect cotton production, requiring control measures in most regions in most seasons:

- Heliothis caterpillar (*Helicoverpa punctigera* or *Helicoverpa armigera*)
- Green mirid (*Creontiades dilutes*)
- Two spotted mite (*Tetranychus urticae*)
- Cotton aphid (*Aphis gossypii*)
- Whitefly (*Bemisia tabaci*)

The Harliquin Bug is one of over 100 pests that attack cotton



Combating insects - ladybugs help to eat the 'bad' pests

The worst and most common cotton pest is the Heliothis. Heliothis caterpillars can attack the plant at any stage throughout the season. They feed on the tender growing points and can cause squares (flower buds) and young bolls to drop off the plant. They can also bore into large bolls and allow diseases to enter.

Combating insects

There are many methods used to control insects to ensure high yields and good quality cotton is produced. Using a combination of these methods is known as Integrated Pest Management (IPM), a widely recognised best practice in agricultural insect control.

Some of the methods used to control insect pests include:

- Encouraging beneficial insects into the crop, such as ladybirds, spiders, wasps and ants, to eat the pests
- Regular monitoring of insect populations and crop damage
- Use of transgenic cotton such as Bt cotton (Bollgard II) that is resistant to heliothis
- Alternating pesticides to reduce the chance of pesticide resistance
- Crop rotation to kill the Heliothis pupae living in the soil
- Ploughing the field after harvesting to destroy the Heliothis pupae (pupae busting)
- Biological sprays containing viruses or the naturally occurring soil bacterium *Bacillus thuringiensis* (Bt) that produces proteins toxic to heliothis
- Management of crops to promote early maturity

- Keeping non-crop areas free from weeds, volunteer cotton and other crops

A combination of all of these things has seen a reduction in insecticide use of 87% since 2003, with some cotton crops not sprayed at all these days.

Pest control is a major focus of the cotton industry's environmental program called myBMP, which sets out the latest research and best practice guidelines for controlling insects.



Cotton Pest and Beneficials Guide



If there's a pest or beneficial insect to be found in cotton, it's in this Pests and Beneficials Guide developed by the Cotton Research and Development Corporation



When enough bolls are opened the crop is ready to be picked

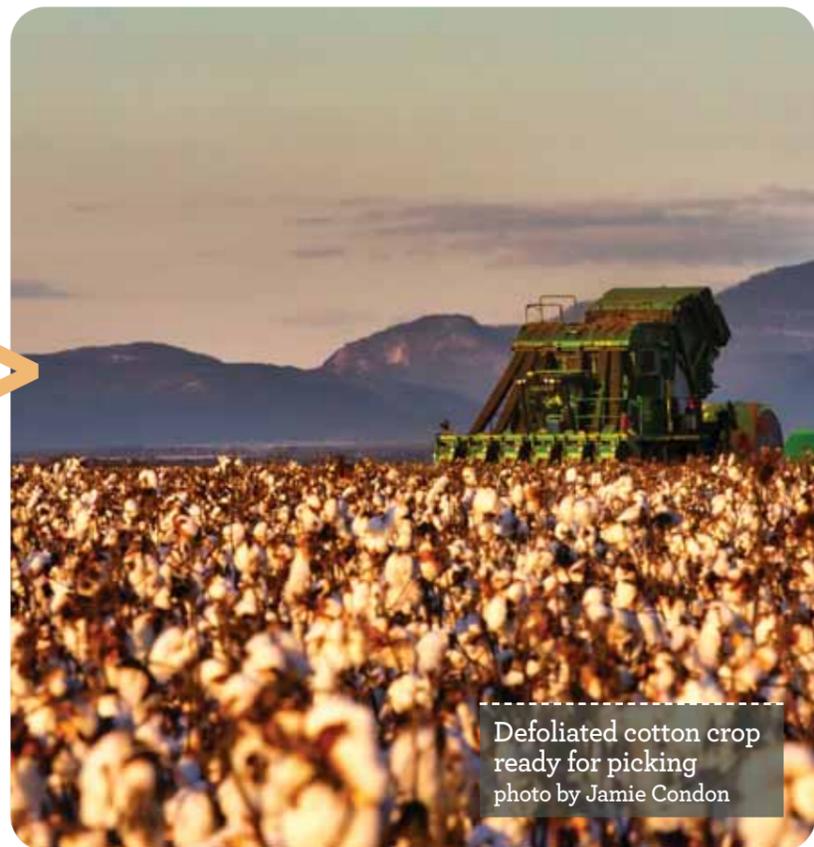
DEFOLIATION

Once the cotton crop has matured and ripened, it is treated with a defoliant before it can be picked (or harvested).

When enough bolls have opened naturally, the cotton is tested to see if it is ready to be defoliated and picked by cutting open the bolls and looking to see if the seeds inside are fully formed.

Defoliant is applied to the cotton plants to help the green leaves dry and fall off and to help any of the remaining unopened cotton bolls to open. The plant itself is not killed and the cotton can be picked cleanly without the leaves staining the lint. This practice enables the grower to hasten the opening of the cotton bolls which can then be picked in a short period of time. It is essential that the crop is harvested before weather and rain can damage or ruin its quality and reduce yield.

Once defoliated, the cotton crop is ready to be harvested.



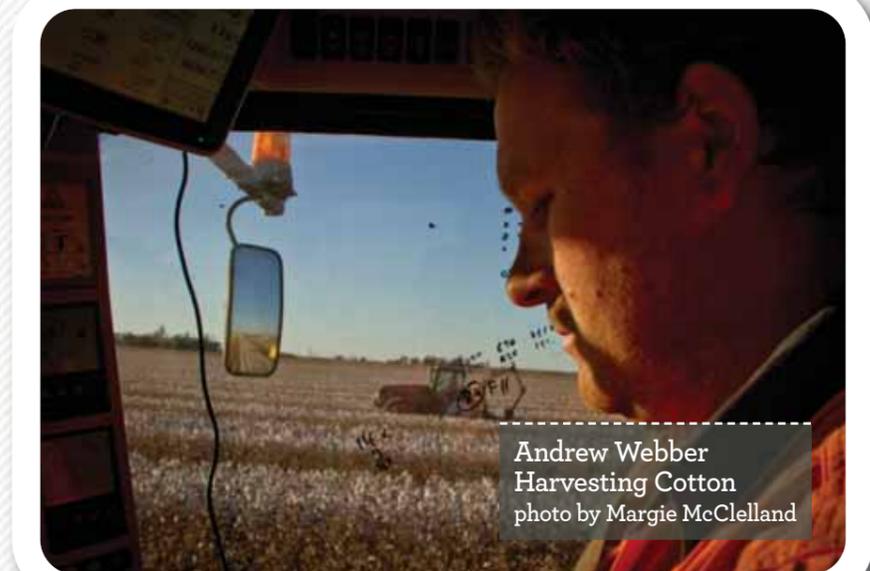
Defoliated cotton crop ready for picking
photo by Jamie Condon

PICKING



Additional manpower is needed on a cotton farm during picking time
photo by Holli Holmes

Cotton picking usually occurs in February to March in Queensland and late March to April in NSW. Cotton picking was once done by hand (and still is in some developing countries) and was therefore a very labour intensive task. Today, it is carried out by large harvesting machines, but still requires significant labour during this busy time of the season. Cotton farmers sometimes own their own picking machinery, but can also use contract harvesters to pick their crop. Additional, casual labour is needed on the farm at this time of year and this is often hard to come by – cotton farmers often use seasonal workers and backpackers to help lighten the load.



Andrew Webber
Harvesting Cotton
photo by Margie McClelland



This work by Cotton Australia is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

TWO PICKING METHODS

A

'BOLL BUGGIES' AND 'MODULE BUILDERS'

Traditional mechanised cotton pickers can harvest 2, 4, 6 or 8 rows at a time and cost approximately A\$500,000 to buy new. The seed cotton is stripped from the bush with a series of rotating combs and then emptied into a tractor-drawn bin called a 'boll buggy'.

When the boll buggy bin is full it is emptied into a 'module builder'. The module builder sits at one end of the cotton field and distributes and compresses the cotton to build a large freestanding stack or 'module' that contains about 13 tonnes of seed cotton. A module is 11-12m long, 2.5m wide and 2.5m high.

The seed cotton in the module consists of lint (fibre) and seed. Modules are covered with plastic tarpaulins to prevent rain damage. They are transported to the gin on either specially designed trucks called chain beds or on normal flat bed trucks where they are stored until they can be ginned (or processed).

A square module builder that compresses the cotton into huge blocks to send to the gin



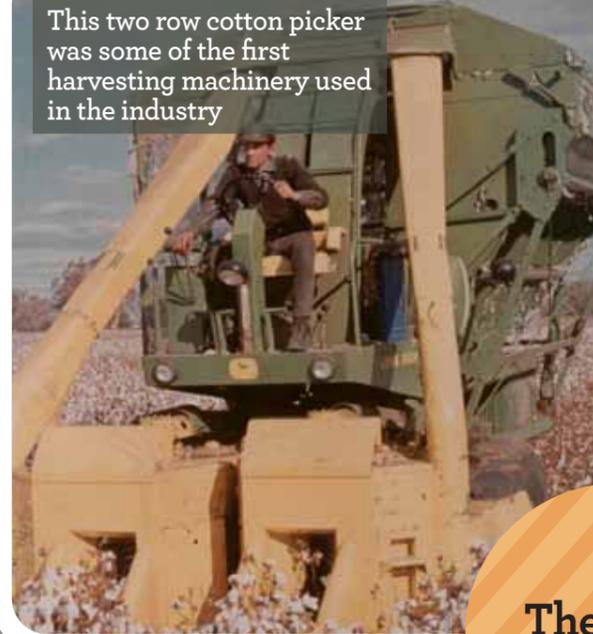
B

ROUND BALE PICKERS

The newest cotton picking technology is an all-in-one machine designed to provide a cotton picker with the ability to build modules while harvesting the crop. These modules are round rather than rectangular and are built and left at intervals all over the cotton field. The round module picker can pick the cotton, compress it into a round module, wrap it in plastic and sit it on the field in a much shorter timeframe than traditional pickers – and using far less labour.

The round module pickers cost approximately A\$750,000 to buy new and over 80% of the Australian cotton crop is now picked with this method.

This two row cotton picker was some of the first harvesting machinery used in the industry



The new round bale technology has cut down the labour required to pick cotton



Then and now



The ins and outs of cotton production from planning to in-season agronomy and getting the crop to market is in the Cotton Production Manual



The myBMP website is the cotton industry's portal for best practice information in all aspects of cotton production. There's even an educators login!