From the seed to the selling: Cotton's life in Hay





Written by Jack Booth, Emily Cai, Nathaniel Clarke, Jacob Lund, Sienna Lund, Isobella Murray and Larissa Sorensen



Hay Public School

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© 2019 Wirraminna Environmental Education Centre, wirraminna.org.au Design by PeeKdesigns, peekdesigns.com.au 'Cobran' is a cotton farm 30km east of Hay on the banks of the Murrumbidgee River. The farm is 13,000 hectares. 'Cobran' has had a very interesting history. It has been a sheep and wool farm as well as a cropping farm. 'Cobran' changed from livestock due to the drought and drop in wool prices and sheep prices. The change to cropping was impacted on by the costs involved in growing a crop. Water prices and the cost of purchasing water meant that an economical and efficient crop needed to be grown. This led to growing cotton on 'Cobran'.

'Cobran' is owned by an American teacher superfund, managed by Westchester Group Investment Management. The Australian cotton company, Auscott Ltd., leases 'Cobran' from Westchester. Auscott planted its first crop of cotton in September 2014 and currently has four farms in NSW. 'Cobran' is the only leased farm, the other three farms are owned by Auscott.



'Cobran' has a huge cotton crop of 3000 hectares (2019 crop). 'Cobran' also has 6000 hectares of developed land so this means that they could grow more cotton on the farm if the costs of water and the climate and other costs were able to be covered by the money made by the crop. The rest of 'Cobran' (7000 hectares) is native and grazing land. Auscott has operated for over 50 years, starting in 1963, in northern NSW. The weather cycle down south meant that it was too cold to grow good, high yielding cotton crops. However, thanks to biotechnology and the development of new varieties of cotton that have shorter growing times, cotton could be grown further down south where the growing seasons were shorter. This meant that southern NSW could start to grow cotton.

Auscott decided to grow cotton down south in the district of Hay. Hay has a permanent water supply as it lies on the bank of the Murrumbidgee River. Another good thing about the land and water around Hay was that it was cheaper than up north.

> These new cotton varieties with shorter growing periods are called genetically modified crops and they are developed through technology advancements made by the CSIRO (Commonwealth Scientific and Industrial Research Organisation), Cotton Research and Development Corporation (CRDC), Cotton Seed Distributors (CSD), as well as big multinational companies.



Ella Steinfort is an agronomist for Auscott and has been working in the cotton industry since 2016, upon completion of her Bachelor of Agricultural Science degree at Charles Sturt University. Ella is currently furthering her education, studying a Graduate Certificate of Cotton Production.

Ella grew up on a sheep farm in Northern Victoria and she knew nothing of cotton prior to attending university! Each day Ella's role involves a wide range of activities depending on the time of year and the crop type. During September to April she only focuses on cotton. Ella physically checks the crops for weeds, pests and diseases as well as nutrition and water stress. She works with Bill and together they decide how to improve the crops through more nutrition. Bill Back is the farm manager of 'Cobran', and started there in 2018. He is married to Skye and they have three boys Lachie, Ethan and the very recent arrival of Elias.

Bill has worked as an agricultural professional for 11 years and enjoys the technical side of agronomy. He first started in the New England Tablelands, advising and conducting trial work on high rainfall properties producing feed for beef cattle. He then worked as an agronomist for Auscott at Narrabri for five years.



Cotton is a desert plant that is used for making fabric. In Australia, it was first grown in Queensland and northern NSW because of the warm temperatures. Generally, hot weather and low rainfall in summer means that the cotton can be finished off in autumn.

New crop varieties with shorter growing seasons means that the cotton can grow in Hay's shorter summers. Hay also has good fresh water. In most years, there is a consistent supply of water flowing past in the Murrumbidgee.



Cotton relies on winter rainfall, to fill the dams and the river. In the summer, water has to be pumped onto the crops so the plants can survive – this is called irrigation. A water license is required to pump water and they are very expensive. The water is only allocated to an irrigator after water has been prioritised for the environment, stock and domestic needs.

In drought and dry times, the allocation of water a farmer can use for irrigation is reduced. Sometimes that means crop yields are affected, and that's not good. This means the farmer may have to buy extra water from someone else. Again that can be really expensive. The costs of growing a crop, including water costs, may end up being more than the money received from selling the harvested crop. In this case, the farmer may decide to grow a different, less expensive crop but they won't make as much money either. This brings down Australia's total cotton harvest for that year.

In times of flood, farmers have different licences that allow them to pump additional amounts of water to help reduce the effects of flooding on the rest of the river system and towns and other farms. This is great for farmers as they can get cheaper water. If they have big storage dams on their property, they can fill them up and have water for years to come. The cotton fields on 'Cobran' normally range from 600m long to 800m wide. The costs are high and include cotton seed (at \$7.50/kg), wages, diesel, vehicles, planting costs, sprays etc.

To break-even, 'Cobran' needs to grow a crop that will produce seven bales of cotton per hectare. Each bale fetches approximately \$450. That means each hectare makes \$3150. If the crop produces more than seven bales per hectare, that is a profit.



A fair bit of money is lost to disease and pests killing the cotton seed, such as the *Heliothis* grub, wireworm and black root rot. A lot of extra seeds have to be planted as many will be lost to pest and disease. In 100 hectares there will be about 17 million seeds planted.



The CSIRO has huge ventures with the cotton industry to produce varieties of cotton which are more pest resistant, more efficient growing and producing higher yields. Cotton Seed Distributors (CSD) are always trying to improve seed development and have trials going all the time in Queensland and NSW.

The CSIRO has plant breeders. The cotton varieties they breed earn royalties from the sale of cotton seed. Australian research has produced profitable cotton varieties for Australian farmers.

Heliothis is the biggest pest in cotton. This grub attacks and eats many of our legume and summer grain crops. The parents (moths) breed and lay their eggs on the cotton plant. When the eggs hatch, the caterpillars (or grubs) are extremely destructive. *Heliothis* has the same life-cycle as the 'hungry caterpillar'.

Scientists are very clever. They have created a genetically modified cotton crop that has three proteins that kill the *Heliothis* grub. This crop is called Bollgard3. With Bollgard3, the grub eats the boles or leaves of the young cotton and then gets a 'tummy ache' from not being able to digest three particular proteins in the cells of the plant and dies. This is fantastic because it means that the pests can be controlled without spraying huge amounts of chemicals. Thanks to biotechnology, the reduction in spraying of chemicals has been reduced by 90% in cotton crops. Next to each Bollgard3 cotton crop there is a sacrificial crop (or refuge crop). This must be a cotton crop that isn't Bollgard3 so it won't affect the heliothis grub, or it can be a crop that isn't cotton, such as Pigeon Pea, which is bright and very attractive to the heliothis moth.

The heliothis moth will happily live in and eat the sacrificial crop, and therefore they don't build up a resistance to the Bollgard3 proteins. That means that their babies won't develop a resistance to Bollgard3. Some heliothis grubs and moths that live in the Bollgard3 cotton may build up a resistance. These moths will breed with others from the refuge crop and the result is their babies won't be resistant to Bollgard3.

Varieties like Bollgard3 mean that less chemicals are sprayed on the crops. This is good for the environment and also helps the cotton crop produce a high yield.





The cycle of growing cotton takes twelve months.



The soil is prepared in January/February in preparation for, hopefully, a wet winter. A wet winter is very important. The cotton bay (field) is like a big bucket, catching and holding the water. If it does not rain, 'Cobran' needs to irrigate the bays by buying water and pumping it through the river pumps. Usually, pumping is required each year but the more winter rainfall, the better. In dry times and droughts, unfortunately there isn't a lot of water and when there's no water, no cotton is grown.

Water can also be recycled after it has watered the bay. The bays are laser levelled so that they slope slowly down towards the end of the bay. The water runs from the top end of the bay, down to the bottom end. When the water arrives at the bottom it is recycled by pumping the water back around through the channels to the top of the bay and it can be used again, if necessary. Just before planting the bays are worked on with tractors and ploughs in a process known as 'hilling up'. These hills are in rows and this is where the seeds will be planted. The rows are one metre apart, from the top of the hill in each row to the next.

When the seed is planted, a machine behind the tractor cuts a line in the soil at the top of the 'hills', plants the seeds and presses the soil back down all in one process. Because of the cooler climate, 'Cobran' loses seeds through black root rot and through pests and disease. Emus and kangaroos can also squash the little cotton plants as they move through the bays. Therefore 17 seeds per metre need to be planted in the field to allow for this loss. Hopefully, the field will end up with 13 or 14 seeds per metre that germinate and grow. That means 140,000 seeds per hectare.



Planes are used to spray the crops with a hormonal-type of spray during defoliation. Planes are more economical and more efficient than any other type of spraying. There are eight passes of planes over the cotton crop while it is growing.

Defoliation is a hormonal-type of spray. It tells the cotton plant that it is 'autumn'. This helps open the unopened cotton boles by adding Ethephon, which is a ripening chemical the plants convert into Ethelene. It is important that the boles all open together so that all the cotton can be ready and ripe for picking at the same time.



After picking, the standing empty bushes are mulched. The plants are cut by two discs rotating in a fixture behind a tractor. The top of the cotton plant is mulched while at the same time the two discs are cutting the root underneath. This is called 'root cutting'.

The cotton trash, organic waste, is put back into the soil. This is fantastic for a number of reasons. Firstly, all the organic matter is good to reduce soil erosion. It is hard for the wind to blow the soil away with so much organic matter holding it together. The organic matter is also mulched back into the soil, which puts minerals and nutrients back into the soil and are available for the next crop.

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The cotton is picked on 'Cobran' towards the end of April/May by machines known as cotton pickers (pickers). The pickers are very expensive machines and cost about \$1.2 million. Auscott have their own pickers and drivers.

'Cobran' owns a number of pickers but they also employ contractors to help pick the cotton. Contractors are people who have their own pickers and pick other people's cotton. They



may start picking cotton in Queensland and then work their way down south where the cotton is picked later on in the season. Contractors also have their own trucks and can float the pickers down from the north. They also use the trucks to cart the cotton from the farm to the cotton gin.

The picker has big spindles at the front that spin around and go up and down. As the picker moves through the cotton crop the bushes pass through the spindles. The spindles comb the cotton off the bushes in a big spiral. It is similar to brushing hair.

Even though the ground has been lasered, it isn't always completely even and flat. The pickers have sensors that guide the spindles to move up and down so the machines aren't destroyed by being driven into the ground.



When the cotton is combed off the plant by the spindles, a fan sucks the cotton up some big black pipes. The cotton then goes into an area behind the cabin called the accumulator. Once the accumulator is full of cotton, it triggers the bale (round/module) process. Four accumulator bins full of cotton are rolled up and pressed into one round/module.

The round/module's average weight varies between 2100-2500kg and 240cm in diameter. The round is wrapped up in plastic in the machine. This is usually yellow plastic but at times can be pink (a fundraiser for breast cancer). A camera in the cabin shows the round being wrapped and dropped out the back. This is called 'laying an egg!'

The pickers weigh about 30 tonnes. One picker can pick around 30 hectares per day. Picking cannot begin if the moisture in the cotton is above 12% because the cotton fibres take in the moisture. This could lead to the cotton rotting in the rounds (modules) or it could even make the module flammable. This is why it is more difficult to pick cotton in cooler climates. A heavy dew in the morning can stop the pickers from starting. Picking usually doesn't begin on 'Cobran' until 10am. If the moisture is 12% or lower, the pickers can keep going until the moisture rises, sometime through till midnight!



It costs \$20/minute to run one picker so it is important that there are no stoppages. Pickers go at a speed of 6 km/hour and 1000 litres of diesel are held in the picker. The picker picks six rows of cotton at a time. Everything is about time and beating the weather.

Safety, servicing and cleaning of the machine, is very important. This helps avoid breakdowns during the day so that the cotton can be taken off the crop as quickly as possible. This saves money and reduces the chance of being held up because it is raining. Also, it is very important to blow the cotton trash off the picker in every nook and cranny as cotton is very flammable. The machine could burn to the ground if the cotton caught on fire.

Once the module has been put on the ground by the cotton picker, it is picked up by a machine known as a bale grabber. It is then loaded on a truck and sent to the Auscott gin in Hay.





The Hay cotton gin is owned by Auscott Limited and was completed in time for ginning in 2015. Auscott is an Australian owned business that started in 1963 (over 50 years ago). Its parent company is an American company JG Boswell and Co., a company from California started by JG Boswell. JG Boswell and Co. grow crops such as tomatoes, pistachios and cotton.

Auscott Australia first started operating in northern NSW and now operates in the river valleys of:

- Namoi Valley, around Narrabri and Wee Waa
- Macquarie Valley, around Warren and Trangie
- Gwydir River, around Moree
- Murrumbidgee River, which includes the area of Hay.





A cotton gin is where cotton is processed. The Hay gin is called Gin No. 11. The gin took 11 months to be built which equals 138,000 man hours. It is the 11th gin built by Auscott in Australia. Five of those gins have been either upgraded or decommissioned, so there are currently six processing gins in Australia owned by Auscott. Gin No. 11 is the most technologically advanced gin in the world. During our visit to the Auscott No. 11 gin we were accompanied by Mr. Eddie Redfern (Grower Services Representative). Eddie was a huge help to us in learning about the workings of the cotton gin and we were really appreciative.

Eddie was born in Warren NSW (where Auscott's Gin No. 7 is located) and grew up in Ganmain NSW. He worked with the Bank of NSW in Albury, which is now Westpac, for many years. He has two children, Rory and Zac, who were both educated locally. Eddie worked at Ravensworth, Hay, and this is where he first encountered cotton. He started working with Auscott in January 2014.

Eddie's role is being a connection between growers and Auscott's processing (ginning) and production (farming) departments. It includes the negotiation of ginning arrangements and purchase/sale of their lint and cottonseed. He is a single point of contact for all growers contracts, deliveries, ginning, reports and payments. Eddie's role allows him the opportunity to be part of a long established and highly regarded Auscott brand within a domestic and international cotton industry.

Craig Gaston is an Operations Manager with Auscott. He comes from a trade background, beginning his career as an apprentice at Auscott in Moree. He went on to a supervisor role in the north west NSW facility before becoming Gin Manager in 2005. Craig has gained post trade engineering, management and leadership qualifications and moved to Hay in 2014 as Commissioning Manager for the Gin No. 11 construction project. After the project was completed, Craig became the Site Operations Manager where he is today, enjoying life with his family in the beautiful Murrumbidgee Valley and the Hay community.

We are very grateful to both Craig and Eddie for allowing us the opportunity to visit Auscott Gin No. 11.

STAFF (L-R): EDDIE REDFERN (GROWER SERVICES REPRESENTATIVE), MEGAN PEARSON (ADMINISTRATION OFFICER), KAREN MARTIN (WHANDS CO-ORDINATOR), HEIDI STEPHENS (ADMINISTRATION OFFICER) AND CRAIG GASTON (SITE OPERATIONS MANAGER). The ginning season runs for approximately four months depending on the amount of cotton received by the gin. That means that there are 7 to 8 months of maintenance. This is a very important time to make sure that all the machines in the gin are running efficiently. In ginning season, the gin runs for 24 hours everyday, so breakdowns in machines can hold up the ginning process.

Each shift for the gin workers is 12 hours. Auscott employs 60 to 70 full-time and casual people during their peak season – picking and ginning.



Gin No. 11 processes all production from Auscott's 'Cobran' property. It also processes other farmer's cotton in the region, which may be sourced from the Lachlan, Murrumbidgee and Murray valleys. The farmer can then sell their cotton (lint) to any cotton merchant, of which Auscott is one. The role of the marketing team at Auscott is to negotiate with the growers (farmers) and the buyers, who buy the processed cotton for their mills. A farmer might ring up and say, "I have 100 hectares of cotton (which usually means 10 bales per hectare or 1000 bales), and I would like to know what price I can get for my cotton". Most negotiations are undertaken carefully to avoid any overcommitment by the farmer.

The Auscott marketing team need to consider the Cotton Futures pricing which is set by the Intercontinental Cotton Exchange (ICE) in New York, USA. This platform enables Auscott to quote the farmer a price for his cotton. The pricing from ICE is in US cents/pound so the foreign weight and currency needs to be converted to Australian dollars (AUD) and kilograms (kg). Farmers are then quoted a domestic bale price (AUD/bale). This price moves up and down, similar to a stock market, so the price will vary depending on the supply and demand of world cotton on a daily, if not hourly, basis.



Under normal circumstances a farmer doesn't get paid for their cotton until 14 days after ginning. Premiums and discounts will be factored into this price, including levies and ginning fees.

Farmers can also forward contract their prices. This means farmers can negotiate with Auscott and set a price for cotton over the next three seasons. This can be a great marketing opportunity for the farmer if cotton prices go down in that time, however the farmer has to be careful to fulfil the contract and provide the quantity of cotton that was set. If it has been a bad year, the farmer may have to source cotton from elsewhere or wash-out/roll-over any shortfall, which could be expensive. Fortunately Australian cotton has a fantastic reputation around the world for being contamination free and of very high quality. This allows for premiums to be provided to producers in the form of a Basis, which is added to the Cotton Futures pricing.

In a healthy growing season, including good water availability, Australia can produce upwards of 4 million bales. This would equal approximately 1 million tonnes of cotton seed being produced and sold. In 2019, a smaller production of approximately 2 million bales is forecast due to dry conditions and lack of water availability.

One of the most expensive factors in growing cotton is water. A farmer needs on average 10 megalitres of irrigated water per hectare to grow a good quality crop of cotton in southern NSW. The numbers of rounds (modules) received by Gin No.11 depends on each farmer's production. This production is largely dependent on water availability. In a good season with lots of water availability, with high allocations of water being pumped from the rivers and underground bores, Gin No. 11 could process (gin) around 200,000 bales of cotton, which is equivalent to 47,500 rounds/modules. In the 2019 season, because there has been less water available and not much rainfall, Gin No. 11 expects to receive around 28,500 rounds/ modules which is the equivalent of around 120,000 bales of cotton.

When the cotton is of good quality, allowing the machinery to run well, Auscott can gin more than 2000 bales of cotton per day. This is equivalent to about 475 rounds. The best production day that has been achieved so far was 2,256 bales – or 94 bales per hour or one bale every 40 seconds! Trucks deliver rounds into the module yard, usually in road-train configuration (2 x 6 modules per trailer). The rounds are protected with a plastic wrap that is applied during the picking process. After ginning, all bales will leave the gin within seven days. That is a really quick time!

Each module that comes in from the farms has its own unique module ID number. This can be scanned and used for identification and the cotton can be tracked back to the farm where it came from.

planting

picking

late April

May-June

Each round module is 2300kg on average. There are three components which make up the seedcotton in each module – cottonseed which is about 50% of the module, cotton (lint) – 40% and trash 10%. Lint and cottonseed are the marketable components.

Once the trucks arrive with the cotton rounds/modules from the farms they drive onto a weighbridge where the modules are scanned and their identification code is put in the system. The truck then offloads the cotton in the module yard.





The 2300kg round is unloaded by a moon-buggy that can carry several rounds (typically 6) at once. When time to be ginned, the moon-buggy tips and rolls the modules onto a 'walking floor' at the gin's feeder bay. This moves the modules towards the feeder-head, which breaks down the seed-cotton for a smooth flow into the gin. While it is on the walking floor the plastic wraps are removed.

At the feeder-head seed-cotton drops down into an area under the ground. The cotton is dried by gas heat ideally down to 6% moisture so it can be cleaned. The seed-cotton passes through various stages of drying and cleaning until it arrives at the gin stands. This is where the cottonseed is separated from the lint by a number of gin saws that effectively pull the fibre away from the seed. The cottonseed is then conveyed and blown through piping across to the seed shed. The trash is also collected at various cleaning points and similarly blown through separate piping to a trash receival shed. The lint receives a final cleaning before it passes through a battery condenser unit where moisture is reapplied to achieve the desired 7% level.





The last step is when the cleaned lint, which is free of cottonseed, moves down a slide through a tramper and into a below ground metal basket or box. The lint is then pushed above ground for pressing using an extremely large single ram. The ram has a 4,000 PSI rating, so the bales are high density pressed. Each bale weighs approximately 230kg after it is pressed, strapped, bagged and labelled.

Two samples are taken from each bale. These samples are sent to classing facilities where the quality of each bale is determined – colour, leaf, staple, strength and micronaire. These provide calculations for any premiums or discounts to apply to a farmer's lint contract. Through the individual round/module serial number each bale of lint can be traced back to a particular producer, farm and field. Amazing!

The cottonseed is used mainly for stockfeed and can also be used for oil. It can be in high demand during droughts or long dry conditions. Hillston has the nearest crush for making cottonseed oil. The cotton is mainly used for fabric. The trash can be composted and returned back to the field which provides minerals and nutrients for the next crop. Even the plastic wrap, which is around each module, is recycled. Practically every bit of the cotton crop is reused.



During the ginning a by-product called 'mote' is produced. Mote is like the 'lint' from your clothing dryers. Even this is not thrown away. It is bailed and sent overseas to make the cotton bags that cover the processed bales.

The square bales are stacked, in lots, on a bale pad at the gin. Different lots represent different merchants (buyers of lint).



After the cotton is processed, the Auscott cotton is sent on trucks to warehouses near the Port of Melbourne ready for shipping/export. Other bales are similarly relocated by merchants to their warehouses ready for export overseas. Road freight is typically in B'Double closed configurations which can transport around 170 bales at a time.

100% of Australian cotton is sent to spinning mills located in Asia.

The seed shed is located close to the gin shed and connected by a pipe which conveys the cottonseed for temporary storage. The roof of the seed shed is pointed and looks like a huge triangular prism with a 45 degree pitch. This is because when the cottonseed is dropped from the roof into the shed, it falls and builds up in the middle like a pyramid. This means that the shed can store the maximum amount of seed with no space wasted.

The level of moisture in the massive seed stack is strictly monitored. If moisture levels are too excessive, the cottonseed can combust. Aeration has to be provided to help maintain moisture and temperature to acceptable levels.

Auscott likes to buy the majority of cottonseed from their growers, which enables them to market the seed for export, oil crush, feedlots or graziers. Some growers retain their cottonseed for use in their own feedlots. Cottonseed has a high nutritional value for stockfeeding purposes and also has the added benefit of roughage from the seed husk.





The cotton industry works with Cotton Seed Distributors (CSD) to produce pure seed for planting purposes. These are typically grown up north under strict conditions where the seed is collected separately after ginning, 'denuded' (removal of remaining lint/fuzz around the seed) and various treatments applied.

CSD are the sole sellers of cottonseed in Australia. These seeds are genetically modified to ensure high quality/yields and resistance to pests and diseases.





The cotton industry is a fantastic industry. We learnt so much about cotton on our field trips to 'Cobran' and Auscott Gin No. 11. We learnt about the science and huge effort that goes into growing cotton. We also learnt about the marketing and production of cotton materials. We are very lucky to have an industry like cotton in our community of Hay.



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2019 Hay Public School

