

Biotechnology traits

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The introduction and adoption of biotechnology traits has delivered significant benefits for Australian cotton growers and cotton production systems. Following the introduction of the first biotechnology trait (INGARD® cotton in 1996), biotechnology has today become a very important

feature of cotton production and a key component in cotton breeding programs. In 2010, approximately 98% of the cotton planted in Australia contained at least one biotech trait which underlines the importance of the technology to Australian cotton growers.

Biotechnology has delivered real benefits to cotton growers and has significantly reduced some of the production risks associated with the crop. This has directly enabled growers to focus on key management strategies to drive yield and fibre quality outcomes. The technology has also allowed growers in non-traditional growing areas to explore cotton as a mainstream cropping option and adapt their farming system (irrigated or dryland) to benefit from cotton as part of their rotation.

Today there are two broad classes of cotton biotechnology traits which are approved and available in Australian cotton varieties providing either insect protection, herbicide tolerance or in varieties which are 'stacked' with a combination of both traits.

Bollgard II® technology provides control and aids the management of *Helicoverpa* species in cotton. It expresses two specific proteins isolated from *Bacillus thuringiensis* (Bt) which are efficacious against *Helicoverpa armigera* and *Helicoverpa punctigera*. One of the key benefits of Bollgard II has been the significant reduction in insecticide use which has allowed for an increased adoption of IPM principles as well as providing growers with a consistent platform to manage insect control costs.

Roundup Ready Flex™ technology confers full season tolerance to glyphosate herbicides. The ability to use Roundup Ready® herbicide in crop to control a wide range of weeds in crop allows growers to design weed control programs that can target individual fields and specific weed problems. The technology has reduced the reliance on pre-emergent herbicides and has allowed growers to more effectively use minimum tillage techniques and reduce manual weed chipping costs.

Liberty Link® cotton confers tolerance to Liberty® (glufosinate ammonium) herbicide which is registered to control a range of broad leaf and grass weeds in crop. This technology utilises the herbicide glufosinate which has particular strengths including the ability to control hard to kill weeds including weeds like peach-vine which are not well controlled by glyphosate. Liberty herbicide also provides useful control of glyphosate tolerant cotton volunteers.

The future

Biotechnology is a rapidly developing field of science and cotton is a global core crop benefiting from this global investment. There is a dynamic horizon of novel and emerging technologies in various stages of development which continue to provide opportunities for the cotton industry to address production and environmental challenges. Whilst today's trait portfolio is strictly confined to insect (lepidopteran) and herbicide tolerance, a raft of new technologies is close at hand with potential solutions likely for abiotic stresses (moisture & disease tolerance), new classes of herbicide tolerance, broader insect control platforms and nitrogen use efficiency technology to name but a few.

Accessing biotechnology traits

The access to the various traits is governed by the major technology companies who develop and commercialise the technology via an annual license called a 'Technology User Agreement' (TUA). The TUA forms the basis of the relationship between the grower and the technology company. Its primary purpose is to clearly define the terms and conditions associated with use of the technology in a particular cotton season. It covers a broad array of matters and includes the prices, payment and risk management options for the technology. It also includes stewardship requirements particular to a technology.

In practicality, the actual licensing process is managed by Technology Service Providers (TSPs) on behalf of the technology companies. TSPs are primarily well known local and national retailers of crop protection products and cotton planting seed. Growers should direct initial enquiries about accessing biotechnology to their local TSPs.

A list of current TSP's can be located at:
www.monsanto.com.au/products/cotton/
www.bayercropscience.com.au/

Stewardship

All cotton biotechnology traits commercialised in Australia are supported by an appropriate stewardship program which forms part of the annual Technology User Agreement (TUA) between technology owners and growers. The stewardship programs are a product of collaboration between the cotton industry and the developers of the technologies with an aim of supporting their long term sustainable use. This is



of natural resistance to technology (for example to prevent the development of populations of target insects that are resistant to the Bt proteins in Bollgard II® cotton, or to prevent the development of annual ryegrass populations that are resistant to glyphosate, the active ingredient in Roundup branded agricultural herbicides). These plans are important to ensure that Australian farmers continue to reap the benefits of GM technologies for many years.

Specific trait stewardship information can be found at the following websites:

www.monsanto.com.au/products/cotton/

www.bayercropscience.com.au/

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important to ensure the traits continue to provide value to growers and more importantly provide a basis for the introduction of new novel traits.

Stewardship programs are reviewed periodically to ensure that they are delivering against this goal and where necessary, changes may be implemented to ensure that any risks to the sustainability of a particular technology can be managed.

A key part of the stewardship program is the development of management plans that clearly set out the requirements for on farm management of crops containing GM technology. These plans are developed in consultation with industry groups and key researchers. They include:

- **Crop Management Plans** that cover all aspects of the crop from seed receipt to grain delivery.
- **Resistance Management Plans** that specifically aim to prevent the development



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