

Given the importance of Bollgard technology to the Australian cotton industry and the performance issues raised by John Barber in the previous article, we gave Monsanto Australia a chance to respond to the concerns.

Sustaining Bollgard performance

By Dave Moore, Technical Development Lead, Monsanto Australia

Bollgard II* is the cornerstone of integrated pest management for the Australian cotton industry. As such Monsanto is committed to ensuring the longevity and ongoing stewardship of the technology and we're investing a large amount of resources in a number of areas to ensure growers and the wider cotton industry continue to benefit from this valuable product.

The performance of Bollgard II

In commercialising Bollgard II we were aware of how the technology would perform in less than ideal conditions, such as high pressure and environmental stress, especially later in the season. This explains the emphasis on monitoring and the possibility of additional *Helicoverpa* control in the accreditation manual and course.

The experience from the pre-commercial data led to the expectation that Bollgard II was a significant improvement in terms of efficacy over Ingard*. In line with this expectation, the extension message from our accreditation manual was that Bollgard II would "provide significantly higher and better protection against *H.armigera* and *H.puntigera* than Ingard cotton provided in the past.

"However, the technology does not make cotton *Helicoverpa*-proof. High pest pressure may still necessitate sprays for *Helicoverpa* during the season and pressure at the end of the season may still require additional chemical control..." (For further information refer to the Bollgard II Accreditation Manual 2003)

This season, as has been the case every season, the technology has performed as we would expect. In fact, of the 1662 fields of Bollgard II planted this season, only 35 (2.1 per cent) have been sprayed for *Helicoverpa*, giving a clear indication that Bollgard II is performing at expectation across a number of geographies.



Monsanto entomologist Kristen Knight inspects a Bollgard crop with Dave Moore.

This is consistent with data collected by the CCA across the cotton growing valleys over the past three years.

Resistance monitoring

For a number of seasons, we have collaborated with the CSIRO on our resistance monitoring program. This has provided a strong basis for effective resistance management through random allele monitoring of the field *Helicoverpa* populations. In Australia, no changes have been seen in the frequencies of resistance alleles over the four years of F2* screening for either Cry1Ac or Cry2Ab proteins.

No resistant individuals have been found in the field and therefore we have confidence in the Resistance Management Plan as it stands today. Obviously we will continue to work closely with the CSIRO on this important program and assess all new scientifically valid data as it comes to hand.

Larval thresholds

While both Cry1Ac and Cry2Ab are both very effective against *Helicoverpa* there are occasions in a season when pollen feeding larvae may cause square and boll loss. It is in these situations that there is a need to have a larval threshold for growers and consultants to use in assessing whether to topically apply pesticides.

Monsanto is funding this Bollgard II threshold research project being con-

ducted by Bao Lu — based at ACRI. The results of this work will assist crop managers in getting the best out of Bollgard II technology.

Refuge efficiency

To ensure that refuges are effective and help sustain Bollgard II technology in the longer term, one of our major research priorities is investigating refuge productivity. Ultimately we would like to have a small refuge requirement that is extremely productive. To assess whether this aim is feasible, Monsanto has initiated further research into the efficacy of the three high adoption refuges — sprayed cotton, unsprayed cotton and pigeon pea.

Our aim, should the data support such a finding, would be to implement a new five per cent refuge option — ideally this would be unsprayed cotton. While pigeon pea can be an extremely effective refuge, it is prone to be variable in productivity and can be difficult to manage.

In terms of stewardship of Bollgard II, all crop managers need to ensure that whichever refuge option they choose to grow, it is attractive to *Helicoverpa* throughout the season.

The first driver of Monsanto's research and development effort is sustaining existing technologies which provide tangible benefits to our customers. The second is developing cutting edge technologies that enable those same customers to become even more competitive.

We will continue to do both in collaboration with our research partners and remain committed to servicing our growers' needs.

*Bollgard II and Ingard are registered trademarks of Monsanto Technologies LLC.
#The F2 screen method estimates the frequencies of rare resistance alleles.

TABLE 1: Single mated pairs (SMP) tested at F2 with Cry2Ab*

Year	Alleles tested	Number resistant	Frequency
2003/04	688	2	0.003
2004/05	500	1	0.002
2005/06	596	3	0.005
2006/07	656	3	0.004
2007/08 (testing not complete)	152	0	0
* Monsanto Australia data			