

**Forum on Managing Biotechnology  
1992 Australian Cotton Research Conference**

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**Chemical pesticides and Bt toxins.**

The Australian cotton industry relies heavily on chemical pesticides for management of a diverse array of pest insects, weeds and diseases. Pesticide use is a major economic and environmental liability for the industry and all measures to reduce this dependence need to be taken.

The bacterial pathogen of *Helicoverpa*, *Bacillus thuringiensis* (Bt) is one avenue for reducing the use of conventional chemicals. Bt produces a series of endotoxins which are highly specific for particular insect groups and is thus ideally suited as an environmentally friendly pest control agent. One Bt strain is toxic to Lepidoptera and is being increasingly used for *Helicoverpa* control in cotton. Many chemical companies are investing heavily to produce efficacious, reliable and cost effective Bt products and their use is likely to increase dramatically over the next decade.

Coincident with this change the industry will see the release of genetically engineered cotton varieties which have been transformed to produce the delta endotoxin from Bt, making them highly resistant to feeding by *Helicoverpa* larvae. CSIRO has transformed all the elite varieties currently available from the Narrabri breeding program to express one of the Bt toxins. *Helicoverpa* larvae feeding on them are quickly immobilised and killed by the bacterial toxin produced in various plant tissues. Other pest resistance genes suitable for engineering into cotton are also being sought, but the first transformed varieties available for commercial release will contain only the Bt toxin gene. Other breeding companies also propose to introduce Bt transformed cotton varieties. With the

first field trials of CSIRO varieties planned for next season, it is likely to be 4-5 years before Bt cottons are commercially available.

### **High Value Technology.**

The technology to genetically engineer plants is of crucial importance to the future of Australian agriculture, and will be especially valuable to the cotton industry through Bt cottons and other future developments. Likewise the conventional use of efficacious Bt sprays will have great value. It is essential therefore that these technologies be used and managed carefully to ensure their long-term viability as pest management tools

### **The danger of resistance.**

Bt is no different to any other chemical in its susceptibility to resistance developing in the target pest. Given sufficient selection pressure through extensive and excessive use of Bt sprays, particularly against *H. armigera*, resistance will occur. Resistance to Bt has already arisen in Lepidopterous pests in several parts of the world, all through overuse of conventional Bt sprays. Transgenic cottons expressing only Bt toxin may also select for resistance, though until we conduct field studies we cannot be sure of the magnitude of the risk. In the longer term CSIRO will be introducing additional unrelated genes for resistance characteristics to provide a multilayered resistance which will be much more difficult for *Helicoverpa* to overcome. In the meantime it will be essential that Bt toxins, whether in sprays or plants, are used and managed in a co-ordinated and sensible manner so as to minimise the risk of resistance.

### **Past Experience.**

The cotton industry has already encountered serious resistance problems. Many growers will remember the DDT resistance experienced in the early 1970's and all are aware of the current problems with pyrethroids and possibly endosulfan resistance. We, the industry and researchers, do not have a good track record in using chemicals rationally to avoid resistance. The pyrethroids are a good case in point. Released euphorically in the late

seventies seemingly as panacea for pest management, we blew them by the early 1980's through overuse. The industry wide implementation and maintenance of the Pyrethroid Resistance Management Strategy has been impressive indeed, but this occurred only after the appearance of resistance. With so much pressure on the industry from environmental groups we cannot allow the same fate for Bt toxins.

The introduction of "the Strategy" demonstrates, however, that the Australian cotton industry is sufficiently well organised and dedicated to a common goal of sustaining production in the long term that voluntary measures which restrict or regulate management practices are possible. The forum session on managing biotechnology at the 1992 Cotton Conference represents the first step in what will be a long process to implement a management strategy for Bt toxins in both plants and sprays to ensure their long term availability.

### **Workshop and Forum**

The process started with a Cotton Research and Development Corporation funded workshop at Narrabri immediately before the conference (August 4-5 1992), where researchers, representatives from chemical companies and various industry bodies met to discuss the issues surrounding the use and management of Bt, whether as a conventional spray or in transgenic plants. The aims of the workshop were:

- to provide a forum for the expression of opinions
- to explore all possible strategies for the management of Bt toxins
- to identify options which are logistically and economically feasible for implementation
- to determine the research needed to underpin a workable management strategy

This was a curtainraiser to the forum session at the conference where growers will be presented with a series of options and viewpoints from invited speakers representing all sectors of the industry. The aim of the forum is to initiate a process of informed

discussion within the cotton industry which will hopefully culminate in an industry agreed management strategy within 2 years (ie. by the 1994 Cotton Research Conference). It is essential that growers realise that it is the industry at large who must develop and implement such strategies. Researchers can advise and assist but without a will throughout all sectors of the industry there is little likelihood of success.

### **The Future**

The forum session will no doubt be the first of many meetings organised by Grower Associations and others to discuss, argue, formulate and ultimately agree on a course of action. Given the same commitment as was made with the "Resistance Strategy", I believe a successful plan can be devised and implemented.