



EXECUTIVE SUMMARY
of
THE RISK ASSESSMENT AND RISK MANAGEMENT PLAN
for
APPLICATION No. DIR 035/2003

(Field trials of herbicide tolerant (Roundup Ready[®] MON 88913) and herbicide tolerant/insect resistant (Roundup Ready[®] MON 88913/Bollgard[®] II) cottons)

THE REGULATION OF GENETICALLY MODIFIED ORGANISMS

The Gene Technology Act 2000 (the Act) and the *Gene Technology Regulations 2001* (the Regulations) set out requirements which the Gene Technology Regulator (the Regulator) must follow when considering an application for a licence to intentionally release a genetically modified organism (GMO) into the environment.

For a licence to be issued, the Regulator must be satisfied that the release will not pose any risks to human health and safety and the environment that can not be managed. To this end, Section 51 of the Act requires the Regulator to prepare a risk assessment and risk management plan (RARMP) for each licence application, in consultation with a wide range of expert groups and stakeholders.

Under Section 52 of the Act, the Regulator is required to seek comment on the RARMP from those consulted in its preparation and to invite submissions from the public. Matters raised relating to the protection of human health and safety or the environment are taken into account in finalising the RARMP, which then forms the basis of the Regulator's decision on whether, or not, to issue a licence.

THE APPLICATION

Monsanto Australia Ltd (Monsanto) has applied for a licence (application number DIR 035/2003) for the limited and controlled release of genetically modified (GM) herbicide tolerant cotton (Roundup Ready[®] MON 88913) and herbicide tolerant/insecticidal cotton (Roundup Ready[®] MON 88913/Bollgard[®] II) into the environment. Monsanto proposes to conduct four trials (two in the southern summer growing season and two in the northern winter growing season) on 50 sites covering a total of 954 hectares, over three years (2003 – 2005), in the traditional cotton growing regions of New South Wales and southern Queensland and in northern Queensland, the Northern Territory and northern Western Australia.

Roundup Ready[®] MON 88913 cotton contains two copies of a gene (*cp4 epsps*), derived from a common soil bacterium, that confers tolerance to glyphosate (the active ingredient in the herbicides, Roundup[®] and Roundup Ready[®]). Conventional cotton is susceptible to

glyphosate damage. The use of Roundup Ready[®] MON 88913 GM cotton thus allows the application of the herbicide Roundup[®] for the control of weeds that emerge in the crop, without damaging the crop itself. Roundup Ready[®] MON 88913/Bollgard[®] II cotton was produced by conventional breeding of Roundup Ready[®] MON 88913 cotton with GM Bollgard[®] II cotton, which produces two insecticidal proteins, making it resistant to the major caterpillar pests of cotton.

Roundup Ready[®] MON 88913 cotton differs from the previous commercially released Roundup Ready[®] cotton in that tolerance to Roundup[®] herbicide is prolonged. Yield loss occurs if Roundup[®] is applied beyond the four-leaf growth stage of “first generation” Roundup Ready[®] cotton. Roundup Ready[®] MON 88913 cottons are able to tolerate application of Roundup[®] at later stages of plant growth without yield loss, allowing a wider window to apply herbicide during growth of the cotton crop. This is intended to give growers increased flexibility in the timing of herbicide application and not expected to increase the overall level of herbicide use.

The applicant's stated aims for the field trials are: to transfer the Roundup Ready[®] MON 88913 GM event into elite cotton varieties suitable for Australia and evaluate their performance under Australian conditions; to combine the Roundup Ready[®] MON 88913 and Bollgard[®] II traits; to evaluate and gather data on levels of CP4 EPSPS protein expression, tolerance to glyphosate, seed composition, weed control effectiveness and glyphosate residue levels; and to produce seed for future large scale or commercial releases, which would require separate approvals.

None of the cotton plants from the release, or their by-products, will be used for animal feed or human food. However, the applicant proposes to sell lint from the release. Lint does not contain genetic material or protein. Transport of the GM material will be in accordance with the transport guidelines issued by the Regulator.

Details of the gene construct, including the plasmid map, some of the regulatory sequences and preliminary protein expression data have been declared as Confidential Commercial Information (CCI) under section 185 of the Act. However, the CCI was made available to the various prescribed expert groups that were consulted on the preparation of the risk assessment and risk management plan.

Roundup Ready[®] MON 88913 and Roundup Ready[®] MON 88913/Bollgard[®] II cotton have not previously been approved for limited and controlled release in Australia. First generation Roundup Ready[®] cotton (containing one copy of the *cp4 epsps* herbicide tolerance gene) and Roundup Ready[®]/INGARD[®] cotton (containing a single copy of both the herbicide tolerance and an insecticidal gene) have been approved for commercial release in cotton growing regions south of latitude 22° South since 2000 (refer licence number DIR023/2002).

Bollgard[®] II and Bollgard[®] II/Roundup Ready[®] cottons were approved for commercial release south of latitude 22° South on 23 September 2002 (licence number DIR 012/2002). The release of these GM cottons in northern Australia is only permitted in field trials under limited and controlled conditions due to ongoing concerns regarding their potential weediness in the prevailing moist, warm conditions.

THE EVALUATION PROCESS

Licence application DIR 035/2003 from Monsanto has been evaluated and a risk assessment and risk management plan (RARMP) prepared, in accordance with the Act and the Regulations, using a Risk Analysis Framework. This framework was developed by the Regulator in consultation with the public and key State, Territory and Australian Government stakeholders and the Gene Technology Technical Advisory Committee, and is available at www.ogtr.gov.au/pdf/public/raffinal.pdf.

Details of the process that the Regulator must follow, including the prescribed consultation process on the application, and the matters that must be considered in preparing a RARMP, are set out in Appendix 8 of the RARMP. The complete RARMP can be obtained from the OGTR or from the OGTR's web site at www.ogtr.gov.au.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has a complimentary regulatory role in respect of this application due to its responsibility for agricultural chemical use, including insecticides and herbicides in Australia under the *Agricultural and Veterinary Chemicals (Code) Act 1994*. For commercial products, the normal form of approval is through registration, but the APVMA may also issue permits allowing restricted use of an insecticide or herbicide, for example for a limited period of time or for a limited area. In considering applications for registration or permits, the APVMA also considers a number of issues that are outside the scope of the Gene Technology Regulator's assessment, such as the efficacy of herbicides and insecticides, and herbicide and insect resistance management. The APVMA can impose conditions on the use of herbicides or insecticides in registrations and permits. The APVMA and the OGTR work closely together to ensure thorough coordinated assessments are undertaken and, wherever possible, that timing of assessments and decisions by both agencies coincide. Further information about how the APVMA's assessment and approval processes can be obtained from their website <http://www.apvma.gov.au/>.

Roundup Ready[®] herbicide (a formulation of glyphosate) is not currently registered for use on cotton beyond the four-leaf stage of growth. A research permit from the APVMA for use of Roundup[®] herbicide after this stage on Roundup Ready[®] MON 88913 cotton is not required for 2003/2004 summer season, i.e. first season, of the proposed field trial as less than one hectare of cotton plants per state is proposed to be sprayed with herbicide. However, a research permit from the APVMA will be required for such use of Roundup[®] herbicide in the subsequent three seasons of the proposed trial or for any further larger scale release. Future releases of Roundup Ready[®] MON 88913 cotton will also require further applications and approvals by the Regulator.

In July 2003, the APVMA registered Bollgard[®] II genes (*cryIAc* and *cry2Ab*) as insecticidal products in GM cotton. As part of the registration, the APVMA has imposed conditions on the use of Bollgard[®] II cotton, including an insect resistance management plan. A condition within this resistance management plan specifies that the amount of combined INGARD[®] and Bollgard[®] II cotton to be grown by one grower (as defined by the growers trading name) in a valley must not exceed 40% of the total cotton being grown by that grower in that valley. A grower may choose to plant up to 40% Bollgard[®] II and no INGARD[®]. These trials will comply with all conditions imposed by the APVMA.

The risk assessment considered information relevant to the evaluation of potential impacts on human health and safety and the environment contained in the application (including

information required by Act and the Regulations on the GMO, the parent organism, the proposed dealings and containment measures), submissions received during consultation with expert groups and authorities, and current scientific knowledge.

Through this process, potential hazards to human health and safety or the environment that may be posed by the proposed release of Roundup Ready[®] MON 88913 cotton and Roundup Ready[®] MON 88913/Bollgard[®] II cotton were identified. These have been evaluated on the basis of the likelihood of each hazard occurring and the likely impact of the hazard, were it to be realised. The identified potential hazards relate to:

- toxicity and allergenicity for humans: could Roundup Ready[®] MON 88913 cotton or Roundup Ready[®] MON 88913/Bollgard[®] II cotton be more toxic or allergenic than non-GM cotton, as a result of the novel gene products or because of unintended effects?
- toxicity for non-target organisms: could Roundup Ready[®] MON 88913 cotton or Roundup Ready[®] MON 88913/Bollgard[®] II cotton be harmful to non-target organisms as a result of the novel gene products or because of unintended effects?
- weediness: could the genetic modifications be harmful to the environment by increasing the potential for the Roundup Ready[®] MON 88913 cotton or Roundup Ready[®] MON 88913/Bollgard[®] II cotton to establish as problem weeds?
- transfer of introduced genes to other organisms: could there be adverse consequences from potential transfer of the introduced genes to non-GM cotton crops, feral or native cottons, or to other organisms? and
- herbicide and insecticide resistance: could weeds develop resistance to glyphosate if the Roundup Ready[®] crop-herbicide combination is used inappropriately and could target insects develop resistance to the insecticidal proteins produced by the introduced insecticidal genes in Roundup Ready[®] MON 88913/Bollgard[®] II cotton?

CONCLUSIONS OF THE RISK ASSESSMENT

The Regulator considers that the limited and controlled release of Roundup Ready[®] MON 88913 cotton, or Roundup Ready[®] MON 88913/Bollgard[®] II cotton, will not pose any significant risk to public health and safety, or to the Australian environment, that cannot be managed. The assessment of each potential hazard identified above is summarised under a separate heading below.

Toxicity or allergenicity to humans

Roundup Ready[®] MON 88913 cotton and Roundup Ready[®] MON 88913/Bollgard[®] II cotton are unlikely to prove more toxic or allergenic to humans via occupational exposure than conventional cotton. The introduced proteins are the same as those expressed by existing commercially released GM cottons (Roundup Ready[®], Roundup Ready[®]/Bollgard[®] II and Bollgard[®] II cottons). Even though the levels of expression may be different, none of the introduced proteins have any known toxicity or allergenicity and the proteins are naturally widespread in the environment. However, Food Standards Australia New Zealand (FSANZ)

is responsible for human food safety assessment, and FSANZ approval will be needed before products of these GM cottons could be used in human food. FSANZ has previously approved the food use of oil and linters derived from Roundup Ready[®] and Bollgard[®] II cotton for use in human food. Cottonseed from the releases will not be used for human food or animal feed. However, lint from the release will be sold commercially for use in fabric, upholstery and other non-food products, as lint contains no DNA or protein and is not used in food.

Toxicity to non-target organisms

Roundup Ready[®] MON 88913 cotton and Roundup Ready[®] MON 88913/Bollgard[®] II cotton are unlikely to prove more toxic to non-target organisms than conventional cotton. The introduced proteins are the same as those expressed by existing commercially released GM cottons, are naturally widespread in the environment and have no known toxicity to mammals, birds, fish, non-target invertebrates and soil microorganisms. Exposure of non-target organisms to the introduced proteins will be low and cottonseed from the release will not be used for stockfeed.

Weediness

The risk of Roundup Ready[®] MON 88913 and Roundup Ready[®] MON 88913/Bollgard[®] II cotton establishing as problematic weeds in the southern cotton growing areas of Australia is low and not likely to be greater than that of non-GM cotton. This is because the germination and persistence of both GM and non-GM cottons in southern Australia are likely to be limited by the availability of adequate soil moisture, nutrients, plant competition and/or frosts. It is highly unlikely that the genetic modifications will affect the response of the GM cottons to these variables and, thereby, alter the weediness of the GM cottons.

Limited experimental data suggests that insecticidal GM cotton may have the potential to be weedier than non-GM cotton in certain habitats in northern Australia. Therefore, the licence conditions imposed include the same containment measures as DIR 012/2002, in order to minimise this risk.

Roundup Ready[®] MON 88913 and Roundup Ready[®] MON 88913/Bollgard[®] II cottons express the same introduced proteins as commercially released Roundup Ready[®] cotton, although the site of insertion and the level of expression of the introduced genes may differ. There is, therefore, a possibility that potential pleiotropic effects resulting from the genetic modifications could alter some aspect of the GM cottons' biology that may affect their potential weediness. Licence conditions have been imposed to minimise the persistence and spread of introduced genes from the release sites (refer to key licence conditions below).

In greenhouse and field trials of Roundup Ready[®] MON 88913 cotton conducted in the United States, no unintended or secondary effects on the GM cotton plants, including on their fertility, have been observed. As part of the field trial, the applicant proposes to evaluate agronomic characteristics of the MON 88913 cottons under Australian conditions. More data on potential pleiotropic effects of the genetic modifications on the GM cottons and how these may affect potential weediness will be required before any future application for a large scale or commercial release of these GMOs could be assessed. These will require separate applications and approval processes.

Transfer of introduced genes to other organisms

Some gene transfer from the GM cottons to other cultivated cottons would be likely under uncontrolled conditions, even though the overall frequency of out-crossing would be very low. It is highly unlikely, however, that the inserted genes would alter the likelihood or frequency of such gene transfer. Transfer of introduced genes to other cultivated cotton would pose the same risks as the low risks posed by Roundup Ready[®] MON 88913 cotton and Roundup Ready[®] MON 88913/Bollgard[®] II cotton themselves. However, licence conditions have been imposed to minimise the transfer of introduced genes to other cotton crops (refer to key licence conditions below).

Transfer of genes to feral/naturalised cotton is unlikely due to geographic isolation and the risk of transfer of the introduced genes to native cotton is negligible, because of genetic incompatibility. Similarly, the likelihood of transfer of the introduced genes to other organisms is negligible because of even greater genetic incompatibility. Even if such transfer occurred it would be unlikely to pose any hazard to human health and safety and the environment.

As part of the OGTR's ongoing commitment to the review of data, specific research conditions have been imposed in the licence. The research is intended to confirm research on gene flow undertaken prior to the implementation of the Act and prior to the commercial release of GM cottons, and in so doing validate the containment measures imposed during the field trials of GM cottons. In order to facilitate this review and data collection, the Regulator has imposed a licence condition to establish 400 metre research zones around proposed field trial sites (locations) in excess of one hectare. This research program will be developed in consultation with the OGTR.

Insecticide and herbicide resistance

These risks will be managed by the APVMA through conditions on the existing registration for the use of the insecticidal genes as an insecticide in the Bollgard[®] II cotton (refer to page III) and any permit or registration for the use of Roundup[®] herbicide on Roundup Ready[®] MON 88913 and Roundup Ready[®] MON 88913/Bollgard[®] II cottons beyond the four leaf stage.

THE RISK MANAGEMENT PLAN (KEY LICENCE CONDITIONS)

As part of the evaluation process for this licence application, a risk management plan has been developed to address the risks identified (refer to Conclusion of the risk assessment, above). This plan is given effect by licence conditions. The key licence conditions are outlined below.

Toxicity or allergenicity to humans

Licence conditions have been imposed which require the applicant to:

- prevent entry of the GMOs and products derived from the GMOs into the human food supply;
- destroy all seed not required for future trials;
- securely transport and store the GMOs; and

- limit the size of field trial sites to a maximum of 50 hectares each.

Toxicity to non-target organisms

Licence conditions have been imposed which require the applicant to:

- prevent cottonseed being used as stockfeed;
- destroy all seed not required for future trials;
- securely transport and store the GMOs; and
- limit the size of field trial sites to a maximum of 50 hectares each.

Weediness

Licence conditions have been imposed which require the applicant to:

- surround the GM cotton by a 20 m pollen trap of non-GM cotton at sites north of 22°S;
- surround the GM cotton by a 20 m pollen trap of non-GM cotton, or GM Roundup Ready® cotton approved for commercial release in Australia at sites south of 22°S;
- surround trial sites in excess of one ha with a 400 m wide research zone for the purpose of conducting research for the ongoing review of the data on spread and persistence of the GMOs and to validate previous research on containment measures;
- securely transport and store the GMOs;
- prevent cottonseed being used as stockfeed;
- clean equipment used at release sites;
- monitor field trial sites after harvest and destroy volunteers; and
- limit the scale of the release (size of individual sites equal to, or less than 50 ha).

Transfer of introduced genes to other organisms

Licence conditions have been imposed which require the applicant to:

- limit the scale of the release (size of individual sites equal to, or less than 50 ha);
- surround the GM cotton by a 20 m pollen trap of non-GM cotton at sites north of 22°S;
- surround the GM cotton by a 20 m pollen trap of non-GM cotton, or GM cottons approved for commercial release in Australia at sites south of 22°S;

- surround trial sites in excess of one ha with a 400 m wide research zone for the purpose of conducting research for the ongoing review of the data on spread and persistence of the GMOs and to validate previous research on containment measures;
- securely transport and store the GMOs;
- clean equipment used at release sites; and
- monitor field trial sites after harvest and destroy volunteers.

Insecticide and herbicide resistance

No conditions have been imposed in relation to managing insecticide or herbicide resistance development, as this is the responsibility of the APVMA. The applicant's obligation to comply with any such conditions imposed by the APVMA has been noted in the licence.

General conditions

The licence issued by the Regulator also contains a number of general conditions, which are also relevant to risk management. These include, for example,

- identification of the persons or classes of person covered by the licence;
- a requirement that the applicant allow access to the release sites by the Regulator, or persons authorised by the Regulator, for the purposes of monitoring or auditing; and
- a requirement to inform the regulator if the applicant becomes aware of any additional information about risks to human health or safety or to the environment.

Monitoring and enforcement of compliance by the OGTR

As well as the legislative capacity to enforce compliance with licence conditions, the Regulator has additional options for risk management. The Regulator can direct a licence holder to take any steps the Regulator deems necessary to protect the health and safety of people or the environment. The OGTR also independently monitors releases that the Regulator has authorised. At least 20% of all field trial sites will be inspected each year, in accordance with a monitoring and compliance strategy based on risk profiling, to determine whether licence holders are complying with the licence conditions, or whether there are any unintended effects.

FURTHER INFORMATION

Detailed information on the evaluation of the application, including the proposed licence conditions, is available in the risk assessment and risk management plan document for this application, which can be obtained from the website of the Office of the Gene Technology Regulator (www.ogtr.gov.au), or by calling 1800 181 030 (please quote application number DIR 035/2003).