



**APPLICATION FOR LICENCE FOR COMMERCIAL RELEASE OF GMOs INTO THE ENVIRONMENT: Application No. DIR 059/2005**

**SUMMARY INFORMATION**

Project Title:	Commercial release of herbicide tolerant (Roundup Ready Flex <sup>®</sup> MON 88913) and herbicide tolerant/insect resistant (Roundup Ready Flex <sup>®</sup> MON 88913/Bollgard II <sup>®</sup> ) cotton south of latitude 22° South in Australia
Applicant:	Monsanto Australia Ltd PO Box 6051 Melbourne, VIC 8008
Common name of the parent organism:	Cotton
Scientific name of the parent organism:	<i>Gossypium hirsutum</i> L.
Modified trait(s):	Enhanced herbicide tolerance, insecticidal action, antibiotic resistance, reporter gene expression
Identity of the gene(s) responsible for the modified trait(s):	<ul style="list-style-type: none"><li>• <i>cp4 epsps</i> gene from <i>Agrobacterium</i> sp. strain CP4 (herbicide tolerance)</li><li>• <i>cry1Ac</i> and <i>cry2Ab</i> genes from the bacterium <i>Bacillus thuringiensis</i> (insecticidal)</li><li>• <i>nptII</i> gene from the bacterial Tn5 transposon (antibiotic resistance)</li><li>• <i>uidA</i> gene from <i>Escherichia coli</i> (reporter gene)</li></ul>
Proposed Location(s)	South of latitude 22° South in areas suitable for cotton growing
Proposed Release Size:	Phased introduction commencing with 20,000 hectares in current cotton growing areas of NSW and QLD in 2006 to commercial scale planting in subsequent years, potentially including other suitable areas south of latitude 22° South
Proposed Time of Release	Ongoing from 2006

**Introduction**

The *Gene Technology Act 2000* (the Act) took effect on 21 June 2001. The Act, supported by the *Gene Technology Regulations 2001*, an inter-governmental agreement and corresponding legislation that is being enacted in each State and Territory, underpins Australia's nationally consistent regulatory system for gene technology. Its objective is to protect the health and safety of people, and the environment, by identifying risks posed by or as a result of gene technology, and managing those risks by regulating certain dealings with genetically modified organisms (GMOs).

The Act establishes a statutory officer, the Gene Technology Regulator (the Regulator), to administer the legislation and make decisions under the legislation. The Regulator is supported by the Office of the Gene Technology Regulator (OGTR), an Australian Government regulatory agency located within the Health and Ageing portfolio.

The legislation sets out the requirements for considering applications for licences for dealings with GMOs and the matters that the Regulator must take into account before deciding whether, or not, to issue a licence.

### **The application and the proposed dealings**

The OGTR has received an application from Monsanto Australia Ltd (Monsanto) for a licence for the intentional release of two genetically modified (GM) cottons into the environment. The aim of the proposed release is to commercially release herbicide tolerant (Roundup Ready Flex<sup>®</sup> MON 88913, abbreviated here as Roundup Ready Flex<sup>®</sup>) and herbicide tolerant/insect resistant (Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup>) GM cotton.

Monsanto is seeking approval for unrestricted commercial scale planting of the two GM cottons. The company anticipates a phased introduction commencing with up to 20,000 hectares in spring 2006 in the current cotton growing areas of New South Wales (NSW) and southern Queensland (QLD). The area is expected to be increased in subsequent years and may include plantings in other areas south of latitude 22° South that are suitable for growing cotton. The GM cottons may also be planted on a small scale for evaluation trial and demonstration, education and research purposes.

No specific containment measures have been proposed for the plantings in areas south of latitude 22° South and Monsanto intends that the GM cotton plants and their products would be used in the same manner as non-GM or other commercially released GM cotton. Hence the dealings would include:

- sale of seed for commercial planting
- use of oil and linters from the GM cotton in human food (subject to approval by Food Standards Australia and New Zealand)
- use of cottonseed from the release as stockfeed anywhere in Australia
- unrestricted transportation south of latitude 22° South
- sale of lint
- export of seed.

Monsanto also proposes restricted transportation of ginned cottonseed from the release to areas north of latitude 22° South in accordance with OGTR guidelines for transportation of GMOs.

Monsanto intends that Roundup Ready Flex<sup>®</sup> and Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton will gradually replace its current GM cottons, Roundup Ready<sup>®</sup> and Roundup Ready<sup>®</sup>/Bollgard II<sup>®</sup> cotton. The length of the phase out period will depend on a number of factors such as availability of seed and grower acceptance.

Details of the complete DNA sequence of the Roundup Ready Flex<sup>®</sup> gene construct have been declared as Confidential Commercial Information (CCI) under section 185 of the Act. However, the CCI will be made available to the prescribed expert groups and agencies that will be consulted on the preparation of the risk assessment and risk management plan for this application.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has regulatory responsibility for agricultural chemical use in Australia, under the *Agricultural and Veterinary Chemicals Code Act (1994)*. Roundup Ready<sup>®</sup> Herbicide is currently not registered for use on cotton beyond the four-leaf stage of growth. Approval from the APVMA will be required to use of Roundup Ready<sup>®</sup> Herbicide after this stage on Roundup Ready Flex<sup>®</sup> and Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton. Further information about the APVMA can be obtained from [www.apvma.gov.au](http://www.apvma.gov.au).

Cotton seed is processed for oil that is used in a variety of food products and for cotton linters (a type of short fibre that does not contain any genetic material) that are used as a cellulose base for several consumer food products. Monsanto has submitted an application to Food Standards Australia New Zealand (FSANZ) for approval of oil and linters derived from Roundup Ready Flex<sup>®</sup> cotton for human food use. Oil and linters from Roundup Ready<sup>®</sup> cotton and Bollgard II<sup>®</sup> cotton have previously been approved by FSANZ for use in human food.

### **Previous releases of the GMOs and similar GM cotton**

Roundup Ready Flex<sup>®</sup> and Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton were previously approved for limited and controlled releases under licences DIR 35/2003 (total area of 946 hectares) and DIR 055/2004 (total area of 1811 hectares). Plantings under DIR 035/2003 were conducted over four seasons from 2003 to 2005 in NSW, southern and central QLD, NT and northern WA. Licence DIR 055/2004 authorises field trial plantings on up to 86 sites (total area of 1769 hectares) during the 2005/06 summer growing season in the cotton growing regions of NSW and southern QLD, and on up to 5 sites (total area of 42 hectares) during the 2006 winter growing season in northern QLD, northern Western Australia (WA) and the Northern Territory (NT).

Roundup Ready<sup>®</sup> cotton, containing one copy of the same herbicide tolerance gene (*cp4 epsps*), was approved for general (commercial) release (south of latitude 22° South) in 2000 (GR-9), by the Minister for Health and Aged Care, on the basis of advice from GMAC (Genetic Manipulation Advisory Committee). After commencement of the Act, on 21 June 2001, Roundup Ready<sup>®</sup> cotton was re-assessed in accordance with the requirements of the regulatory system and the Regulator issued a licence for commercial release south of latitude 22° South in June 2003 (DIR 023/2003). Roundup Ready<sup>®</sup> cotton can only tolerate the application of Roundup Ready<sup>®</sup> herbicide up to the four-leaf stage of growth.

Bollgard II<sup>®</sup> and Bollgard II<sup>®</sup>/Roundup Ready<sup>®</sup> cotton were approved for commercial release by the Regulator in September 2002 (licence DIR 012/2002). This commercial release was restricted to the cotton growing regions of NSW and QLD south of latitude 22° South because of concerns about potential weediness of the GM insecticidal cotton in northern tropical areas. Some field trials were approved under limited and controlled conditions north of latitude 22° South.

Prior to commercial release, numerous limited and controlled releases of Roundup Ready<sup>®</sup>, Bollgard II<sup>®</sup> and Roundup Ready<sup>®</sup>/Bollgard II<sup>®</sup> cotton were conducted under the voluntary system overseen by GMAC, and four licences for limited and controlled releases of Bollgard II<sup>®</sup> and/or Roundup Ready<sup>®</sup>/Bollgard II<sup>®</sup> cotton have been issued by the Regulator (DIR licences), as listed below.

Roundup Ready<sup>®</sup> cotton - 23 limited and controlled releases undertaken by:

- CSIRO Division of Plant Industry (PR-55, PR-55X, PR-55X2, PR-55X3 and PR-55X5 and PR-55X6);

- Deltapine Australia Pty Ltd (PR-32, PR-52, PR-52X, PR-52X2, PR-52X3, PR-71, PR-71X, PR-71X2, PR-83, PR-83X, PR-83X3, PR-140, PR-140X and PR-143);
- Monsanto (PR-83X2 and PR-83X4); and
- Cotton Seed Distributors Pty Ltd (PR 55-X4).

Bollgard II<sup>®</sup> and Roundup Ready<sup>®</sup>/Bollgard II<sup>®</sup> cotton – 18 limited and controlled releases undertaken by:

- CSIRO Division of Plant Industry (PR-123, PR-123X, PR-123X2, PR-131, PR-131X, PR-131X2, PR-131X3);
- Deltapine Australia Pty Ltd (PR-51X4, PR-112, PR-112X, PR-112X2, PR-118, PR-118X, PR-118X2);
- Cotton Seed Distributors (Bollgard II<sup>®</sup> and Bollgard II<sup>®</sup>/Roundup Ready<sup>®</sup> cotton in QLD; DIR 005/2001);
- CSIRO (INGARD<sup>®</sup>, Bollgard II<sup>®</sup> and Bollgard II<sup>®</sup>/Roundup Ready<sup>®</sup> cotton in WA and NT; DIR 006/2001);
- Department of Agriculture (WA) (Bollgard II<sup>®</sup> cotton in WA; DIR 009/2002); and
- Monsanto (Bollgard II<sup>®</sup> and Roundup Ready<sup>®</sup>/Bollgard II<sup>®</sup> cotton in northern WA, NT and northern QLD; DIR 012/2002).

There have been no reports of adverse effects on human health or the environment resulting from any of these releases.

## Parent organism

The parent organism is cultivated cotton (*Gossypium hirsutum* L.), which is exotic to Australia and is grown as an agricultural crop in NSW and southern and central QLD, and on a trial basis in northern QLD, WA and the NT.

## Genetic modification and its effect

Roundup Ready Flex<sup>®</sup> cotton contains two copies of the *cp4 epsps* gene from the common soil bacterium *Agrobacterium* sp. strain CP4 that encodes the enzyme CP4 EPSPS.

The native<sup>1</sup> *epsps* gene in plants encodes an enzyme (EPSPS) that is critical for the synthesis of aromatic amino acids (essential building blocks for proteins). Glyphosate inhibits this enzyme resulting in the death of the plant, whereas the CP4 EPSPS enzyme naturally produced by the bacterial gene is insensitive to the effect of glyphosate and is able to function normally in the synthesis of aromatic amino acids in the presence of the herbicide.

Consequently, in GM plants containing the bacterial *cp4 epsps* gene, synthesis of aromatic amino acids is not blocked by glyphosate and the plants are not killed by Roundup Ready<sup>®</sup> herbicide application. While non-GM cotton is killed by glyphosate, Roundup Ready<sup>®</sup> herbicide can be applied to Roundup Ready Flex<sup>®</sup> cotton for the control of weeds that emerge in the crop without damaging the crop itself.

Roundup Ready<sup>®</sup> cotton contains only one copy of the *cp4 epsps* gene and has little tolerance to glyphosate in reproductive tissues. This means that glyphosate can currently only be applied up to the four leaf stage of growth (ie prior to flowering) to control weeds. After this stage, application of the herbicide can lead to yield loss. The applicant has indicated that, as Roundup Ready Flex<sup>®</sup> cotton has increased and prolonged expression of the *cp4 epsps* gene it

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<sup>1</sup> In the context of genes and other genetic material, the term ‘native’ refers to genes and regulatory sequences that are naturally present in the parent organism.

is tolerant to glyphosate at later stages of growth. Hence, the window in which glyphosate can be applied for weed control is longer, giving growers increased flexibility in timing herbicide applications for integrated weed management.

Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton was produced by conventional crossing of Roundup Ready Flex<sup>®</sup> cotton with Bollgard II<sup>®</sup> cotton. Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton plants contain all the genes introduced into each of the parental GMOs. This means that the plants contain, in addition to the herbicide tolerance genes, two insecticidal genes (*cry1Ac* and *cry2Ab*) derived from the common soil bacterium *Bacillus thuringiensis* (Bt). The insecticidal genes encode proteins that are specifically toxic to lepidopteran caterpillars, including the two key *Helicoverpa* pests of cotton.

No antibiotic resistance marker genes are present in Roundup Ready Flex<sup>®</sup> cotton. However, Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton plants contain bacterial genes, as a result of the crossing with Bollgard II<sup>®</sup>, conferring resistance to the antibiotics kanamycin and neomycin (*nptII* gene), and streptomycin and spectinomycin (*aad* gene). The *aad* gene is not expressed in the plants because the bacterial regulatory sequence that controls its expression is not active in plants. This gene was used in the laboratory prior to the production of the genetically modified plants to select for bacteria containing the modified DNA.

A reporter gene (*uidA*) from the bacterium *Escherichia coli* is also present in the Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton plants. This gene encodes the enzyme β-glucuronidase (GUS) that enables visual identification of plant tissues in which it is being expressed.

Short regulatory sequences that control expression of the genes are also present in the genetically modified cotton. These sequences are derived from the cauliflower mosaic virus, figwort mosaic virus, *Agrobacterium tumefaciens* and from soybean and two other plant species. Although the first three of these organisms are plant pathogens, the regulatory sequences comprise only a small part of their total genome and are not in themselves capable of causing disease.

### **Method of genetic modification**

Roundup Ready Flex<sup>®</sup> cotton was produced by the introduction of two copies of the *cp4 epsps* gene and associated regulatory sequences on a plasmid vector carried by *Agrobacterium tumefaciens*. The vector is ‘disarmed’ since it lacks the genes that encode the tumour-inducing functions of *A. tumefaciens*.

Bollgard II<sup>®</sup> cotton was generated by particle bombardment of the *cry2Ab* and *uidA* genes into the GM INGARD<sup>®</sup> cotton (containing the *cry1Ac*, *nptII* and *aad* genes). This technique involves coating the DNA consisting of the *cry2Ab* and *uidA* genes onto very small particles which were ‘shot’ into the cotton tissue, followed by selection of plants that contained single, functional copies of the genes.

Roundup Ready Flex<sup>®</sup>/Bollgard II<sup>®</sup> cotton was generated through conventional breeding of GM Roundup Ready Flex<sup>®</sup> cotton and GM Bollgard II<sup>®</sup> cotton.

### **Consultation on preparation of the Risk Assessment and Risk Management Plan**

The Regulator has made an initial assessment as to whether the proposed release may pose significant risks to human health and safety or the environment, in accordance with section 49 of the Act. **The Regulator has decided that the proposed release does not pose a**

**significant risk to human health and safety or the environment for the following reasons:**

- The proposed commercial release is restricted to areas south of latitude 22° South in Australia, where environmental conditions are not conducive to GM cotton becoming a weed;
- there have been a number of field trials of the same or similar GMOs and commercial releases of similar GM cotton in Australia with no reported adverse effects on human health and safety or the environment; and
- based on the initial analysis of the application, the risk of weediness, increased toxicity or allergenicity and the impact of outcrossing to native or naturalised cotton or other plant species in the areas proposed for release are no greater than for non-GM or other commercially released GM cottons.

This means that the Regulator **is not required to seek public comment** on the assessment of this proposal until after a risk assessment and risk management plan (RARMP) has been prepared. However, in preparing the RARMP, the Regulator will seek input from a wide range of key stakeholders and expert groups comprising State and Territory Governments, relevant Australian Government agencies, the Minister for the Environment and Heritage, the Gene Technology Technical Advisory Committee and appropriate local councils, as required by section 50 of the Act. In accordance with section 52 of the Act, the Regulator will again consult with these prescribed agencies and authorities as well as the public in finalising the RARMP.

At this stage, the consultation version of the RARMP is expected to be issued for an extended 8 week consultation period in **mid October 2005**. The public will be invited to provide submissions on the RARMP via advertisements in the media and direct mail to anyone registered on the OGTR mailing list. Summaries and copies of the RARMP will be available from the OGTR, or on the OGTR website. In the interim, copies of the application are available on request from the OGTR. Please quote application number DIR 059/2005.

**Issues to be considered by the Regulator**

In making a decision on whether to issue a licence for the proposed release, the Regulator is required to consider the application and submissions within the context of the object of the Act, which focuses upon **protecting the health and safety of people and the environment**.

**Please note that issues such as food labelling, the use and safety of herbicides, marketability and trade implications do NOT fall within the scope of the evaluations conducted under the Act as these are the responsibility of other agencies and authorities.**

If you have any questions about the application or the assessment process, please contact the OGTR at:

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