

**LICENCE No:** DIR 066/2006  
**LICENCE HOLDER:** Monsanto Australia Limited  
**PROJECT SUPERVISOR:** [REDACTED]  
**ACCREDITATION NO:** ACCR 034/2002

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**SUBMISSION:** 2010 Annual Report for Commercial release of GM herbicide tolerant and/or insect resistant cotton lines.  
**REPORTING PERIOD:** 26 October 2009 – 26 October 2010 (Covering 2009/10 cotton growing season)  
**DATE:** 9 December 2010

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**PREPARED BY:** [REDACTED]  
[REDACTED]

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## SECION 1. LICENCE HOLDER DETAILS

**Name:** Monsanto Australia Limited  
**Address:** 600 St Kilda Road, Melbourne 3004  
PO Box 6051  
St Kilda Road Central,  
Melbourne Victoria 8008

**Telephone:** 03 9522 7121  
**Facsimile:** 03 9522 6121

**Contact email:** [REDACTED]

**Accreditation  
Number:** ACCR 034/2002

## SCOPE OF THE REPORT

This report addresses the annual reporting condition of the DIR 066/2006 commercial licence covering Roundup Ready Cotton, Roundup Ready Flex Cotton and the Bollgard II trait issued to Monsanto Australia Limited by the Office of the Gene Technology Regulator.

This report details compliance with general and specific conditions of Sections 2 to 6 of the DIR 066 licence as issued to Monsanto Australia Limited on 26 October 2006, and as varied 22 December 2006, 6 December 2007 and 15 April 2009.

The report covers the period of time from 26 October 2009 to 26 October 2010, including the 2009/10 cotton growing season.

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## **SECTION 2. GENERAL CONDITIONS**

### **2.1 Duration of Licence**

DIR066/2006 (DIR066) has not been suspended, cancelled or surrendered.

### **2.2 Holder of Licence**

Monsanto Australia Ltd (Monsanto) remains the holder of the licence.

### **2.3 Project Supervisor**

██████████ is the project supervisor as per Attachment A of the licence. The licence was varied 15 April 2009 to reflect the change of contact details.

### **2.4 No dealings with GMOs except as authorised by this Licence**

Persons covered by the licence did not deal with GMOs except as expressly permitted by the licence.

### **2.5 Location**

The licence allows for dealings with GMOs to be conducted anywhere within Australia. This licence supersedes any previous licences regarding location.

### **2.6 Persons covered by this GMO Licence**

Monsanto acknowledges that the persons covered by the licence are the licence holder and employees, agents or contractors of the licence holder and other persons who are, or have been, engaged to undertake any activity in connection with GMOs grown in a location pursuant to this licence.

### **2.7 Informing people of their obligations**

DIR066 was issued in October 2006, permitting dealings with the GMOs to be undertaken during the cotton growing seasons in 2006/07, 2007/08 2008/09 and 2009/10.

Monsanto Australia Limited informed all persons covered by the DIR066/2006 licence of the obligations imposed on them as a result of the conditions of this licence. This was primarily achieved through the Monsanto accreditation program and information course which includes information on regulatory obligations, as well as management of the crop.

Accreditation programs require all persons having management responsibility for Roundup Ready, Roundup Ready Flex and Bollgard II cotton crops, to undergo training.

## **2.8 Applicant to notify of circumstances that might affect suitability**

During the reporting period, Monsanto Australia Ltd did not receive a relevant conviction occurring after the commencement of this licence; nor was there any revocation or suspension of a licence or permit held by Monsanto Australia Ltd under a law of the Australian Government, a State or a foreign country, being a law relating to the health and safety of people or the environment; or any event or circumstance occurring after the commencement of the licence that would affect the capacity of Monsanto to meet the conditions of the DIR 066 licence.

## **2.9 Licence holder must provide information on matters related to suitability**

Monsanto acknowledges that it must provide information related to its ongoing suitability to hold a licence when requested to do so in writing by the Regulator and must provide the information within a time period stipulated by the Regulator.

## **2.10 Additional information must be given to the Regulator**

During the reporting period, Monsanto did not become aware of additional information as to any risks to the health and safety of people, or to the environment, associated with the dealings authorised by the licence; or of any unintended effects of the dealings authorised by the licence.

## **2.11 People dealing with GMOs must allow auditing and monitoring of the dealing**

Monsanto acknowledges that if a person is authorised by this licence to deal with GMOs and a particular condition of this licence applies to the dealing by that person, the person must allow the Regulator, or a person authorised by the Regulator, to enter premises where the dealing is being undertaken, for the purposes of auditing or monitoring the dealing.

## **2.12 Remaining an Accredited organisation**

At all times, Monsanto remained an accredited organisation and complied with conditions of accreditation as set out in the OGTR Guidelines for Accreditation of Organisations.

## **SECTION 3. GROWING THE GMOS**

### **3.1 GMOs covered by this licence**

The only dealings with GMOs under this licence were those with the GMOs described in DIR 066/2006 Licence.

### **3.2 Permitted dealings**

Sales and planting of the Roundup Ready Cotton (RRC), Roundup Ready Flex (RRF), Bollgard II (BGII) and Bollgard II stacked with [REDACTED] were undertaken under a Technology User Agreement, which sets out the conditions for planting and growing a cotton crop containing RRC, RRF and BGII technology. In order to be eligible to sign such an agreement, a grower was required to attend an accreditation program and pass a test based on the material covered in the accreditation program.

### 3.3 Crop Location and Volumes

Valley	BGII ha	RR ha	RRF ha	BGII w RR ha	BGII w RRF ha	BGII w LL ha	Total ha
Bourke	-	-	-	-	5,792.14	123.00	5,915.14
Darling Downs	261.30	-	1,522.29	182.95	24,843.97	349.04	27,159.55
Dawson/Callide	149.20	-	274.38	-	4,770.84	-	5,194.42
Dirranbandi	-	-	-	-	2,189.58	-	2,189.58
Emerald	8.46	-	435.11	-	16,158.84	214.98	16,817.39
Gwydir	94.65	2.67	8,966.24	168.00	19,781.74	-	29,013.30
Lachlan	-	-	-	117.00	2,027.23	-	2,144.23
Lower Namoi	136.31	121.32	2,246.49	476.82	23,144.04	186.00	26,310.98
MacIntyre	2,231.75	-	1,331.22	-	21,039.16	147.63	24,749.76
Macquarie	-	-	727.04	429.88	4,754.58	-	5,911.50
Mungindi	344.36	-	4,517.27	-	6,486.40	15.80	11,363.83
Murrumbidgee	-	-	-	-	1,164.74	-	1,164.74
St George	129.03	-	315.42	-	8,318.90	75.07	8,838.42
Upper Namoi	-	13.29	115.68	885.99	8,940.62	30.20	9,985.78
Walgett	-	-	-	-	3,429.47	-	3,429.47
Burdekin	-	-	55.49	-	585.26	-	640.75
The Ord W.A.	-	-	-	-	3.90	-	3.90
<b>Grand Total</b>	<b>3,355.06</b>	<b>137.28</b>	<b>20,506.63</b>	<b>2,260.64</b>	<b>153,431.41</b>	<b>1,141.72</b>	<b>180,832.74</b>

**Total Bollgard II Hectares planted:**

**160,188.83 Ha**

**Total Roundup Ready/Roundup Ready Flex Hectares planted:**

**176,335.96 Ha**

**Valley:** Ord (WA)

**Boundaries:** Area north of 22° south in Western Australia.

**Crop Location:**

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**Valley:** Burdekin (QLD)

**Boundaries:** Area north of 22° South in Queensland.

**Crop Locations:**

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**Note:** Yellow highlight indicates research trial sites



**Valley:** Emerald (QLD)

**Boundaries:** South-eastern boundary formed by the Expedition Ranges between Rolleston and Bauhinia. Region runs north-west from there to include Emerald and Dysart.

**Crop Locations:**




**Valley:** Dawson/Callide (QLD)

**Boundaries:** Includes Taroom, Biloela, Moura and Theodore regions.

**Crop Locations:**

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**Valley:** Darling Downs (QLD)

**Boundaries:** Follows the Condamine River. Includes Toowoomba, Murgon, Dalby, Chinchilla, Condamine, and Roma. South-west boundary is Surat.

**Crop Locations:**

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**Crop Locations:**

**Valley:** Dirranbandi (QLD)

**Boundaries:** Runs north toward St George and includes Lower Plains, follows south along the Balonne River right down to the NSW border.

**Crop Locations:**

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**Valley:** Macintyre (NSW/QLD)

**Boundaries:** North of Gwydir, western boundary is Garah to Talwood Road north include Moonie and east to include Texas. Southern boundary is Foxes Lane which runs Garah back to the Newell Highway and then along to Croppa Creek, Yallaroï and Coolatai.

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**Valley:** Mungindi (NSW/QLD)

**Boundaries:** West of Garah and Boomi Road to Talwood and follows Barwon River south-west of Mungindi towards Collarenebri. Southern boundary is the Watercourse Road from Colly through to Gingham and then to Garah.

**Crop Locations:**

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**Valley:** Gwydir (NSW)  
**Boundaries:** South of Fox Lane, north-west to Garah, west to Collarenebri, south to Bellata. The road that runs east-west through Bellata and to Rowena is southern boundary.

**Crop Locations:**

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**Valley:** Walgett (NSW)  
**Boundaries:** Includes almost entirety of Walgett Shire, with eastern boundary being the road that runs south from Collarenebri to Burren Junction.  
**Crop Locations:**

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**Valley:** Bourke (NSW/QLD)

**Boundaries:** West of Walgett Shire, north of Coolahbah. Includes Cunnamulla in Queensland.

**Crop Locations:**

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**Valley:** Upper Namoi (NSW)

**Boundaries:** South-east of Baan Baa-Manilla Road. Includes Coolah, Merriwa, Mullaley, Gunnedah and Quirindi.

**Crop Locations:**

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**Valley:** Lower Namoi (NSW)  
**Boundaries:** North-west of Baan Baa-Manilla Road and south of Bellata-Rowena Road.  
Western boundary is formed by the road that runs from Pilliga via Burren Junction to Collarenebri.

**Crop Locations:**

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**Valley:** Macquarie (NSW)

**Boundaries:** Dubbo and south to Peak Hill. West to Tullamore. North through Tottenham. Nyngan and Coolabah, then east via southern boundary of Walgett shire and then south back to Dubbo via Coonabarabran.

**Crop Locations:**

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**Valley:** Lachlan (NSW)

**Boundaries:** Northern boundary is Peak Hill and Tullamore and the cotton follows the Lachlan River through to Booligal. The southern boundary is the road through to Gunbar and then follows the Great Western Highway through to West Wyalong.

**Crop Locations:**

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**Valley:** Murrumbidgee (NSW)

**Boundaries:** Northern boundary is the Great Western Highway from West Wyalong through Goolgowi to Gunbar, from Gunbar west to Booligal on the Lachlan River. Downstream of Booligal on the Lachlan and south-west is the Murrumbidgee River.

**Crop Locations:**

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**Research Trial Site Locations:**

Valley	TUA#	BGII ha	RR ha	RRF ha	BGII w RR ha	BGII w RRF ha	BGII w ■ ha
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<b>Subtotal</b>		<b>4.40</b>	<b>0.00</b>	<b>23.97</b>	<b>0.00</b>	<b>167.59</b>	<b>28.53</b>

### 3.4 Resistance Management Plan for Bollgard II 2009/10

#### SCHEDULE A -

#### Resistance Management Plan for Bollgard II<sup>®</sup> Cotton 2009/2010

Developed by Monsanto Australia Limited and the Transgenic and Insect Management Strategy (TIMS) Committee of Cotton Australia Ltd.

The resistance management plan is based on three basic principles: (1) minimising the exposure of *Helicoverpa* spp. to the *Bacillus thuringiensis* (Bt) proteins Cry 1Ac and Cry 2Ab; (2) providing a population of susceptible individuals that can mate with any resistant individuals, hence diluting any potential resistance; and (3) removing resistant individuals at the end of the cotton season.

Growers of Bollgard II cotton are required to practice preventative resistance management as set out below. Compliance with the Resistance Management Plan is required under the terms of the Bollgard II Technology User Agreement and under the conditions of registration (*Agricultural and Veterinary Chemicals Act 1994*).

Section 1 is applicable to all regions in New South Wales and Queensland that grow cotton while sections 2 and 3 detail specific requirements for New South Wales and Southern Queensland, and Central Queensland respectively.

#### SECTION 1: NEW SOUTH WALES, SOUTHERN QUEENSLAND & CENTRAL QUEENSLAND

##### 1. Refuges

Growers planting Bollgard II cotton will also be required to grow a refuge crop that is capable of producing large numbers of *Helicoverpa* spp. moths which have not been exposed to selection with Bt proteins Cry 1Ac and Cry 2Ab. These unselected moths are expected to dominate matings with any survivors from Bollgard II crops and thus help to maintain resistance to Bt proteins Cry 1Ac and Cry 2Ab at low levels.

All refuge options are based on the requirement of a 10% unsprayed cotton refuge or its equivalent, as determined by the relative production of *Helicoverpa* spp. from each of the refuge types as described in Tables 1 and 2, for irrigated and dryland production scenarios respectively.

For each area of irrigated Bollgard II cotton planted, a grower is required to plant a minimum of one or a combination of the following:

Table 1. Irrigated Bollgard II cotton refuge options

Crop	Conditions	% of Bollgard II
Cotton	Irrigated, sprayed conventional cotton	100
	Irrigated, unsprayed conventional cotton	10
Pigeon pea	Irrigated, unsprayed	5
Sorghum	Irrigated, unsprayed – conditions apply, see box below	15
Corn	Irrigated, unsprayed – conditions apply, see box below	20

Table 2. Dryland Bollgard II cotton refuge options

Crop	Conditions	% of Bollgard II
Cotton	Dryland or irrigated, sprayed conventional cotton	100
	Dryland or irrigated, unsprayed conventional cotton	10
Pigeon pea	Irrigated, unsprayed pigeon pea	5

No other refuge options are approved for dryland Bollgard II.

**Note:** Unsprayed means not sprayed with any insecticide that targets any life stage of *Helicoverpa* spp.

Bt products must not be applied to any refuge (including sprayed cotton).

If the viability of an unsprayed conventional cotton refuge is at risk due to early season pressure by *Helicoverpa* spp., and with prior approval from the Monsanto Compliance and Stewardship Manager, a non-Bt heliocide can be applied up to the 4<sup>th</sup> true leaf stage.

An unsprayed refuge should not be planted in the same field as any crop sprayed with a rate of insecticide that is registered for *Helicoverpa* spp, with the exception of Bollgard II. Sprayed crops and unsprayed refuges that are planted in adjacent fields must be separated by sufficient distance to *minimise the likelihood of insecticide drift onto the unsprayed refuge.*

For the purposes of this Resistance Management Plan, conventional cotton includes any cotton varieties that do not have Bt proteins in the plant that control *Helicoverpa* spp. moths.

**Irrigated sorghum or corn.**

NB: The following special conditions apply to growers who wish to grow sorghum or corn as refuges.

- A plan indicating how either of these refuges will be managed must be submitted to, and approved by, the local Accounts & Stewardship Specialist before planting either of these two options. A farm map must be included with the plan.

Either refuge option requires three sequential plantings of the same variety. The initial planting date should be determined by the time taken to flower for the varieties chosen for use in each particular area so that the need for part of the refuge to be in flower from January 15 is satisfied. Subsequent plantings should follow at 2-weekly intervals so that some of the refuge is continuously in flower until February 28.

- A single planting of mixed maturity varieties is not acceptable.
- Each planting should be one third of the total area required for that refuge type, as described in Table 1 or Table 2. If there is no sprayed conventional cotton on the same farm unit the refuge must be a minimum of 24 metres wide. However, if there is sprayed conventional cotton on the same farm unit the refuge must be a minimum of 48 metres wide (see also clause (f) below).
- These refuge options will be closely monitored during the season to ensure that all such refuges are managed appropriately and are effective and attractive from January 15 to February 28.
- Corn refuges may be harvested after complete cob maturity.
- Sorghum refuges may be harvested after complete head maturity.

**General conditions for all refuges:**

- (a) Refuge crops are to be planted and managed so that they are attractive to *Helicoverpa* spp. during the growing period of the Bollgard II cotton varieties. It is preferable that all refuge is planted within the 2 week period prior to planting Bollgard II. If this is not possible, refuge planting must be completed within 3 weeks of the first day of sowing of Bollgard II. At this time, sufficient refuge must have been planted to cover all of the Bollgard II cotton proposed to be planted for the season (including Bollgard II already planted and any that remains unplanted). Should additional Bollgard II planting be made after this date, which is not already covered by refuge, additional refuge must be planted as soon as possible and no more than 2 weeks after sowing of the additional Bollgard II.
- (b) Pigeon pea refuges should not be planted until the soil temperature reaches 17°C, which is the requirement for germination. If soil temperatures are not suitable to allow germination of pigeon peas in line with condition (a), an alternative refuge must be planted in its place within the prescribed period (under (a) above).
- (c) Once the Bollgard II crops begin flowering, and are highly attractive to *Helicoverpa* spp. moths, cultivation of refuges (e.g. for weed control, row formation etc) must be matched by cultivation of the associated Bollgard II field(s).
- (d) Insecticide preparations containing Bt may be used on Bollgard II cotton throughout the season BUT NOT on any refuge crops.
- (e) All refuges are to be planted within the farm unit growing Bollgard II cotton. Subject

to clause (f) below all reasonable effort should be taken to plant the refuge either on one side of, or next to a Bollgard II cotton field, and all Bollgard II fields must be no more than 2 km from the nearest Bollgard II refuge.

- (f) To minimise the possibility of refuge attractiveness being affected by herbicide drift, non-herbicide tolerant refuges should be separated from herbicide tolerant Bollgard II cotton crops by a sufficient distance to minimise such drift but no more than 2km from the Bollgard II cotton.
- (g) To account for possible insecticide drift, the options for the width of refuge crops vary according to spray regime. If any sprayed conventional cotton is grown on the same farm unit, Bollgard II refuge crops must be at least 48 metres wide and each refuge area must be a minimum of 2 hectares. If no sprayed conventional cotton is grown on the same farm unit, Bollgard II refuge crops must be at least 24 metres wide and 24 metres long. Different unsprayed refuge options may be planted in the same field as a single unit; however a sprayed conventional cotton refuge must not be planted in a field that is also planted to an unsprayed refuge type.
- (h) In New South Wales and Southern Queensland, to ensure maximum emergence of late pupae from associated refuges, soil disturbance of refuge crops should not be undertaken until after the pupae busting in Bollgard II cotton crops on the farm unit is complete. In Central Queensland soil disturbance of refuge crops can only occur after Bollgard II cotton plants have been removed. In all regions, destruction of refuges other than corn and sorghum should only be carried out after Bollgard II cotton lint removal has been completed.
- (i) Refuges for dryland Bollgard II crops must be planted in the same row configuration as the Bollgard II crop unless the refuge is irrigated. If an irrigated option is utilised for a dryland Bollgard II crop, then that refuge may be planted in a solid configuration. Dryland cotton is measured as green hectares (calculated as defined in the Technology User Agreement).

## **2. Control of volunteer and ratoon cotton**

Volunteer and ratoon cotton may impose additional selection pressure on *Helicoverpa* spp. to develop resistance to the Bt Cry 1Ac and Cry 2Ab proteins produced by Bollgard II cotton.

Growers must make all reasonable efforts to remove volunteer and ratoon plants, as soon as possible from all fields, including fallow areas, Bollgard II crops, conventional cotton crops and all refuges.

## **3. Post-harvest crop destruction**

As soon as practical after harvest, Bollgard II cotton crops must be destroyed by cultivation or herbicide so that they do not continue to act as hosts for *Helicoverpa* spp. Unsprayed refuges must be left uncultivated for two weeks after harvest to allow emergence of any pupating *Helicoverpa* spp.



**SECTION 2: NEW SOUTH WALES AND SOUTHERN QUEENSLAND ONLY**

**1. Planting windows**

All Bollgard II crops are to be planted into moisture or watered-up by 15 November, unless otherwise advised by a Bollgard II Planting Window Variation Notice.

**2. Pupae destruction**

In Bollgard II cotton fields, each grower will be required to undertake *Helicoverpa* spp. pupae destruction after harvest according to the following key guidelines:

- Bollgard II crops should be slashed or mulched and fields cultivated for pupae control within 4 weeks of harvesting. All pupae busting must be completed by July 31.
- Ensure disturbance of the whole soil surface to a depth of 10 cm.
- All fields that are sown to any winter crop following a Bollgard II crop must be inspected by the Technology Service Provider before sowing commences in order to ensure that pupae busting has occurred.

In Refuge crops:

All unsprayed refuges should preferably be left uncultivated until the following October.

**3. Failed crops**

Bollgard II crops that will not be grown through to harvest for various reasons and are declared to, and verified by, Monsanto as failed must be destroyed within two weeks after verification, in such a way that prevents regrowth. Crops abandoned before February 28 do not require pupae busting. Crops abandoned on February 28 or later must be pupae busted.

**NB:** If any grower encounters problems in complying with the Resistance Management Plan please contact your local Accounts & Stewardship Specialist.

**SECTION 3: CENTRAL QUEENSLAND ONLY**

**1. Planting Windows**

**Emerald:** All Bollgard II crops are to be planted into moisture or watered-up in the period between September 15 and October 26, unless advised otherwise by a Bollgard II Planting Window Variation Notice.

**Dawson Callide Valleys:** All Bollgard II crops are to be planted into moisture or watered-up in the period between September 15 and October 26, unless advised otherwise by a Bollgard II Planting Window Variation Notice.

**Belyando:** All Bollgard II crops are to be planted into moisture or watered-up in the period between October 10 and November 20, unless advised otherwise by a Bollgard II Planting Window Variation Notice.

**2. Late summer pigeon pea trap crop**

A late summer trap crop (pigeon pea) must be planted for all Bollgard II cotton grown in Central Queensland. The planting configuration of the trap crop should be the same as that of the Bollgard II crop. Irrigated Bollgard II must have an irrigated trap crop. Table 3

shows the requirements for the late summer pigeon pea trap crop. Dryland Bollgard II growers who do not have any irrigated cotton on their farm should contact their Accounts & Stewardship Specialist for alternative options.

Refuge and late summer trap crops have different purposes and, if pigeon pea is selected for both, two separate plantings are required.

**Table 3. Late summer pigeon pea trap crop requirements in Central Queensland**

Criterion	Trap crop**
Minimum area & dimension (Requirement)	A trap crop of 1% of planted Bollgard II crop is required. If sprayed conventional cotton is grown on that farm unit: the trap crop must be at least 48m x 48m. If no sprayed conventional cotton is grown on that farm unit: the trap crop must be at least 24m x 24m.
Planting time	The trap crop must be planted between November 20 and December 20.
Planting rate ***	35kg/ha (recommended establishment greater than 4 plants per metre)
Insect control	The trap crop can be sprayed with virus after flowering; while avoiding insecticide spray drift.
Irrigation	Irrigation of the trap crop must be the same as for cotton, plus one additional irrigation after cotton is finished.
Weed control	The trap crop must be kept free of weeds.
Crop destruction	The trap crop must be destroyed 2 to 4 weeks after defoliation of Bollgard II cotton (slash and pupae bust – full soil disturbance to a depth of 10cm across the entire trap crop area).

\*\* A pigeon pea trap crop is to be planted so that it is attractive (flowering) to *Helicoverpa* spp. after the cotton crop has cut out, and as any survivors from the Bollgard II crop emerge. Planting pigeon pea too early (e.g. before mid-November) or too late (e.g. January) is not adequate for cotton crops planted during September through to October.

\*\*\* The planting rate is a recommendation based on a minimum of 85% seed germination.

**NB: If any grower encounters problems in complying with the resistance management plan, please contact your Accounts & Stewardship Specialist.**

For further background information on the various components of this plan see the "Preamble to the Resistance Management Plan for Bollgard II" in the current Cotton Pest Management Guide

## SCHEDULE A -

### Resistance Management Plan for Bollgard II<sup>®</sup> Cotton 2009/2010

Ord River Irrigation and Burdekin Bowen Basin Areas

Developed by Monsanto Australia Limited and the Transgenic and Insect Management Strategy (TIMS) Committee of Cotton Australia Limited.

The resistance management plan is based on three basic principles: (1) minimising the exposure of *Helicoverpa* spp. to the *Bacillus thuringiensis* (Bt) proteins Cry 1Ac and Cry 2Ab; (2) providing a population of susceptible individuals that can mate with any resistant individuals, hence diluting any potential resistance; and (3) removing resistant individuals at the end of the cotton season.

Growers of Bollgard II cotton are required to practice preventative resistance management as set out below. Compliance with the Resistance Management Plan is required under the terms of the Bollgard II Technology User Agreement and under the conditions of registration (*Agricultural and Veterinary Chemicals Act, 1994*).

#### **This RMP is for the following areas:**

- **Ord River Irrigation Area**, Western Australia
- **Burdekin Bowen Basin Area**, Queensland

#### **1. Refuges**

Growers planting Bollgard II cotton will also be required to grow a refuge crop that is capable of producing large numbers of *Helicoverpa* spp. moths which have not been exposed to selection with Bt proteins Cry 1Ac and Cry 2Ab. These unselected moths are expected to dominate matings with any survivors from Bollgard II crops and thus help to maintain resistance to Bt proteins Cry 1Ac and Cry 2Ab at low levels.

All refuge options are based on the requirement of a 10% unsprayed cotton refuge or its equivalent as determined by the relative production of *Helicoverpa* spp. from each of the refuge types as described in the tables below.

For each area of irrigated Bollgard II cotton planted, a grower is required to plant a minimum of one, or a combination of, the following:

Table 1. Irrigated Bollgard II cotton refuge options

Crop	Conditions	% of Bollgard II	Regions permitted
Cotton	Irrigated, unsprayed conventional cotton	10	Ord River, Burdekin Bowen
Pigeon pea	Irrigated, unsprayed	5	Ord River
Chick pea	Irrigated, unsprayed	5	Ord River
Corn	Irrigated, unsprayed – conditions apply, see box below	10	Ord River

**Note:** Unsprayed means not sprayed with insecticides that target any life stage of *Helicoverpa* spp.

Bt products must not be applied to any refuge.

If the viability of an unsprayed refuge is at risk due to early season pressure by *Helicoverpa* spp., and with prior approval from the Monsanto Compliance and Stewardship Manager, a non-Bt heliocide can be applied up to the 4<sup>th</sup> true leaf stage.

An unsprayed refuge should not be planted in the same field as any crop sprayed with a rate of insecticide that is registered for *Helicoverpa* spp, with the exception of Bollgard II. Sprayed crops and unsprayed refuges that are planted in adjacent fields must be separated by sufficient distance to *minimise the likelihood of insecticide drift onto the unsprayed refuge.*

For the purposes of this Resistance Management Plan, conventional cotton includes any cotton varieties that do not have Bt proteins in the plant that control *Helicoverpa* spp. moths.

**Irrigated corn**

NB: The following special conditions apply to growers who wish to grow corn as a refuge.

- A plan indicating how the refuge will be managed must be submitted to, and approved by, the local Accounts & Stewardship Specialist before planting. A farm map must be included with the plan.
- Corn refuge option requires three sequential plantings of the same variety. The initial planting date should be determined by the time taken to flower for the varieties chosen for use in each particular area so that the chosen variety is to flower simultaneously with the Bollgard II crop in the region. Subsequent plantings should follow at 2-weekly intervals so that some of the refuge is continuously in flower during this period.
- A single planting of mixed maturity varieties is not acceptable.

- Each planting should be one third of the total area required for that refuge type. If there is no sprayed conventional cotton on the same farm unit, the refuge must be a minimum of 24 metres wide.
- This refuge option will be closely monitored during the season to ensure that all such refuges are managed appropriately and are effective and attractive whilst the Bollgard II cotton crop is flowering.
- Corn refuges may be harvested after complete cob maturity.

**General conditions for all refuges:**

- (a) Refuge crops are to be planted and managed so that they are attractive to *Helicoverpa* spp. during the growing period of the Bollgard II cotton varieties. It is preferable that all refuge is planted within the 2 week period prior to planting Bollgard II. If this is not possible, refuge planting must be completed within 3 weeks of the first day of sowing of Bollgard II. At this time, sufficient refuge must have been planted to cover all of the Bollgard II cotton proposed to be planted for the season (including Bollgard II already planted and any that remains unplanted). Should additional Bollgard II planting occur after this date, which is not already covered by refuge, additional refuge must be planted as soon as possible and no more than 2 weeks after sowing of the additional Bollgard II.
- (b) Pigeon pea refuges should not be planted until the soil temperature reaches 17 °C, which is the requirement for germination. If soil temperatures are not suitable to allow germination of pigeon peas in line with condition (a), an alternative refuge must be planted in its place within the prescribed period (under (a) above).
- (c) Once the Bollgard II crops begin flowering, and are highly attractive to *Helicoverpa* moths, cultivation of refuges (e.g. for weed control, row formation etc) must be matched by cultivation of the associated Bollgard II field(s).
- (d) Insecticide preparations containing Bt may be used on Bollgard II cotton throughout the season BUT NOT on any refuge crops.
- (e) All refuges are to be planted within the farm unit growing Bollgard II cotton. Subject to clause (f) below, all reasonable efforts should be taken to plant the refuge either on one side of, or next to, a Bollgard II cotton field, and all Bollgard II fields must be no more than 2 km from the nearest Bollgard II refuge.
- (f) To minimise the possibility of refuge attractiveness being affected by herbicide drift, non-herbicide tolerant refuges should be separated from herbicide tolerant Bollgard II cotton crops by a sufficient distance to minimise such drift, but no more than 2km from the Bollgard II cotton.
- (g) To account for possible insecticide drift, Bollgard II refuge crops must be at least 24 metres wide and 24 metres long. Different unsprayed refuge options may be planted in the same field as a single unit.
- (h) Soil disturbance of refuge crops can only occur after Bollgard II cotton plants have been removed. Destruction of refuges other than corn should only be carried out after

Bollgard II cotton lint removal has been completed.

- (j) Refuges for Bollgard II crops must be planted in the same row configuration as the Bollgard II crop.

## 2. Control of volunteer and ratoon cotton

Volunteer and ratoon cotton may impose additional selection pressure on *Helicoverpa* spp. to develop resistance to the Bt proteins Cry 1Ac and Cry 2Ab produced by Bollgard II cotton.

Growers must make all reasonable efforts to remove volunteer and ratoon plants as soon as possible from all fields - including fallow areas, Bollgard II crops, conventional cotton crops and all refuges.

## 3. Post-harvest crop destruction

As soon as practical after harvest, Bollgard II cotton crops must be destroyed by cultivation or herbicide so that they do not continue to act as hosts for *Helicoverpa* spp. Unsprayed refuges must be left uncultivated for two weeks after harvest to allow emergence of any pupating *Helicoverpa* spp.

## 4. Planting windows

All Bollgard II crops and cotton refuges are to be planted into moisture or watered-up in a five week window. In each region, the start date of the planting window will be determined by TIMS in consultation with local growers and reflected in a regionally amended "Bollgard II Planting Window Variation Notice".

The planting window will occur within the following periods:

**Ord River Irrigation Area:** March 1 and May 1.

**Burdekin Bowen Basin Area:** December 1 and April 1.

## 5. End of season chick pea trap crop

An end of season chick pea trap crop must be planted. The planting configuration of the trap crop should be the same as that of the Bollgard II crop. Table 2 shows the requirements for the chick pea trap crop.

**Table 2. End of season chick pea trap crop requirements**

<b>Criterion</b>	<b>End of season chick pea trap crop</b>
Minimum area & dimensions	A trap crop of 1% of planted Bollgard II crop area is required. This planting must be at least 24 m wide.
Planting time	In April for Burdekin Bowen Area. In July/August for Ord area. The trap crop is to be planted such that it is attractive to <i>Helicoverpa</i> spp. from 2 weeks before defoliation of the Bollgard II cotton. It must remain attractive to <i>Helicoverpa</i> spp. until at least 2 weeks after defoliation of the Bollgard II cotton.
Insect control	The trap crop should be monitored and sprayed with insecticide if the larval pressure threatens the viability of the crop.
Irrigation	The trap crop is to remain attractive to <i>Helicoverpa</i> spp. until after defoliation of cotton. In some cases this may require one additional irrigation after the cotton is defoliated.
Weed control	The trap crop must be kept free of weeds.
Crop destruction	The trap crop must be destroyed 2 to 4 weeks after defoliation of Bollgard II cotton (slash and pupae bust – full soil disturbance to a depth of 10 cm across the entire trap crop area).

**NB: If any grower encounters problems in complying with the resistance management plan, please contact your Accounts & Stewardship Specialist.**