



# BIOTECH TOPIC

## RESISTANCE MANAGEMENT: CONTROL OF VOLUNTEER AND RATOON COTTON



**Bollgard<sup>®</sup>3**

## The importance of resistance management, disease prevention and insect population control.

A key part of any Resistance Management Plan for growers of Bollgard® 3 cotton is the control of volunteer and ratoon cotton.

This can, however, be difficult to achieve, as shown in a recent survey carried out by staff from the Queensland and New South Wales Departments of Primary Industries. Volunteer cotton plants from the previous season were present on 71% of cotton farms in QLD and 81% of cotton farms in NSW. On more than 50% of farms, volunteers were found in the current year's cotton crop, however most volunteers were found on roadsides, in channels and along fence lines.

Before looking at methods to improve control of volunteer and ratoon cotton, it's good to understand why it is so important. In short, it helps achieve resistance management, disease prevention and insect population control objectives.

### 1. Resistance management

The presence of volunteer and ratoon cotton is a risk factor for the development of resistance in moth (*Helicoverpa* spp.) populations to the insecticidal proteins (Cry1Ac, Cry2Ab and Vip3A) in Bollgard 3 cotton. This is because ratoons and volunteers provide additional opportunities for *Helicoverpa* spp., that may carry the resistance genes to these proteins, to survive and propagate.

Similarly, fields containing Bollgard 3 ratoons and volunteers are unsuitable for planting a refuge because the population of *Helicoverpa* spp. moths, provided by the refuge, may have been exposed to the insecticidal proteins and therefore may not be susceptible to the proteins.



### 2. Disease prevention and risk mitigation

The ratoon and volunteer plants can act as crop hosts and/or stimulate the growth of soil bacteria, increasing the risk of verticillium wilt, fusarium wilt, black root rot and alternaria leaf spot.

**Ratoon or volunteer cotton is one of the major risk factors for several viruses and soil borne diseases, which may result in significant yield losses in following years.**

Viruses such as tobacco streak virus and cotton bunchy top (CBT) virus are unable to survive without a live plant host. In particular, the risk of cotton bunchy top virus is increased when ratoon and volunteer cotton plants are present anywhere on a farm.

Cotton volunteers and ratoons provide both a host for CBT and also a green bridge for the vector of the disease – the cotton aphid – to survive over winter. Cotton aphids may then spread the virus to nearby cotton crops, often resulting in severe yield losses.

Removing volunteers and ratoons is the simplest way of preventing aphid survival, even though CBT can survive in several other broadleaf weeds. Unfortunately, chemical control of aphids is often not effective due to resistance issues.

### 3. Control of insect populations

The presence of cotton volunteers and ratoons gives many insects an opportunity to survive over winter, increasing the risk of early season infestations and crop damage the following year. These insects include cotton aphids, mealybugs, silverleaf whitefly and pale cotton strainers.

Infestation of the crop early in the season can result in yield losses through square damage or a reduction in leaf area. It may also require costly insecticide sprays for control – for example, silverleaf whitefly sprays can cost dryland growers between \$55 and \$105/ha, an expense that could be avoided had insect populations been controlled through good volunteer and ratoon control.



**Insect populations can be quite mobile, even over winter, as they seek suitable host plants or are spread via wind, surface water run-off, rain splash, birds, and the movement of people and farm equipment. This makes farm-wide or even valley-wide volunteer and ratoon control a key objective.**

### 4. Agronomic considerations

Cotton volunteers compete with the plants in your refuge crop in the same way that weeds do.

As well as competing for water, nutrients and light, volunteers may cause other agronomic problems. These include poor water flow through furrows and a reduction in the effectiveness of sprays of other weeds through shielding.

If your refuge is in a fallow area and volunteers are left to grow, they can cause a significant drying down of the soil profile, and reduce the available water in the soil for following crops. In fact, ratoon cotton can dry the profile down to over one metre.

## Strategies for the management of volunteer cotton in refuge crops

### Implement appropriate cultural methods

The best way to avoid the presence of Bollgard 3 volunteers in refuge crops is not to plant refuges into fields that were planted to Bollgard 3 the previous season. If this is unavoidable, proactive control methods must be in place before planting. These include:

- Reducing the amount of viable seed left in fields and surrounding areas by using herbicide options and cultural practices will reduce the number of volunteers that germinate.
- Cultivation of broadacre fields in fallow areas will act as a control method for volunteers of differing sizes, from seedlings to plants.
- Manual removal of plants (chipping) can also be effective in low-density situations. Cultivation is also useful to manage other weeds present in the field.

### Develop appropriate herbicide strategies

If refuge crops are planted into a Bollgard 3 field from the previous season, ensure appropriate control mechanisms are available and can be implemented in a timely fashion.

Pre-watering is a method used to establish volunteers prior to planting a refuge into moisture. This allows a window for appropriate herbicide control of seedling volunteers prior to the emergence of the refuge crop.

Table 1 shows herbicide options registered for control of cotton volunteers. Most herbicide options work well on seedling volunteers, but once plants are established, control becomes increasingly difficult.



# WEEDS

**TABLE 1: Herbicides for volunteer cotton control**

ACTIVES	MOA	CONC & FORMULATION	APPL RATE	STAGE	COMMENT
Amitrole + Ammonium Thiocyanate	Q	250 g/L + 220g/L SL	4.3 – 5.6L/ha	Cotyledon – 8 leaf	See label for rain fastness. Apply in 50-100L/ha water. Addition of 0.25% LI700 may improve results. Tank mix with glyphosate. Sowing can occur immediately after application. Bleaching of isolated crop leaves may be seen after emergence.
Amitrole + Paraquat	Q + L	250g/L + 125g/L SC	2-4L/ha	Up to 8 leaf	Can be applied after an initial spray of a glyphosate herbicide (Double Knockdown). Refer to label for spot spray rates.
Bromoxynil	C	200g/L EC	1.5 L/ha or 1–1.5 L/ha with glyphosate	Cotyledon – 6 leaves	Apply in minimum of 80 L/ha water for Roundup Ready cotton. See label for rain fastness. Refer to label for restrictions on spray quality 400 g/L EC & condition.
		400 g/L EC	750mL or 500-750mL with wipeout		
Carfentrazoneethyl	G	600 g/L EC	Roundup Ready: 0.03–0.04 L/ha plus adjuvant Conventional: 0.02–0.03 L/ha	2–6 leaf and post harvest control	Apply minimum spray volume of 80 L/ha. Tank mix with glyphosate, or products containing paraquat. Refer to label for adjuvant recommendation.
		400 g/L EC	Roundup Ready: 0.045–0.060 L/ha plus adjuvant Conventional 0.030 – 0.045 L/ha		
		240 g/L EC	Roundup Ready: 0.075–0.1 L/ha plus adjuvant Conventional 0.050–0.075 L/ha		
Paraquat + Diquat	L	135g/L +115g/L SL	1.6-2.4L/ha SL 2.4-3.2L/ha	1–4 leaf 5–9 leaf	Apply in 50-100L water/ha. For best results, spray during humid conditions in the late evening.
Flumetsulam	B	800g/kg WG	50g/ha	Pre-emergent	Do not apply post emergent treatments if rain is likely within 4 hours. Do not irrigate (any method) treated crop of pasture for 48 hours after application. May be banded (>40%) over the row or broadcast. Minimum spray volume 150L/ha for optimum results.
Flumioxazin	G	500 g/kg WG	45 g/ha plus adjuvant	Up to 4 leaf	Do not apply post-sowing pre-emergent. Apply no later than 1 hour prior to sowing or post sowing up to 2 days before first crop emergence. Can be tank mixed with glyphosate to control other weeds that may be present. Refer to label for adjuvant details.
Glufosinate – Ammonium	N	200 g/L SL	3.75 L/ha in 100 L water	2–6 leaf; summer fallow	Liberty® 200 is registered for non-residual control of conventional cotton volunteers in Liberty Link crops. Basta® is only registered for summer fallow situations. Do not apply more than 3 applications per season. DO NOT APPLY TO COTTON VARIETIES OTHER THAN LIBERTY LINK COTTON.
Metribuzin	C	750g/kg WG	470g/ha	Pre-emergent	Registered for control of volunteer cotton in pigeon pea. Refer to label for critical comments.
		480g/L SC	0.750L/ha	Pre-emergent	Registered for control of volunteer cotton in pigeon pea. Refer to label for critical comments.
Fluroxypyr	I	333 g/L	0.45 L/ha 0.6 L/ha	2–6 leaf 5–7 leaf	Summer fallow.
Saflufenacil	G	700 g/kg	17–26 g/ha plus 1% Hasten or high quality MSO	17 g/ha for cotyledon to 4 leaf; 26 g/ha from cotyledon to 6 leaf in fallow or post harvest	Use a spray volume of 80–250 L/ha. Increase water volume if weed infestation is dense if weed infestation is dense and/or tall. See label for mandatory no spray zone.



## FOR MORE INFORMATION CONTACT:

### Monsanto Regional Business Managers



**EMMA BROTHERTON**  
Regional Business Manager  
Central Queensland  
& Dawson/Callide  
0409 742 738  
emma.brotherton@monsanto.com



**DEAN WHITTON**  
Regional Business Manager  
Namoi & Walgett  
0447 328 619  
dean.whitton@monsanto.com



**MICK FING**  
Regional Business Manager  
Darling Downs  
& St George/Dirranbandi  
0417 305 717  
michael.fing@monsanto.com



**PAUL BRADY**  
National Business Manager  
– Cotton Expansion  
0409 935 513  
paul.1.brady@monsanto.com



**TOM LUFF**  
Regional Business Manager  
Gwydir, Macintyre & Mungindi  
0400 491 902  
thomas.bernard.luff@monsanto.com



**MARK DAWSON**  
Sales Lead  
0428 106 090  
mark.m.dawson@monsanto.com



**LUKE SAMPSON**  
Regional Business Manager  
Lachlan, Macquarie,  
Bourke & Southern NSW  
0427 701 986  
luke.sampson@monsanto.com



**DR KRISTEN KNIGHT**  
Entomologist  
0429 666 086  
kristen.m.knight@monsanto.com

#### Monsanto Australia Head Office

Level 12, 600 St Kilda Road  
Melbourne, VIC 3004  
Phone (03) 9522 7122  
Fax (03) 9522 6122

[www.monsanto.com.au](http://www.monsanto.com.au)  
[www.twitter.com/MonsantoANZ](https://www.twitter.com/MonsantoANZ)

**For more information visit  
[www.bollgard3.com.au](http://www.bollgard3.com.au), contact your  
Monsanto Regional Business Manager.**