



BIOTECH TOPIC

RESISTANCE MANAGEMENT: CONTROL OF VOLUNTEER AND RATOON COTTON



Bollgard³

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 pass on those genes.

Similarly, fields containing Bollgard 3 cotton ratoons and volunteers are unsuitable for planting a refuge for the same reasons listed above. Refuges must be free of any ratoons and volunteers to decrease the risk of extra selection of resistance genes.

The RMP now states that all ratoons and volunteers must be removed prior to flowering.

2. Disease prevention and risk mitigation

The ratoon and volunteer plants can act as crop hosts and/or stimulate the growth of soil pathogens, 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, thrips, silverleaf whitefly and pale cotton stainers.

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 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 cotton volunteers in refuge crops is not to plant refuges into fields that were planted to Bollgard 3 cotton 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 mature 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 cotton 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	COMMENTS (ALWAYS REFER TO PRODUCT LABELS)
Amitrole + ammonium thiocyanate	Q	See label for rain fastness. Apply in 50-100 L/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	Can be applied after an initial spray of a glyphosate herbicide (Double Knockdown). Refer to label for spot spray rates. <i>Glyphosate will not be effective on Roundup Ready® cotton volunteers.</i>
Bromoxynil	C	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 & condition.
Carfentrazone-ethyl	G	Apply minimum spray volume of 80 L/ha. To broaden weed spectrum may be tank mixed with the recommended rate of a knockdown herbicide. Refer to label for adjuvant recommendation.
Paraquat + diquat	L	Apply in 50-100 L water/ha. For best results, spray in the evenings or in humid conditions.
Flumetsulam	B	Do not apply post-emergent treatments if rain is likely within 4 hours. Do not irrigate (any method) treated crop or pasture for 48 hours after application. May be banded (>40%) over the row or broadcast. Minimum spray volume 150 L/ha for optimum results.
Flumioxazin	G	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	Good coverage is essential. Do not apply more than three applications per season. <i>Glufosinate-ammonium will not be effective on XtendFlex® cotton volunteers.</i>
Metribuzin	C	Registered for control of volunteer cotton in pigeon peas or pigeon pea crops. Refer to label for critical comments.
Fluroxypyr	I	Summer fallow.
Saflufenacil	G	Do not apply post-sowing pre-emergent. Use a spray volume of 80-250 L/ha. Increase water volume if weed infestation is dense and/or tall. See label for mandatory no spray zone.
Pyraflufen-ethyl (Sledge®)	G	Fallow – apply to cotton seedlings up to 8 leaf. Apply by ground rig only. Good spray coverage is essential.

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