

2016 IRM GROWER GUIDE

INSECT RESISTANCE MANAGEMENT



IRM Overview

Resistance has developed in nature to many pest control tactics. The risk of insect resistance is real, but may be reduced with proper planning. The best way to preserve the benefits and insect protection of *Bacillus thuringiensis* (*B.t.*) technology is to develop and implement an Insect Resistance Management (IRM) plan.

A key component of any IRM plan is a refuge. A refuge is a block or strip of the same crop that does not contain a *B.t.* technology for controlling targeted insect pests, or the refuge can be included in an EPA (United States Environmental Protection Agency) approved seed blend product provided by qualified seed producers/conditioners, licensed by Monsanto.



The EPA mandates a refuge for *B.t.* technology. **In Arizona, California, New Mexico and west Texas, a planted refuge is a requirement for purchasing and growing Genuity® Bollgard II® cotton.** The primary purpose of a refuge is to maintain a population of insect pests that are not exposed to *B.t.* proteins. The lack of exposure to *B.t.* proteins allows susceptible insects emerging from the refuge to mate with the rare resistant insects that may emerge from the *B.t.* crop. Susceptibility to *B.t.* technology would then be passed on to their offspring, helping to preserve the long-term effectiveness of *B.t.* technologies.

To help reduce the risk of insects developing resistance, the refuge should be planted with a **similar variety, as close as possible to, and at the same time as, the crop containing *B.t.* technologies.**

As a condition of registration of *B.t.* products by the EPA, seed companies are required to conduct IRM compliance assessments during the growing season to ensure grower compliance. Failure to follow IRM guidelines and properly plant a refuge may result in the loss of access to *B.t.* technologies. Please do your part to ensure these technologies are preserved by fully cooperating in refuge management. Continued availability of *B.t.* technologies depends on grower compliance with EPA registration conditions. With an effective IRM plan in place, growers will continue to benefit from the effective and consistent insect protection and top-yield potential found in crops containing these technologies.

Good Stewardship Includes:

- Reading and signing a Monsanto Technology/Stewardship Agreement (MTSA).
- Complying with all the IRM practices for specific biotech traits as mandated by the EPA, this IRM Grower Guide and the MTSA.
- Complying with any additional stewardship IRM requirements that Monsanto deems appropriate or necessary to implement for proper stewardship or regulatory compliance.

Where Genuity® Bollgard II® Cotton Can be Grown and the Area Where a Planted Refuge is Required

● Natural Refuge Area

In the natural refuge area, cotton growers are not required to plant non-*B.t.* cotton as a refuge for Genuity Bollgard II cotton. Natural refuge refers to cultivated crops as well as plants other than cotton that serve as hosts of susceptible target pests. Monsanto, in conjunction with USDA and university researchers, demonstrated that numbers of tobacco budworm and cotton bollworm moths produced from hosts other than cotton within this area are sufficient for fulfilling refuge requirements.

● Planted Refuge Required Area

In the planted refuge required area, growers must plant non-*B.t.* cotton that serves as a refuge for the tobacco budworm, cotton bollworm and/or pink bollworm moths. Options include an embedded, 5% external unsprayed or 20% external sprayed refuge. Confirm with local authorities (such as your state Department of Agriculture) if there are any county-specific exemptions from refuge requirements that may be allowed in accordance with state pink bollworm eradication programs. This may include counties in Arizona, New Mexico, California, and west Texas.

● Natural Refuge

● Planted Refuge Required

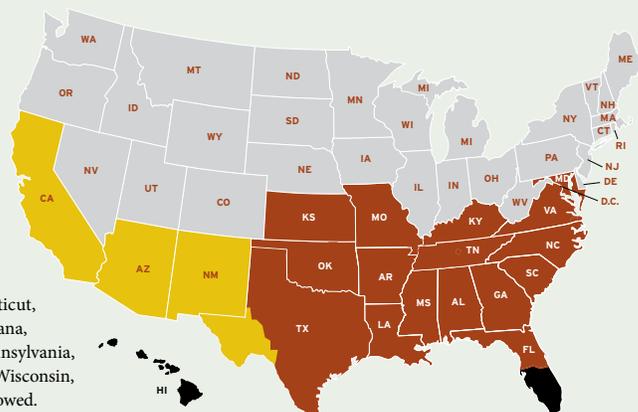
Includes all counties in Arizona, New Mexico, California, and the Texas counties of Brewster, Crane, Crockett, Culberson, El Paso, Hudspeth, Jeff Davis, Loving, Pecos, Presidio, Reeves, Terrell, Val Verde, Ward and Winkler.

● Sale Prohibited — By Federal Registration

Sale or commercial planting of Genuity Bollgard II cotton is prohibited in Hawaii, Puerto Rico, the U.S. Virgin Islands, and in Florida south of Route 60 (near Tampa).

● Sale Prohibited — No State Registration

Genuity Bollgard II cotton is not registered in the following states: Alaska, Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, Washington D.C., West Virginia, Wisconsin, and Wyoming. Therefore, sale or commercial planting of Genuity Bollgard II cotton is not allowed.



Genuity® Bollgard II® Refuge Requirements

Genuity® Bollgard II® Cotton varieties contain two distinct insecticidal proteins, *Cry1Ac* and *Cry2Ab2*, from *B.t.* that increase the efficacy and spectrum of control and reduce the chance that resistance will develop to the *B.t.* insecticidal proteins. Genuity Bollgard II cotton controls tobacco budworm, pink bollworm and cotton bollworm. Genuity Bollgard II cotton also provides control against fall armyworm, beet armyworm, cabbage and soybean loopers and other secondary leaf- or fruit-feeding caterpillar pests of cotton.

Refuge Planting

- The variety of cotton planted in the refuge must be comparable, especially in the maturity date, to the Genuity Bollgard II cotton for which it serves as refuge.
- The refuge must be managed similarly to Genuity Bollgard II cotton (example: planting time, use of fertilizers, weed control, irrigation, terminations, and management of other pests).
- Plant the refuge at the same time as the *B.t.* technologies.
- Grower mixing of non-*B.t.* seed with *B.t.* technologies is not permitted. However, non-*B.t.* seed can be included in an EPA approved seed blend product, if provided by qualified seed producers/conditioners, licensed by Monsanto.
- To avoid inadvertent mixing of seed in the planting process, be sure to clean all seed out of hoppers when switching from non-*B.t.* seed to traited seed, or vice versa.
- All refuge fields must be planted and managed by the same grower.

The graphic depictions of refuge configurations in this IRM Grower Guide are offered merely as examples to growers and are not necessarily drawn to scale.

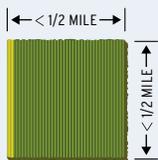
Embedded Refuge

 Genuity Bollgard II  Refuge

Option A

Fields **less than** 1/2 mile in length and width:

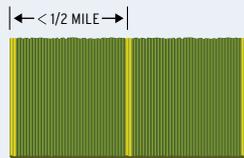
- Plant at least 5 acres of non-*B.t.* cotton for every 95 acres of Genuity Bollgard II cotton.
- May be embedded as a continuous block at one edge of the field or at the field perimeter.



Option B

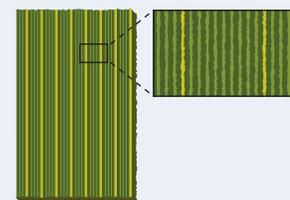
Fields **greater than** 1/2 mile in length and/or width:

- Plant at least 5 acres of non-*B.t.* cotton for every 95 acres of Genuity Bollgard II cotton.
- Plant the refuge in more than one location to ensure compliance with the 1/2 mile distance requirements.
- May be embedded as continuous blocks within the Genuity Bollgard II cotton field and/or perimeter.



Option C

- Due to the unique biology of pink bollworm, and a scarcity of tobacco budworm and cotton bollworm, in some regions, growers may mix individual rows of non-*B.t.* cotton with Genuity Bollgard II cotton.
- Plant one single refuge row for every 6 (six) to 10 (ten) *B.t.* rows.
- Interspersing single row refuge is not recommended for regions with a history of significant cotton bollworm or tobacco budworm damage.
- Check with a qualified expert, including your seed company, crop advisors and/or extension specialists.



Treatment (follow all pesticide label directions)

Prior to squaring*—The refuge may be treated with any insecticide labeled for cotton, including those to control foliage-feeding caterpillars.

After squaring—The refuge may not be treated with any insecticide or pheromone labeled for the control of tobacco budworm, cotton bollworm or pink bollworm.

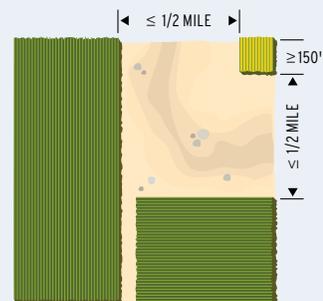
Throughout season—In addition to the above, the refuge and/or Genuity Bollgard II may be treated with labeled insecticides for control of pests other than lepidopteran targets of Genuity Bollgard II cotton.



5% External Unsprayed Refuge

 Genuity Bollgard II  Refuge

- Plant at least 5 acres of non-*B.t.* cotton for every 95 acres of Genuity[®] Bollgard II[®] cotton.
- The external unsprayed refuge **must be at least 150 feet wide**.
- All associated Genuity Bollgard II cotton fields **must be within 1/2 linear mile** (preferably adjacent to or within 1/4 mile or closer), field border to field border of the unsprayed refuge.
- In cases where placement of the refuge within 1/4 mile of the Genuity Bollgard II cotton is in conflict with the state seed production regulations, the grower must plant the refuge as close to the Genuity Bollgard II cotton as permitted.
- The refuge can be planted as a separate block, or as an adjacent block of a field.



Treatment (follow all pesticide label directions)

Prior to squaring*—The refuge may be treated with any lepidopteran insecticide to control foliage-feeding caterpillars.

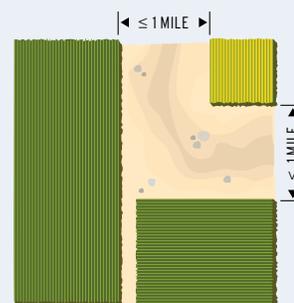
After squaring—The refuge may not be treated with any insecticide or pheromone labeled for the control of tobacco budworm, cotton bollworm or pink bollworm, or with sterile pink bollworm.

Throughout season—In addition to the above, the refuge and/or Genuity Bollgard II may be treated with labeled insecticides for control of pests other than lepidopteran targets of Genuity Bollgard II cotton.

20% External Sprayed Refuge

 Genuity Bollgard II  Refuge

- Plant at least 20 acres of non-*B.t.* cotton for every 80 acres of Genuity Bollgard II cotton.
- Refuge can be planted as separate fields, as a block within a field, or at the perimeter of a field.
- This external sprayed refuge may be treated **with any insecticide** (excluding foliar *B.t.* products).
- All associated Genuity Bollgard II cotton fields **must be within one linear mile** (preferably within 1/2 mile or closer), field border to field border of the sprayed refuge.



Treatment (follow all pesticide label directions)

At any time during the season, the refuge and/or Genuity Bollgard II cotton may be treated with any labeled insecticide (excluding foliar *B.t.* products).

*From emergence and prior to squaring, the refuge may be treated with acephate or methyl parathion at approved rates (typically equal to or less than 0.5 pounds of active ingredient per acre) which will not control tobacco budworm or the cotton bollworm, but may control other pests. Follow all pesticide label directions.

Integrated Pest Management

Sustainable Agriculture

Monsanto *B.t.* cotton products are highly compatible with the goals of Integrated Pest Management (IPM) and sustainable agriculture. Sustainability of cotton agricultural systems is enhanced when growers follow recommended IPM practices, including cultural and biological control tactics, and appropriate use of pest thresholds and sampling. These latter measures are not only important for non-*B.t.* refuge acres, but are equally important for detecting and controlling non-target pests that exceed established thresholds on *B.t.* crops.

Pests Not Controlled

Although *B.t.* cotton will sustain less damage from some of the most troublesome lepidopteran pests, it will not provide control against non-lepidopteran species. Therefore, it is important to understand that, in some cases, severe infestations of target and/or non-target insects may require additional control measures/treatment. **Fields should be scouted regularly, especially during periods of heavy or sustained pest presence.** Consult local IPM monitoring guidelines to identify insects that should be routinely monitored, and for recommended controls and thresholds. When insecticide treatments are required, select products that have the least impact on beneficial insects. Consult your local crop adviser or extension specialist for the most up-to-date information.

An IPM Checklist

- Employ appropriate scouting techniques and treatment decisions.
- Select insecticide treatments that have minimal negative impact on beneficial insects; these insects are conserved by *B.t.*-protected crops and can contribute to insect pest control.
- Select cultivars well-adapted to your setting, giving appropriate attention to impact of crop maturity and timing of harvest on pest severity.
- Use recommended cultural control methods to reduce pest over-wintering; destroy crop promptly after harvest and use other soil management practices to reduce overwintering insects.

Questions? We're Here to Help.

Monsanto works to develop and implement IRM programs that strike a balance between available knowledge and practicality, with grower acceptance and implementation of the plan as critical components. Please contact your seed dealer with any questions and/or call 1-800-768-6387.

If you have questions about seed stewardship or become aware of individuals utilizing biotech traits in a manner other than as noted previously, please call 1-800-768-6387. Letters reporting unauthorized or improper use of biotech traits may be sent to:

Monsanto Stewardship
800 N. Lindbergh Boulevard E3NA
St. Louis, MO 63167

Anyone may provide Anonymous or Confidential reports as follows:

"Anonymous" reporting occurs when a person reports information to Monsanto in such a way that the identity of the person reporting the information cannot be identified. This kind of reporting includes telephone calls requesting anonymity and unsigned letters.

"Confidential" reporting occurs when a person reports information to Monsanto in such a way that the reporting person's identity is known to Monsanto. Every effort will be made to protect a person's identity, but it is important to understand that a court may order Monsanto to reveal the identity of people who are "known" to have supplied relevant information.

Growers should monitor their fields and contact their seed dealer or Monsanto at 1-800-768-6387 if performance problems are observed.



Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management**, for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.



Monsanto Company is a member of Excellence Through Stewardship® (ETS). Monsanto products are commercialized in accordance with ETS Product Launch Stewardship Guidance, and in compliance with Monsanto's Policy for Commercialization of Biotechnology-Derived Plant Products in Commodity Crops. Commercialized products have been approved for import into key export markets with functioning regulatory systems. Any crop or material produced from this product can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted. Growers should talk to their grain handler or product purchaser to confirm their buying position for this product.

***B.t.* products** may not yet be registered in all states. Check with your Monsanto representative for the registration status in your state.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Bollgard II®, Genuity Design®, Genuity®, Monsanto and Vine Design® and Respect the Refuge and Cotton Design® are trademarks of Monsanto Technology LLC. ©2015 Monsanto Company. [15-00519pgd] 5A5B152741