

AGRONOMIC Spotlight



Technology
Development
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Insect Resistance Management in Corn

A corn refuge is the key component of an Insect Resistance Management (IRM) plan. Proper implementation of an IRM plan is important and mandatory for corn products that contain *B.t.* (*Bacillus thuringiensis*) technology or insect protection traits. Grower compliance is critical to the success of an IRM plan, and new requirements have been incorporated in refuge assurance programs for the 2012 growing season.

Importance of IRM and a Corn Refuge

The purpose of an IRM plan is to preserve the benefits and insect protection of corn products that contain *B.t.* technology (*B.t.* corn). All *B.t.* corn products require planting a refuge as part of an IRM plan. A refuge is typically non-*B.t.* corn planted within or near a *B.t.* corn product. Other corn products could be used as long as they do not contain the same *B.t.* technology. Options to plant a structured refuge include blocks, perimeter, or strips within the *B.t.* technology field; or placing the refuge adjacent to the *B.t.* technology field (can be separated by a road, path, ditch, etc.). Due to recent U.S. Environmental Protection Agency (EPA) approvals, refuge-in-a-bag options are also available. Refuge-in-a-bag is a single bag solution that contains a specific percentage of *B.t.* seed interspersed in the same bag with non-*B.t.* refuge seed. Therefore, no separate structured refuge planting arrangements are needed when planted in the corn-growing area.

The reason for planting a refuge is to maintain a population of *B.t.* susceptible insects that are not exposed to the *B.t.* protein or toxin. The lack of exposure to *B.t.* proteins allows susceptible insects that are nearby to mate with any rare resistant insects that may emerge from *B.t.* corn. Susceptibility to *B.t.* technology would then be passed on to their offspring, helping to reduce selection pressure on the insect and preserve the effectiveness of the technologies.

Following the approved refuge plan for each type of *B.t.* corn technology is the only strategy to prevent pest resistance. Requiring that all *B.t.* corn have a refuge benefits all growers directly by preserving the long-term effectiveness of *B.t.* technologies. Adherence to refuge requirements gives growers continued access to the technology, and is also important for the commercialization of next generation biotech traits. Given the benefits of *B.t.* corn products, growers, seed dealers, and trait providers have a responsibility to ensure proper stewardship to keep the technology viable and available in the industry.

Refuge Compliance Requirements

Growers now have more *B.t.* corn product choices offering unique IRM requirements, which can add complexity to refuge planting. Compliance means correctly meeting all of the refuge requirements, which can vary by product. Always planting the refuge in the same field or in a field adjacent to the *B.t.* corn product field can simplify refuge planting options.

In an effort to improve *B.t.* corn refuge compliance, the EPA mandated new requirements as part of the *B.t.* corn re-registration process. Seed providers incorporated the new requirements into their Compliance Assurance Programs for the first time during the 2011 growing season. The new requirements are as follows:

- It is now mandated that all technology providers use an independent third party to conduct on-farm refuge compliance assessments, no longer having the option of doing the assessment internally. Assessments will focus on areas of highest risk of insect pest resistance development, and on growers who did not buy sufficient refuge seed for the amount of *B.t.* corn grown. However, assessments will still be conducted in areas not considered to be high risk or high-pressure insect areas.
- Grower compliance will be checked more frequently by the *B.t.* corn providers. Growers found to be out of compliance with the refuge requirements now have a higher probability of losing access to *B.t.* corn if compliance is not established and maintained.
- Seed bag tags will better depict refuge size requirements. It will now be more of a standardized tag, and should be much easier for growers to understand what refuge requirements there are for a particular *B.t.* corn product.

Growers planting *B.t.* corn need to develop an IRM plan for their farm, and keep good records for compliance purposes. The National Corn Growers Association (NCGA) recently launched a new IRM calculator to help growers plan how to meet the minimum refuge requirements for each of the *B.t.* corn products. The IRM calculator can be used to help clarify refuge system options and show growers how to execute the requirements properly. The free calculator can be downloaded at www.irmcalculator.com.

Source: *New requirements aim to improve Bt corn refuge compliance.* 2/7/2011. National Corn Growers Association. <http://www.ncga.com>

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4 Steps to Refuge Compliance*

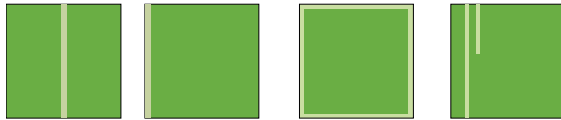
1. Refuge size

- Plant the CORRECT size refuge for the area and corn product.
 - The Corn-Growing Area
 - 20% required for some *B.t.* products, such as Genuity® VT Triple PRO® and YieldGard VT Triple® (20 acres refuge for every 80 acres of *B.t.*)
 - 5% only for Genuity® SmartStax® and Genuity® VT Double PRO® (5 acres refuge for every 95 acres of *B.t.*)
 - The Cotton-Growing Area
 - 50% required for some *B.t.* products, such as YieldGard VT Triple® (50 acres refuge for every 50 acres of *B.t.*)
 - 20% only for Genuity® SmartStax®, Genuity® VT Triple PRO® and Genuity® VT Double PRO® (20 acres refuge for every 80 acres of *B.t.*)
- One of the most common mistakes made while calculating refuge size for a field is multiplying the estimated *B.t.* acres (instead of the total acres) by the percent of required refuge.
- An example of the CORRECT WAY to calculate a **20% refuge** for a **200 acre field**:
 - START with the TOTAL number of corn acres you want to plant in an area.
 - Correct Calculation Example: TOTAL field acres x % refuge required = minimum refuge size
 - 200 acres x 20% = **40 acres (minimum refuge size)**

2. Refuge Location

- Plant the required refuge within each field that contains *B.t.* insect-protected corn. There are other options, but an in-field refuge is always accepted.
- Refuge should always be a minimum of four rows wide. A refuge less than four rows would be out of compliance with the product registration.

Within **



Block Perimeter Strips

Adjacent **



Adjacent within Adjacent field

**Refuge graphics depict a 5% refuge.

3. Refuge Planting

- In each field, plant your refuge first before planting any insect-protected corn. This will ensure that the minimum refuge size requirement is met should unforeseen circumstances (i.e., adverse weather) alter your planting schedule and strategy.
- Use a refuge product that contains no *B.t.* insect-protection traits (i.e., Roundup Ready® Corn 2 or conventional corn are acceptable). Grower must read the IRM Grower Guide for complete refuge planting requirements.

4. Treatment

- If you need to treat your refuge with a non-*B.t.* foliar insecticide, you may need to treat the *B.t.* technology in a similar manner. Grower must read the IRM Grower Guide for complete treatment options.

* The 4 Steps to Refuge Compliance, mentioned above, have been provided as a summary only. Growers must read the IRM Grower Guide prior to planting for important information on planting and insect resistance management. The 4 Steps to Refuge Compliance do not include refuge-in-a-bag.

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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.

