Product Safety Assessment
REFUGE ADVANCED™ Products

Product Safety Assessment documents are available at www.dow.com/productsafety/finder/.

Select a Topic:

Names
Product Overview
Product Description
Manufacture of Product
Product Uses
Exposure Potential
Health Information
Environmental Information
Regulatory Information
Additional Information
References

Names

- Refuge Advanced™
- PowerCore™ Refuge Advanced™
- SmartStax® Refuge Advanced™
- Refuge Advanced™ powered by SmartStax® Technology

Product Overview

- Refuge Advanced™ products are seed corn blends with refuge seeds that do not contain insect-resistant traits (non-Bt; minimum 5%) interspersed with seed containing insect-resistant traits (Bt), also known as plant-incorporated protectants (PIPs).
- Growers who purchase seed containing insect-resistant traits (Bt) must plant a refuge. A refuge is a portion of the corn area planted to seed that does not contain Bt technology for the insect pests targeted by the planted insect-resistant traits. The lack of exposure to Bt proteins allows susceptible insects emerging from the refuge to mate with rare resistant insects that may emerge from the Bt crop. Susceptibility to Bt technology would then be passed on to their offspring, helping to preserve the long-term effectiveness of Bt technologies.
- Prior to introduction of Refuge Advanced products, refuge areas were planted in blocks or strips either across or in close proximity to the field containing insect-resistant traits. This required the grower to manage planting requirements such as field location and configuration, as well as percentage of total acres for two products, the non-Bt refuge seed, and the Bt-containing seed.
- The blended seed in Refuge Advanced products provide single-package solutions to growers to meet refuge requirements in the United States Corn Belt and Canada, and simplifies grower compliance with insect resistance management (IRM) requirements. In the cotton growing regions of the States, an additional 20% refuge area is required to be planted when a Refuge Advanced seed corn blend is planted.
Refuge Advanced products are currently sold as blends such as SmartStax® Refuge Advanced™ or PowerCore™ Refuge Advanced™. For information on what insects are controlled by the traits in SmartStax or PowerCore, see their individual Product Safety Assessments.

These products are registered by the EPA in the United States and CFIA in Canada. The Bt events are also approved for cultivation by USDA and CFIA and have completed food and safety reviews by FDA in the US and Health Canada.

Product Description
Refuge Advanced™ products provide an interspersed refuge approach (commonly referred to as a ‘seed mix’, or ‘refuge in a bag’), in which a minimum 5% non-Bt seed is included within each bag of SmartStax® or PowerCore™ Bt seed corn to create an interspersed distribution of non-Bt refuge plants among the Bt corn plants to be planted per field.

The interspersed refuge planting configuration of Refuge Advanced products fulfills the grower’s refuge requirements for this product in non-cotton growing regions of the United States and Canada and in cotton growing regions where corn earworm is not a significant pest.

For information on the PIP elements of the Refuge Advanced products, see the SmartStax or PowerCore Product Safety Assessments.

Manufacture of Product
Refuge Advanced™ products are prepared by blending Bt seed of SmartStax® or PowerCore™ hybrids with an appropriate non-Bt refuge seed at the required minimum 5% that satisfies the refuge requirements of the United States Corn Belt and Canada. For example, in the US Corn Belt, the seed producer must ensure that a minimum of 5% non-Bt (non-PIP) seed is incorporated into each lot of SmartStax® Refuge Advanced™. Seed bagging equipment is calibrated to ensure the minimum 5% refuge (non-Bt) seed is provided in each seed batch.

The interspersed refuge planting system can only be used by planting seed corn specifically generated by qualified seed producers/conditioners licensed by the registrant. Seed producers must ensure that the required minimum percent of non-Bt refuge seed is within the bag/container.

Product Uses
PowerCore™ seed provides protection from feeding damage by major lepidopteran pests of corn through the production of Cry1F, Cry1A.105 and Cry2Ab2 insecticidal proteins from Bacillus thuringiensis (Bt). SmartStax® seed provides the same lepidopteran pest protection and is combined with protection from root-feeding by corn rootworms through the production of Cry3Bb1 and Cry34Ab1/Cry35Ab1 insecticidal Bt proteins. Refuge Advanced™ seed blends produce high-quality corn with improved efficiency by simplifying growers’ field management as it eliminates the need to plant a separate structured refuge in Canada, the US Corn Belt, and certain cotton growing regions of the US. These products also typically reduce the need for insecticide applications.
Refuge Advanced products ensure the mandated refuge is interspersed within the field as opposed to being placed in separate rows or blocks within or adjacent to the field. By replacing the structured refuge, the interspersed refuge option ensures compliance with refuge requirements by growers in Canada, the US Corn Belt, and parts of the cotton growing region.

Seed mixes of Bt and non-Bt seed have been recognized as a valuable insect resistance management (IRM) strategy because refuges are implemented by the technology provider rather than growers. This removes the issue of grower compliance with refuge planting requirements of the IRM strategy and ensures that a refuge will be present within every Bt crop field. Benefits of an interspersed refuge via seed mixes from an IRM perspective include:

- Consistent percentage of non-Bt plants in every Bt field
- An interspersed, in-field distribution of non-Bt plants, which is particularly beneficial for very large fields
- Reduced probability of mating between Bt-resistant adult insects
- Appropriate choice of refuge hybrid seed
- Identical management of Bt and non-Bt plants

Refuge planting strategies are designed to support sufficient populations of susceptible target insects while enabling mixing of these insects with any resistant insects surviving in Bt corn fields. Growers have traditionally planted refuge in a block or strip format in close proximity to the Bt corn field. The novel characteristic of a seed mix is the spatial distribution of interspersed Bt and non-Bt plants within a field, which enhances the mixing of adult insects coming from Bt and non-Bt plants, resulting in Bt-susceptible offspring.

**Exposure Potential**

Refuge Advanced™ products contain insecticidal and herbicide tolerance proteins derived from common, non-pathogenic soil bacteria, so environmental exposure presents no issues unique to these proteins and products. The potential for external exposure to genetically modified corn seed and plants is greatest for farmers who plant the seed, grow the plants, and harvest the crop. Because harvested corn in Refuge Advanced products is equivalent to corn without these traits, standard farm workplace procedures and precautions should be followed. See Health Information.

**Health Information**

On the basis of rigorous testing, regulatory agencies concluded that corn used in Refuge Advanced™ blends is equivalent to non-transgenic corn. See SmartStax® or PowerCore™ Product Safety Assessment for additional health information.

**Seed Treatments**

Agricultural seeds, including Refuge Advanced corn seed blends, may be treated with an insecticide, nematicide, and/or a fungicide. These seed treatments as used in conventional crops can present certain health risks, which are associated with the seed treatments and not the seed itself.
For more information, growers should consult the appropriate Safety Data Sheet and/or label or tag for seed treatment hazard information, and wear all recommended personal protective equipment.

**Back to top**

**Environmental Information**

Before a biotechnology product can be introduced to the market, approval by appropriate governmental agencies is required. Using the criteria established by these agencies, Dow AgroSciences conducts extensive, validated tests for its biotechnology products. For the registration of Refuge Advanced™ seed blends, extensive safety data were provided to the EPA as well as to the regulatory agencies of other countries.

Dow AgroSciences promotes use of best management practices with Refuge Advanced products to manage target pests and to reduce the risk of pest populations developing resistance to the insect-control proteins.

**Back to top**

**Regulatory Information**

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of Refuge Advanced™ seed blend products, especially if the seed is treated with an insecticide, nematicide, or fungicide. These regulations may vary by city, state, country, or geographic region. Please review the Product Use Guide for additional information. For more information, growers should consult the appropriate Safety Data Sheet and/or label or tag for seed treatment hazard information, and wear all recommended personal protective equipment.

**Back to top**

**Additional Information**

- Canadian Corn Pest Coalition ([www.cornpest.com](http://www.cornpest.com))
- Dow AgroSciences website ([www.dowagro.com](http://www.dowagro.com))
- Dow AgroSciences Corn Product Use Guides ([www.traitstewardship.com](http://www.traitstewardship.com))
- Refuge Advanced website ([www.refugeadvanced.com](http://www.refugeadvanced.com))
- Biotechnology Industry Organization “Commercial Status of Certain Agricultural Biotechnology Products” ([www.biotradestatus.com](http://www.biotradestatus.com))

**Back to top**

**References**


**Back to top**
NOTICES

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

The information herein is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Dow be responsible for damages of any nature whatsoever resulting from the use of or reliance upon the information herein or the product to which that information refers.

Nothing contained herein is to be construed as a recommendation to use any product, process, equipment or formulation in conflict with any patent, and Dow makes no representation or warranty, express or implied, that the use thereof will not infringe any patent.

NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HERELUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

Dow makes no commitment to update or correct any information that appears on the Internet or on its World-Wide Web server. The information contained in this document is supplemental to the Internet Disclaimer, www.dow.com/homepage/term.asp.

Back to top

Form No. 233-01127-XX-0116

™Refuge Advanced and the DOW Diamond is a trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow PowerCore™ and SmartStax® multi-event technology developed by Dow AgroSciences and Monsanto. PowerCore™ and SmartStax® are registered trademarks of Monsanto Technology LLC. Always follow grain marketing and IRM requirements and pesticide label directions. B.t. products may not yet be registered in all states. Check with your seed representative for the registration status in your state. Refuge Advanced is not registered for sale or use in all states. Contact your state pesticide regulatory agency to determine if a product is registered for sale or use in your state.