

BIOTECHNOLOGY GUIDE 2017

DUPONT PIONEER

GENETICALLY MODIFIED ORGANISMS (GMOs)

GROWING CONVENTIONAL AND BIOTECH CROPS:

For decades, multiple agricultural systems have coexisted successfully around the world from production through supply chains. Over time, best practices to facilitate these different agricultural systems have developed and have been improved continuously to ensure that high-purity and high-quality seed and grain are available to support trade from various agricultural systems. One example of such coexistence is the production of similar commodities in close proximity such as field corn, sweet corn, white corn and popcorn. Coexistence strategies should meet market requirements using science-based industry standards and management practices, and should be flexible to facilitate options and choices for growers and the food and feed supply chain. This flexibility should also include the ability of coexistence strategies to be modified as changes in products, markets or practices occur.

The ongoing success of coexistence strategies has depended upon co-operation, communication, flexibility and mutual respect for each cropping system and among growers using these various systems. Over the years, growers have adapted to changes and innovations in agriculture by using new farm management practices, new technologies and other appropriate practices. It is incumbent upon a grower who is growing a crop to satisfy a particular market and to implement best practices to satisfy those marketing standards. By seeking to satisfy that market, the grower inherently agrees to use the appropriate practices to ensure the integrity and marketability of his or her crop in the market in which he or she seeks to market it. This is true, regardless of the particular market being served, whether it is white corn, sweet corn, organically produced corn or conventionally produced corn. In each of these cases, the grower is producing a crop supported by a special market price and therefore assumes responsibility for meeting any applicable market specifications to receive the applicable premium price from that market. Even though the responsibility rests with the grower producing the crop for a particular market, it is each grower's responsibility to communicate with, and be aware of the planting intentions of his or her neighbours to gauge the need for any appropriate best management practices.



IDENTITY PRESERVED (IP) CROPS

IP crops are crops produced to meet the needs of specialty end-use markets. These crops are grown with a specific end use in mind, such as waxy, white and organic, among others, and should meet the defined requirements of that market. IP crops provide benefits for both the grower, with processor-paid incentives, as well as the end user. Growers who choose to preserve the identity of their crops to receive the additional end-use market value assume the responsibility of ensuring that their crops meet the contract specifications. To meet these specifications, the specialty end-use agricultural industry has developed generally accepted IP agricultural practices to manage IP production as further described below. Accordingly, IP growers have the responsibility to implement any processes that are necessary to meet quality specifications. The special care required for IP crop production generally causes an increase in production costs that, in turn, causes an increase in the value of the goods sold.

MAINTAINING THE INTEGRITY OF IP CROPS

In order to preserve the identity of IP crops, thorough clean-out procedures should be implemented before and after contact is made with the IP crop. This may include cleaning areas in seed storage bins, seed hopper/boxes, transportation vehicles, combines and harvesters. Thorough clean-out procedures should be upheld throughout all aspects of the planting procedure, which include storage, transportation, planting and harvesting. Additionally, growers of IP crops should consider steps to minimise the potential for cross-pollination given the generally recognised and accepted occurrence of the movement of incidental amounts of pollen. As previously stated, communication between growers is key in determining the best agricultural management practices that should be implemented to maintain the identity of IP crops.

STEWARDSHIP OVERVIEW:

A MESSAGE ABOUT STEWARDSHIP

When DuPont Pioneer introduces a new product, we are in it for the long haul. Our philosophy of product stewardship means responsible management of the life cycle of our technologies, every step of the way – from initial research to the discontinuation of a product – for maximum product value, benefits and longevity. This is why Pioneer requires all growers to comply with regulations, Pioneer® policies and crop management strategies specific to the product. In the DuPont Pioneer Technology Use Agreement (TUA) and Terms and Conditions of Purchase, growers who plant Pioneer® brand seed with biotech traits agree to adhere to the stewardship requirements described in this guide including, without limitation:

- Following directions of use on all seed, pesticide or other product labels
- Implementing Insect Resistance Management (IRM) practices, before and after planting, for specific biotech traits as required by Pioneer and SA authorities
- For crops or material containing biotech traits, confirming trait acceptance and intended uses and destinations with grain handlers prior to delivery or using those products on-farm
- Not sending seed or other material containing biotech traits into countries where the product is not allowed, including through a third party
- Following any additional stewardship requirements that Pioneer deems necessary for a particular product (e.g. grain or feed use restrictions and geographical planting restrictions)

Growers are responsible for following the applicable stewardship guidelines and weed resistance management guidelines as set out in this guide.

WHY IS STEWARDSHIP IMPORTANT?

Proper stewardship of products is important because it offers the following benefits to growers:

- Signing the TUA permits access to Pioneer germ plasm and biotech trait technologies in its seed products
- Following IRM requirements delays the development of insect resistance to incorporated plant protection technologies and helps to maintain the long-term durability of these technologies
- Using seed products solely for producing a single commercial crop encourages the development of better, higher-yielding germ plasm and additional technologies and innovations, further improving agricultural productivity

DUPONT PIONEER TECHNOLOGY USE AGREEMENT (TUA)

It is of the utmost importance and required by law for the supplier and purchaser who intend to use the technology to enter into a lawful agreement by signing a TUA.

The DuPont Pioneer TUA allows farmers to purchase and plant Pioneer® brand products containing certain technology traits. Such an agreement should be signed every season and be available on demand.

The TUA also stipulates that:

- Any grower who has not signed a TUA must immediately notify Pioneer and make arrangements to sign the TUA or return the seed to the company
- Licensed products are to be used solely for planting a single commercial crop and shall not be exported for planting in another country by growers or supplied to any other person for planting
- Any purchase of licensed products by a grower who is not authorised or is not a licensed grower (i.e. did not sign a TUA) shall be void

OUR COMMITMENT TO EXCELLENCE THROUGH STEWARDSHIP®

Pioneer is a member of Excellence Through Stewardship® (ETS). Pioneer® products are commercialised in accordance with ETS Product Launch Stewardship Guidance and in compliance with the Pioneer® policies regarding stewardship of these products. Crops and materials containing biotech traits may only be exported to or used, processed or sold in jurisdictions where all necessary regulatory approvals have been granted for these crops and materials. It is a violation of national and international laws to move materials containing biotech traits across borders into jurisdictions where their import is not permitted. Growers should discuss these issues with their purchaser or grain handler to confirm the purchaser or handler's position on products being purchased. For further information on the approval status of biotech traits, please visit www.biotradestatus.com. Excellence Through Stewardship® is a registered trademark of the Biotechnology Industry Organisation.

GUIDE FOR THE USE OF BIOTECHNOLOGY PRODUCTS:

This guide contains information for proper Insect Resistance Management for Pioneer® brand maize with the YieldGard® and Genuity® YieldGard® II technology.

Further information includes the proper management of herbicide-tolerant crops for Pioneer® brand maize Genuity® YieldGard® II, stacked with Roundup Ready® Maize 2 technologies and Pioneer® brand soybean varieties containing Glyphosate Tolerant technology.

IMPORTANT – READ BEFORE PLANTING

WHAT IS YIELDGARD® AND GENUITY® YIELDGARD® II STALK BORER TECHNOLOGY?

YieldGard® and Genuity® YieldGard® II technology allows farmers to plant Pioneer® brand maize with built-in protection to control several important maize insect pests. Pioneer® brand maize with the YieldGard® and Genuity® YieldGard® II technology control *Busseola Fusca* (maize stalk borer) and *Chilo Partellus* (sorghum stem borer).

Note: These insects will be referred to collectively as ‘stalk borers’ throughout the balance of this document.

EFFECTIVENESS OF MAIZE HYBRID WITH THE YIELDGARD® AND GENUITY® YIELDGARD® II TECHNOLOGY:

STALK BORER TECHNOLOGY

The *Busseola* stalk borer is not easily controlled. Please note that in general the population pressure of stalk borers is higher during the reproductive phase of the plant (window period – VT to R1 stage) compared with the first generation that infests the plants in an earlier growing phase. Stalk borer resistance is therefore scored lower for the window period compared to the first generation.

It is of the utmost importance to monitor stalk borer resistance throughout the season and consult with your DuPont Pioneer agronomist.

THE IMPORTANCE OF INSECT RESISTANCE MANAGEMENT (IRM)

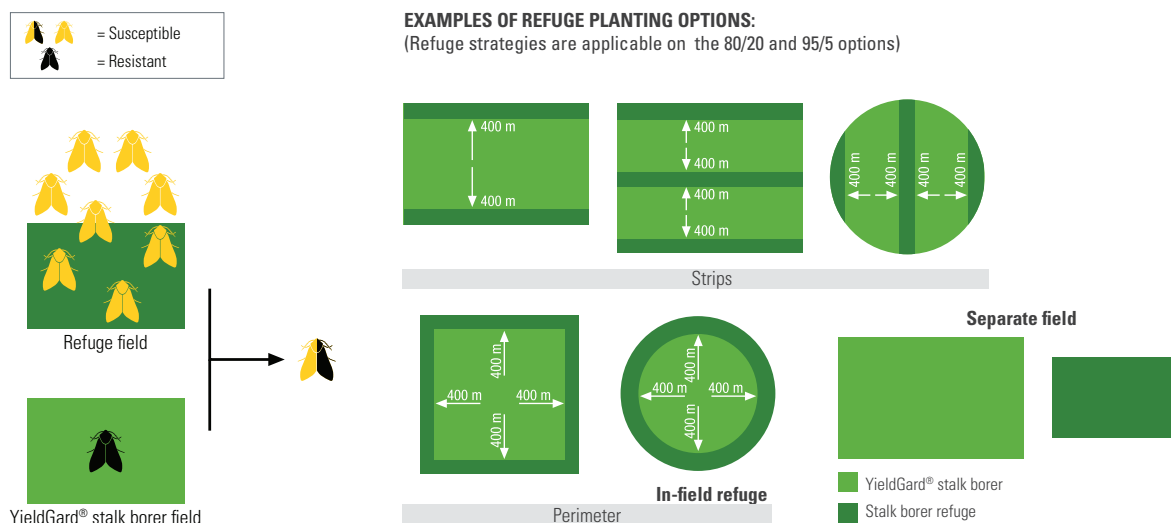
Compliance with IRM requirements is a stewardship obligation and is critical to maintaining the longevity and effectiveness of maize with YieldGard® and Genuity® YieldGard® II technology. If only maize with YieldGard® or Genuity® YieldGard® II technology is cultivated, rare insects that may be resistant and which survive could mate with other resistant insects and thus pass on the resistance to their offspring. To delay the development of insect-resistant populations to maize with YieldGard® and Genuity® YieldGard® II technology, growers planting maize with the technology are required to also plant a separate area of Pioneer® brand maize without the technology known as a ‘refuge’.

INSECT RESISTANCE MANAGEMENT (IRM)

A refuge is a block or strip of maize without technology. The primary purpose of a refuge is to maintain a population of stalk borers that are susceptible to the YieldGard® and Genuity® YieldGard® II technologies. Potentially resistant insects emerging from fields with the YieldGard® or Genuity® YieldGard® II technology can mate with susceptible stalk borer moths from the refuge, resulting in offspring that are susceptible to YieldGard® and Genuity® YieldGard® II stalk borer technologies. Please refer to the illustration.

REFUGE MANAGEMENT FOR PIONEER® BRAND MAIZE WITH YIELDGARD® AND GENUITY® YIELDGARD® II TECHNOLOGY:

- Planting a refuge is a requirement for growing the technology and is a primary component of IRM. There are two acceptable refuge options:
 - ✓ 95% YieldGard® and Genuity® YieldGard® II technology with an accompanying 5% refuge – with this option no chemical control for targeted insects is permitted on the refuge hectares
 - ✓ 80% YieldGard® and Genuity® YieldGard® II technology with an accompanying 20% refuge – with this option, chemical control of targeted insects is permitted on refuge hectares if economic thresholds are met
- Maize refuge options include hybrids without the stalk borer trait, hybrids with Roundup Ready® Corn 2 technology and conventional maize
- Pioneer® brand maize with YieldGard® and Genuity® YieldGard® II technology and refuge hybrids must be of similar maturity
- The refuge must be planted within seven days, under the same growing conditions as the hybrid with YieldGard® and/or Genuity® YieldGard® II technology. For example, if the hybrid with YieldGard® and/or Genuity® YieldGard® II technology is planted under irrigation, the refuge must also be under irrigation
- The refuge area must be closer than 400m from the furthest point of the field containing Pioneer® brand maize with YieldGard® and/or Genuity® YieldGard® II technology
- A neighbour's field does NOT qualify as a refuge
- Mixing of seed containing YieldGard® and Genuity® YieldGard® II technology with seed without the stalk borer trait is NOT an acceptable refuge design
- Clean planter bins before switching from seed containing YieldGard® or Genuity® YieldGard® II technology to seed without the stalk borer trait, and vice-versa
- Avoid volunteer plant with YieldGard® and/or Genuity® YieldGard® II technology in the refuge area
- Monitor and scout fields frequently:
 - ✓ Immediately report to the authorised Pioneer sales professional if unexpected damage is observed with YieldGard® or Genuity® YieldGard® II technologies
 - ✓ Apply curative chemical applications when advised



BEST PRACTICES FOR FOLLOWING INTEGRATED PEST MANAGEMENT (IPM):

The value of any biotech trait or insecticide spray programme could be enhanced if used within the context of an IPM programme. DuPont Pioneer has implemented an IPM programme to help farmers maximise the yield of their high-yielding Pioneer® brand maize with YieldGard® technology. To qualify for the benefits of the programme, customers need to:

- Sign the TUA at least once a year and return it to DuPont Pioneer
- Refuge areas have to be planted in fields with insect-resistant maize according to the prescribed guidelines contained in this brochure
- NON-COMPLIANCE with any of the above requirements will disqualify the farmer from the IPM programme

DuPont Pioneer also recommends implementing the following best practices to maximise the value of the Bt trait:

- Regular scouting of the crop to look for unexpected damage caused by *Busseola Fusca*
- Immediately report to the authorised Pioneer sales professional, if unexpected damage is observed
- Insecticide sprays are implemented at >5% damage and no tassel formation present
- Only insecticide costs are covered and NO application costs will be incurred by the spray programme
- Where it is practical, early burndown of weeds, tillage, planting date adjustment and crop rotation are all aspects that could help control *Busseola Fusca*

Please consult your seed sales agent for additional information regarding specific details of the IPM programme.

BEST PRACTICES FOR MANAGING HERBICIDE-TOLERANT CROPS:

IMPORTANT – READ BEFORE PLANTING

WHAT IS HERBICIDE-TOLERANT SEED TECHNOLOGY?

Herbicide-tolerant crops can tolerate herbicides at application rates that will kill non-herbicide-tolerant Pioneer® brand maize or varieties of the same crop species. Crops with traits for herbicide tolerance allow farmers to apply herbicides to their crops that they would otherwise be unable to utilise without causing death or unacceptable injury to that crop.

IMPORTANCE OF MANAGING HERBICIDE-TOLERANT CROPS AND WEED RESISTANCE TO HERBICIDES

Properly managing herbicide-tolerant crop technology is important to preserve the effectiveness and value of the tolerant crop seed and its corresponding herbicides in the future. Growers utilising herbicide programmes that include herbicide-tolerant crops can do so on an annual basis provided the technology is managed effectively. If you have any questions after reviewing this information, please contact your authorised Pioneer® brand seed dealer or agronomist.

BEST PRACTICES

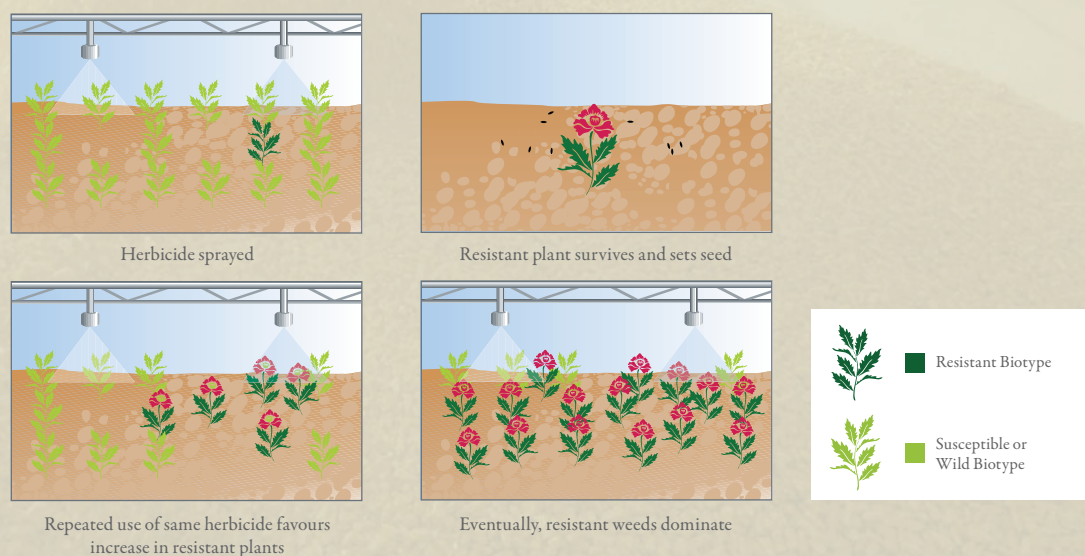
- The use of herbicide-tolerant crops does not limit the grower to use only one herbicide product. Conventional herbicides can and should still be part of the grower's overall weed management system
- Limit the number of applications of a single herbicide or herbicides from the same mode of action family within a single growing season
- Apply herbicides at labelled rates and at the recommended stage of weed growth, as stated on the label
- Use mixtures or sequential treatments of an effective alternative mode of action to control target weeds
- Use alternative weed management practices such as crop rotation, mechanical cultivation, delayed planting and weed-free crop seed
- Clean equipment before moving between fields to minimise the dispersion of weed seed
- Scout fields after herbicide application to detect weed escapes or shifts. If a potentially resistant weed or weed population has been detected, use available control methods to avoid seed dispersion in the field

MANAGE VOLUNTEER HERBICIDE-TOLERANT CROPS

The seed of some crops can escape harvest, germinate the following year and become 'volunteer' weeds in a rotational crop. This can happen regardless of whether the crop seed was herbicide-tolerant or not. Many tools are available for managing herbicide-tolerant volunteers, but advanced planning is advised to provide the greatest flexibility and success.

The best strategies for managing herbicide-tolerant volunteers are crop rotation and rotation of herbicides. The proper adjustment of harvesting equipment and the cultivation and tillage management will also help reduce volunteer plants from previous crops. Plan at least a year ahead when planting a herbicide-tolerant crop, to make sure you have a weed management plan that will control any herbicide-tolerant volunteers, using alternative herbicide mode-of-action families and/or tillage for the next crop.

HOW DOES WEED RESISTANCE TO A HERBICIDE DEVELOP?





REPORT SUSPECTED CASES OF WEED RESISTANCE TO HERBICIDES:

Possible indicators of weed resistance to herbicides include achieving good control of all but one of the labelled weed species in the field with the herbicide, and/or failure of repeated applications of the same herbicide to control only that weed species in a field. Take note that weed control failures can have many causes that are not related to herbicide resistance.

Lack of rainfall to activate pre-emergence herbicides, rainfall right after post-emergence applications that wash the herbicide off the plant, cool temperatures, slow growth reducing herbicide activity in the plant, improper application timing, or improperly calibrated application equipment are among the many causes of less-than-expected herbicide performance. If you suspect a weed control failure is caused by weed resistance to a herbicide, you should first contact your herbicide retailer's or herbicide manufacturer's representative and your local DuPont Pioneer agronomist and conduct a thorough investigation that can eliminate other more common causes of poor weed control. Your local DuPont Pioneer agronomist will assist you with the additional steps that will be required if weed resistance to the herbicide is believed to be the issue.

SEED TREATMENT STEWARDSHIP:

Seed treatments, including fungicides, insecticides, nematicides and amendments play a critical role in agriculture and the production of a healthy crop. In addition to managing early-season pests and diseases, they serve as a viable alternative to foliar and soil applications.

Seed treatment management and responsible stewardship play a vital role in sustaining our environment, while maximising crop health. Responsible stewardship practices help maintain seed and seed treatment integrity, which keeps the active ingredient on the seed to achieve the maximum crop health benefit for the investment. In addition, these practices help minimise the potential for adverse effects on producers and the environment, including pollinators, which may be present at the time of planting.



DuPont Pioneer is committed to our Core Values of Safety and Health, Environmental Stewardship, Respect for People and Highest Ethical Behaviour. In addition, the Pioneer® Long Look philosophy states that we are committed to providing helpful management suggestions to our customers. The following best management practice suggestions are in the spirit of our Core Values and the Pioneer® Long Look:

HANDLING

- Always read and follow the label directions and recommendations for proper handling and use of treated seed and seed treatments
- Use personal protection equipment as recommended on the product label or seed tag
- Follow all safety precautions as indicated on the label/seed tag
- Transport and transfer treated seed safely and in a manner that eliminates the risk of spill and dust

PLANTING

- Always follow planter manufacturer recommendations and avoid excess use of talc and graphite
- Be aware of the environment in and around your field, taking note of nearby hives and flowering plants and weeds, which could be attractive to pollinators
- Limit dust movement from seed packages containing seed treatment. For example, consider factors such as wind speed and direction and avoid shaking the bottom of the treated seed bag when filling planting equipment
- Do not transfer treated seed next to active hives, at field margins and adjacent to flowering plants and vegetation
- For pneumatic planters, direct the exhaust towards the soil surface
- Ensure all seeds are planted/incorporated into the soil at a proper planting depth
- Follow labelling requirements for disposal/use of unused seed

DISPOSAL AND CLEAN-UP

- Properly dispose of seed packaging/containers in accordance with national and local regulations and the container return policy
- Clean the planting equipment in a manner that minimises dust
- Avoid cleaning the planting equipment next to active hives, at field margins and adjacent to flowering plants and vegetation