Best Management Practices for Identity Preservation in Corn

Introduction

Pioneer Hi-Bred International, Inc., has earned an excellent reputation of supplying high quality seed to growers. To continually achieve this high level of quality, Pioneer invests significant time, resources and technology to ensure we deliver seed products with high quality and purity to our customers. To the extent we can keep our seed pure through the production process, our customers will enjoy the full genetic potential plant breeders built into each hybrid.

One challenge seed companies, producers, processors and regulatory officials face, and work to minimize, is the adventitious or unintended presence of genetic material or whole seeds from another variety, crop, or weed, in a seed or grain shipment.

Virtually all seed and commercial grain shipments contain some adventitious material. There are a number of steps that are taken to minimize this presence, but it is unrealistic to expect adventitious presence to be zero. For example, the only way that anyone can be sure that any given bag of seed is 100% genetically pure is to test every kernel - a process that would leave no seeds for planting.

Country and international regulations of the seed and grain industries have taken adventitious presence into account for years, establishing international thresholds and policies for purity levels in seed, grain and food products. The desire by some to avoid even trace amounts of non-native material in grain and food products has prompted a re-evaluation of existing standards.

How Adventitious Presence Happens

There are three primary places that adventitious presence can occur: during seed production including handling and conditioning, in a farmer's commercial crop production field and in the grain handling and transport system.

Seed Production.

Adventitious presence in the seed that farmers purchase for planting can happen in a number of ways - including pollen mixing during seed production or inadvertent mixing with other parent seed lines when seed companies plant, harvest, transport or condition their seed products.

Quality requirements and international standards are in place to minimize adventitious presence in seed production, conditioning and shipment. Pioneer's seed production process meets or exceeds all of these standards. The standards include requiring minimum distances between fields, and conducting field and seed lot inspections. Despite meeting these requirements, trace amounts of unintended material are virtually unavoidable in seed and in commodity grain produced from this seed.

Seed companies rely on natural pollination processes in producing corn seed for farmers. Corn is open-pollinated; meaning pollen from a corn plant passes through the air to pollinate the silks of itself and/or other corn plants in the area. Pollen may shed from the tassels for up to eleven days. Silks emerge within three to four days after pollen shed begins and the silks remain receptive to pollen for up to ten days.

Compared to pollen from other crops and plants, corn pollen is heavy. Studies have shown that most corn pollen settles within 20 to 50 feet of its originating plant, thus limiting the distance pollen can travel to a neighboring field. Yet, it is possible for pollen from a hybrid corn plant to be carried by wind into a seed production field and land on silks of a parent corn plant. If this occurs, that pollen would produce a kernel with genetic material not planned for that field.

How does Pioneer Minimize Adventitious Presence?
While it is unrealistic to expect 100 percent purity in a seed variety, Pioneer uses a number of practices to reduce the presence of material not intended for a given seed product. Some of these practices take advantage of natural factors, while others require stringent management practices from planting through conditioning of the seed.

Pioneer strives to meet or exceed all international standards for seed purity, including isolation, segregation and final release criteria. During seed production, research data and planting dates are used to take advantage of a plant's natural pollination cycles. Male and female plants are planted to harmonize silk and pollen shed dates so that pollen load is highest when the seed parent (female) has receptive silks. In doing so, there is a higher probability that enough desired pollen exists within a particular seed field to pollinate the crop, thereby limiting the opportunity for outside foreign pollen to cause unwanted pollinations.

Pioneer also has detailed product identification and tracking systems that are supported by ISO 9000 and a sophisticated information management system. In addition, Pioneer has a state-of-the-art purity-testing program to help ensure, within reasonable tolerances, that customers receive the high seed quality that they expect.

Commercial Corn Production.

Certified seed standards for hybrid seed production may have some application when trying to achieve purity of commercial grain. ***However, the same isolation standards as used in seed production may result in much higher purity in commercial grain production fields*** because commercial cornfields produce pollen loads that are many times (10x to 100x) greater than that of a seed production field. In addition, the timing of pollen shed in a commercial cornfield is often synchronized closely with the emergence of silks. Large pollen load and exact pollen/silk timing are two characteristics of commercial cornfields that serve to greatly limit pollen mixing from outside sources.

In addition to seed production standards, standards for producing hybrid specialty corn (such as white corn) are appropriate to consider. Both seed standards and white corn standards are generally designed to achieve purity of 98-99%.

Seed also can be mixed if planters and other equipment are not thoroughly cleaned when changing hybrids during planting. In most cases, there are no visual differences between corn hybrid plants. That makes it difficult to identify and destroy unwanted plants prior to harvest.

Grain that is left behind in a field after harvest can germinate the following year. This re-growth from a previous crop ("volunteer" plants) can lead to pollen mixing with the new crop.

Grain Handling and Transport

The existing commodity grain handling system is designed to store transport and distribute billions of bushels of crops. Growers, grain handlers, and processors did not have special segregation of crops in mind when they built bulk-handling systems. Consequently, there are numerous ways that adventitious presence may occur during grain handling and transport. Commonly referred to as "mechanical mixing" or "co-mingling", these include mixing of grain in harvesting, hauling or in processing equipment or storage facilities.

Harvesting a number of border rows (for example, 16 - 24) from one side of the field and separating the grain from these rows can help achieve a higher purity level in the remainder of the field. To avoid mixing of crops during harvest, growers must also clean, or flush, combines, augers, wagons and trucks thoroughly between fields of individual crops. It is a necessary step in keeping crops separate, because several pounds of grain often remain hidden inside the equipment.

In addition to the possibilities listed above, adventitious presence also can occur during the food processing or production process as grain shipments and ingredients are mixed.

Who is Responsible for Maintaining Isolation and Purity in Corn Production?

Pollen mixing has always been a normal occurrence in corn production. The accepted practice has been that each grower is responsible for any isolation that may be required for various types of crops. Examples include production of white, waxy, sweet and high oil corn. The markets for these products have developed industry standards or tolerances to allow for a small level of pollen or grain mixing. Typically, these tolerances are in percentages or ranges that can be met with reasonable management or production practices.

Another example is hybrid corn seed production. Meeting the genetic purity standards described in this paper, including isolation, production practices and identity preservation is the responsibility of the seed grower.

A 100% purity standard (zero tolerance for adventitious presence) is nearly impossible to achieve for any seed or food crop. However, reasonable purity standards for grain should be attainable with reasonable management practices.