

# Separation Requirements and Recommendations

GMO Study Committee

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ICN Room, State Capitol



- Gregory Lamka, Quality Supply Technology Manager at Pioneer Hi-Bred
- Native Iowan from Fredericksburg in Chickasaw County
- Attended ISU: BA in Agronomy, MS Plant Pathology, PhD Plant Pathology
- Worked in seed industry entire working career
- Pertinent jobs to this topic: managed a parent seed facility, soybean plant breeder, managed a world wide quality assurance program for a parent corn program, and currently have responsibilities for a corn seed field inspection program that documents isolation distances, silking dates, pollen shed dates, and detasseling information
- Current past president of the Iowa Seed Association

## Topics

- Agencies involved in seed certification and standards
- Cross pollinated crop seed production concepts and standards (corn)
- Self pollinated crop seed production concepts and standards (soybeans)
- IP grain production considerations
- Conclusions



•I would like to acknowledge that this information has come from various sources:

- Dr. Michael Lauer, Pioneer Hi-Bred—part of study with ISU and Dr. Westgate
- Identity Preserved Systems by Dennis Strayer
- Iowa Seed Certification Requirements published by ICIA

## Federal Seed Act

- Seed producers need to achieve a minimum of 95% genetic purity or the label must list the other seed mixtures in the product.



- In order to call a seed product a hybrid or variety it must be 95% that product.
- If the product is not 95% pure it would be labeled as a blend

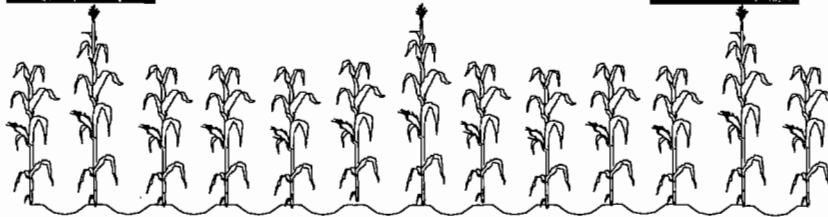
## Association of Official Seed Certifying Agencies

- Third party organization
- Involved in establishing minimum genetic standards and uniform certification procedures
- Iowa Crop Improvement is a member
- Most member organizations have programs for IP grain as well as seed certification



- AOSCA was originated in 1919
- So seed companies have been doing IP (seed) crops for a very long time
- Today seed companies are producing non-GM and GM seed in an environment where non-GM and GM commercial grain is being produced.

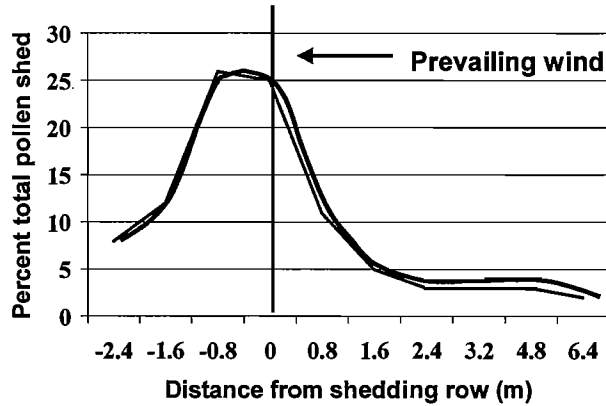
## Diagram of corn plant-showing tassel and ear-



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- A quick review to show you what principles are applied in a seed corn production field
- Corn is a monoecious plant—separate male and female flowers on the same plant
- Two inbreds are planted
  - A male inbred supplies the pollen
  - A female inbred (detasseled) is cross pollinated and produces the seed crop

## Pollen deposition and movement



- Corn pollen is relatively heavy
- It can and does blow in the wind but
- It falls out of the air rapidly

From Arnault et al., 2001



- The majority of the corn pollen drops out of the air very quick so male rows can not be very far from the female rows.
- If there is not a high concentration of male pollen in the seed production field the seed set will be reduced and yields will be limited.

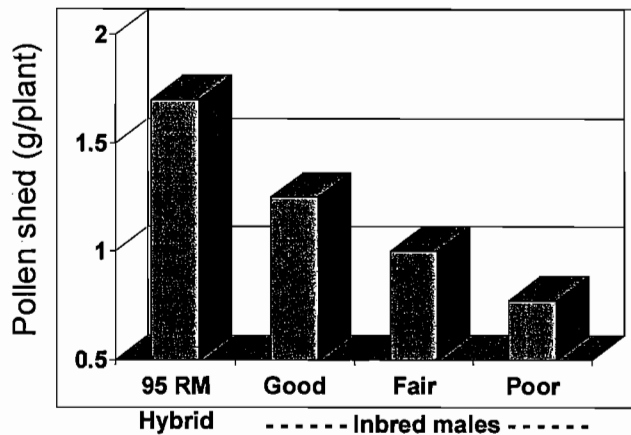
## Picture of detasseled corn field



- Example of a detasseled seed corn production field
- Hawaii seed production field

# Pollen in corn seed production

## Inbreeding decreases pollen production



But we still succeed in managing for purity

Isolation is key

From Lauer and Westgate, 1997



- Inbreds vary greatly in their ability to produce pollen but generally produce considerably less pollen than a hybrid plant.
- Male inbreds typically are  $\leq 20\%$  of the plants in a seed production field
- In an IP grain production field all the plants have tassels therefore the pollen production will 10X that found in a seed field.



## **Bottom Line – Corn pollen**

- **Blows in the wind but most remains in or near field**
  - Heavy, settles fast
- **Abundant pollen shed – some will be transported over considerable distance**
- **Pollen typically dies within hours of shed**
- **Germinates within minutes of landing on receptive silk**

### **Within field pollen creates a dense pollen**

- **Provides high coverage of the silks in the field. Most of the grain will be fertilized with pollen from the same field**
  - This protects field from adventitious pollen



## **Bottom Line – Corn silks**

- **Receptive as long as they are actively growing**
- **Lose receptivity as they age ~ receptive for about 6 days**
- **Provide nutrients for pollen tube growth**
- **Silk emergence occurs over several days for a plant – longer for a field**



## Iowa Seed Certification Requirements—Hybrid Corn

- Plant eligible seed stock
- Field inspections
  - Field Standards
    - Isolation
    - Detasseling or pollen control
    - Roguing



- Seed companies enter into production agreements with seed producers
- Seed companies provide the seed stock for planting
- Seed producers must provide land that has the proper crop rotation and isolation
- The seed producer will plant the seed with a clean planter
- The seed company will usually contract the detasseling and roguing

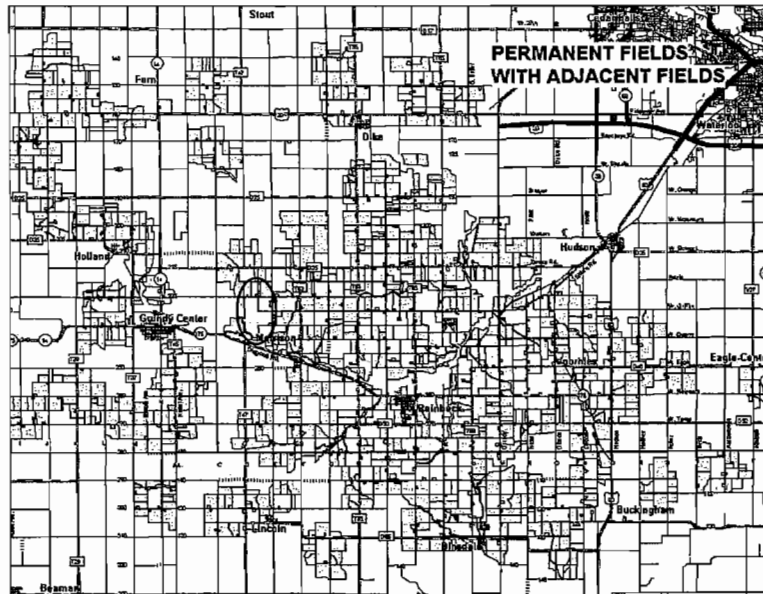
## Certification Isolation Requirements: 1-20 Acres

Dist. from other corn-feet	Min. borders rows
410	0
390	1
370	2
350	3
330	4
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105	15
85	16



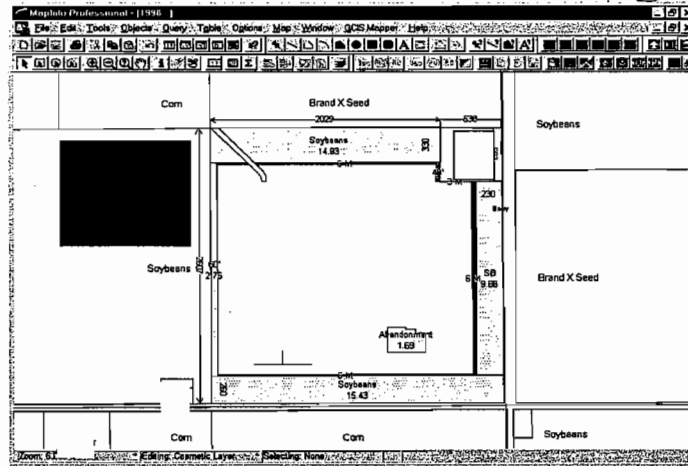
- Note that as the distance is reduced more border rows are needed
- Parent seed (inbred) production requires 660 feet of isolation
- Corn of a different color or texture must be isolate by 660
- Sorghum may require isolations of 1,320 feet from other sorghum or shatter cane (some companies may require more, up to 2 miles)
- Sunflowers may require long distances from other sunflowers and wild sunflowers as well because of bees moving pollen (up to 2 miles)

All fields are displayed relative to one another.



- We often grow seed in adjacent fields on multiple farms to increase total field size and correct pollen concentration.
- Growers are responsible for asking neighbors about their planting intentions so proper isolation and border rows can be planned for.
- For example in California multiple seed companies map entire production areas (valleys) and isolate sunflowers by distance and time.

## Current Seed Field Drawing



- SB = Green
- Seed Corn = Yellow
- Every field has a detailed map with all surrounding fields and crops identified.
- The grower's ability to meet isolation requirements dictates what seed or IP crops are reasonable for him to produce.

## Field Inspections

- A minimum of three field inspections must be done by representatives of the certifying agency.
- When the previous crop was corn, at least one additional (Final Inspection) shall be done to verify the field is sufficiently free of volunteer plants from the previous crop.



— ASOCA will do third party inspections of seed or IP production fields.

## Roguing

- Definite off-type plants must be completely destroyed (plants showing hybrid vigor or different plant type from parental lines)
- A field is disqualified for certification if:
  - >0.1% (1 per 1,000) off type plants shed pollen when >5% receptive silks are present
  - >0.1% (1 per 1,000) off type plants are present at Final Inspection



•Note AP can come from within the field depending on crop rotation or impure seed stock.





- Soybean flowers primarily self pollinate.
- Flowers are very small-about the size of an eraser on a pencil.

*Handwritten notes:*  
self pollinate  
eraser on a pencil

# Soybeans

- Land Requirements
  - The previous crop can not be soybeans unless it was the same variety and passed field inspection for varietal purity
- Field Standards
  - Isolation distances
    - 40 feet when the adjoining field was broadcasted planted
    - 5 feet when the adjoining field was planted with a drill or row planter
  - Roguing
    - Off-type plants or other varieties in excess of the field standards must be removed from the field prior to the certification inspection



- Growers must have proper land rotation and isolation for the seed crop.
- Planters, combines, augers, wagons, bins, etc. must all be kernel cleaned by the grower to prevent seed mixtures.

## Soybeans-Cert. Requirements

- Field Inspection
  - The field will be inspected by a representative of the certification agency during the time when genetic purity and identity can be determined



- AOSCA can provide third party inspections for seed or IP contracts.

## Soybean Field Standards


Class	Other varieties & off-types
Foundation	0.1% (1:1,000)
Registered	0.2% (1:500)
Certified	0.5% (1:200)



- Different purity standards are required depending on the class of seed planted and the class being produced.

Iowa Crop Improvement Association: Identity Preserved Grain Services - Microsoft Internet Explorer

# Iowa Crop Improvement Association



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## Identity Preserved Grain Services



The Identity Preserved (IP) program of Iowa Crop Improvement Association can offer you the assurance that the desired traits in your specialty crop production are maintained throughout all production and handling processes.


The IP program is designed for application on special-use raw products under agricultural or horticultural production, including those destined for use as food, nutraceuticals, fiber and unique oils or grain.

ICIA oversees the following points during the production and handling process:

- Field inspection of production to specified standards.
- Proof of seedstock with plant description or specific trait definition.
- Quantity of harvested product.
- Representative sampling.
- Laboratory evaluation.
- Documented transfers of product.
- IP official labeling of product with labels, imprints, or certificates.

This program provides a structured system to identify grain and plant products that have met specific genetic traits and to preserve the genetic and/or physical identity of those products.

Contact us for more information on ICIA's Identity Preserved program.

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- As previously mentioned the ICIA has IP inspection services for producers.
- [www.agron.iastate.edu/icia](http://www.agron.iastate.edu/icia)

## IP Grower Responsibilities

- Land selection
  - Previous crop grown
  - Isolation distances
- Planting
- Growing
- Harvesting
- Storage
- Delivery
- Grower records



- These are some of the considerations a grower needs to think about when entering an IP contract or market.
- The response to these items will determine which IP crops are best suited to a particular farm.
- The grower is paid for his ability to supply or meet these responsibilities.

## **Strategies to reduce adventitious presence in IP grain**

- **Select large fields**
- **Increase isolation distances**
- **Remove 12-16 border rows**
- **Clean planting equipment**
- **Plant high quality seed**
- **Avoid corn following corn**
- **Clean harvest, handling, hauling and storage equipment**
- **Maintain good records**

From Burris, 2000



- Corn strategies
- The ability of the grower to meet these criteria are the reason they are being paid a premium.
- Not all farms can expect to raise all crops for seed or IP grain.

## **IP corn grain - summary**

- **Dense pollen cloud in the production field**
  - **High seed set**
  - **Blocks adventitious pollination**
- **Flowering synchrony**
- **Good purity possible but exact isolation distance will vary based on several parameters**



- 100% of the plants in an IP production field have tassels and shed more pollen than inbred plants.
- Hybrid IP production fields therefore have 10X the pollen of a seed production field.
- Field isolation distances depend on kernel color, endosperm type, field size, etc.



## Conclusions

- Seed is the original IP crop
- Growers and seed companies are responsible for the isolation and other practices needed to meet genetic standards
- Seed production and commercial grain crops have co-existed for decades
- GMO's and IP programs can co-exist



•Growers are paid to have the proper isolation—it is not the responsibility of adjoining growers.



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•The seed industry is successfully supplying non-GM and GM crops to our customers today.



•Questions?