Fusarium Ear Rots and Fumonisin on the Texas High Plains
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In Response to 2017 High Plains Fumonisins Crisis:

1. What is fumonisins?
2. What is the farmer doing to minimize fusarium infection and fumonisins development?
3. What can we expect as we approach 2018 harvest?
What is fumonisin?

• A mycotoxin produced by the fusarium fungi (*Fusarium verticilloides*)
  • Mycotoxin – a toxic, carcinogenic chemical compound produced by fungi
  • Not all *Fusarium* species produce fumonisin
  • 5 primary mycotoxins: aflatoxins, fumonisins, ochratoxin, deoxynivalenol (vomitoxin) and zearalenone

• Found worldwide in soil and crop residues

• *F. verticilloides* (fumonisin) likely to grow in stressed plants
How bad were 2017 fumonisin levels?

Parmer:
Max 106 ppm
Min 3.0 ppm
Avg 29.8 ppm
6 Samples Reported

Castro:
Max 40 ppm
Min 3.0 ppm
Avg 18.4 ppm
18 Samples Reported

Randall:
Max 165.5 ppm
Min 8.6 ppm
Avg 34.8 ppm
22 Samples Reported

Moore:
Max 88.2 ppm
Min 1.6 ppm
Avg 26.2 ppm
4 Samples Reported

Potter:
Max 214.4 ppm
Min 4.2 ppm
Avg 57.5 ppm
32 Samples Reported

5-6 year Avg. levels below 60 ppm threshold
20.0 ppm reported in Moore in 2016
141.0 ppm reported in Castro in 2016

20.0 ppm reported in Moore in 2015
18.0 ppm reported in Castro in 2015
How did we get Fusarium.....

1. Stressful Conditions: Hot, Dry conditions in early vegetative stages and flowering followed by rain and high humidity to favor fungal growth (Weak Plant)

2. Susceptibility Increases: Kernel Integrity, Insect, Hail, Wind, Husk Coverage, Smut

3. Fusarium infects ear: can grow without showing visual symptoms
   1. White, pinkish kernels
   2. Starbust patterns or streaking

4. But just because have fusarium ear rot, you do not have fumonisin....
When is fumonisin forming?

• The fusarium fungus needs the correct moisture and amylopectin (STARCH) to form fumonisin

• Optimal temperature 50 to 86 F

• Temperature fluctuations favor rapid development

• Increased RH

• 20% grain moisture peak development

• Is 2018 conducive for fumonisin?
August 10 – September 10, 2018 Hereford, Texas

Rain in Past Month: 3.43 in

Rain in in

10693332-1
Daily Totals

12Aug 19Aug 26Aug 02Sep 09Sep

100 90 80 70 60

Why do we care about Mycotoxins?

- Significant food/feed safety hazard
- Low levels (ppm or ppb) cause serious health problems for humans and animals
- Stable and persistent once formed
  - Remain intact after processing, cooking, drying, freezing or storage conditions.
  - Higher concentration per unit in DDGs
- No treatment for mycotoxin poisoning (mycotoxicosis)

Not all toxic compounds produced by fungi are called mycotoxins. Fungal products that are mainly toxic to bacteria (such as penicillin) are usually called antibiotics.
Consistent Hybrid Characteristics Associated with Fusarium

• Kernel Integrity
• Open, short husks
• Smut
• Bt traits
Kernel Integrity and Silk Cut
Kernel Integrity and Silk Cut

- A lateral split in the kernel pericarp
- Exposes the kernel to fungi
- Silk cut prevalent in 2017 corn
- Silk cut greatest with open husks
- Rapid drying of kernel surface
  - Premature hardening of the kernel surface
- Rehydration at nights results in splitting

- Odvody evaluated presence of silk cut from 1986 to 1994
  - Silk cut greatest in normal to high yield potential corn exposed to environmental stress
  - Small kernels less prone to silk cut

From Odvody
Dent Corn and Kernel Integrity

- Thinner pericarp
  - More digestible
  - Easier to process
  - More prone to cracking during dry down

- Shorter maturity classes
  - Cumulatively use less water during growing season
  - Often dry down earlier in growing season
Ear and Husk Characteristics

• Upright ears holding water and magnifying molds
• Damage still present in down facing ears, but molds not as heavy --- visual no quantifiable results about fumonisin levels
Open Husks = Ears Rotting
Smut and Fusarium Susceptibility
2017: A Smutty Year

• **Common Smut** (*Ustilago z.*)
  - Fungicides do not control common smut
  - Crop rotation will not minimize smut
  - Tillage can bury fungus and reduce inoculum – not an option for No-Till
  - High N can trigger common smut

• **Head Smut** (*Sphacelotheca r.*)
  - Can infect plant systemically
  - Can be a problem when emergence is slow or delayed
  - Planting in warm soils can favor infestation
  - Systemic fungicide and fungicide seed treatments can be effective
  - Burning reduces inoculum

• *Plant resistant hybrids*
Hybrid selection for Bt traits is an important consideration for Fusarium and Fumonisins.
Closed Husks + Vip3A = Good Ear
Same hybrid family but one with Vip 3a and one a non-Vip Bt (double pro) trait. Image from Pat Porter
2017 High Plains CEA Corn Trials

• Evaluation of 15 commonly planted corn hybrids in Texas High Plains

• Opportunity to evaluate GxExM Interaction
  • Genetics
  • Environment
  • Management

• Dallam, Moore and Hansford Counties

• Variations across locations in fumonisin levels BUT Vip 3a low at all locations

Fumonisin analyses from Tom Isakeit
Location difference but no yield difference due to mycotoxin levels.
2017 Bushland Dryland Corn Trial

Thomas Isakeit performed fumonisin tests

2017 Bushland Dryland Corn Yields

2017 Bushland Dryland Fumonisin Levels
Can management overcome in-season stress?

6.29 gal min\(^{-1}\) acre\(^{-1}\)

3.14 gal min\(^{-1}\) acre\(^{-1}\)
Is fumonis in a concern for 2018 corn?

High stress environments and susceptible hybrids are a concern.
What should we expect at the elevator in 2018?

- Elevators have testing procedure in place
- OTSC One Sample Strategy recommended for sampling and testing
  - Ensures each sample is representative of the entire load following FGIS probe pattern
  - Minimum 5-pound sample collected and composited from ea. load
    - 15-pounds required for composite loads
    - 500 grams of ground sample retained for a file sample
  - OSS does not enforce regulation, it ensures consistency
What are preharvest decisions that can be made to minimize the risk of fumonisin development?

• Identify potential “hot” areas in their fields.
  • Rather than mixing contaminated corn into several loads, it may be beneficial for the producer to segregate the clean and moldy areas to minimize risk of contaminating multiple loads from the field.

• Consider adjusting the fan speed to blow out light weight, moldy corn, cob pieces, and fines that are often highly contaminated with fumonisin.
  • In some regions, it is recommended to leave tip kernels attached to the cob because the tip kernels are often at the greatest risk for Fusarium and fumonisin.

• If the producers suspect high levels of fumonsin present based on visual observations of Fusarium, the producer needs to contact his or her insurance agent prior to harvesting.
Key Points

• 2016 and 2017 Perfect Environmental Storm

• 2018 Perfect June and July for Fusarium

• Consider strategic combining

• How to minimize future risk?
  • Fusarium Ear Rot Ratings
  • Kernel Integrity
  • Bt trait selection to minimize insect damage
  • Check hybrid smut susceptibility
  • Managing population to minimize stress ESPECIALLY with low well capacities
As well capacities decline and producers cannot meet corn water demands acres are transitioning.
So what is happening in High Plains Cotton?

Cotton Acres are Increasing!
Questions?
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