



Fusarium Ear Rots and Fumonisin on the Texas High Plains

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In Response to 2017 High Plains Fumonisin Crisis:

1. What is fumonisin?
2. What is the farmer doing to minimize fusarium infection and fumonisin 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?

Level of Fumonisin in Corn Sampled & Tested by OTSC - 2017 Crop Year by County

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

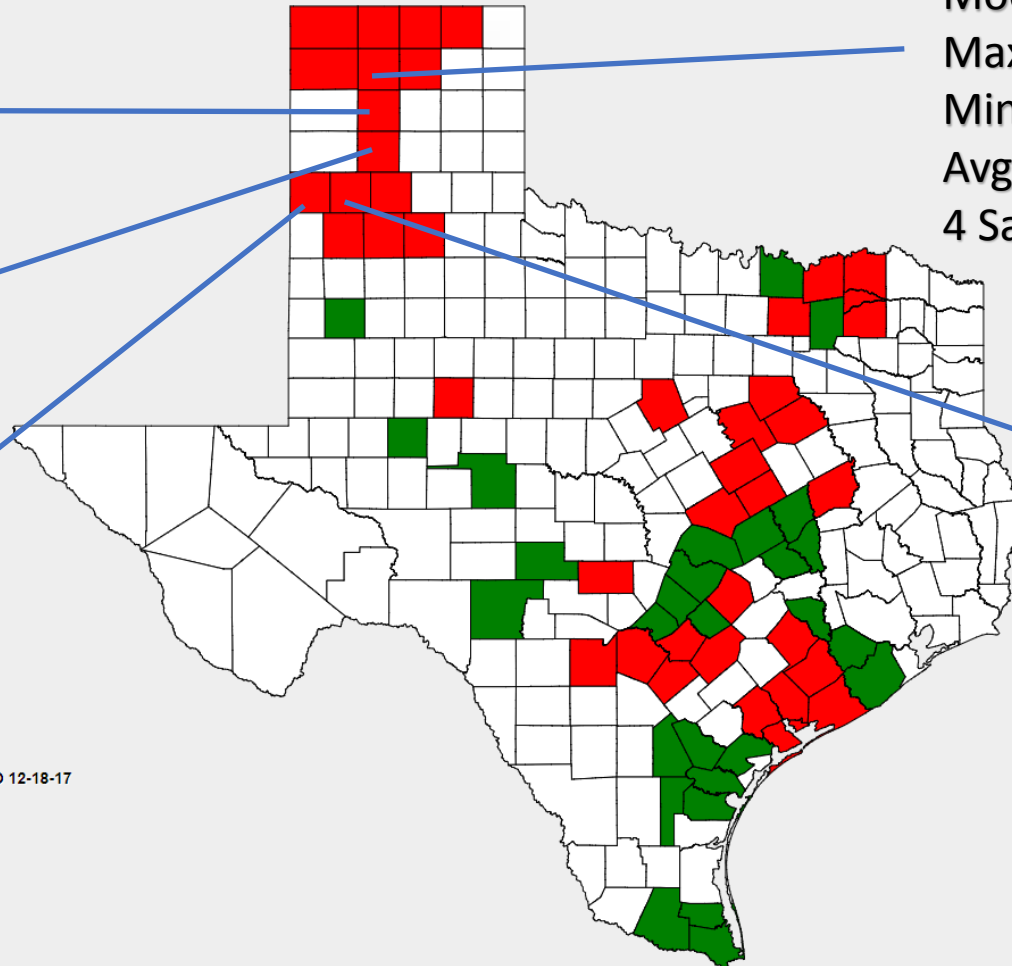
Randall:
Max 165.5 ppm
Min 8.6 ppm
Avg 34.8 ppm
22 Samples Reported

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

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

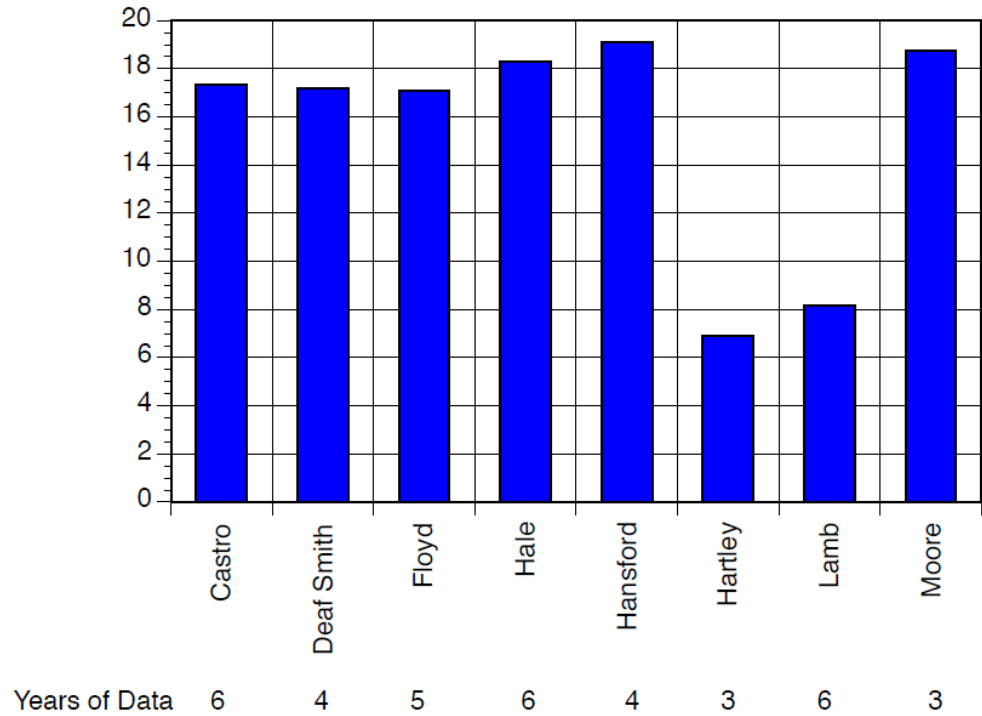
Castro:
Max 40 ppm
Min 3.0 ppm
Avg 18.4 ppm
18 Samples Reported

LEGEND:
06-01-17 TO 12-18-17

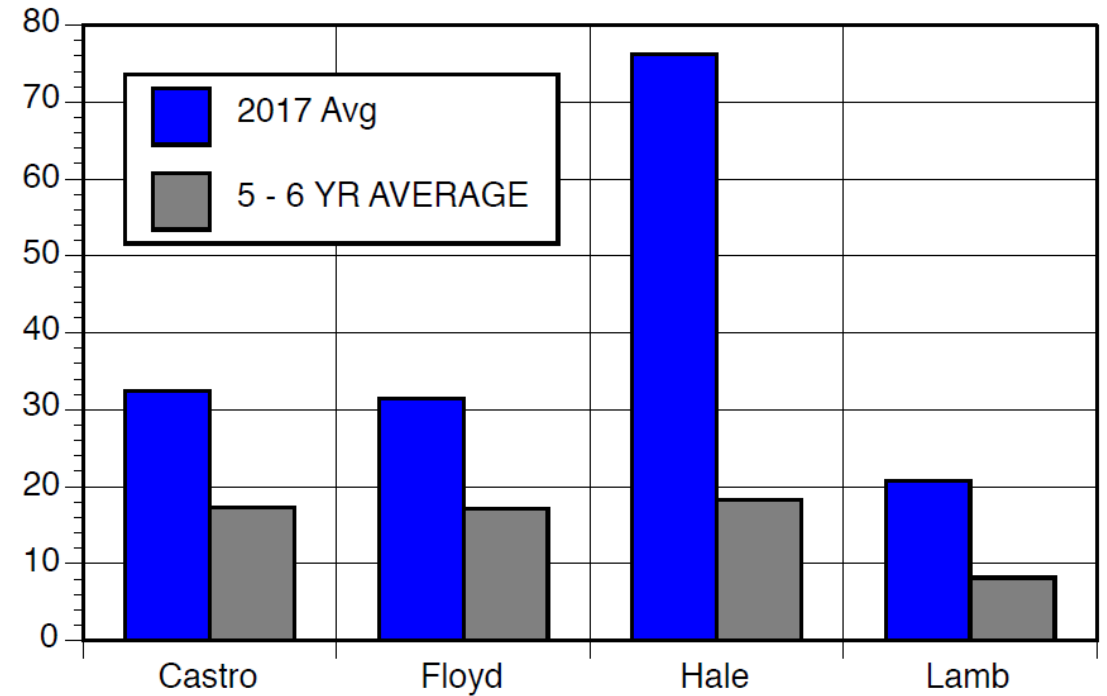


≤ 5 ppm
> 5 ppm

Average PPM Fumonisin in Select Texas High Plains Counties.
Years 2012 - 2017, with some years missing for certain counties.



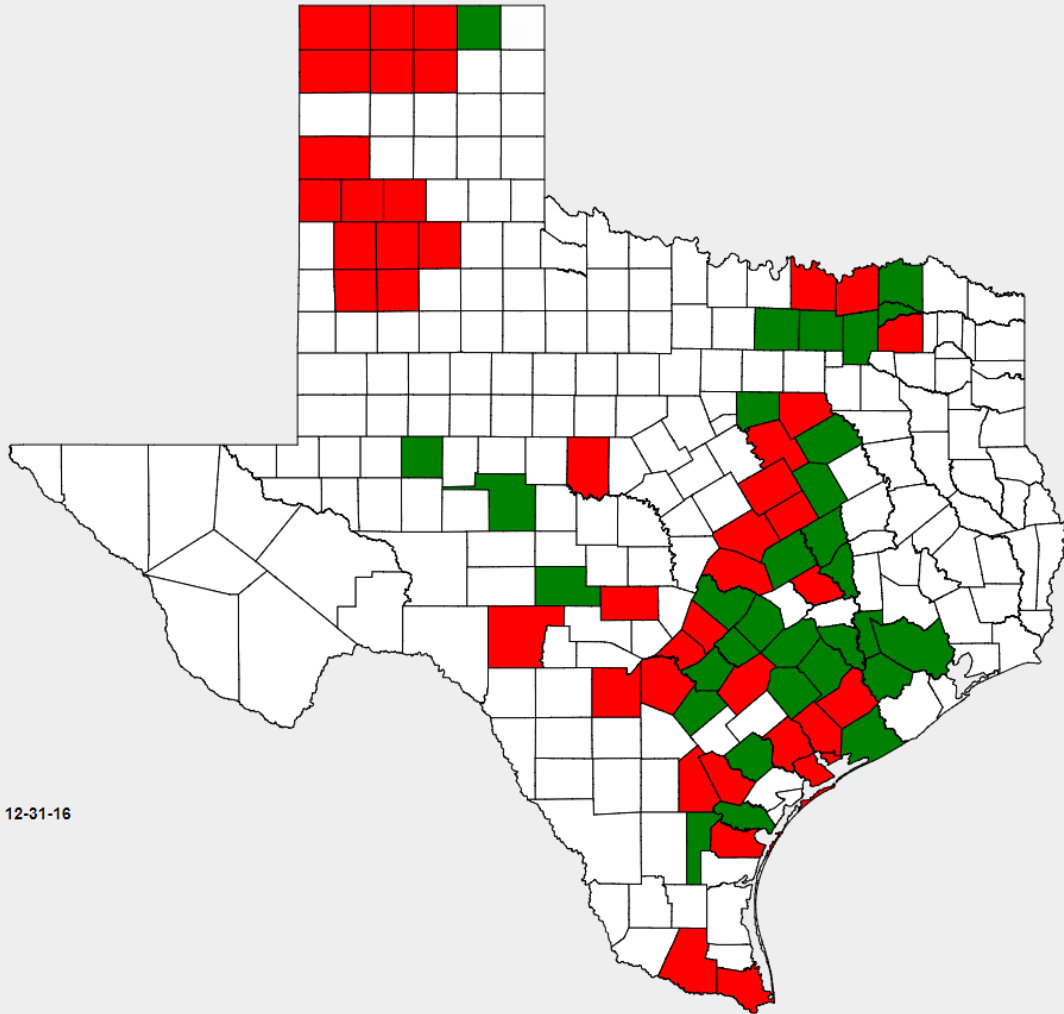
2017 Average PPM Fumonisin vs. The 5 - 6 Year Average for Select Texas High Plains Counties.



Plots from Pat Porter

5-6 year Avg. levels below 60 ppm threshold

Level of Fumonisin in Corn Sampled & Tested by OTSC - 2016 Crop Year by County

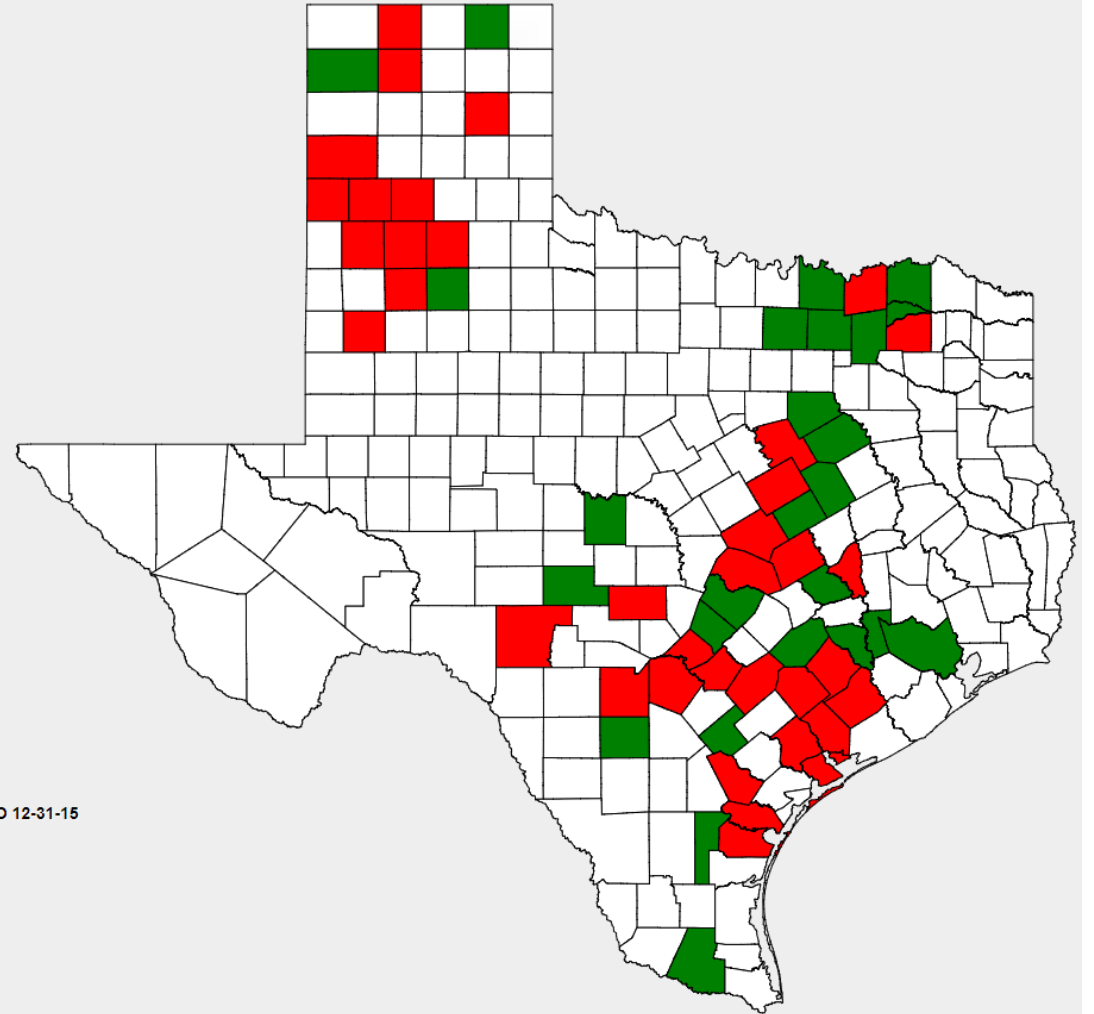


ND:

06-01-16 TO 12-31-16

20.0 ppm reported in Moore in 2016
141.0 ppm reported in Castro in 2016

Level of Fumonisin in Corn Sampled & Tested by OTSC - 2015 Crop Year by County



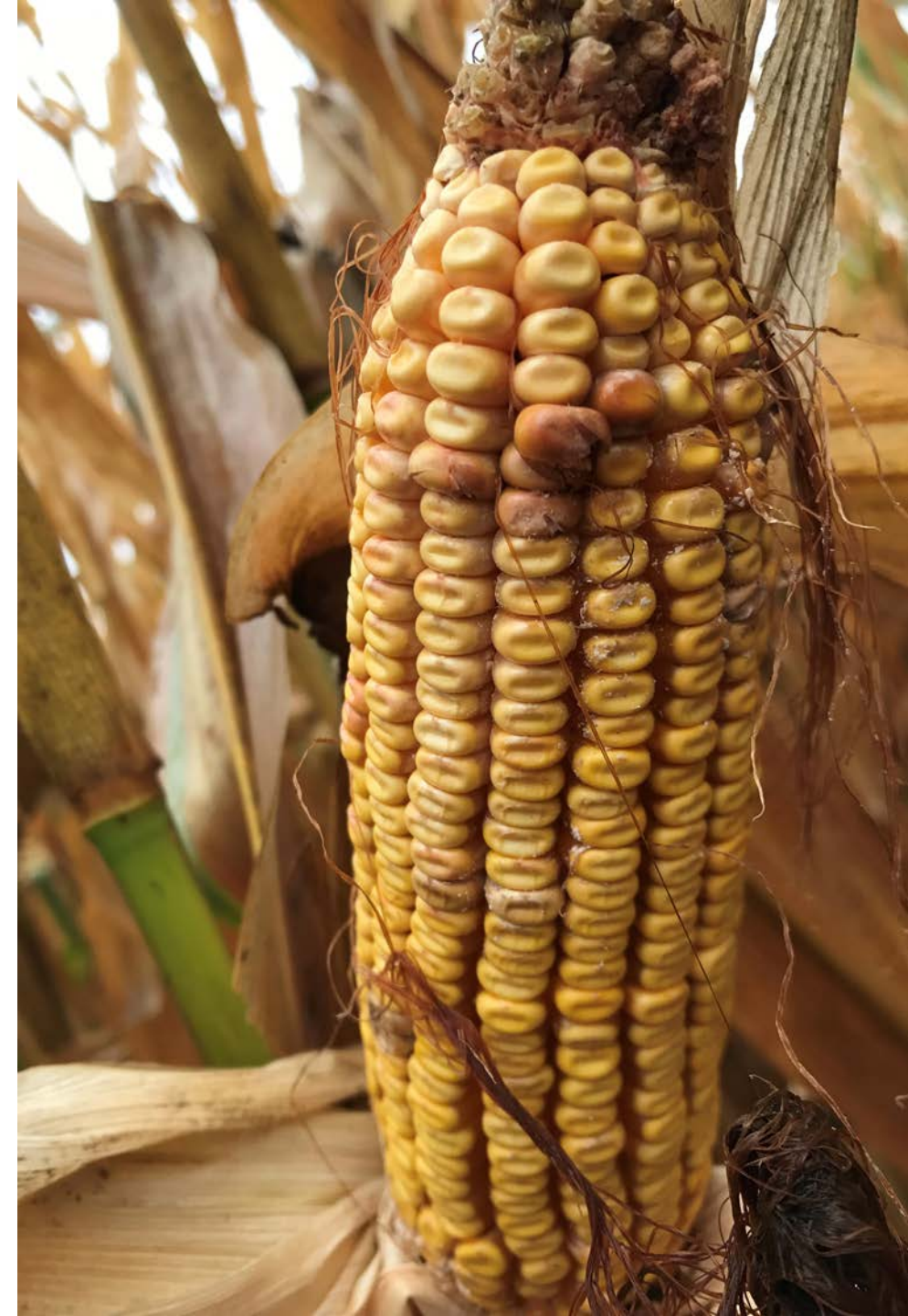
END:

06-01-15 TO 12-31-15

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....



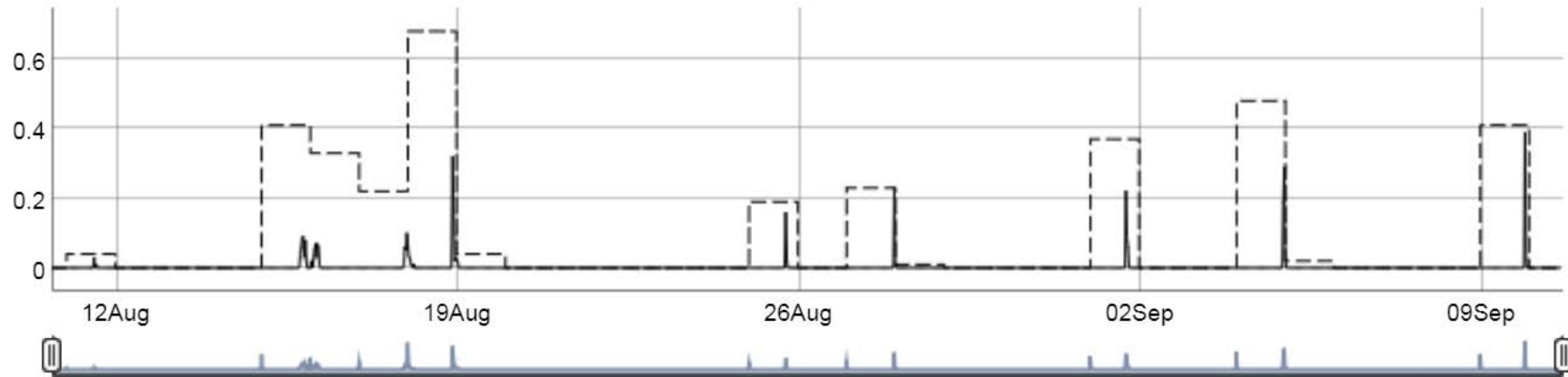
When is fumonisin forming?

- 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?



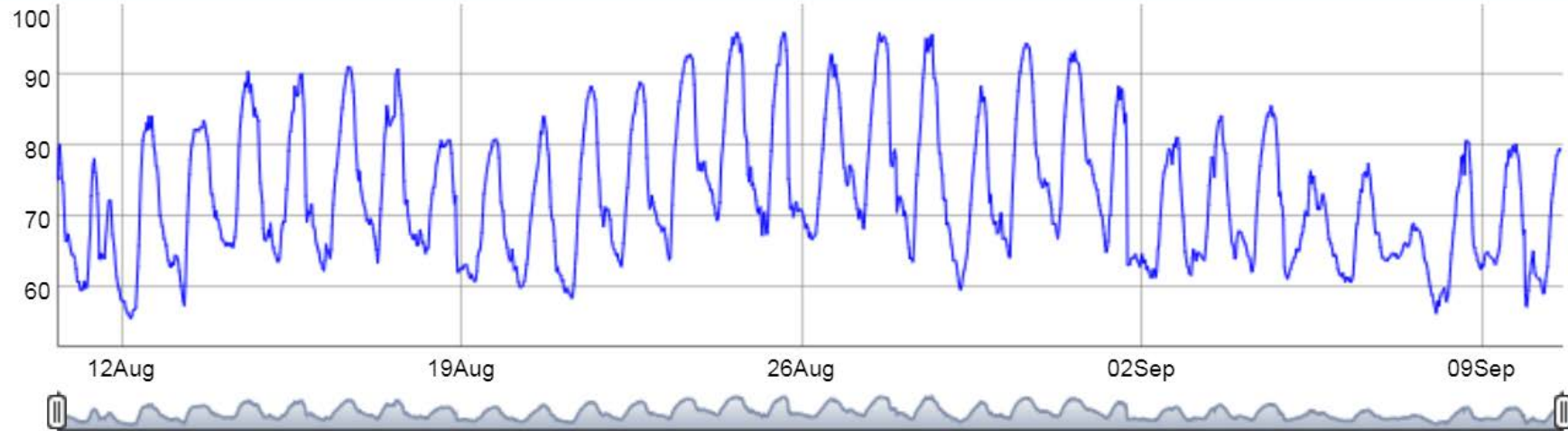
August 10 – September 10, 2018 Hereford, Texas

Rain in Past Month: 3.43 in



Rain: in

10693332-1
Daily Totals



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



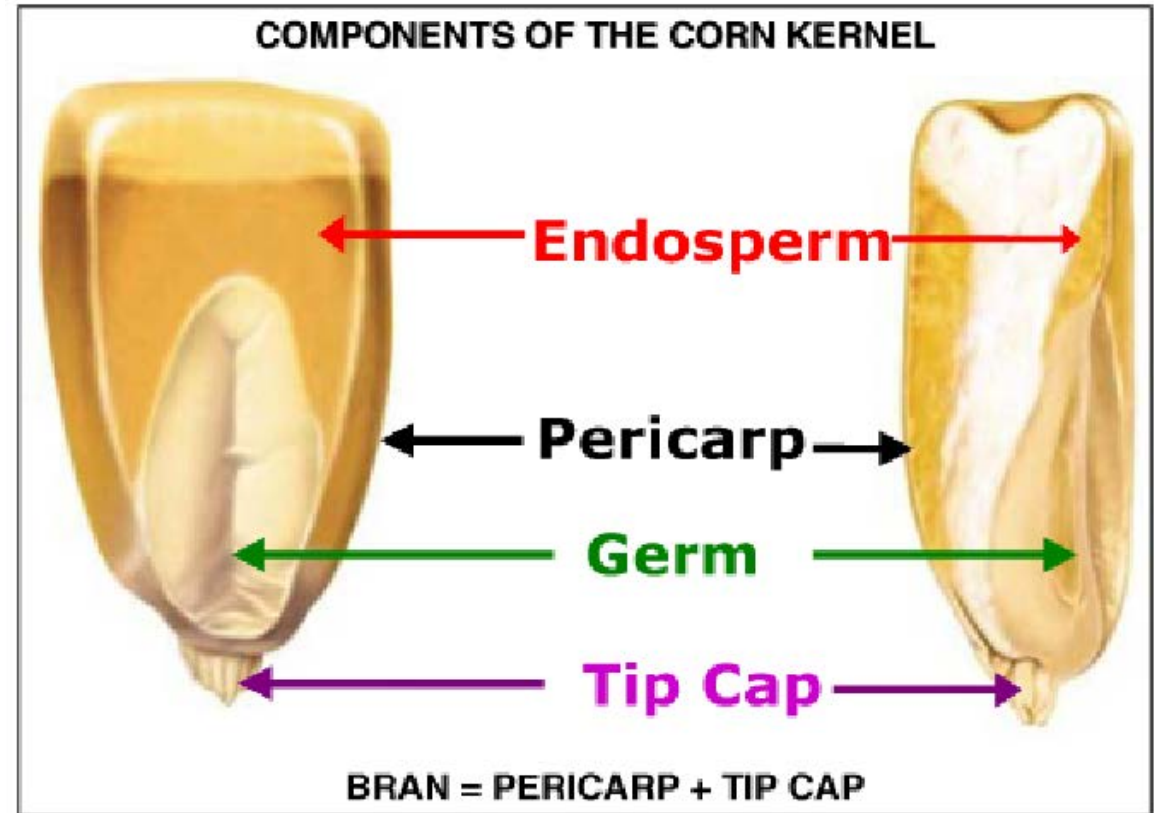
From Odvody

<https://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS.1997.81.5.439>

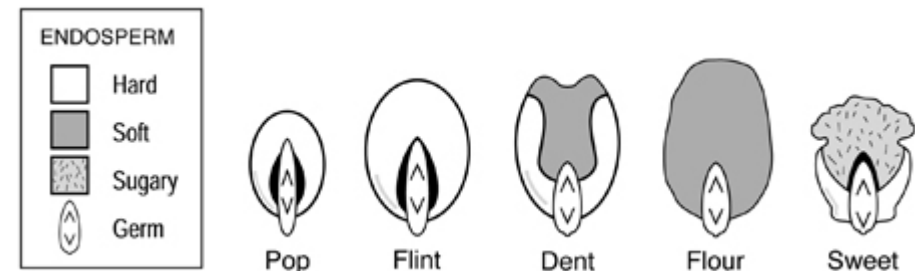
- Odvody evaluated presence of silk cut from 1986 to 1994
 - Silk cut greatest in normal to high yield potential corn exposed to environmental stress
 - Small kernels less prone to silk cut

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



www.cerealprocess.com/images/corn-components.jp



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 Fumonisin



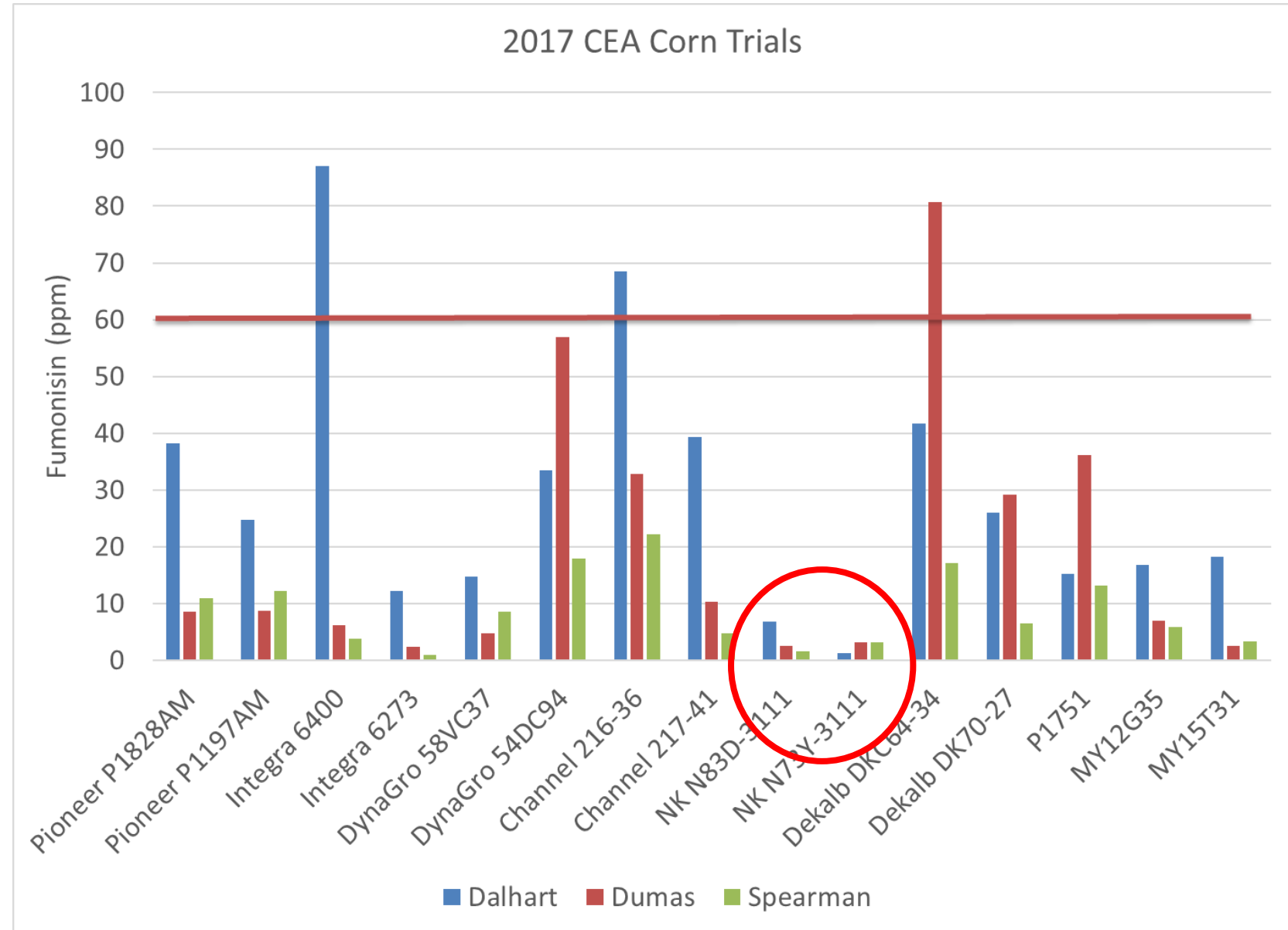
Closed Husks + Vip3A = Good Ear

Same hybrid family
but one with Vip
3a and one a non-
Vip Bt (double pro)
trait. Image from
Pat Porter



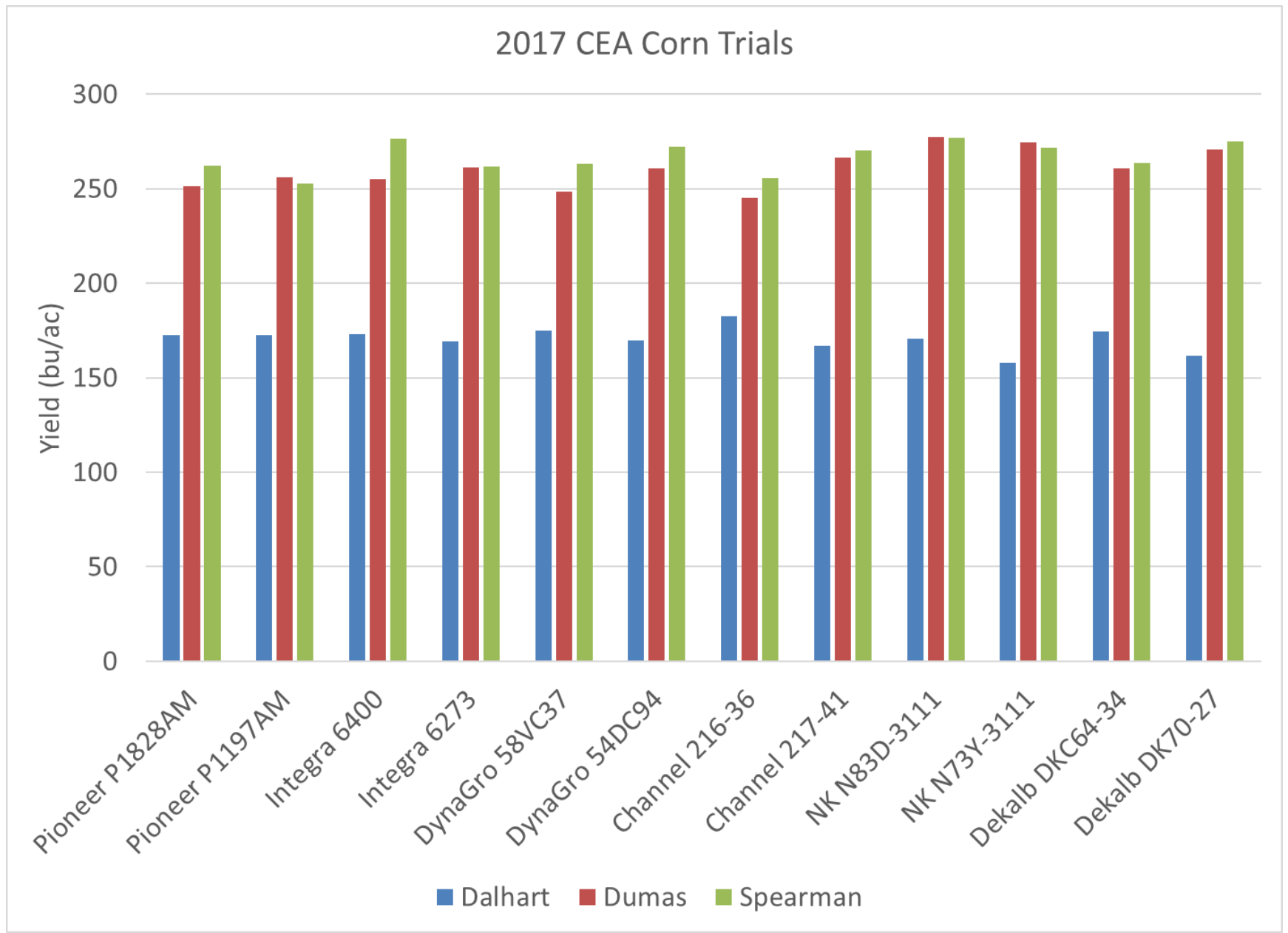
2017 High Plains CEA Corn Trials

- 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



198-00DGVT2P PD1



198-00DGVT2P PD2



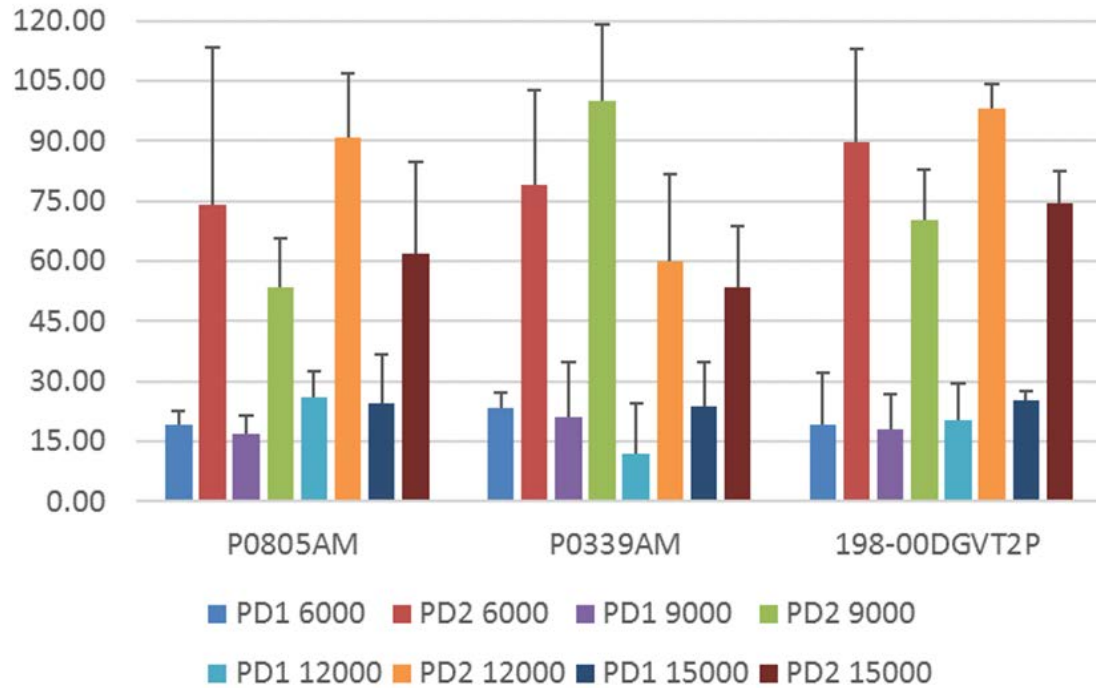
12K



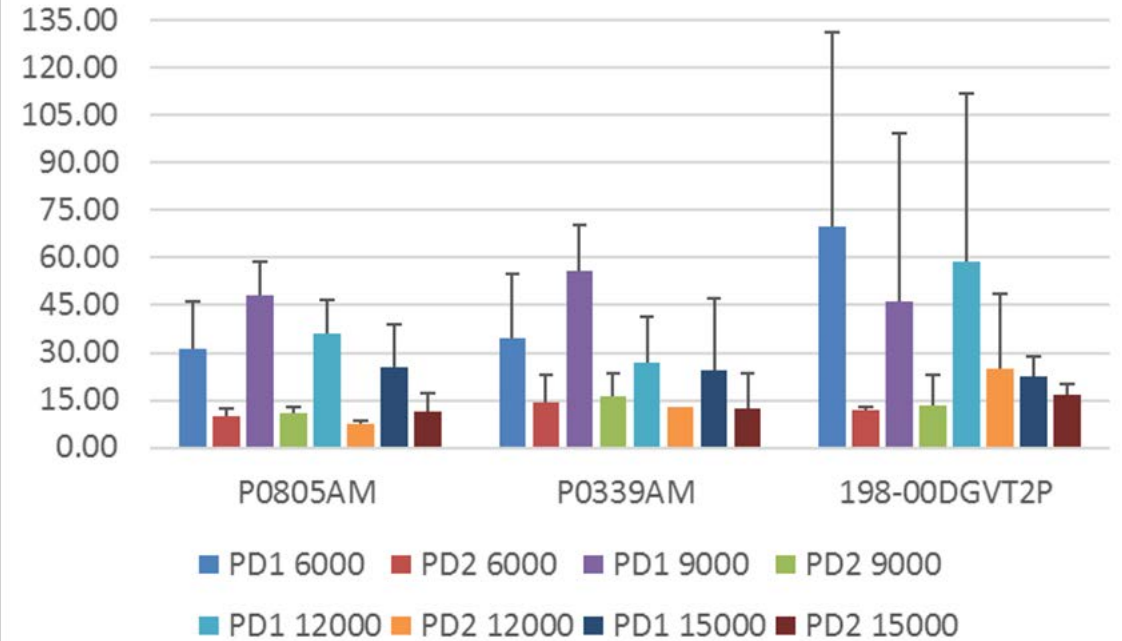
12K



2017 Bushland Dryland Corn Yields



2017 Bushland Dryland Fumonisin Levels



Thomas Isakeit performed fumonisin tests

2017 Bushland Dryland Corn Trial

Can management overcome in-season stress?

6.29 gal
min⁻¹
acre⁻¹



3.14 gal
min⁻¹
acre⁻¹



Is fumonisin a concern for 2018 corn?

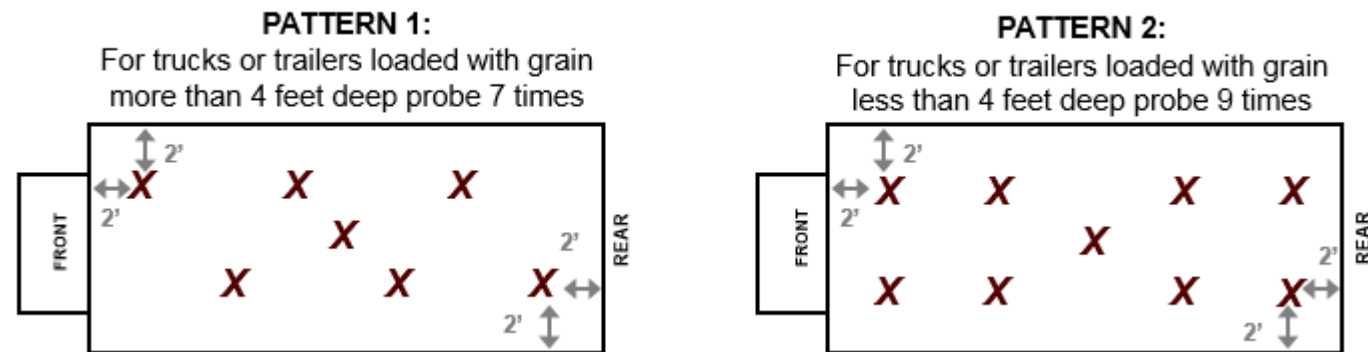
High stress environments and susceptible hybrids are a concern.





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?

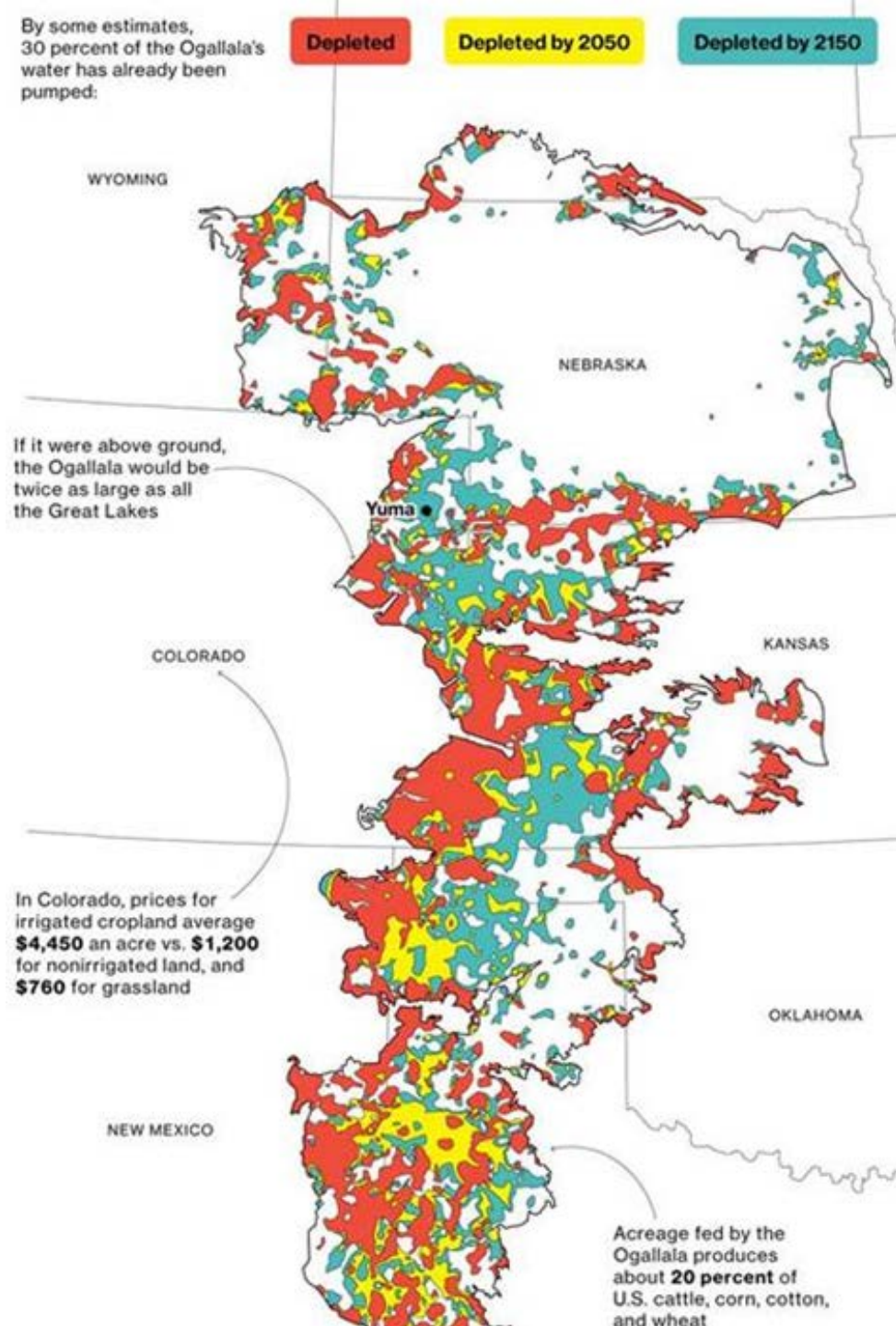
- Identify potential “hot” areas in their fields.
 - Rather than mixing contaminated corn into several loads, it may be beneficial for the producer to segregate the clean and moldy areas to minimize risk of contaminating multiple loads from the field.
- Consider adjusting the fan speed to blow out light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



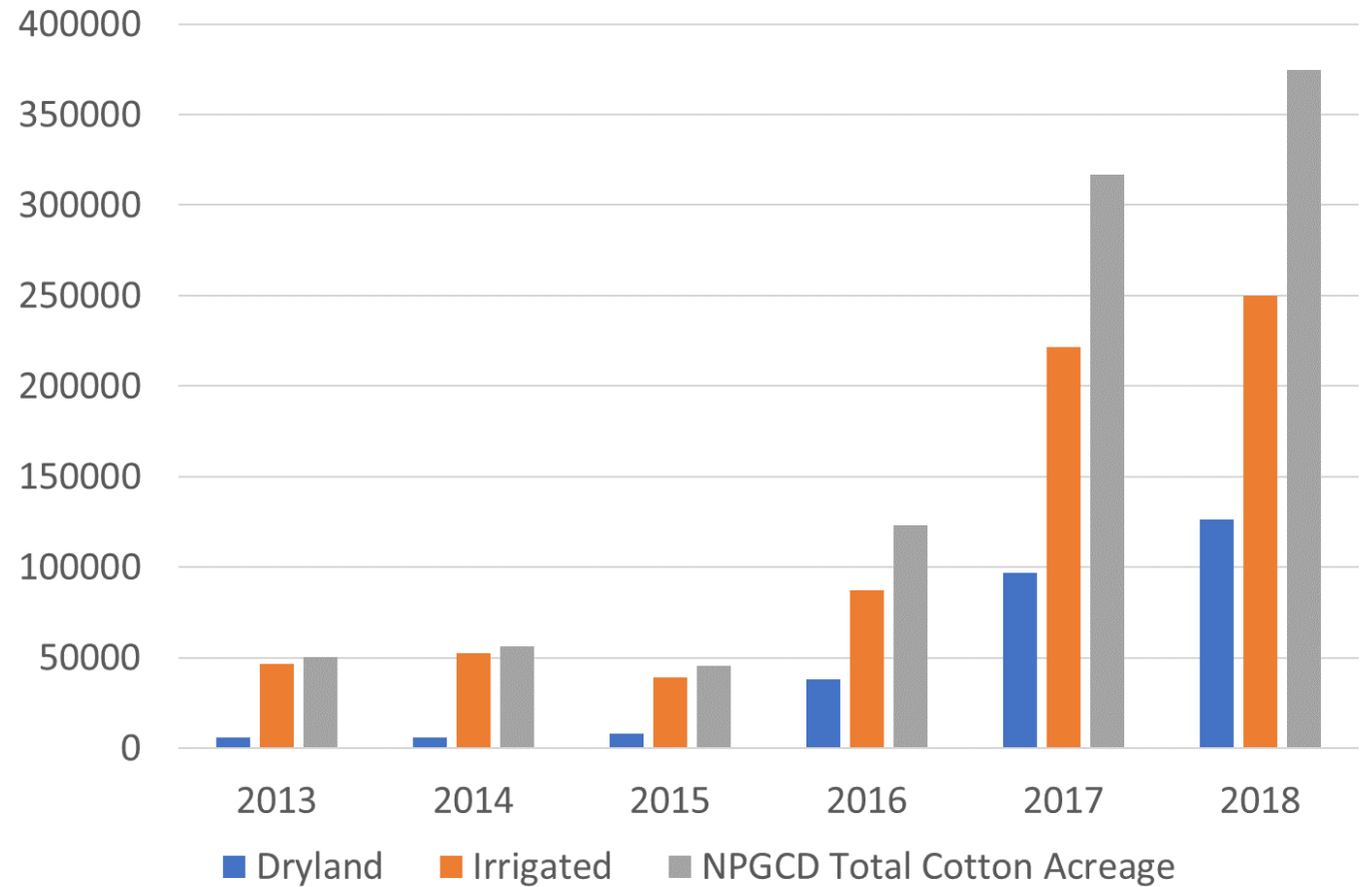
As well capacities decline and producers cannot meet corn water demands acres are transitioning



So what is happening in High Plains Cotton?

Cotton Acres are Increasing!

NPGCD Total Cotton Acreage



Questions?
Contributions from:
Ed Bynum, Pat Porter,
Jason Woodward,
Tom Isakeit, Gary
Odvody, Wenwei Xu

