

## Ear Development Issues in Corn

Osler Ortez

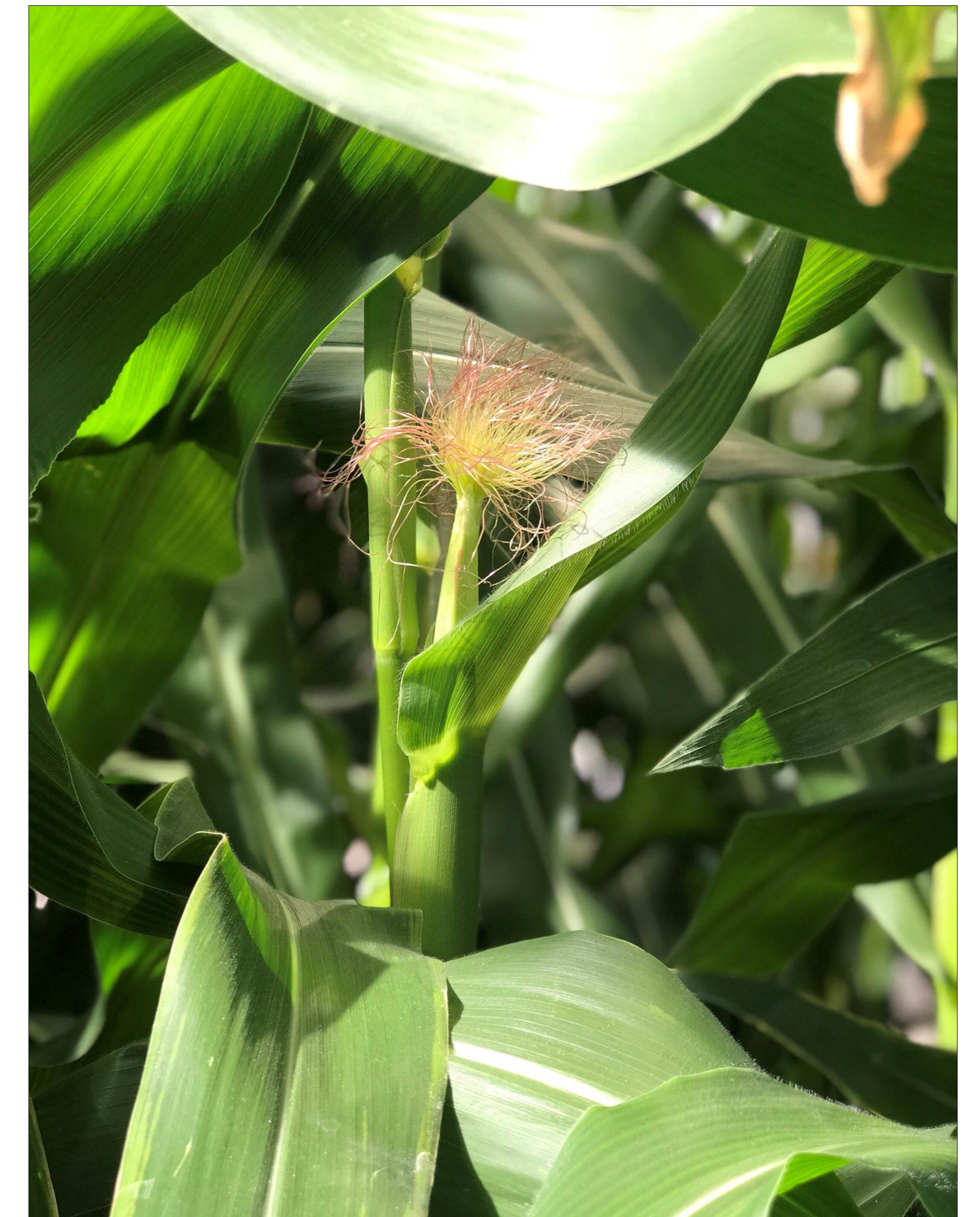
Doctoral Student | Agronomy & Crop Production

Justin McMechan || Tom Hoegemeyer || Roger Elmore





- **Introduction**
- **Review of literature**
- **Field surveys, 2016**
- **Field work, 2018 through 2020**
- **Summary of results**



Reports of ear issues in **August 2016**

Initially thought it was isolated to **Nebraska**

## Introduction

The screenshot shows a web page from the CropWatch website. The header includes the logo for the Institute of Agriculture and Natural Resources and the CropWatch title. A breadcrumb trail shows the path: UNL > IA... > Nebraska Extensi... > CropWat... > Corn Ear Formation Issues Likely Correlated With the Loss of the Primary Ear Node. The main navigation bar has links for HOME, WEATHER (GDD & ET) INFO & RESOURCES, CROPS, MANAGEMENT, RELATED TOPICS, and ARCHIVES. The article title is "Corn Ear Formation Issues Likely Correlated With the Loss of the Primary Ear Node" and the date is "AUGUST 19, 2016". The authors listed are Roger Elmore, Jenny Rees, Justin McMechan, Tamra Jackson-Ziems, and Tom Hoegemeyer. The article text discusses corn yield forecasts and seed-fill stages. Two photographs show corn ears with short husks. The caption reads: "Figure 1. 'Normal' length ears with short husks most likely on the".

# Crop Production Clinics

Reports of ear issues in **August 2016**

Initially thought it was isolated to  
**Nebraska**

Well-substantiated reports  
from:

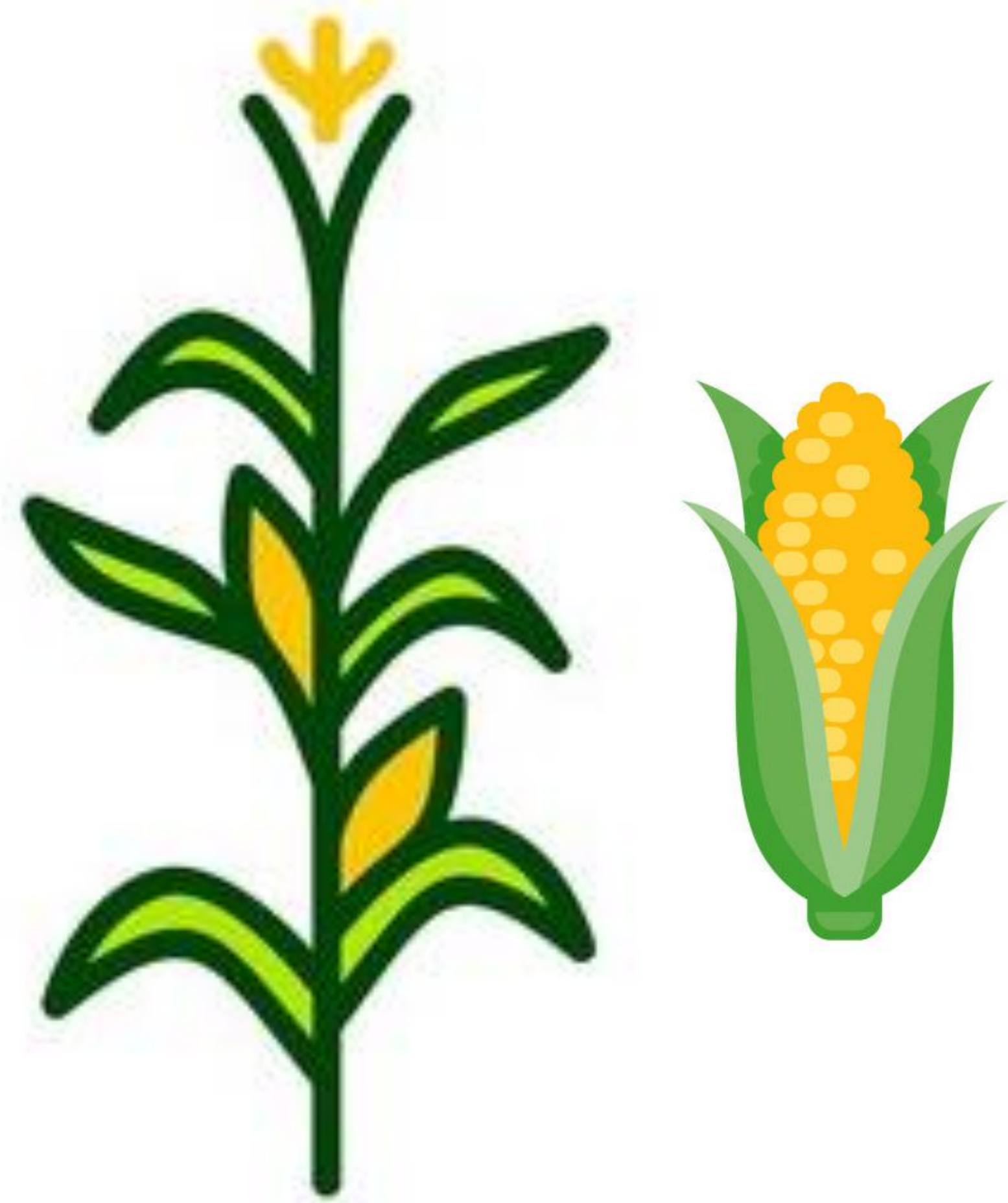
**Texas Panhandle**  
**Eastern Colorado**  
**Iowa**  
**Illinois**





## Literature review, ear abnormalities

- **Not enough research** has been done in this specific area
- **Ten commonly known** and **three as recent concern** symptoms
- Possible outcome from **genetics**, **environment**, and **management**
- They affect **grain yield** and **grain quality**
- **Its mitigation** is imperative towards **productivity & sustainability**



# Crop Production Clinics

## What is known?

- Flattened / fasciated / branched
- Pinched / reduced row number
- Arrested ears
- Blunt / beer can ears
- Tassel ears
- Silk balled ears
- Silk clipped ears
- Banana ears
- Zipper ears
- Tip backed ears

## Recent concern?

- Multi-ears
- Barbell-ears
- Short-husks



Translating Visionary Science to Practice

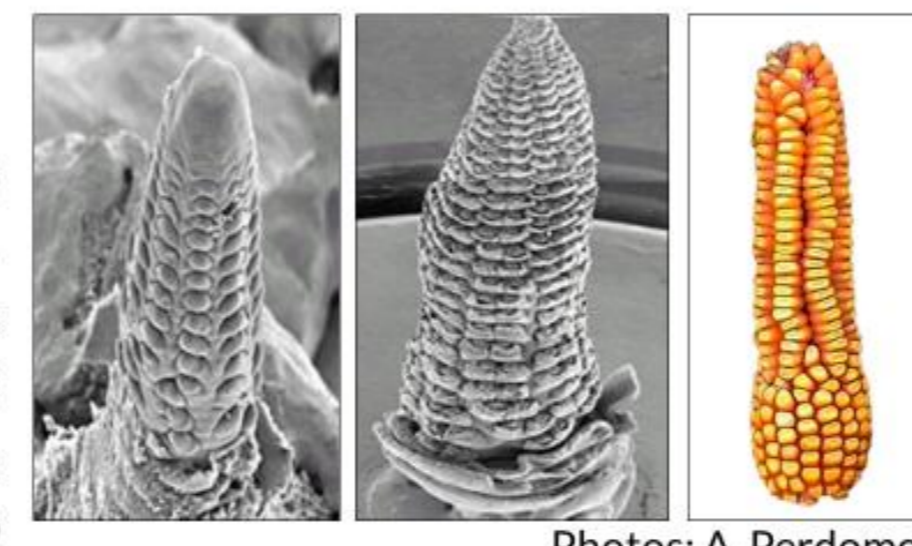
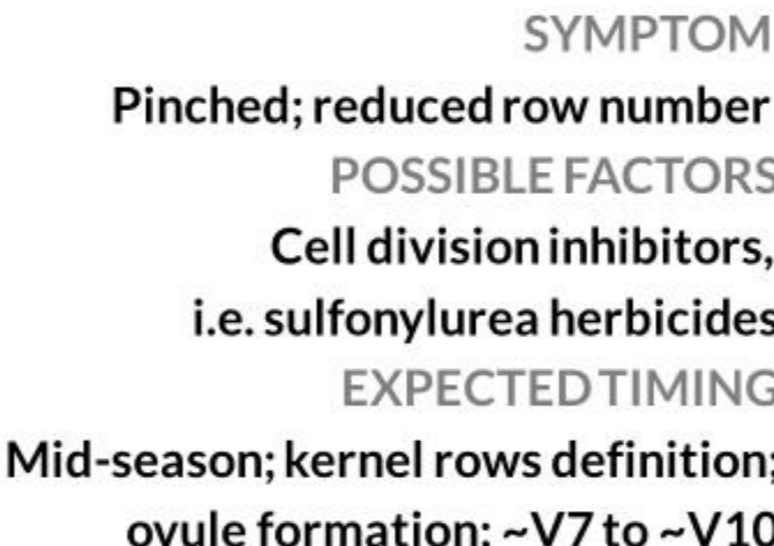


LEAD: Osler Ortez  
EMAIL: [osler.ortez@huskers.unl.edu](mailto:osler.ortez@huskers.unl.edu)  
TEAM: Justin McMechan  
Roger Elmore



Photos: O. Ortez

**SYMPTOM**  
Flattened; fasciated; branched  
**POSSIBLE FACTORS**  
Specific mutants; genetics  
**EXPECTED TIMING**  
Early-season; ear formation; number of kernel rows/ear definition; ~V4 to ~V7



Photos: A. Perdomo



Photo: O. Ortez

**SYMPTOM**  
Arrested ear  
**POSSIBLE FACTORS**  
Non-Ionic Surfactant (NIS) formulations  
**EXPECTED TIMING**  
Mid-season; number of kernels per row definition; ~V10 to ~V16

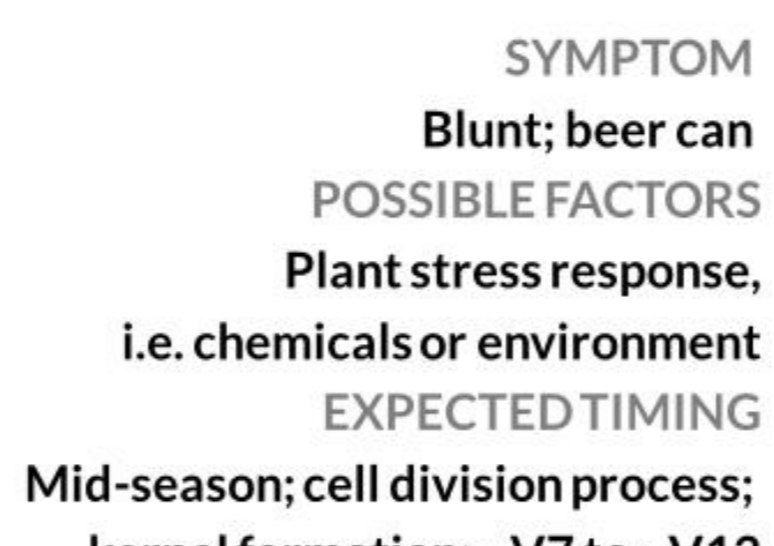


Photo: B. Nielsen



Photo: O. Ortez

**SYMPTOM**  
Tassel ear  
**POSSIBLE FACTORS**  
Normally on tillers; lower populations; end rows; border rows  
**EXPECTED TIMING**  
Mid-season; ear and tassel formation on tillers

### PROJECT BACKGROUND

- New corn ear abnormalities reported in recent years.
- Little is known about abnormalities or their causes.
- Hence, a comprehensive review of literature is needed to better understand ear abnormalities in corn.

## What is known about Corn Ear Abnormalities?

### OUR FOCUS

**SYMPTOM:** Multi-ear; bouquet



Photos: O. Ortez

**POSSIBLE FACTORS**  
Environmental stress; cold temperatures; genetics;

**EXPECTED TIMING**  
Early-season; sometime during or after ear initiation; ~V4 to ~V6

**SYMPTOM :** Barbell-ear; dumbbell-shaped



Photos: O. Ortez

**POSSIBLE FACTORS**  
Temperature stress; limited solar radiation; hormonal changes

**EXPECTED TIMING**  
Mid-season; when kernel rows per ear are set; ~V12 to ~V15

**SYMPTOM :** Short-husk ear



Photos: O. Ortez

**POSSIBLE FACTORS**  
Heat/drought followed by cooler temperatures and precipitation; high speed winds; storms

**EXPECTED TIMING**  
Late-season; close to flowering and pollination time; ~VT and ~R1

### CLOSING REMARKS

One would think that after 70+ years studying corn, it would be understood completely... Not true! Widespread cases of ear abnormalities have been reported in recent years, little is known about the causes...



**SYMPTOM**  
Silk balling  
**POSSIBLE FACTORS**  
Cold temperatures; drought; genetics  
**EXPECTED TIMING**  
Mid-season; silk elongation stage; before and after V15



Photos: J. Hardwick



Photo: B. Nielsen

**SYMPTOM**  
Silk clipped  
**POSSIBLE FACTORS**  
Insects, i.e. Japanese/corn rootworm beetles  
**EXPECTED TIMING**  
Mid-season; flowering and pollination time; ~VT and ~R1



Photos: O. Ortez

**SYMPTOM**  
Banana shaped  
**POSSIBLE FACTORS**  
Heat/drought; chemical applications; stink bug injury  
**EXPECTED TIMING**  
Mid-season: around pollination time, ~R1



Photo adapted from Thomison et al, 2020

**SYMPTOM**  
Zipper  
**POSSIBLE FACTORS**  
Genetics; high-seeding rates; drought stress; defoliation  
**EXPECTED TIMING**  
Late-season; during/after pollen kernels formed & aborted, >R1

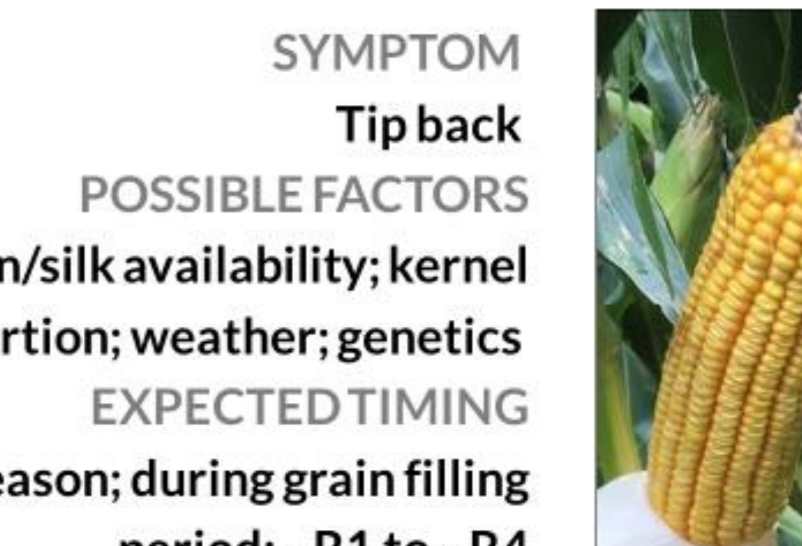


Photo: J. McMechan

**SYMPTOM**  
Tip back  
**POSSIBLE FACTORS**  
Pollen/silk availability; kernel abortion; weather; genetics  
**EXPECTED TIMING**  
Late-season; during grain filling period; ~R1 to ~R4

### NEXT STEPS

- Summarize survey results from grower fields, in 2016.
- Summarize experimental results 2018-2021: hybrids, planting dates, seeding rates, delayed planting.
- Summarize greenhouse results, 2020: stress impacts.

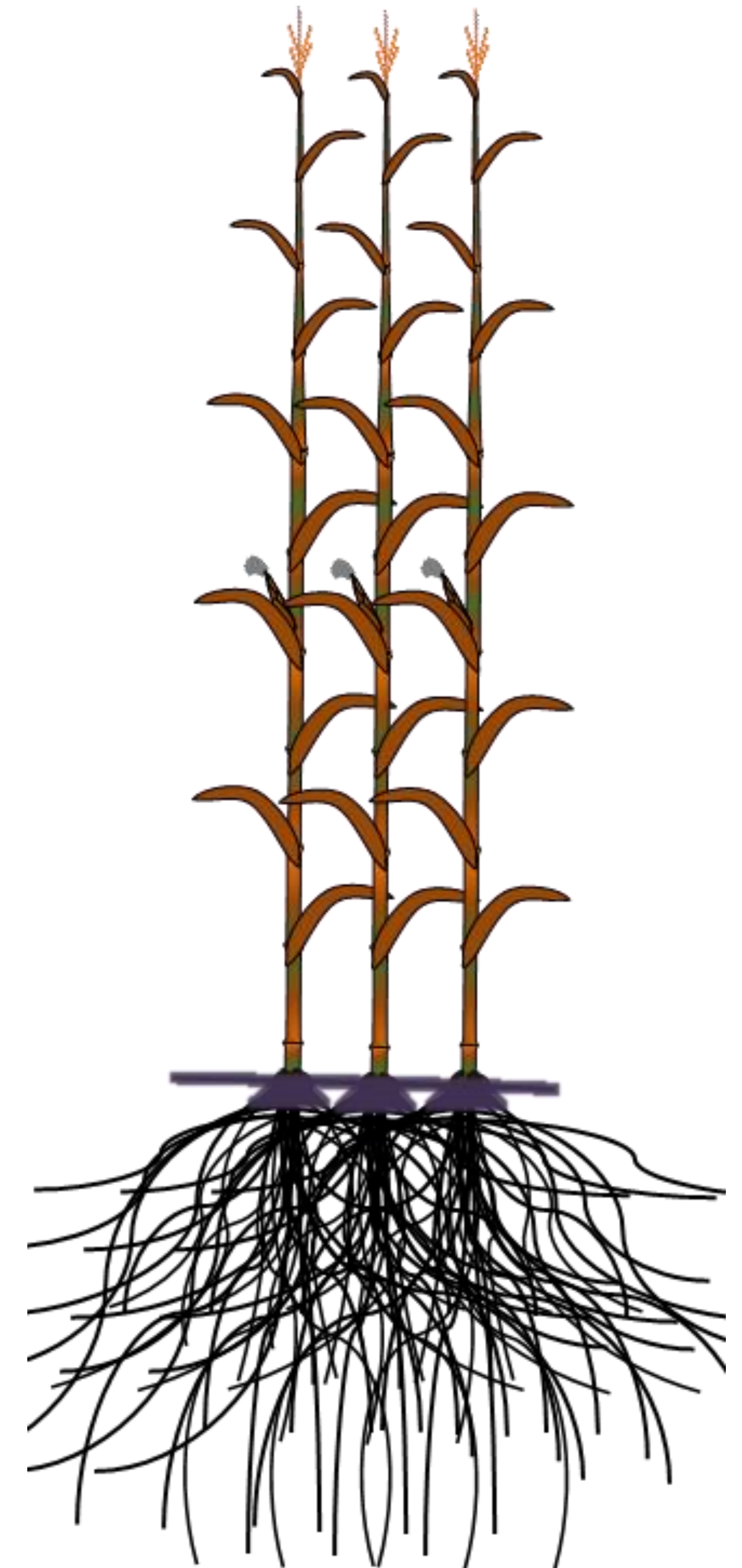
Ear development issues as result of **interactions** among **G x E x M**:

**genetics (G)**

**environment (E)**

**management practices (M)**

**... but specific causes are still to be found!**

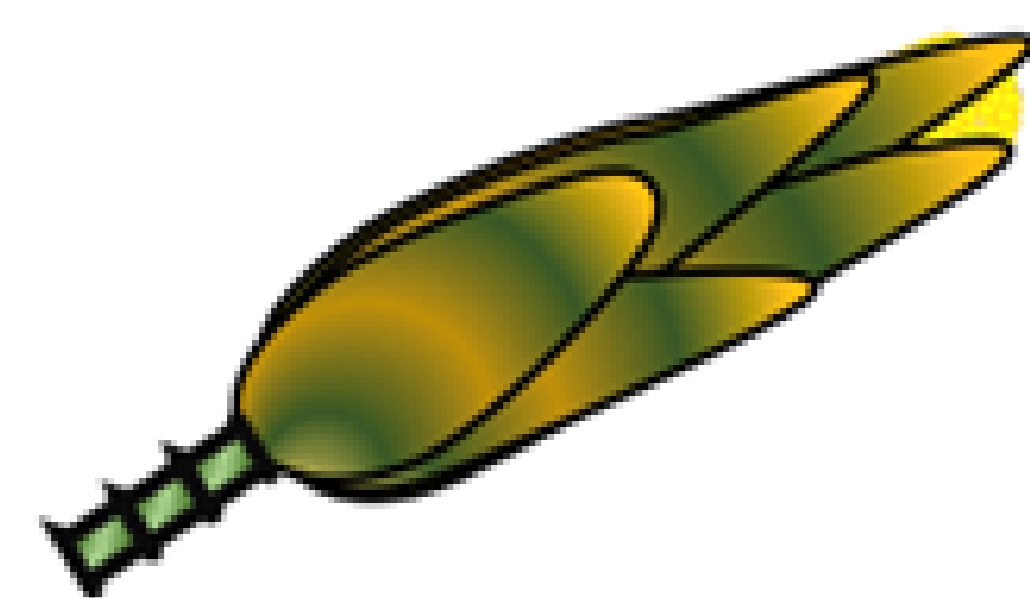


## Overarching Objective

To study **causal agents** of **ear development issues** and **productivity losses** in corn







**Normal Ears**



**Ear Classification**



**Multi-Ears**



**Three ears**



**Four ears**



**Seven ears**

## Ear Classification



**Barbell-Ears**



**Barbell-1: base**



**Barbell-2: middle**



**Barbell-3: tip**

## Ear Classification



## Short Husks



70% short



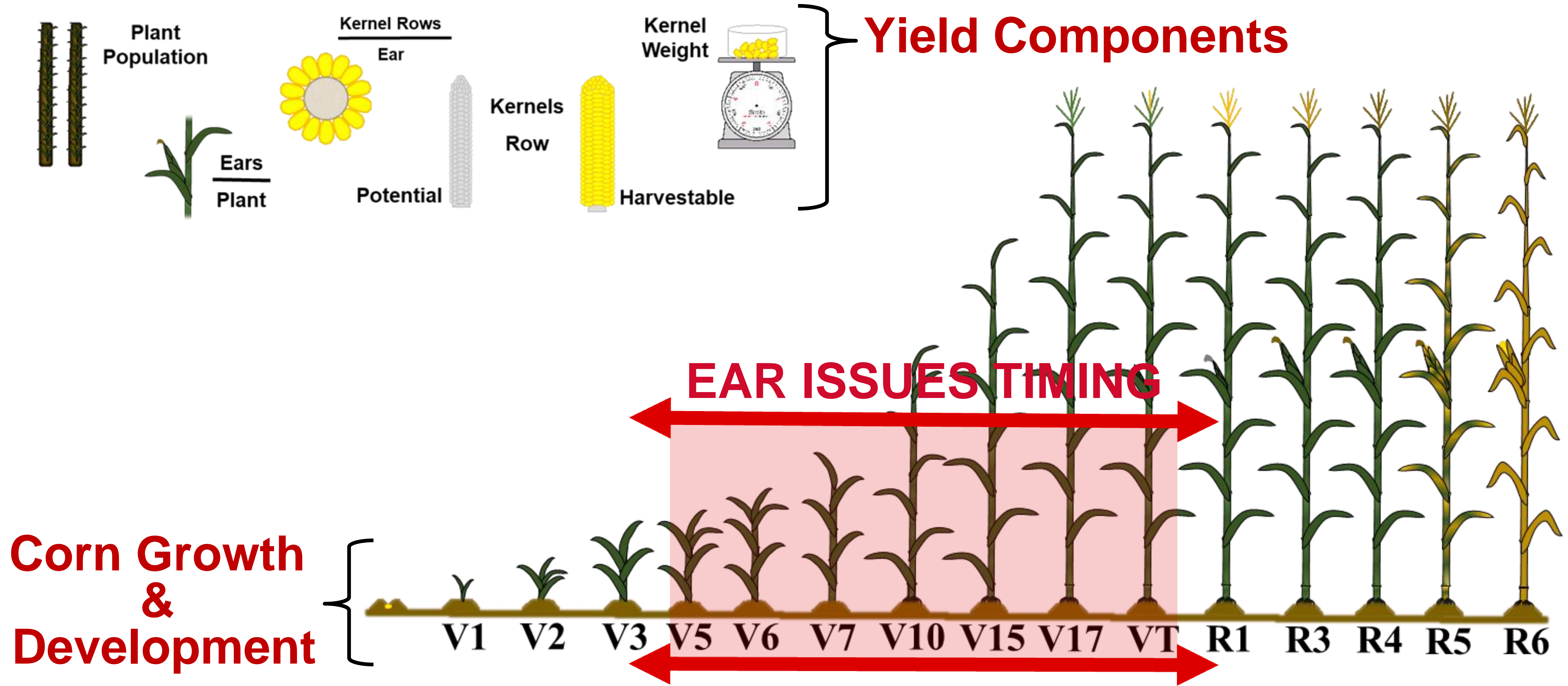
80% short



90% short

## Ear Classification

# Crop Production Clinics



# Crop Production Clinics

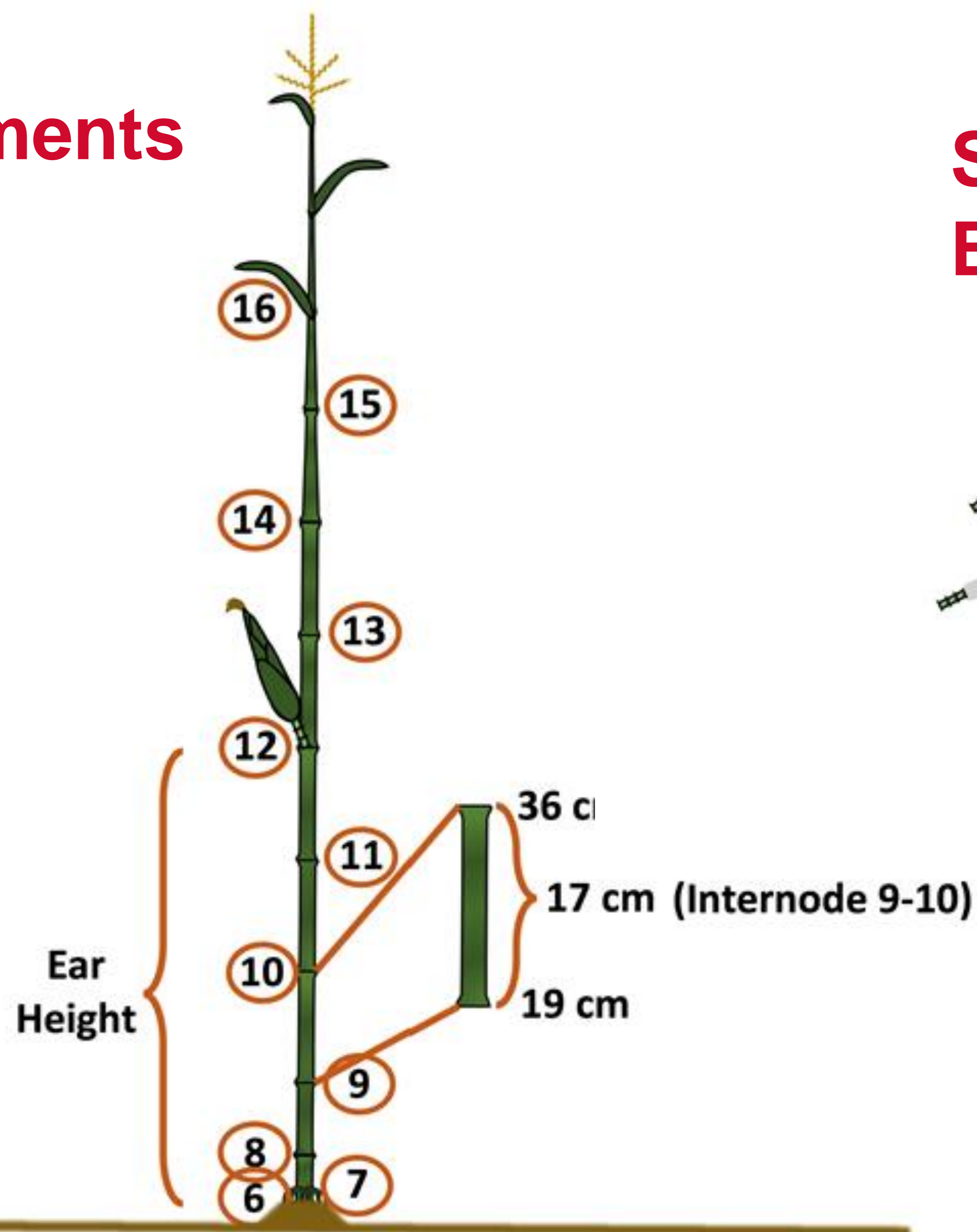
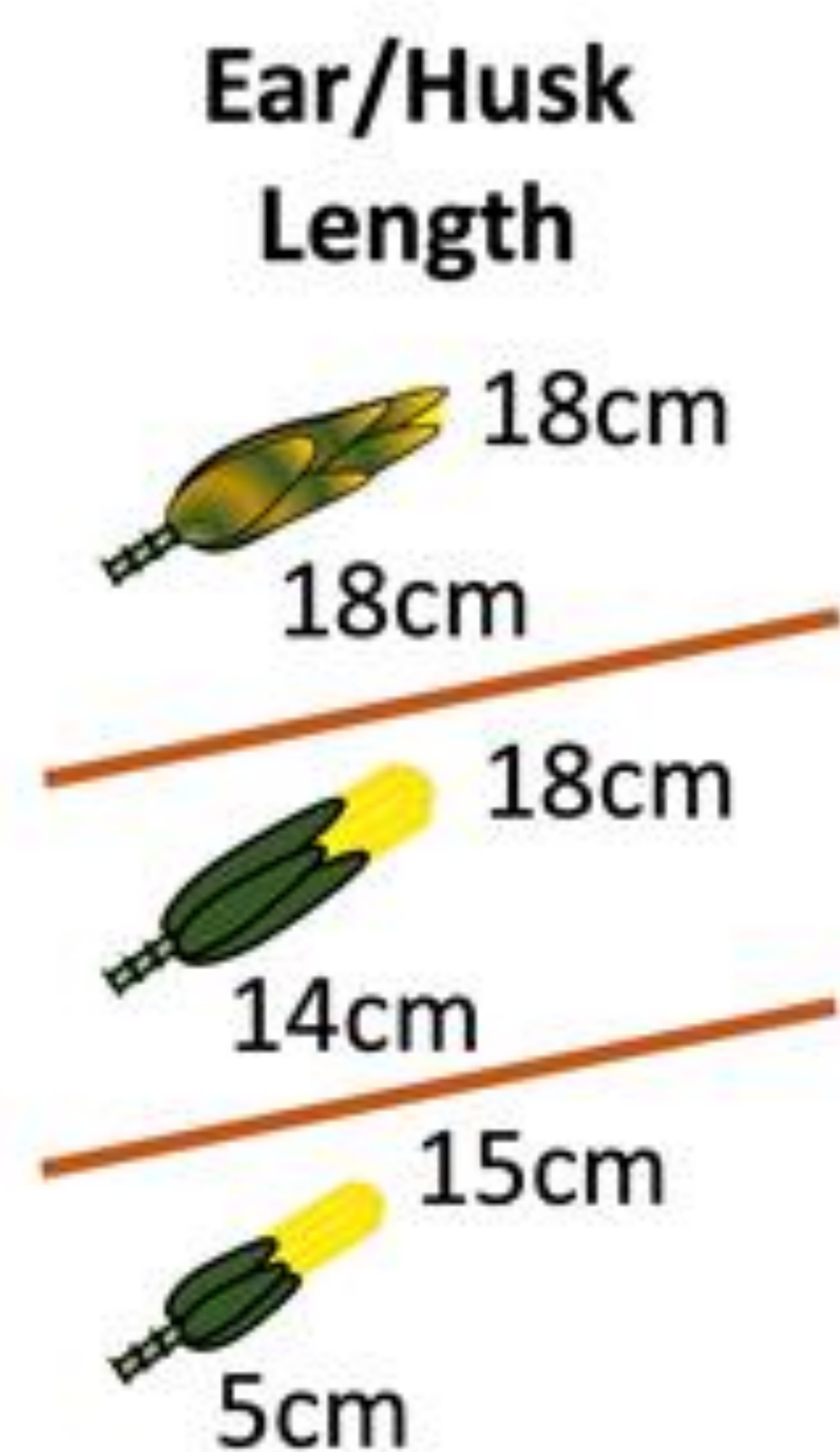
## Field Surveys, 2016

- 15 grower fields in Nebraska
- Multiple hybrids included
- 50-100 plants sampled per field
- Yields ranged 103 to 260 bu/Ac
- Up to 49% of issues

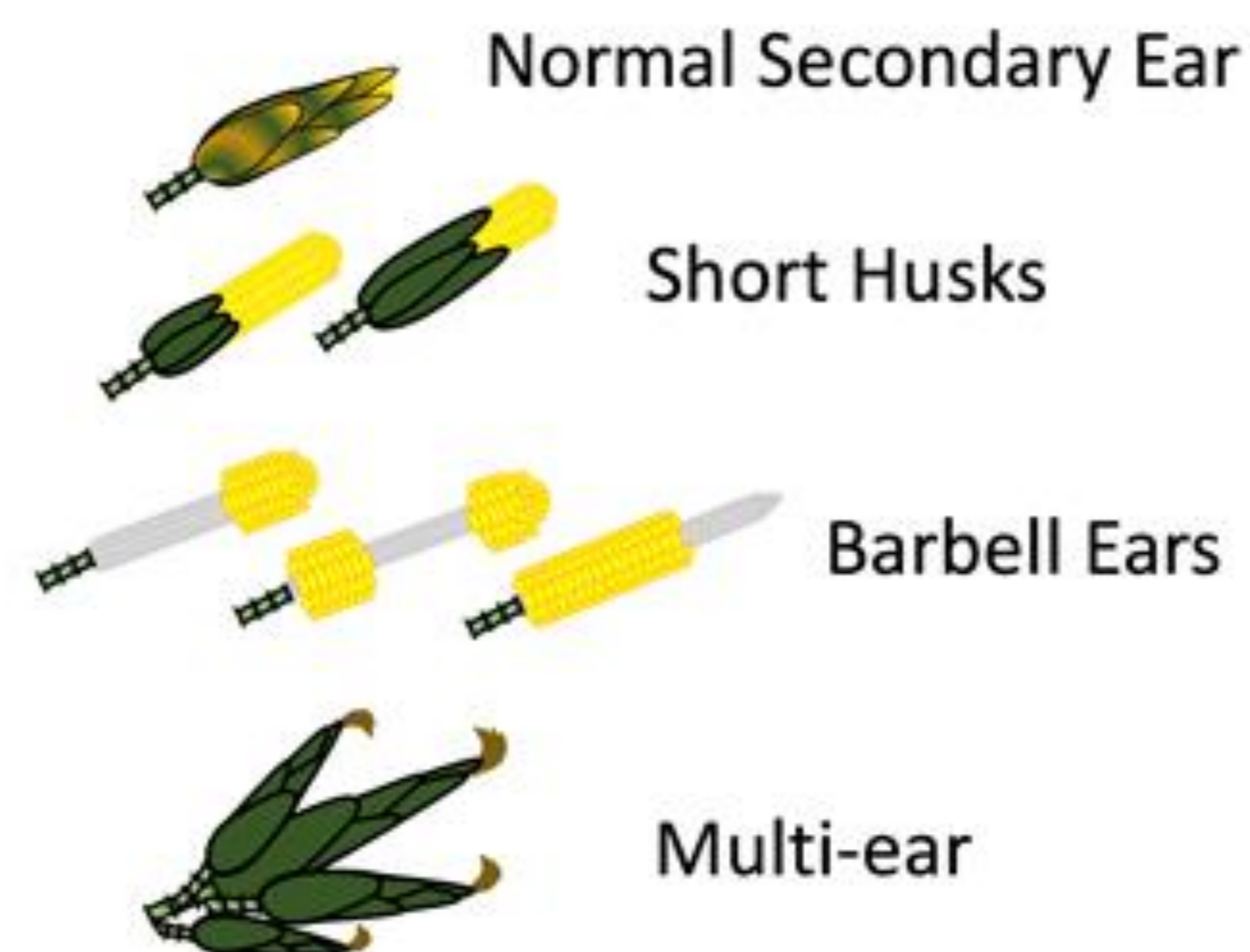


## Data Collection, 2016 through 2020

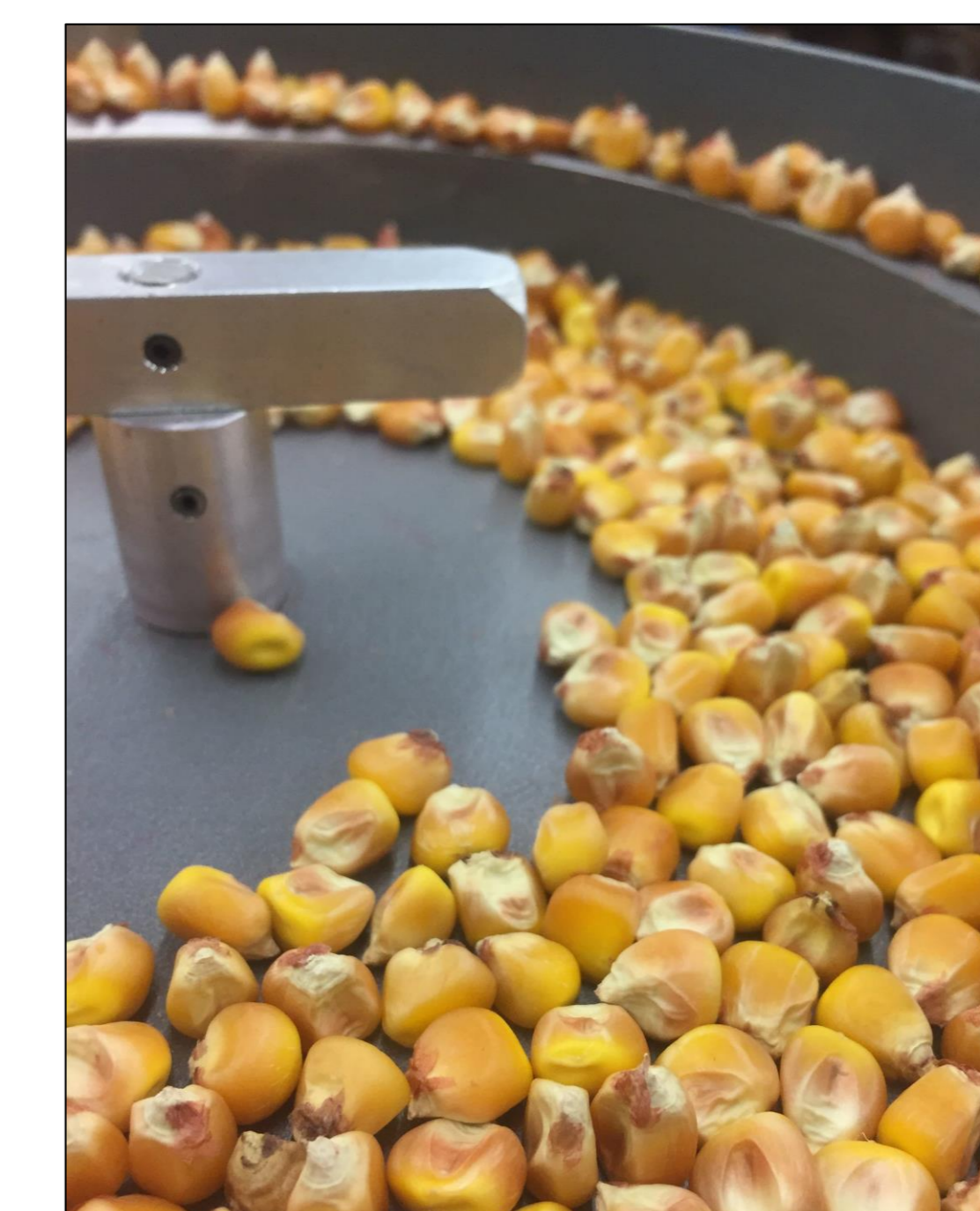
### Step #1 Plant Measurements



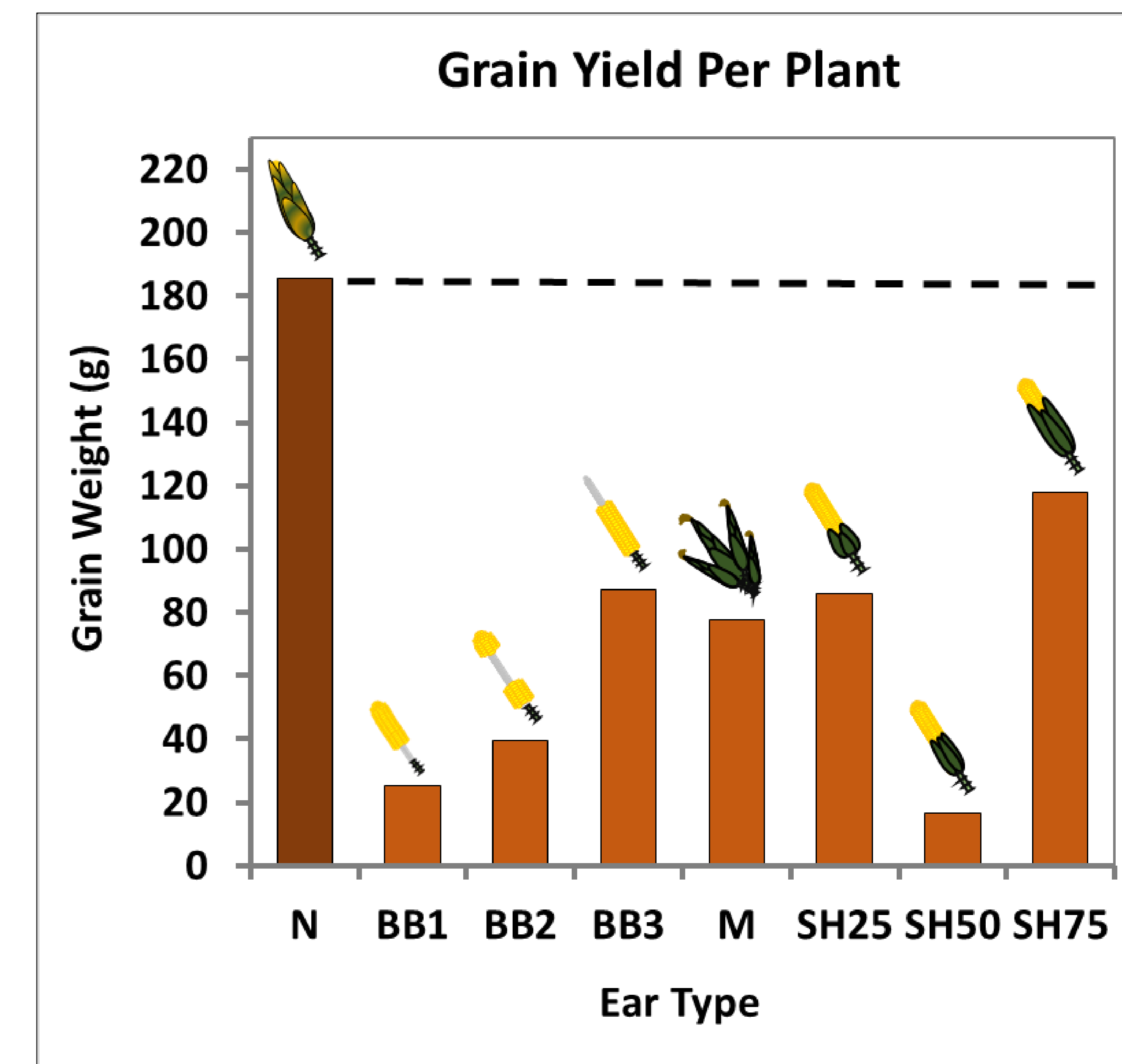
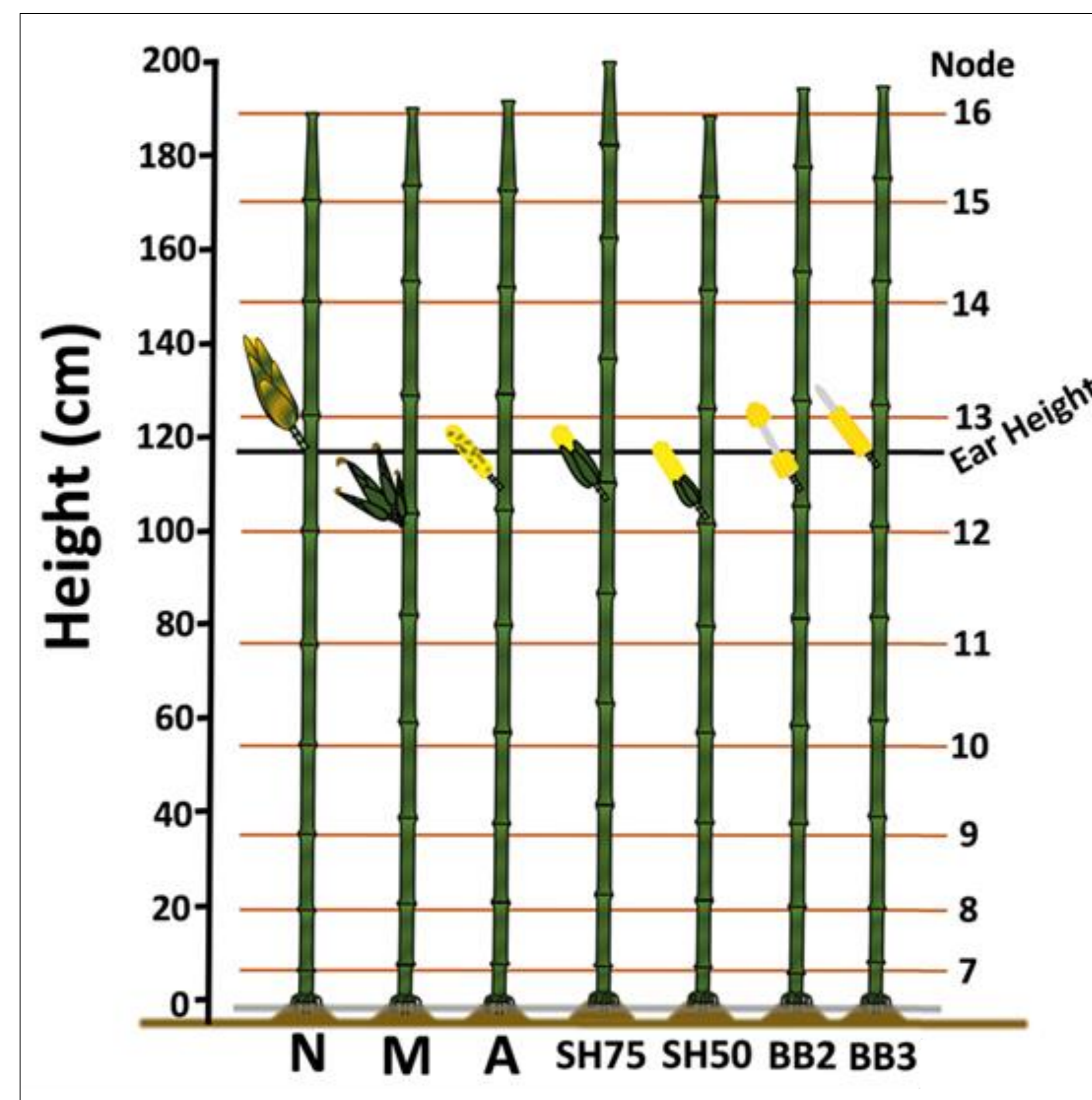
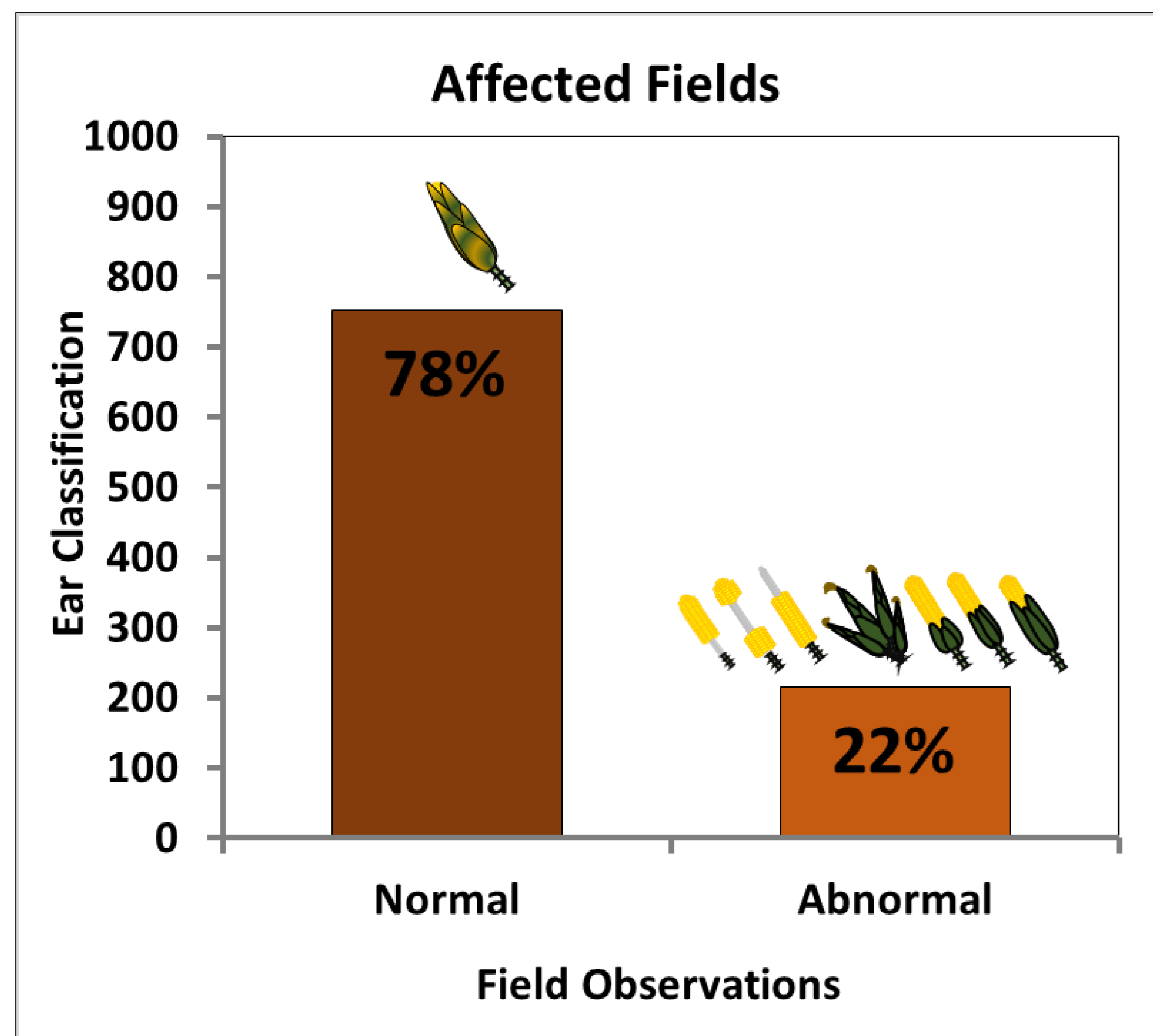
### Step #2 Ear Classification



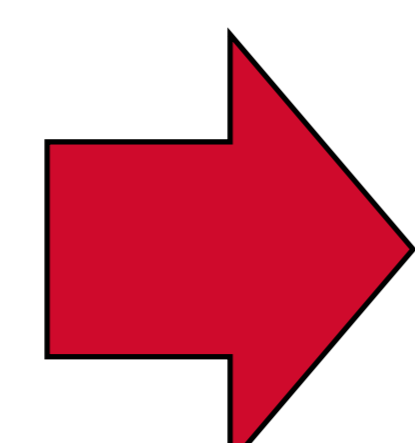
### Step #3 Yield Components



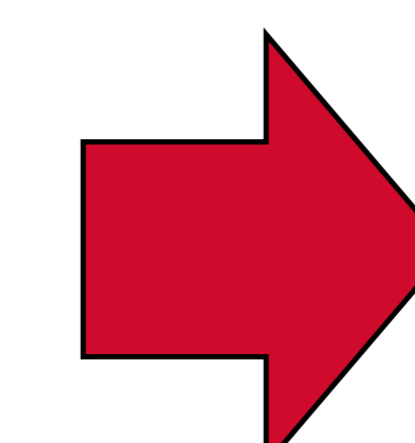
## Field Surveys, 2016



12 **affected** fields,  
**22%** of ear **abnormalities**



**Lower** ear placement  
for **abnormal** ears



**Lower** yield for **abnormal**  
ears, **35** to **91%** losses





## 2016 & 2017:

- Primary ear loss?
- Internode length?



## 2018 through 2020:

- Primary ear loss?
- Internode length?
- Sheath constriction?
- Hybrid specific?
- Weather stress?
- Ethylene levels?
- Seeding rates?
- Planting dates?
- Emergence timing?
- Ear placement?
- Solar radiation?

# Crop Production Clinics

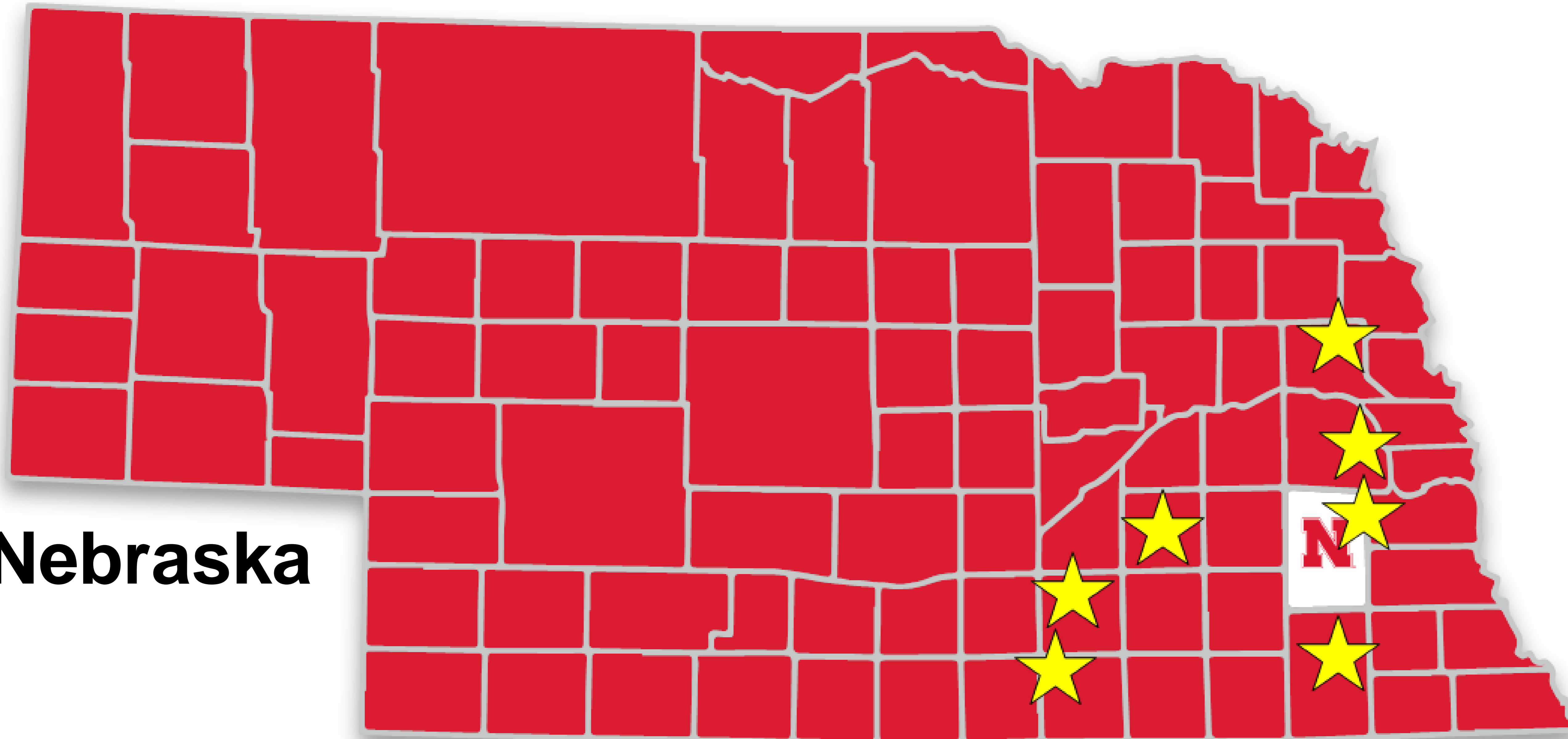
## Field Trials, 2018 through 2020

### UNL Farms (3):

HAVELOCK, Lincoln  
SCAL, Clay Center  
ENREC, Mead

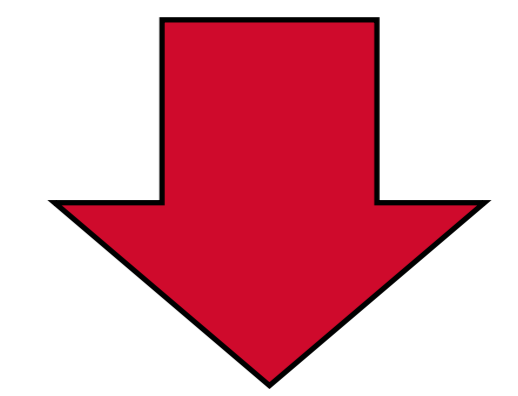
### Industry Trials(4):

Lawrence  
Hooper  
Filley  
York

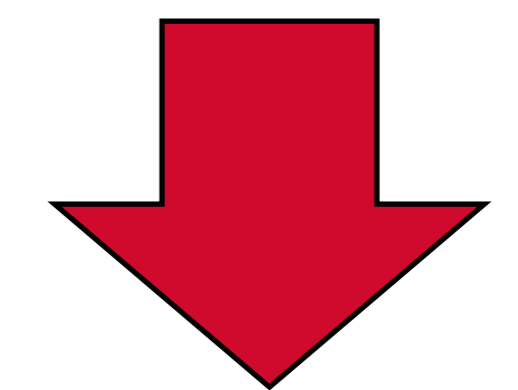


Nebraska

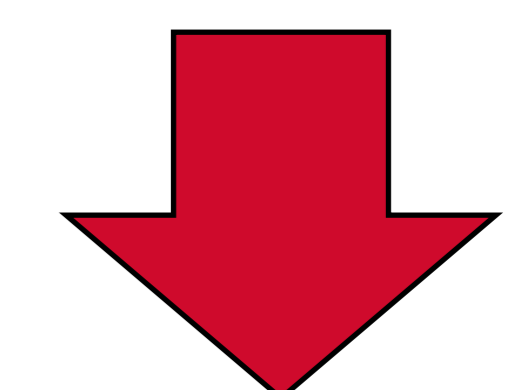
**Eight Hybrids**



**Four Planting Dates**



**Five Seeding Rates**



**Seven Hourly Plantings**

# Crop Production Clinics

## Locations (2):

South Central Agricultural Lab, Clay Center, NE

Eastern Nebraska Research & Extension, Mead, NE

## Planting

### Dates (4):

Mid/Late April

Early May

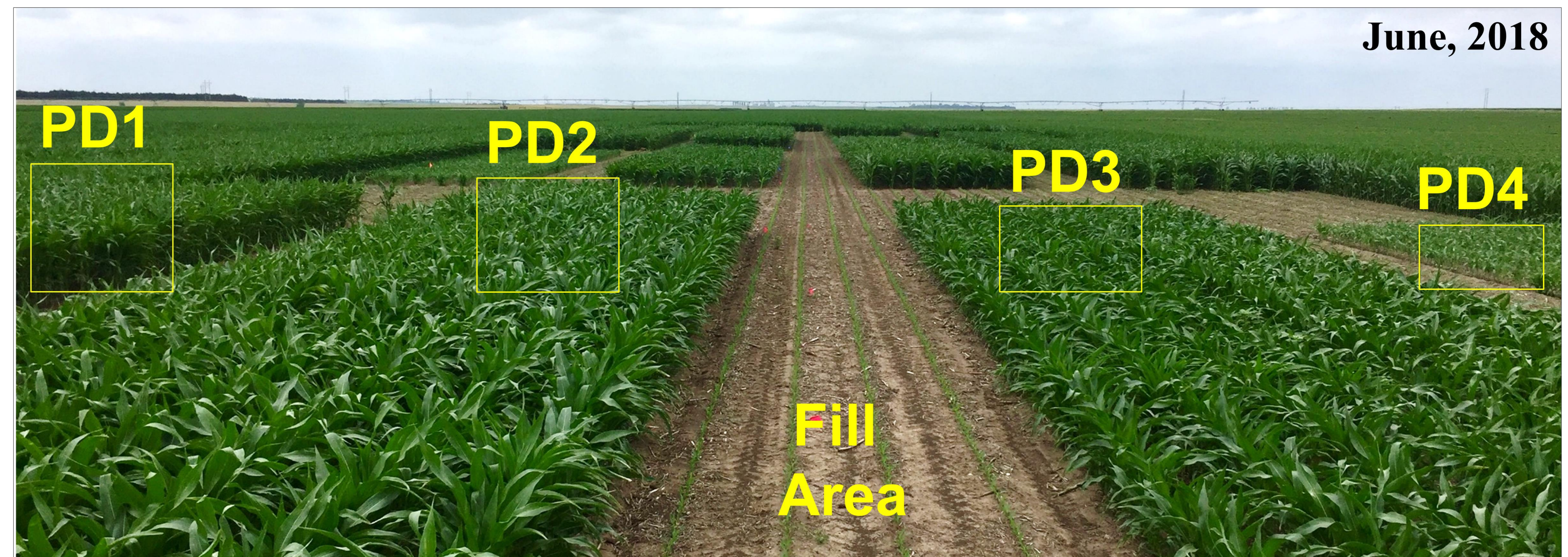
Mid May

Late May

### Hybrids (6):

Three Susceptible (racehorses) = yield varies

Three Checks (workhorses) = stable yields



# Crop Production Clinics

## Locations (4):

Lawrence, NE

Filley, NE

Hooper, NE

York, NE

## Seeding rates (5):

18,000 seeds/Ac<sup>-1</sup>

26,000 seeds/Ac<sup>-1</sup>

34,000 seeds/Ac<sup>-1</sup>

42,000 seeds/Ac<sup>-1</sup>

50,000 seeds/Ac<sup>-1</sup>

## Hybrids (8):

Four Susceptible (racehorse)

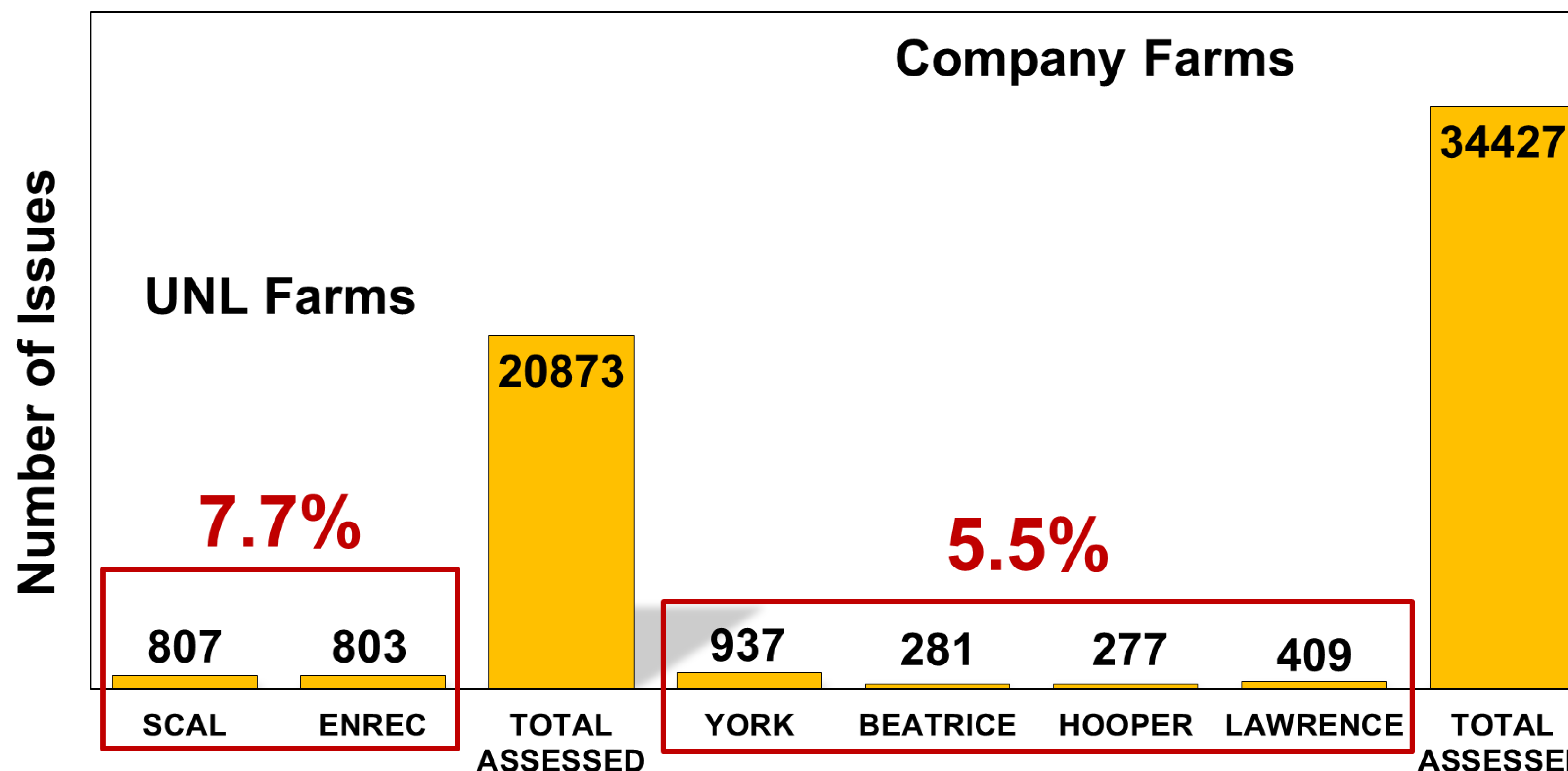
Four Checks (workhorse)



# Crop Production Clinics

## 2018: six fields summary

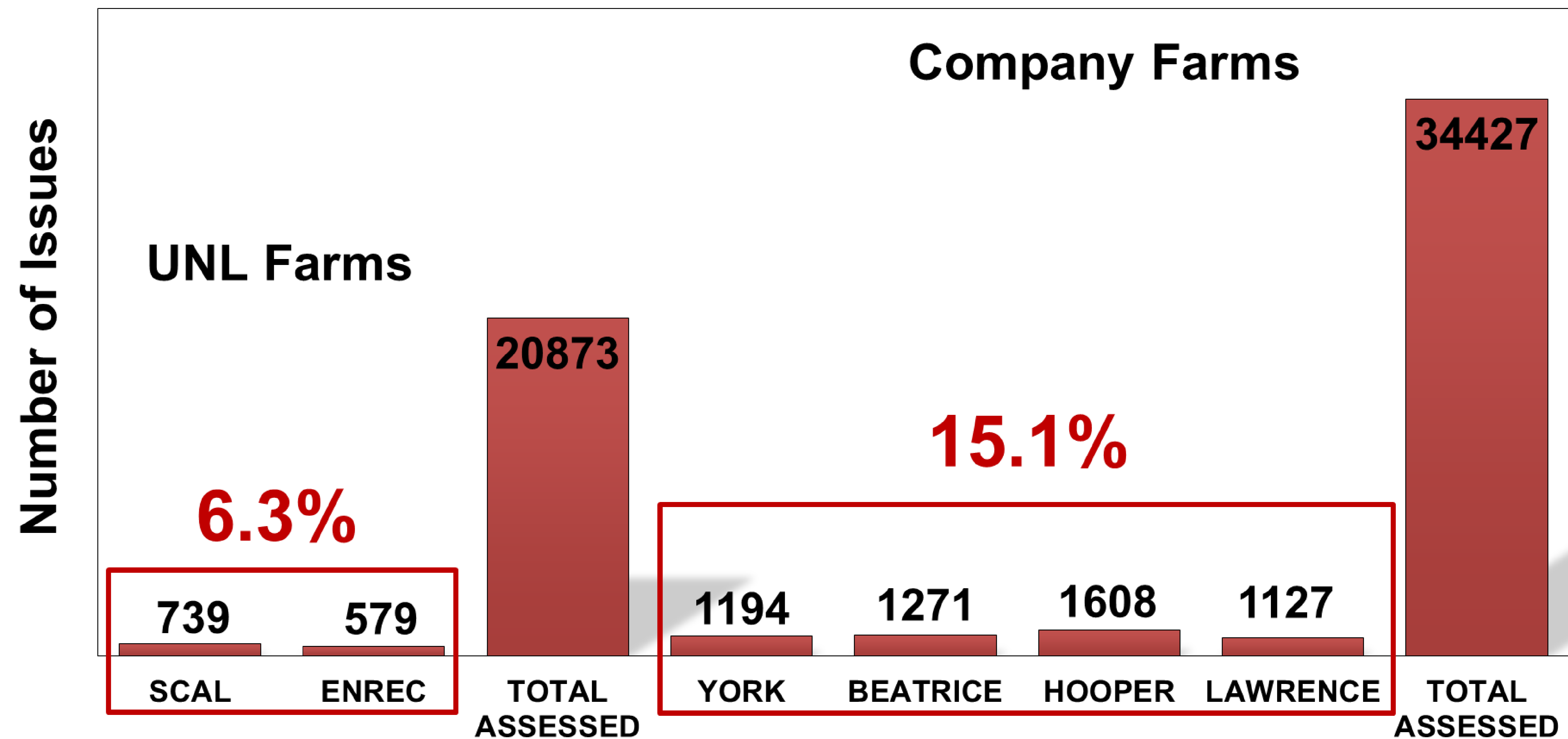
**About 7% of ear issues documented across fields**



# Crop Production Clinics

## 2019: six fields summary

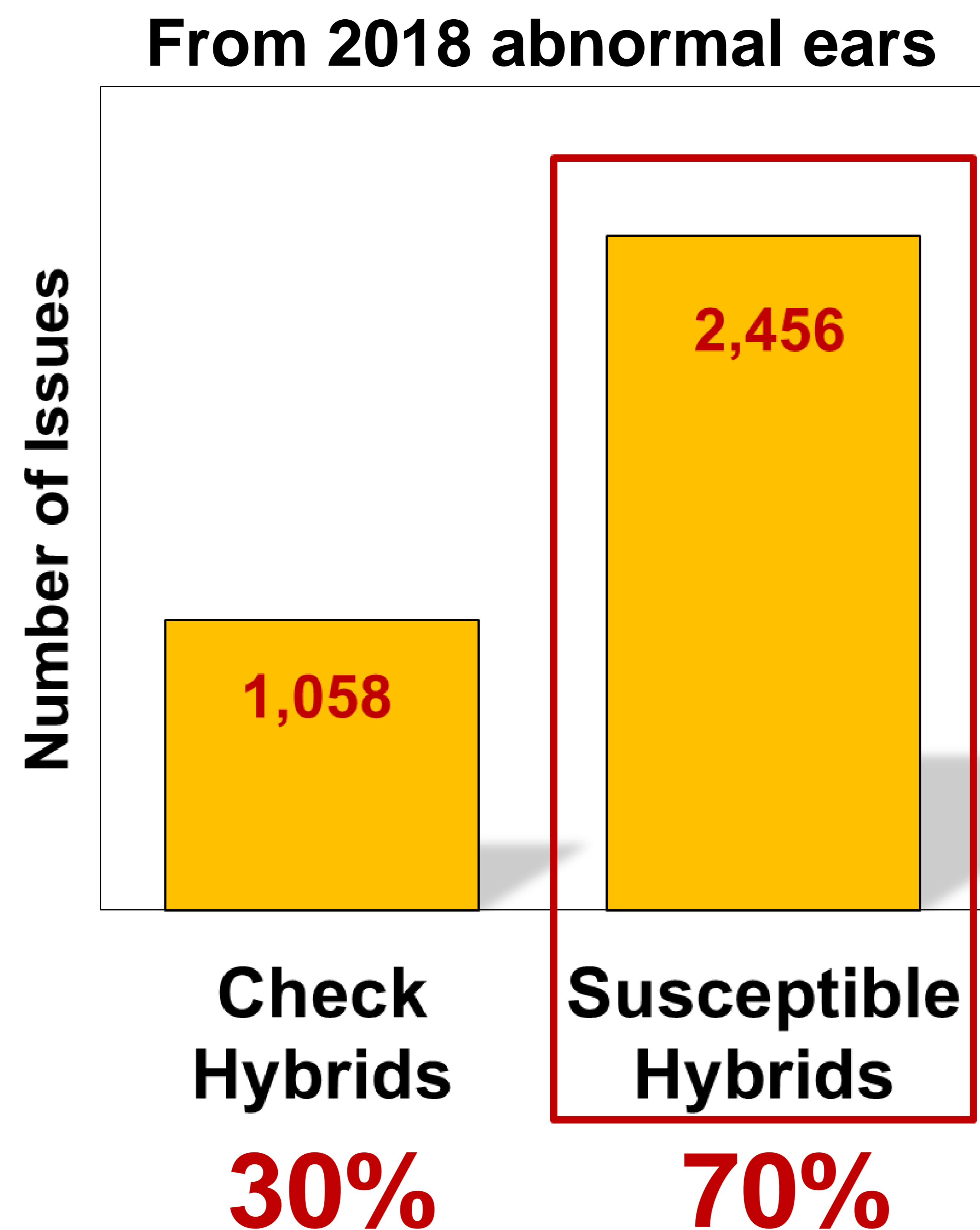
**About 12% of ear issues documented across fields**



# Crop Production Clinics

## Hybrids: check vs. susceptible

**More issues with  
susceptible hybrids,  
2016  
through  
2020**

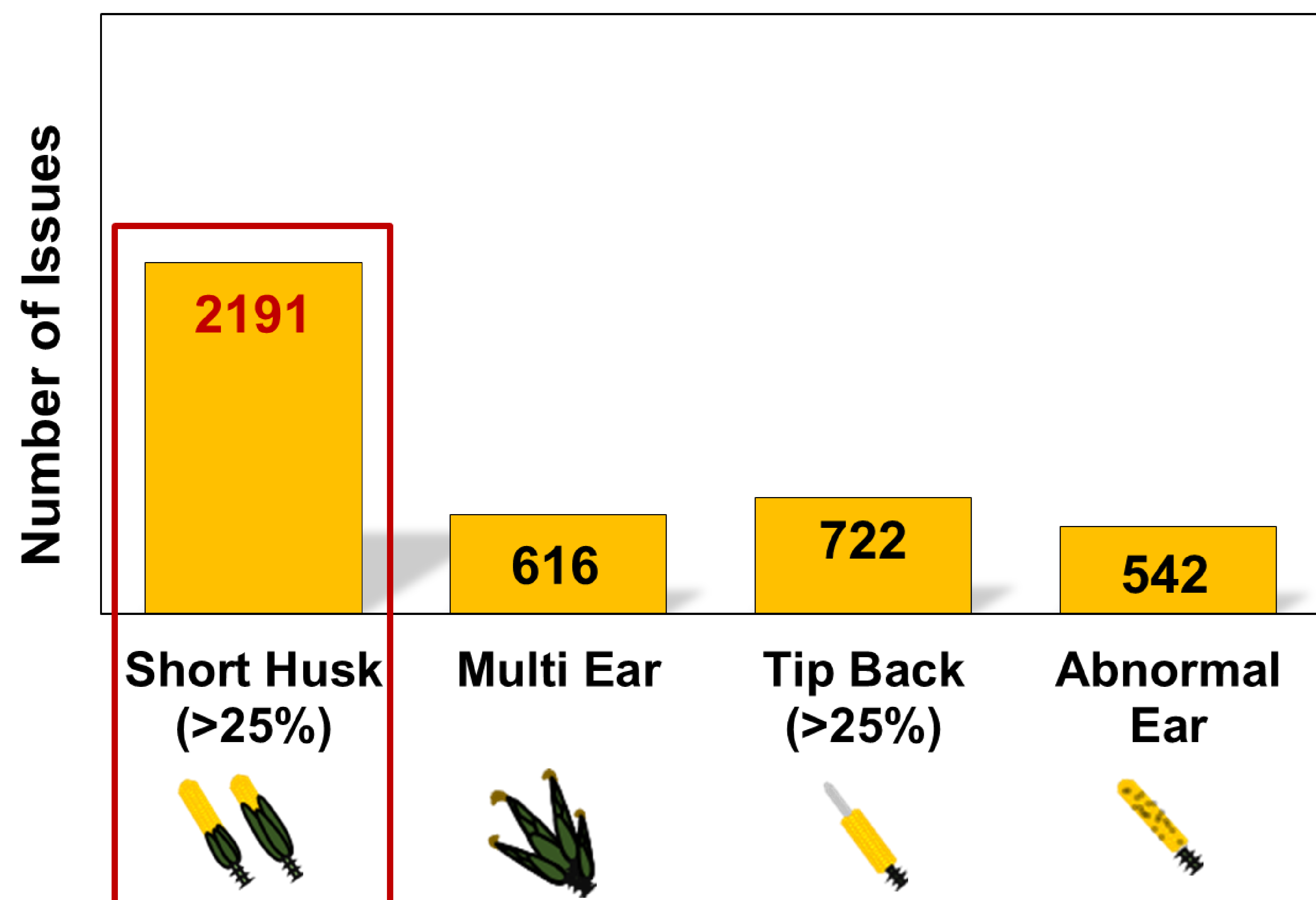


**Hybrids:**  
**Four Susceptible  
racehorse = yield varies**

**Four Checks  
workhorse = stable yields**

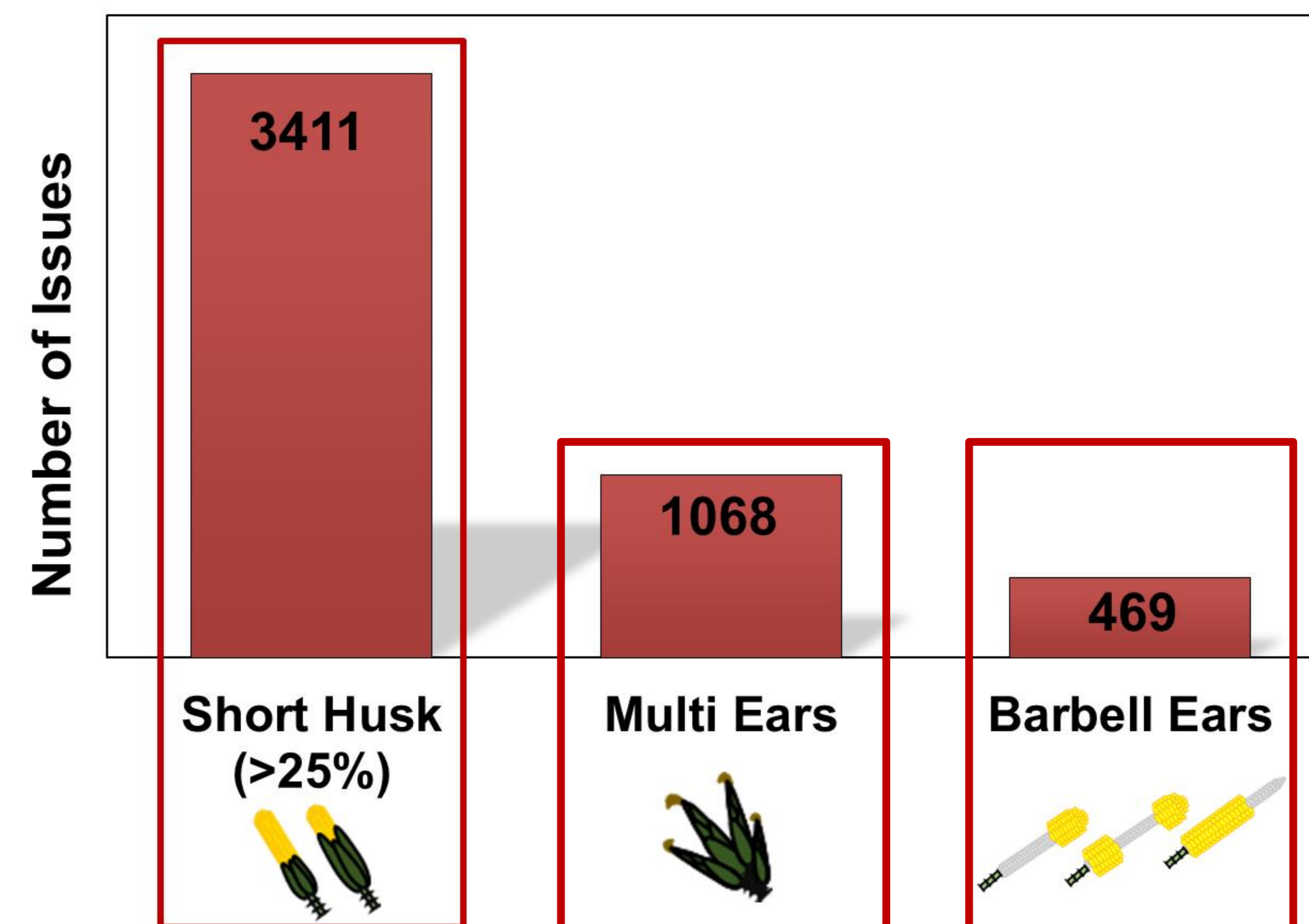
# Crop Production Clinics

## 2018: ear types



**Short husks** accounted for **54%** of the issues

## 2019: ear types

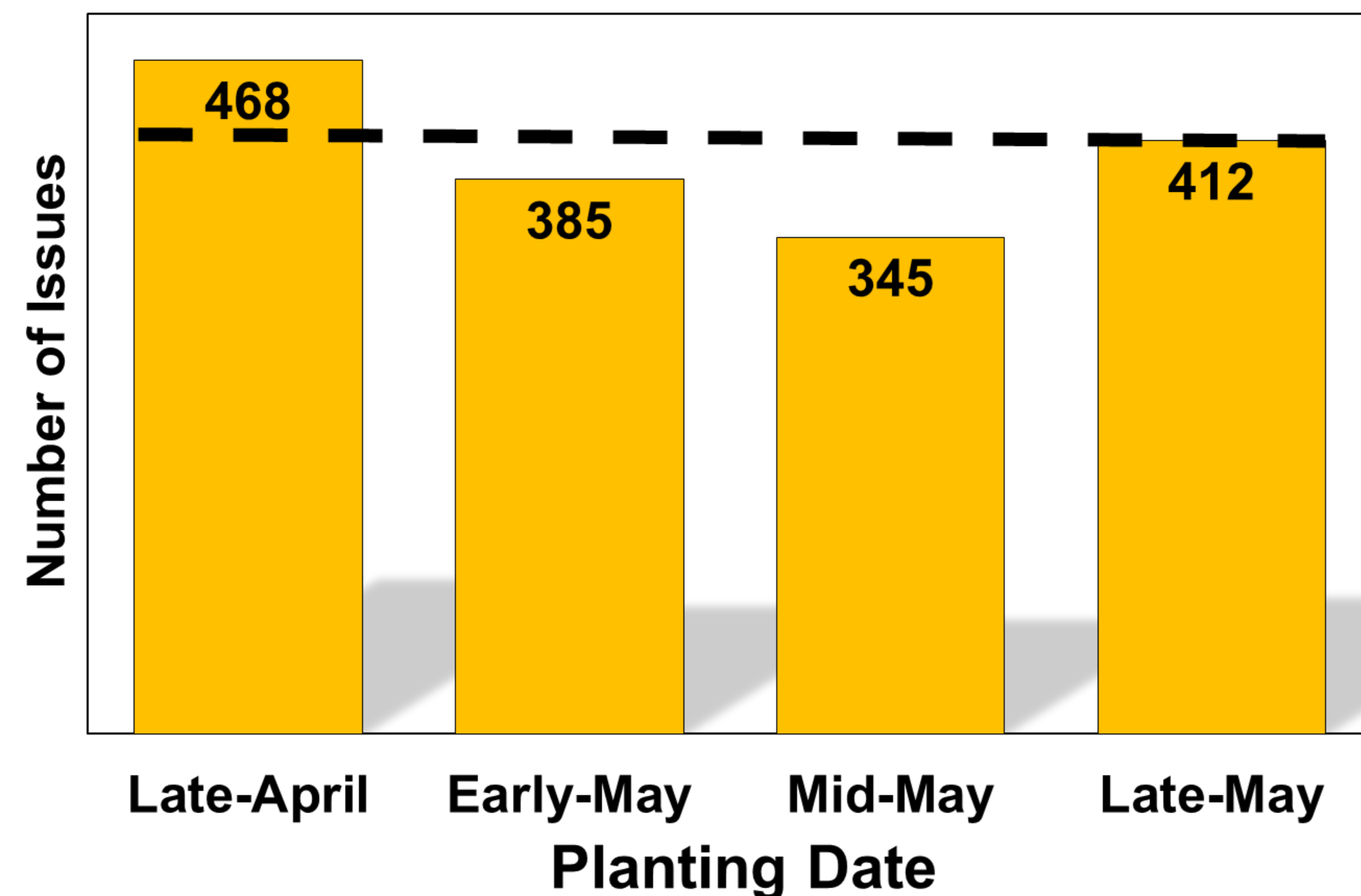


**Short husks**, **69%** of the issues  
**Multi Ears** increased by about **73%**  
**Barbell Ears** observed in 2019



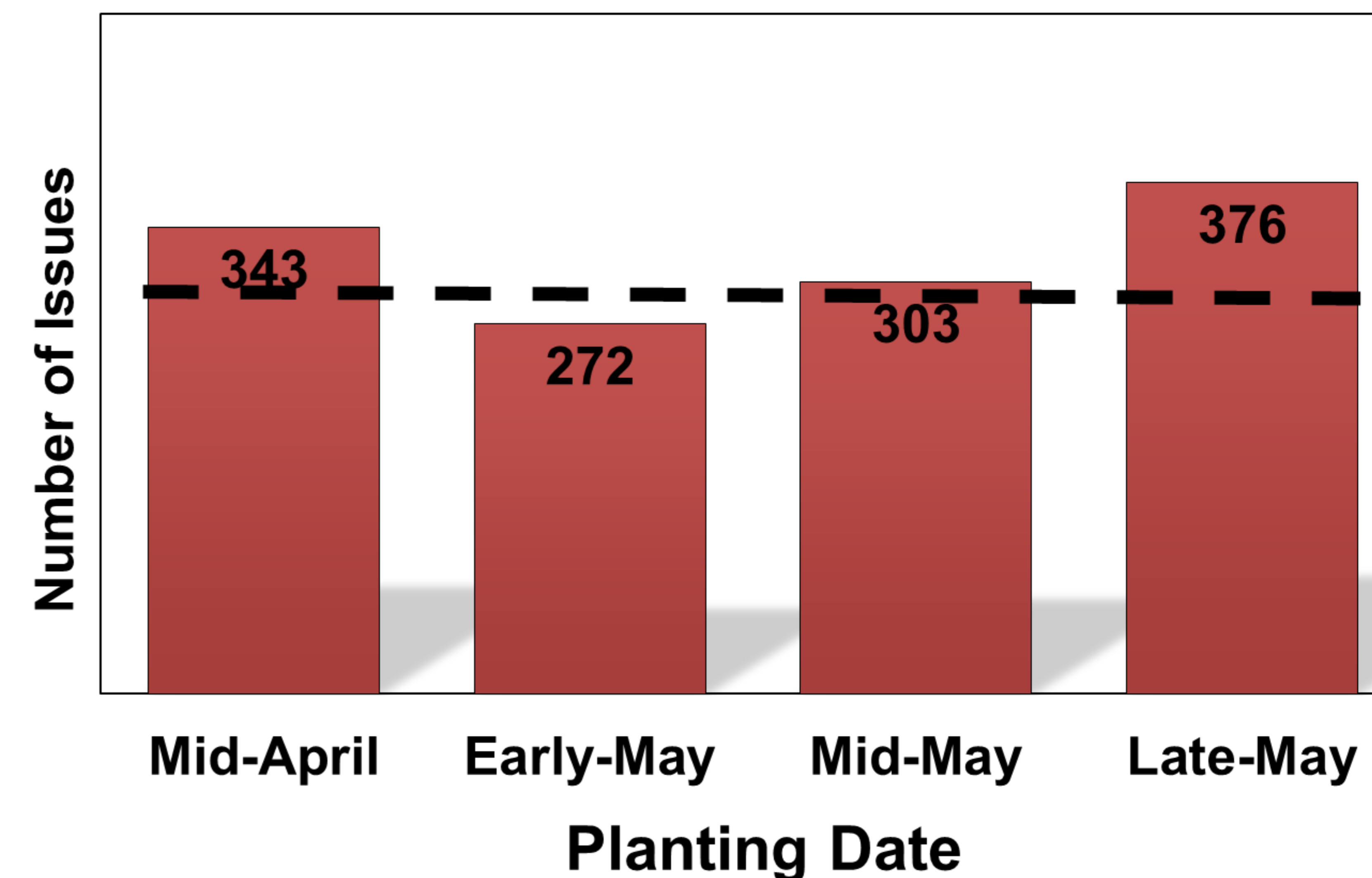
# Crop Production Clinics

## 2018: planting dates



Tendency to less issues with optimum planting dates, early and mid May

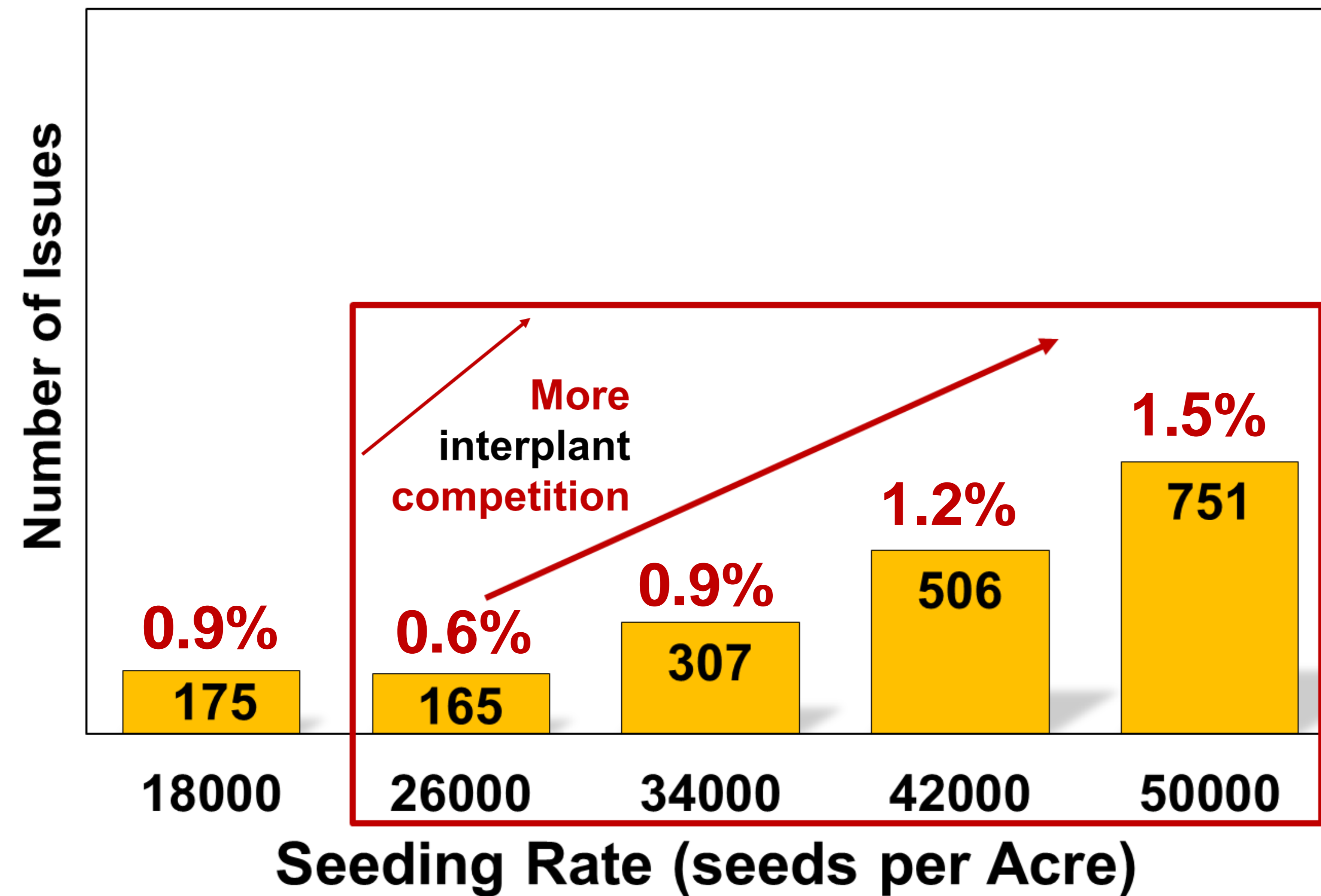
## 2019: planting dates



Tendency to less issues with optimum planting dates, early and mid May

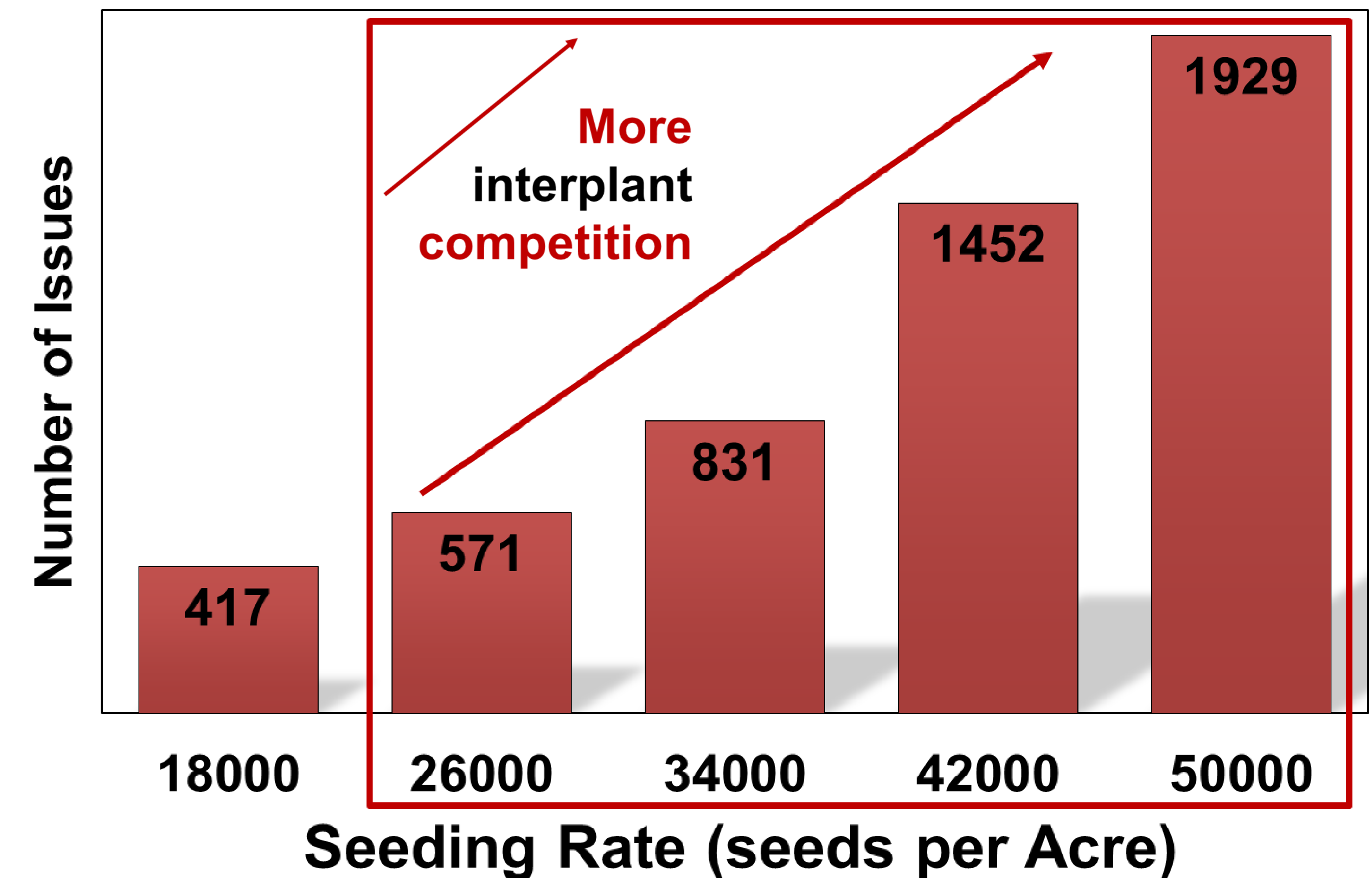
# Crop Production Clinics

## 2018: seeding rates



**More issues with** higher seeding rates  
(absolute and relative terms)

## 2019: seeding rates



**More issues with** higher seeding rates  
**More issues in 2019** (compared to 2018)

# Crop Production Clinics

## SUMMARY, 2016 through 2020

**Ear issues** decreased **grain yield**

**Lower** placement for **abnormal ears**

**Ear issues** found across **sites & conditions**:  
2016 (**22%**), 2018 (**7%**), 2019 (**12%**), 2020 (**%**)

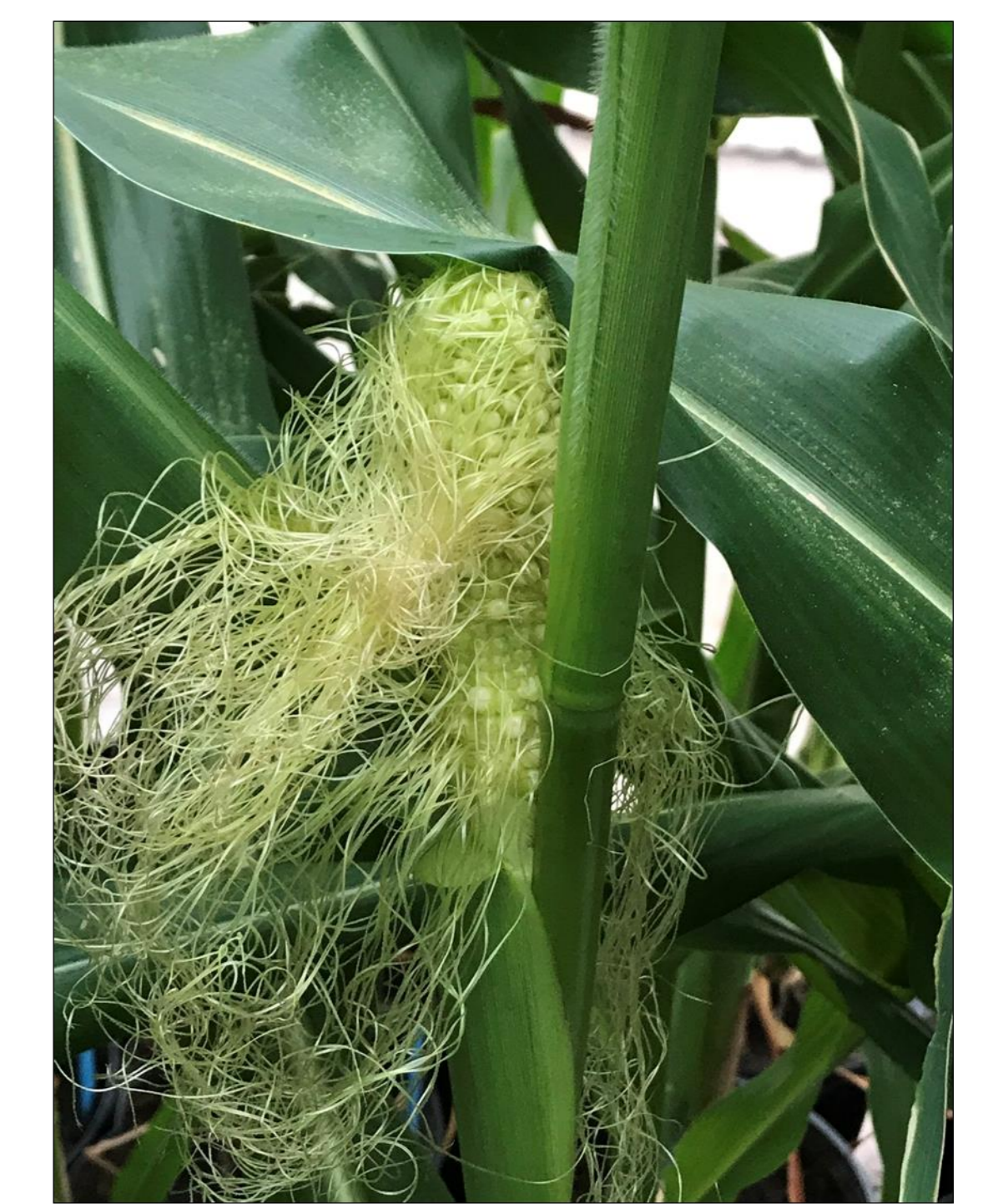
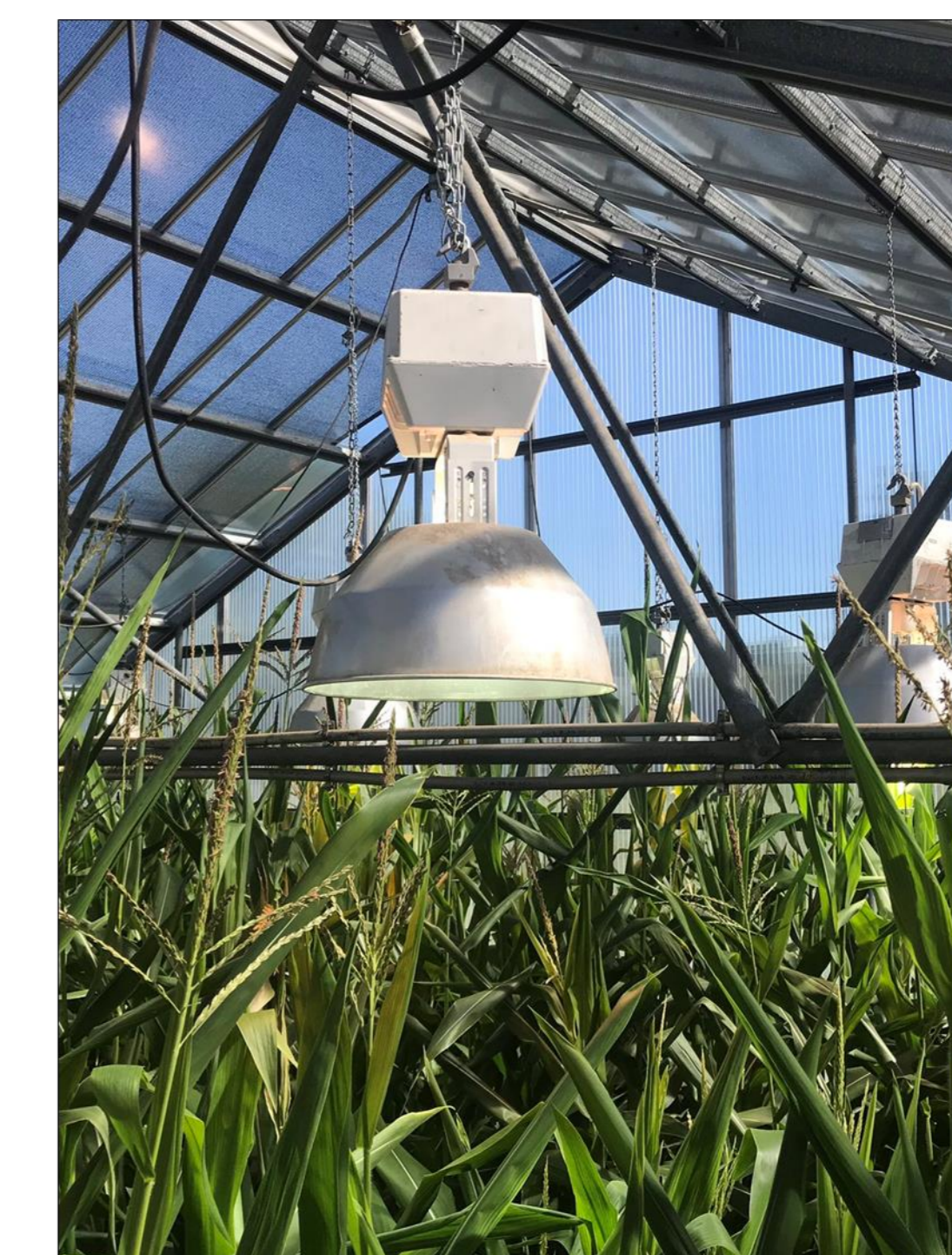
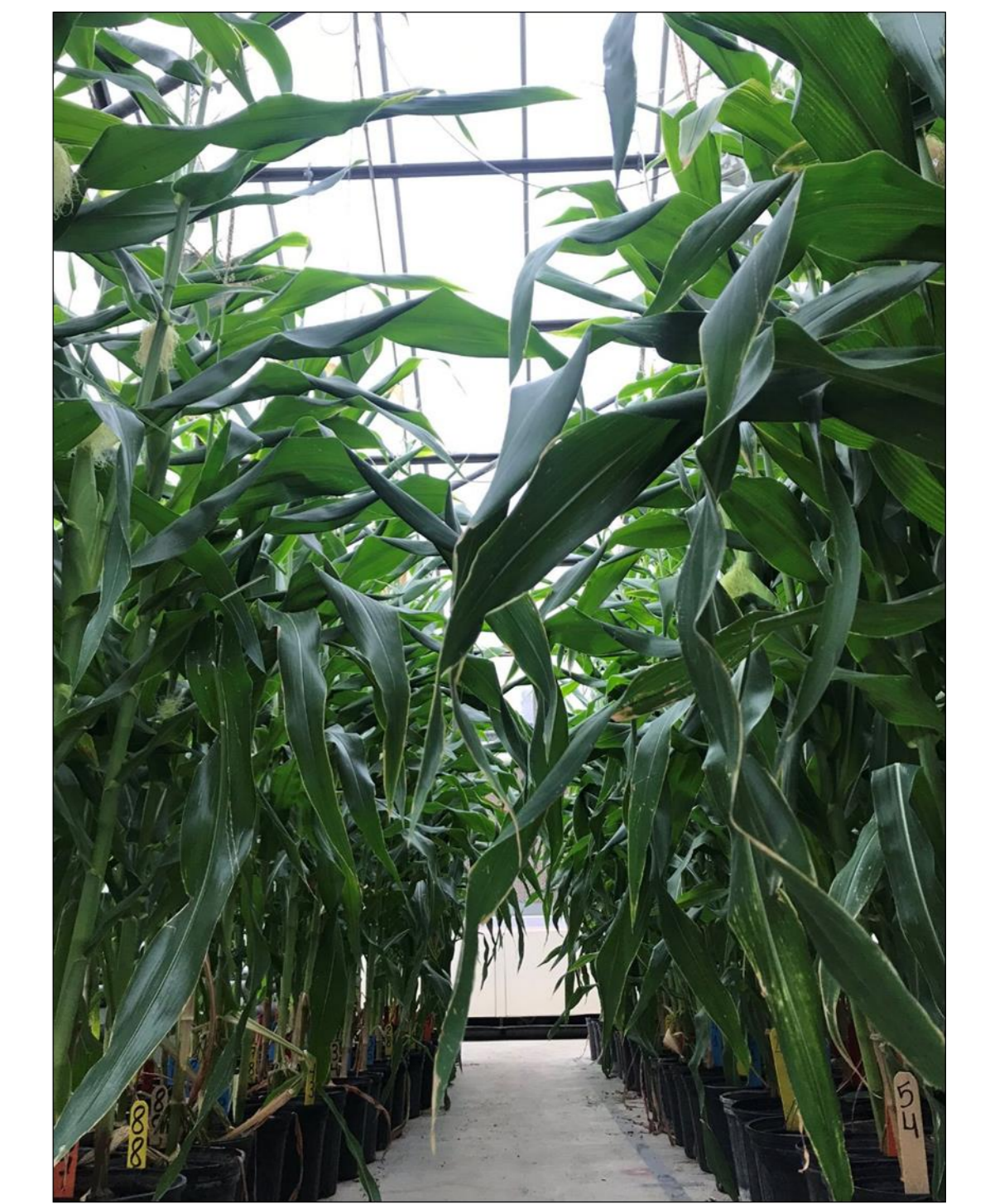
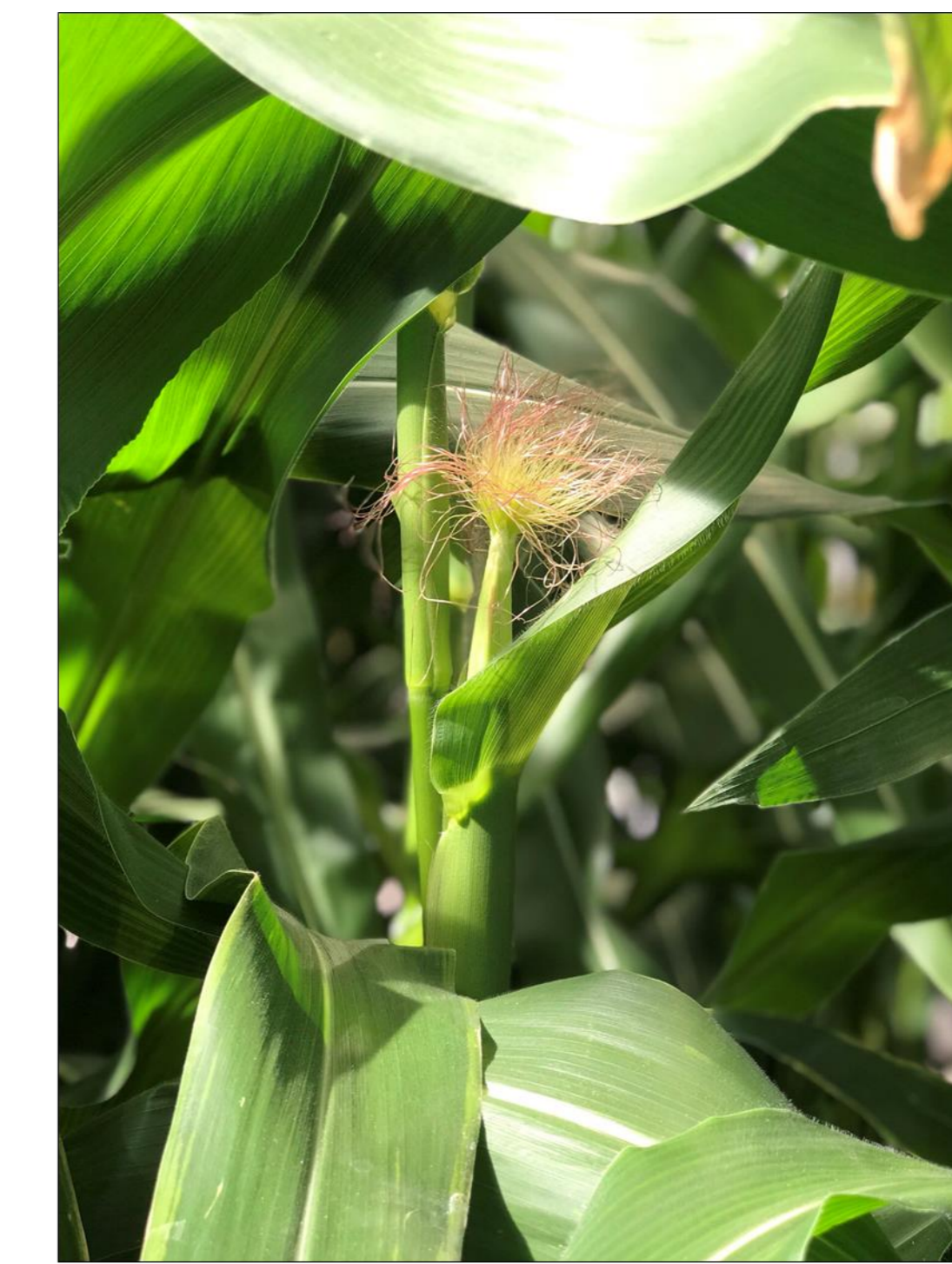
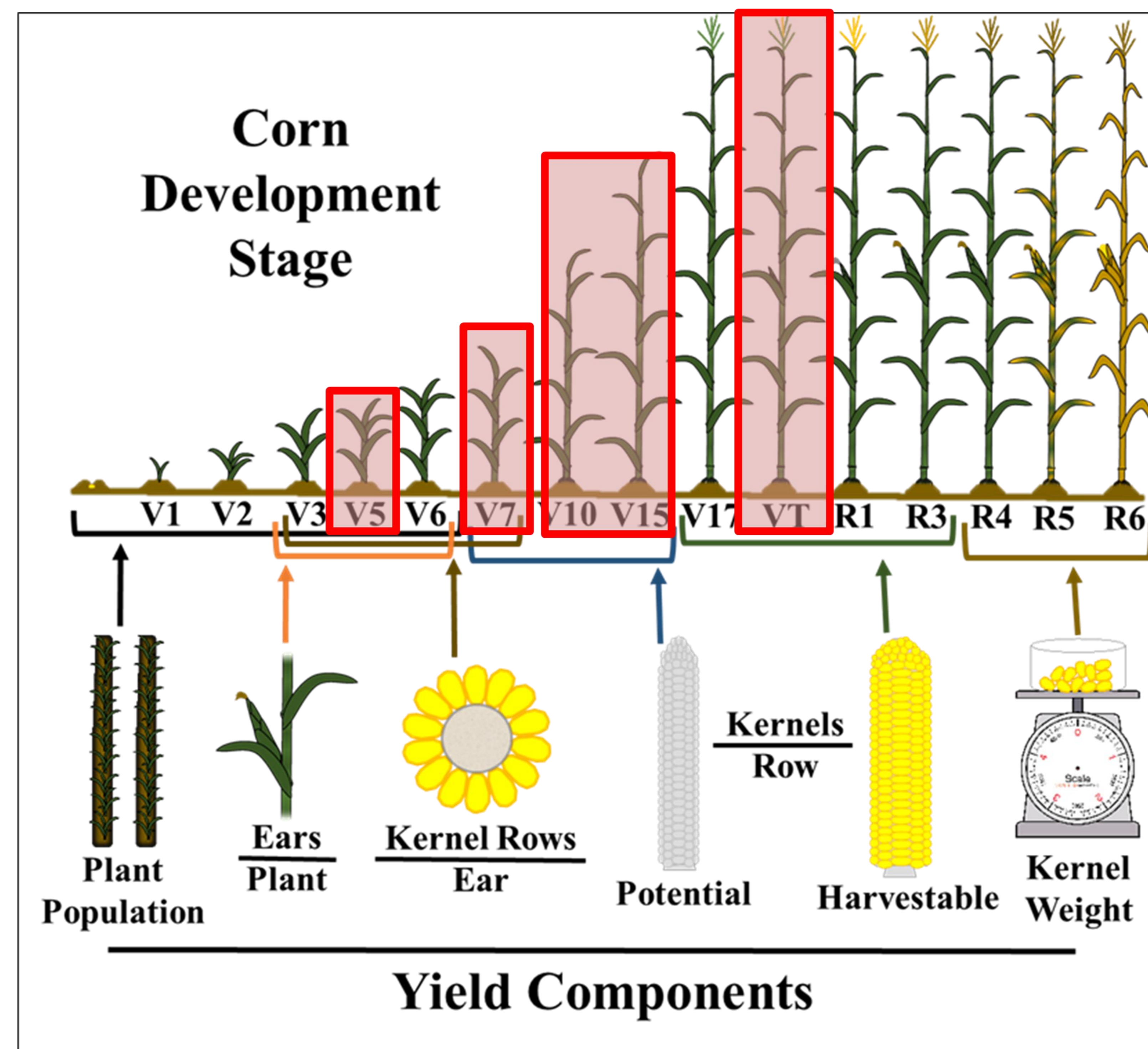
- **Susceptible hybrids** showed more issues
- **Short-husks** led the counts
- **Early & late planting dates** presented more issues
- **Higher seeding rates** resulted in more issues



# Crop Production Clinics

**Greenhouse trial added in 2020:**

**Hybrids | Timings | Temperatures | Growth regulators**

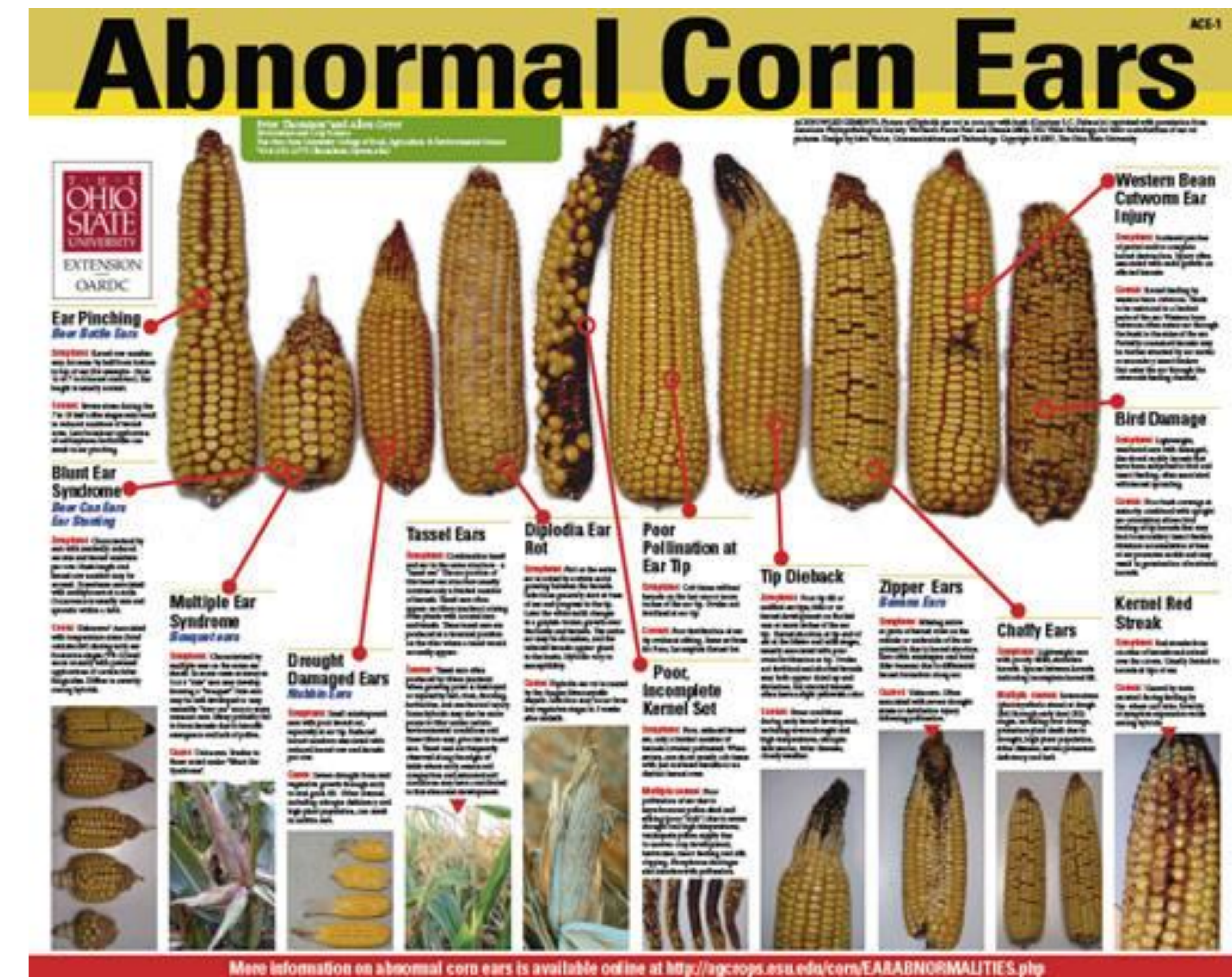


# Crop Production Clinics

## Take-Home Message

We can think that after **70+ years** of **basic understanding** of corn, it would be **understood completely...**

**...Not true!!!** Ear issues affronted in 2016 are **still present** in corn fields, **reducing productivity** and causing us to **continue investigating the causes**

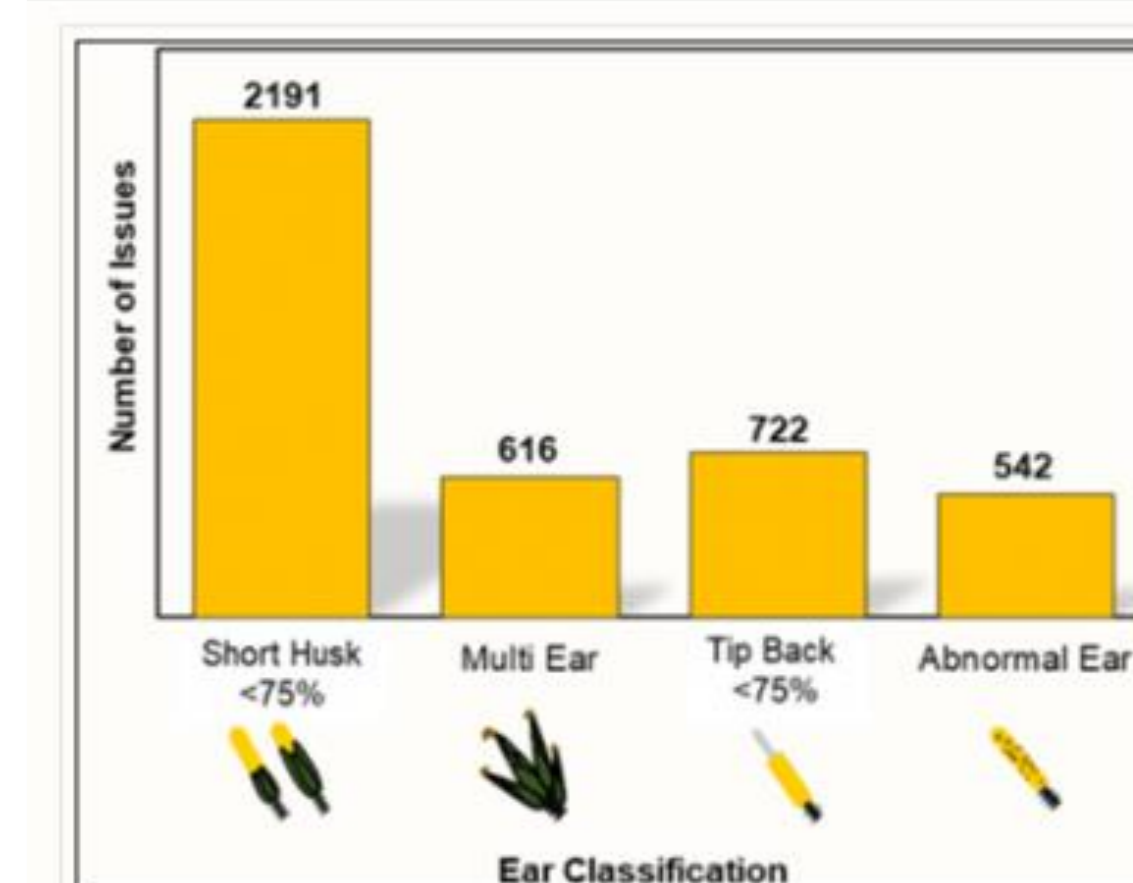
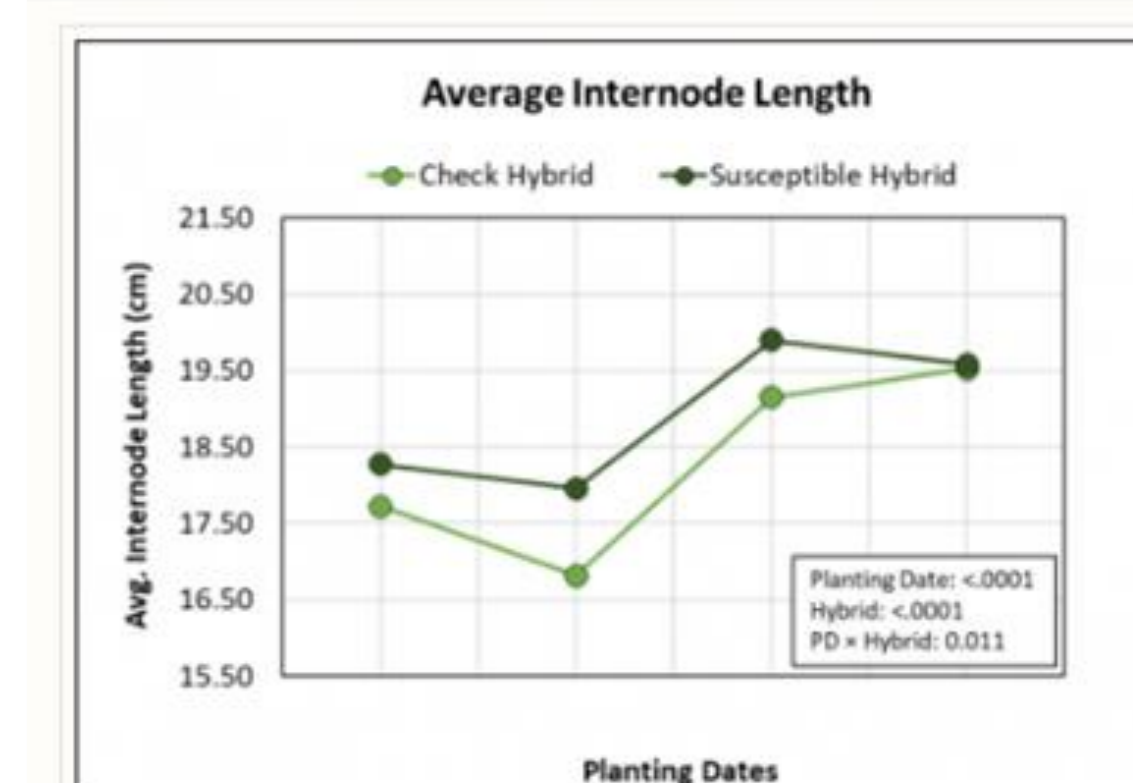


Source (2014): <http://corn.agronomy.wisc.edu/Management/L018.aspx>

# Crop Production Clinics

## Some resources available

- Nebraska Farmer: [Does planting date affect corn growth, ear issues?](#)
- UNL CropWatch: [Planting Date Impact on Corn Growth and Ear Issues](#)
- UNL CropWatch: [Corn Development from Studying Ear Issues](#)
- UNL Crop Management Conference Proceedings: [Corn Growth and development](#)
- North Central Integrated Pest Management Center: [Corn Growth and Development](#)
- UNL South Central Agricultural Lab Field Day Proceedings (pp. 8-9): [Ear Issues in Corn](#)
- UNL Crop Production Clinics Proceedings (pp. 27-29): [Corn Ear Formation Issues of 2016](#)
- UNL CropWatch: [Corn ear issues likely correlated with the loss of the primary ear node](#)



## Thank you Questions?

**Osler Ortez**  
**Ph.D. Student, Agronomy**  
[osler.ortez@huskers.unl.edu](mailto:osler.ortez@huskers.unl.edu)  
**Phone: (785) 370-9369**

