Thanks for joining!

**Hometown:** Hartville, Missouri  
**Background:** Family cow-calf operation  
B.S., Missouri State University  
Ph.D., Kansas State University  
**Dissertation:** Drivers, development, and impact of *tillering* plasticity mechanisms for *corn yield stability* in Kansas environments
Crop plasticity

**Definition:** crop ability to express different traits in different environments

- Natural characteristic (*adapt or die!*)
- Suppressed or removed through domestication
- Extent/expression differs by crop species

Plasticity types

Different characteristics in different environments

**Source:** energy accumulation

- Leaf number, size, shape
- Canopy architecture, branching

**Sink:** energy use

- Yield components
- Root structure
Corn tillers – both!

Historically called “suckers” (Lyon, 1905; Williams, 1912)

**Masked** through genetic selection (still observed in modern hybrids)

Generally **unstudied** with mixed yield reports and conclusions

Oddities pique interest

Greg Lyon
Adams, TN

Robert Brunel
Sainte Rose, MB

Benji Ellis
Statesboro, GA
Oddities pique interest

Dusty Rich
Earlham, IA

John Lopez
Italy, TX

Nathan Vander Schaaf
Okaton, SD

Today’s question

Are corn tillers good, bad, or just flat ugly?
Plant density dependence


Introduction
Field Studies
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The Bad
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Summary

Kansas corn production

Optimum plant densities vary seasonally
Reduced plant density dependence could be useful

Field Study Summary

Context for our results

Plot Structure

Treatments:
- Plant density
- Hybrid
- Tiller presence

10,000 pl ac\(^{-1}\)
17,000 pl ac\(^{-1}\)
24,000 pl ac\(^{-1}\)

P0657AM
P0805AM

Tillers intact
Tillers removed

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Tiller removal

Target stage: **V10** (tenth-leaf), by hand

- Avoid V12+ ear development
- Avoid regrowth

Trials (2019-2021)

Total sites: **17**
Trials (2019-2021)

Intensive sampling total: 7

Limited subsurface irrigation: 11
The Good.

Can tillers contribute anything positive?
What good could they possibly provide?

Effect of tillers on corn yield: Exploring trait plasticity potential in unpredictable environments

Rachel L. Veenstra, Carlos D. Messina, Dan Berning, Lucas A. Haag, Paul Carter, Trevor J. Hefley, P.V. Vara Prasad, Ignacio A. Ciampitti
Will tillers reduce yields? Not in our case!

Tiller effectiveness varies by environment.

Tillers could compensate for lost plants to a limited degree in our plots.

Does the number of tillers that develop matter?
Tiller presence did not reduce yield in evaluated environments or plant densities.

Tillers could produce ears and harvestable grain.

In favorable scenarios, corn tillers had plant density compensation potential.
Do corn tillers reduce whole plant reproductive efficiency?

**No**, tiller development had no impact on full HI.

### Field Studies

**The Good**

**The Bad**

**The Ugly**

### Summary

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- **The Ugly**
- **Summary**

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**Carbohydrates**

Corn stem is **storage organ**

Sugars stored in stems, **moved to ears** during grain fill

**Stem carbohydrates**

Indicates energy needs and internal plant balance

**WSC** = water-soluble carbohydrates
Carbohydrate reserves

Do tillers **increase** C reserves and can plants **use** that stored energy?

**Yes,** tillers increase WSC reserves with added stems.

WSC buffering is **agronomically** significant:
1) increased standability
2) stabilized kernel weights.

**Yes,** we found evidence that WSCs were moving from tillers to main ears. *(70s study too, and P in the 80s)*
The Bad.

What about all the extra leaf area?
Can you predict how my tillers will yield?

Happy plants? A disaster?
Common Concerns

Yield
Water
Nutrient use
Harvest index
Water
Tassel ears
Predictability
Water

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Common Concerns

Yield

Our studies showed no reductions in yield **JUST** because tillers were present.

This does **NOT** mean yield reductions could never happen.

Our 17 sites give a strong case that we should not **ASSUME** yield reductions if tillers are present.

**Tillers? Don’t panic.**
Common Concerns

Harvest Index and Nutrient Use

Our studies showed no significant impact on harvest index *JUST* because tillers were present. Again, this may not *ALWAYS* be the case. Agrees with previous research that demonstrated carbohydrate and nutrient *movement* from tillers to main stalk.

Tillers? Don’t panic.

Common Concerns

Water, water, water

Site context:
- 13 to 22 in
- <100 to 200+ bu/acre

2022 plots might have performed differently...
Common Concerns

Water, water, water

More tillers = more leaf area = more transpiration?

Alternative planting geometry

• More humidity in canopy
• Extending soil water
• Clumped plants = fewer tillers

At which point do tillers hurt more than help? Or is the plant just “dead” at that point?

Common Concerns

Tassel Ears and Predictability

How to predict tassel ears?
How to prevent tassel ears?
How to predict tiller yields?

Good questions – not much information available.
The Ugly.

Ever heard of tassel ears? Now THOSE are ugly.

Where were the observed yield increases coming from?

High **kernel numbers** were the most closely associated component.

**More ears = more kernels**

Ear **type** was also important.
Ear Type

Primary Ears
- Yield drivers *(why density is key)*

Secondary Ears
- Form of plasticity *(in a good year)*

Tiller Axillary Ears
- Typical-looking ears on tiller stems *(harvestable)*

Field Studies

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Ear Type

Tiller Tassel Ears
- Atypical, ugly, and confused mixes of ear and tassel *(NOT harvestable)*

Male/female flower abortion process is disrupted during development.

Field Studies

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**Ear Type**

**Tiller Tassel Ears**
- Atypical, ugly, and confused mixes of ear and tassel (*NOT harvestable*)

Our analysis showed no detectable yield penalty with tassel ears – very surprising!

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**Ear Type**

**Yield Environment**

**Relative Yield Contributions**

- **Low**
  - Primary
  - Secondary
  - Tiller Axillary

- **Mid**

- **High**

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**Introduction**

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**Summary**
Ear Type

Tiller ears have less direct competition than secondary ears would.

Adding more shoots – mimic of adding to plant population.

To-Go Box

Three key points to remember.
Key points

1) Tillers did **not** reduce corn yields in any of our trials. *(doesn’t mean it can’t happen)*

2) Environment impacted the **number** of tillers and the **performance** of those tillers.

3) Tillers **increased** energy reserves and these reserves could move throughout the plant.

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Thanks for having me!

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#TillerQueen