

High Yield Corn: It's about paying attention to detail

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The folks who set the yield bar...

NATIONAL 2018 Winners Guide COORN VIE CONTEST





Average yields over time for nonirrigated and irrigated winning entries





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Can we learn anything from the NCYC winners guides?

- Hybrid brand or hybrid number
- Hybrid traits
- Seed treatment
- Harvest population
- Rates of N/P/K

- Insecticide
- Herbicide
- Fungicide
- Planter
- Combine





Apparently, equipment color is important...





Data adapted from annual published NCYC summaries

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Disclaimer: This is a tongue in cheek slide!

Some argue that you need aggressively high plant populations to achieve record-winning high yields.

Well, maybe you do...

...or maybe you don't!

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Grain Yield vs. Reported Population

Top 3 winners each NON-IRRIGATED class, 2007 - 2018





Some argue that you need aggressively high N rates to achieve record-winning high yields.

Well, maybe you do...

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Video © RLNielsen, Purdue Univ.



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Grain Yield vs. Reported N Rate

Top 3 winners each NON-IRRIGATED class, 2011 - 2018





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So, what is the common thread among national corn yield contest winners?

A Few Legends:

Herman Warsaw Francis Childs David Hula Randy Dowdy



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Options for increasing yields

- 1. Blindly shoot at the target and hope it works
- 2. Throw the entire kitchen sink at the problem
- Approach the challenge from a thoughtful agronomic perspective





Tips for a Winning Program

- Improve your agronomic knowledge
 - Never stop the learning process
- Identify, locate, and diagnose important yield limiting factors
 - Early crop diagnostics are usually more successful than "post-mortem"
- Make sound agronomic decisions based on facts and data... not based simply on logic...





Critically evaluate what you read, see, and hear



Mark Twain, ca. 1907. Library of Congress, Washington, D.C. LC-USZ62-112065

"It ain't what you" don't know that gets you into trouble... It's what you know for sure that just ain't so."

- - attributed to Mark Twain



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High-yielding corn requires...

...a uniform, healthy crop canopy capable of intercepting and utilizing no less than 95% of the incoming solar radiation by the time the crop flowers **AND** throughout the rest of the grain filling period.

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That fact gives me something to aim for.

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Building the solar canopy...



... begins with agronomic choices made prior to planting (crop rotation, tillage, soil drainage, hybrid choice, etc.) and continues through to the end of the growing season.





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Simply put, the goal is to optimize the four individual components that contribute to yield

Plants per acre

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Ears per plant

Kernels per ear

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Weight per kernel

Because yield is the product of the season-long development of the individual components of yield...



...achieving high yield requires minimizing stress all season long.

Successful germination, emergence, & stand establishment set the stage

Season-long development of yield components



Germ. and	Stand
emergence	establishment

The success or failure of stand establishment largely determines the final harvest population... unless you replant.

Health & uniformity of the stand by V6 has large impact on future potential growth rates & tolerance to stress.

Sucessful stand establishment relies on..

Excellent seed quality * Excellent genetic seedling vigor * Seedbed and soil free of crust or compaction * Seed & seedling protection from insects or diseases

Sufficient soil nutrients & pH * Error-free seeding * Adequate & uniform seed2soil contact * Adequate & uniform soil temperature and soil moisture

* Things you can control



Rapid Growth Period

Shortly after V5, a healthy corn field "turns the corner" and its growth rate begins to accelerate as it enters the rapid growth period (RGP).

- Above ground
- Below ground
- Reproductively



Potential ear size (# of ovules) is determined during the RGP

Season-long development of yield components



Image source: Somewhere on the Internet

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Severe stress during RGP...

...can directly reduce yield potential by limiting the potential number of kernels (ovules) on the developing ears (no. of rows or no. of ovules per row). Conversely, minimal stress from ~V6 to ~V14 favors large potential ears, especially ovule # per row.

Perhaps more importantly...

- Severe stress during RGP can reduce yield potential later by stunting the potential size of the photosynthetic "factory" prior to pollination and thus limiting the potential photosynthate output during pollination and grain filling.
 - Incomplete pollination success
 - Abortion of young kernels
 - Low kernel weights





So, certainly makes sense...

...to minimize the risk of severe stress during the rapid growth phase that would significantly decrease photosynthesis.

- Excessively wet or dry soils
- Significant competition with weeds *
- Root-limiting soil compaction *
- Significant nutrient deficiency *
- Significant herbicide injury *

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Things you can contro

Pollination and subsequent 2 to 3 weeks determine actual # of kernels...

Season-long development of yield components



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Silk + Pollen "nick" is crucial, especially for tip silks. Post-silk stress can easily cause kernel abortion.

Pollination can fail due to...

- Persistent silk clipping by insects, esp. CRW
- Silk emergence delay due to drought stress
- Absence of pollen
- Desiccation of exposed silks due to heat & low humidity
- Excessively cloudy weather

- Herbicide injury to the developing ovules or tassel
- Severe photosynthetic stress in general





Kernel abortion

 Young, developing kernels often abort in response to severe stress during blister and early milk stages of kernel development.



 Symptoms are shrunken, white or yellow kernels, often with a visible yellow embryo.



Kernel abortion occurs primarily in response to severe reduction of photosynthesis

Severe heat or drought Severe nutrient deficiency Severe leaf disease Leaf loss due to hail Excessively high population * Excessively warm nights during or shortly after pollination Consecutive cloudy days during or shortly after pollination-

* Yield limiting factors you can control.

Grain filling completes the story...

Season-long development of yield components

		Potential # of rows & kernels	Actual # of		Dry weight
Productive # of plants		per row	kernels per ear		per kernel
		A			
Germ. and emergence	Stand establishment	Ear size determination	Success of pollination	Kernel survival	Grain filling

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Kernel black layer (R6) "closes the book" on further dry matter accumulation by the kernels.

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Light-weight kernels result from inadequate photosynthesis from R3 (milk) to R6 (maturity) Excessive drought & heat Corn borer damage * **Defoliation by hail** Severe leaf disease * Severe nutrient deficiency * Early onset of stalk rots Killing frost prior to maturity

* Yield limiting factors you can control

The secret to achieving higher yields in the future is... figuring out why you're not achieving high yields now...

...in other words, identifying & mitigating Yield Limiting Factors (YLFs) specific to individual fields

Image © RLNielsen, Purdue Univ



If you fail to identify and diagnose those yield limiting factors...

...then some of your agronomic decisions will "miss the mark" and you either waste \$\$ on inputs or leave yield "on the table" or both.





The search for yield limiting factors...

- Requires agronomic knowledge / skills.
- Takes time and is often difficult.
- Identifying YLFs is important because we should not be spending \$\$ on solutions for problems we don't have!





Successfully identifying YLFs involves walking fields, scouting for problems, and taking extensive notes throughout the entire growing season.





Source of graphic: Nielsen's imagination



As-applied maps pinpoint equipment issues



Yield maps can be road maps to problem areas in a field

 Yield (Dry)
 Image: Constraint of the second sec

Grain Harvest | 2010 | P

Map 3 Layers

Helps us focus on specific problem areas

Maximum	7 5 15.55 60/0
Average	/ 100.33 bu/a
Total	/ 2,996.6 bu
Area	/ 29.87 ac
Length	/ 86,923 ft
Count	/ 17234

Screenshot from Ag Leader SMS Advanced v18.5

Aerial images can also serve as "road maps" to problem areas in fields



Red-NDVI, 17 July

Both help us focus on specific problem areas

Aerial images often good mirrors of yield



Grain yield map, 16 Oct



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Screenshots from DroneDeploy and Ag Leader SMS Advanced v18.5

Aerial imagery has its advantages over yield maps

 Spotting problem areas earlier in the season enables more accurate crop diagnostics

 High resolution of UAV imagery detects problems not likely detected by yield maps

Some YLFs to consider...



Improve soil drainage where needed and feasible

- Improved drainage reduces the risk of...
 - Ponding & saturated soils
 - Soil nitrate-N loss due to denitrification
 - Soil compaction from tillage, planter, & other field equipment operations
 - Cloddy seedbeds from tillage of wet soils
- Enables successful root development and stand establishment of the crop



Some YLFs to consider...

Poor soil drainage Hybrid performance is a HUGE consideration

Hybrid 1

Cold, wet, crusty, and otherwise crappy conditions after planting

"Glad that's not my field" © Purdue Univ, RLNielsen



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Do not underestimate the importance of this seemingly simple decision...

Thoughtful hybrid selection can easily add 20 to 30 bu/ac to your bottom line. Pay attention to hybrid characteristics that relate to stress tolerance. Look for hybrids that consistently yield well across a wide range of growing conditions (i.e., stress tolerance).

Some YLFs to consider...

Poor soil drainage Hybrid performance Soil compaction from tillage operations or repeated heavy equipment traffic





Soil compaction

 Risk of soil compaction goes hand-in-hand with poor soil drainage plus large & heavy field equipment.

 Compaction makes poor drainage even poorer and saturated soils last longer.

- Soils most vulnerable to compaction when soil moisture is near field capacity.
- Compaction limits rooting depth and, subsequently, crop resilience to stress.

Some YLFs to consider...





Do your fields need sulfur?



Corn & Sulfur

 Sulfur (S) deficiency is more common today than 30 years ago because of cleaner air



- Yield response to applied S fertilizer can be as high as 20 to 40 bu/ac in some fields
- However, only 9 of our 22 field scale trials since 2017 have shown yield responses
- So, not every field needs S fertilizer



Consider conducting a simple onfarm sulfur trial with us in 2020



Focus on the fundamentals

- We all need to sharpen our focus on the agronomic fundamentals of growing corn.
- There are no "silver bullets" or "one size fits all" solutions to improving corn yields.
- Use today's technologies to supplement your agronomic decision-making, not replace it.

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Timely agronomic information

the Chat 'n Chew Cafe

The Chat 'n Chew Cafe

Agronomy

Timely Agronomic News & Information for the U.S. Corn Belt

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Corny News Compendium

Topic Areas

General information

Hybrid selection

Planting date, replanting

Plant populations, seeding depth

Stand uniformity, planter maintenance

Soil fertility & plant nutrition

Growth staging

Early season problems

Mids Available at...

Corny News Compendium

O ne of the great characteristics of the Web is its ability to serve as a repository of historical information that is accessible at the click of a mouse. These Corny News Network (CNN) Archives serve as a repository for the agronomic articles published by yours truly at the <u>Chat 'n Chew Café</u> since 1995, with some additional others written by some of my colleagues here at Purdue. There is value to preserving these articles because the problems and issues they speak to repeat themselves in corn fields somewhere every year. Even though you may not have seen a particular problem before, chances are that I have during my nearly 40 years of walking corn fields.

The articles are grouped by topic areas in the sidebar list to the left on large screen devices or by clicking the menu icon in the upper

> the topic of rowse.

www.kingcorn.org/cafe

"Some problems are so complex that you have to be highly intelligent and well informed just to be undecided about them. -- Laurence J. Peter



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"Always do right..... This will gratify some people and astonish the rest." — Mark Twain

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