

In This Issue:

- From South to North: Indiana's Corn Progress Update
- Is Short-Stature Corn More Resistant to Lodging?
- Purdue Corn Team Research Update
- Apple Vision Pro for Agriculture
- Explore the New cli-MATE: Your self-service Portal to U.S. Climate Data, Maps, and More

From South to North: Indiana's Corn Progress Update

(Jeferson Pimentel, Bruno Scheffer, Dan Quinn & Betsy Bower)

Corn Condition

Indiana's crop condition edged lower this week, with 48% rated good and 8% excellent. Fair rose to 30%, while combined poor-to-very-poor sits at 14%. By comparison, Iowa continues to post stronger ratings (55% good, 19% excellent), and the 18-state average shows 49% good and 17% excellent, slightly weaker than earlier this month. See more in interactive maps 1.

Corn Dented

Indiana has reached 91% dented, up from 85% last week and in line with the 5-year average (92%). Illinois leads slightly ahead at 96%, while Iowa is at 95%.

Nationwide, the 18-state average is 91%, just a touch under the long-term pace (93%). See more in interactive maps 2

Corn Maturity

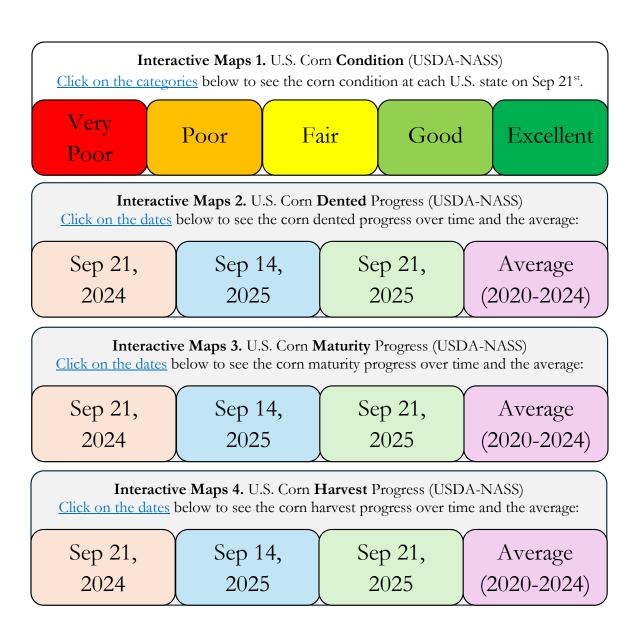
Maturity advanced quickly, with Indiana now at 54%, well above last week's 40% and a bit faster than the 5-year average (51%). Iowa is at 66%, Illinois at 69%, and Kentucky leads at 83%. The 18-state average sits at 56% mature, consistent with the historical pace. See more in interactive maps 3.

Corn Harvest

Indiana has harvested **10% of its crop**, marking steady progress and slightly ahead of the 5-year average (**7%**). Illinois is at **12%**, Iowa **8%**, and Missouri **28%**, while Texas (**76%**) and North Carolina (**74%**) are the most advanced. Across the 18 states, harvest is **11% complete**, right on the long-term norm. See more in **interactive maps 4**.

✓ Indiana remains on track for a record corn yield in 2025. Despite a slight dip in September crop ratings, nearly 56% of corn is still rated good to excellent, and maturity and harvest are both running slightly ahead of normal.

Let us know if we can help.



(Bruno Scheffer & Daniel Quinn)

When plants lean or fall due to root failure or stalk breakage we call it **lodging**. Root lodging is typically caused by **wind and saturated soils** that loosen the

root-soil anchor point at the soil surface causing the plants to lodge, but the stalk integrity remains intact. Stalk lodging is the physical failure of stalk tissue, and usually occurs later in the season. Early root lodging can partially recover if brace roots re-anchor, or if the plant "goosenecks" upright, but recovery is often slow and



Figure 1. Drone image of treatment lodging differences between short and tall stature corn at the Southeast Purdue Agricultural Center. Butlerville, IN 2024.

incomplete, and plants may lean permanently, kink at the lower nodes, and suffer yield losses from shading and harvest loss (Nielsen, 2011; Quinn, 2024).

Why lodging hurts yield and why timing matters

Across three years in Ohio, Lindsey and Thomison (2022) quantified yield loss when root lodging occurred at different growth stages (Figure 2). The closer lodging occurs to pollination, the worse the yield penalty.

Mechanistically, lodging near tasseling/silking disrupts photosynthesis and light interception, delays or desynchronizes pollen shed and silk emergence, and **restricts assimilate flow to ears**. Lodging later (R3) still reduces photosynthesis and increases ear drop and harvest losses, but pollination

is already complete, so barren plants (no yield) are fewer (Nielsen, 2011; Quinn, 2024; Lindsey & Thomison, 2022).

So... is short-stature corn more resistant to lodging?

According to Barten et al. (2022), Bayer's Preceon short-stature corn resisted up to 75 mph winds in

some trials, but could not withstand winds over 100 mph.

In the 2024 Purdue trials, a late-September wind event (remnants of Hurricane Helene; gusts ~36 mph, avg ~17 mph) at Southeast Purdue Agricultural Center (SEPAC) gave us a real-world stress test. Full-stature Dekalb hybrids showed substantial lodging that increased with population, reaching

~41% at 44,000 seeds/ac, while short-stature Preceon hybrids remained essentially at 0% across the same seeding rates (Figure 1 and 3; Oliva et al., 2024). The

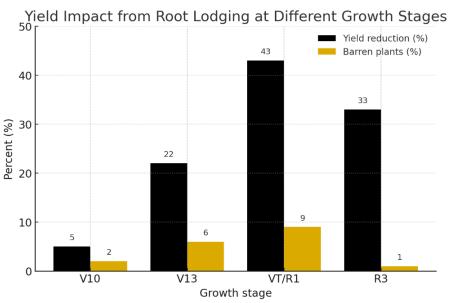


Figure 2. Corn yield and barren plants impact from root lodging at different growth stages. Graph adapted from the data of Lindsey & Thomison (2022).

effect was location- weather-, and management practicedependent, but when winds struck saturated soils, shorter hybrids with lower centers of gravity and thicker stalk architecture stood better. However, it is important to note that tall-stature corn planted at lower seeding rates and with lower N feritlizer rates, also had lower lodging potential. Therefore, management practices and hybrid selection are both important factors for lodging tolerance.

SEPAC 2024: Lodging by hybrid (colors = seed rates; letters compare hybrids within seed rate) Seed rate (seeds/ac) 32000 38000 44000 b b print-20ssc PR116-20ssc DKC61-41RIB DKC62-70RIB

Figure 3. Lodging rate (%) by hybrid and seeding rate at SEPAC (Butlerville, IN). Short-stature (Preceon) remained upright; full-stature (Dekalb) lodged increasingly at higher populations. Data from Oliva et al, 2024.

Bottom line for harvest order

As harvest approaches, it is important to assess fields for lodging potential and harvest priority. Using simple tactics such as the <u>pinch or push test</u> can be useful to determine which fields, hybrids, or locations may need to be harvested first to avoid lodging risks. In addition, areas with significant plant stress, foliar disease, and stalk rots should also be examined and prioritized as these factors may result increase lodging potential. Furthermore, hybrids with taller plant architecture and/or different management practices (e.g., higher seeding rate) may also need to be harvested earlier due to increased lodging risks.

Take-home points

- Short-stature hybrids resisted lodging far better than full-stature corn during a significant wind event, especially at high populations.
- Management practice (e.g., high seeding rate) can increase lodging risk.
- Lodging risk is a function of weather events, environmental conditions, plant stress, management, and plant architecture.

- Yield penalties are worst when lodging happens at VT/R1, but can still reduce yields at late-vegetative and early grain fill stages.
- Harvest strategy: assess fields for potential stress and lodging risk prior to harvest to help idenitfy harvest order and priorities.

References

Barten, T.J., et al. (2022). <u>Short-stature maize reduced wind damage during the 2020 midwestern derecho, improving yields, and greenhouse gas outcomes.</u> Crop Sci. 62:2439-2450.

Lindsey, L., & Thomison, P. (2022). <u>Corn response to root lodging at different growth stages</u>. Ohio State Univ. Fact Sheet AC-1054.

Nielsen, R. L. (2011). *Wind-damaged (root-lodged) corn: Now what?* Corny News Network, Purdue University.

Oliva, E., Wahlman, J., Helms, A., Rieker, S., and Quinn, D., 2024. Comparison of Short and Tall-Stature Corn Hybrids to Nitrogen Fertilizer and Seeding Rates (SEPAC) - <u>Applied Research for Corn Production in Indiana</u> – 2024. Purdue University.

Quinn, D. J. (2024). <u>Flattened or Root-Lodged Corn Caused by Heavy Rain and Wind — Now What?</u> Purdue Pest & Crop Newsletter.

Furdue Corn Team Research Update

(Narciso Zapata, Betsy Bower & Daniel Quinn)

Can Asymbiotic N-Fixing Biologicals Reduce Corn's Nitrogen Needs?

Nitrogen (N) fertilizer is one of the largest costs in corn production and also one of the hardest to manage. Weather, soil type, and crop demand make N availability unpredictable, leading to economic risk and environmental loss. Therefore, interest is increasing in alternative management practices to reduce synthetic N fertilizer requirements. Recently, bioinoculant products (asymbiotic N-fixers) have been marketed to enhance corn N availability and reduce fertilizer need through N-fixation functions within the rhizosphere and/or plant tissue.

Since 2023 the Kernel Lab has conducted eight site-years of research trials across six locations testing several commercial bioinoculants (Proven40, Utrisha, Envita) applied either in-furrow, on-seed, or as foliar sprays. These were tested across multiple N rates to determine whether biologicals could reduce the Agronomic Optimum N Rate (AONR) while maintaining yields.

What are they?

Unlike rhizobia in soybeans, asymbiotic N-fixers don't need a plant partner to function. Instead, these bacteria live in the soil or around roots, using significant energy to convert atmospheric N₂ into plant-available forms. Their success depends on many factors—soil structure, moisture, temperature, tillage, and crop root exudates.

Purdue Research: 2023-2025

2023: The research trial evaluated sixteen treatments using four N fertilizer rates (0, 60, 120, and 180 lbs N/ac) across three asymbiotic N-fixing bioinoculants (Proven40, Utrisha, Envita) compared to an untreated check at the Agronomy Center for Research and Education (ACRE). In addition, a subtrial with Proven40 was evaluated across three N fertilizer rates (80, 160, and 240 lbs N/ac) at Davis Purdue Ag Center

(DPAC) in Farmland, IN. See the tables below containing yield results.

ACRE: Mean grain yield (bu/ac) differences observed across biological products and nitrogen (N) fertilizer application rate. West Lafayette, IN 2023.

Biological	N Fertilizer	Grain
product	Rate	Yield
	lb N/ac	bu/ac
No Diological	0	141.83 c*
	60	209.40 b
No Biological	120	233.39 a
	180	247.84 a
	0	135.70 cd
Envita	60	200.18 b
	120	233.70 a
	180	251.40 a
	0	119.91 cd
Utrisha	60	208.69 b
utrisna	120	239.39 a
	180	245.17 a
Proven40 (in-furrow)	0	151.43 с
	60	211.02 b
	120	234.93 a
	180	250.75 a

^{*} Mean values which do not contain the same corresponding letter are determined statistically different (P < 0.1).

DPAC. Mean grain yield (bu/ac) differences observed across biological products and nitrogen (N) fertilizer application rate. Farmland, IN 2023.

Proven40 OS (Seed-applied)	N Fertilizer Rate	Grain Yield
(beed applied)	lb N/ac	bu/ac
No	80	197.7 c*
Yes	80	195.9 c
No	160	219.3 b
Yes	160	236.2 a
No	240	226.7 b
Yes	240	235.1 a

^{*} Mean values which do not contain the same corresponding letter are determined statistically different (P < 0.1).

2024: In 2024, the trial expanded to four additional Purdue research sites. Some locations tested the full set of treatments, while others ran smaller sub-trials focused on specific bioinoculant products. See the tables below for treatments and location distribution, and yield responses at ACRE and DPAC.

2024. Trial treatments and location distribution for the 2024 research study around the state of Indiana.

Locations	Biological	N
	product	Fertilizer
	produce	rate (lb
		N/ac)
Agronomy Center for	Untreated	0, 60, 120,
Research and	control,	and 180
Education (ACRE) in	Proven40	
West Lafayette,	OS, Envita,	
Pinney Purdue Ag	and	
Center (PPAC) in	Utrisha	
Wanatah, and		
Southeast Purdue Ag		
Center (SEPAC) in		
Butlerville		
Throckmorton	Untreated	0, 150, and
Purdue Ag Center	control,	200
(TPAC) in Lafayette	Envita,	
	and	
	Source	
Northeast Purdue Ag	Untreated	200
Center (NEPAC) in	control,	
Columbia City	Proven40	
	OS, Envita,	
	and	
	Utrisha	
Davis Purdue Ag	Untreated	0, 60, 120,
Center (DPAC) in	control	180 and
Farmland	and	240
	Proven40	
	OS	

ACRE: Mean grain yield (bu/ac) differences observed across biological products and nitrogen (N) fertilizer application rate. West Lafayette, IN 2024.

N Fertilizer	Biological	Grain
Rate	product	Yield
lb N/ac		bu/ac
0	None	192.1 g*
	Envita SC	196.2 g
	Proven40 OS	190.9 g
	Utrisha N	191.9 g
60	None	253.1 ef
	Envita SC	253.6 ef
	Proven40 OS	265.4 d
	Utrisha N	248.9 f
120	None	285.7 c
	Envita SC	282.9 c
	Proven40 OS	290.7 bc
	Utrisha N	286.8 c
180	None	298.6 ab
	Envita SC	307.5 a
	Proven40 OS	299.6 ab
	Utrisha N	299.5 ab

^{*} Mean values which do not contain the same corresponding letter are determined statistically different (P < 0.1).

DPAC. Mean grain yield (bu/ac) differences observed across biological products and nitrogen (N) fertilizer application rate. Farmland, IN 2024.

Proven40 OS	N Fertilizer	Grain
(Seed-applied)	Rate	Yield
	lb N/ac	bu/ac
No	0	71.2 f*
Yes	0	77.7 f
No	60	129.8 e
Yes	60	131.9 e
No	120	201.5 d
Yes	120	207.3 cd
No	180	226.8 ab
Yes	180	213.2 bcd
No	240	234.4 a
Yes	240	226.8 ab

^{*} Mean values which do not contain the same corresponding letter are determined statistically different (P < 0.1).

DPAC. Agronomic Optimum Nitrogen Rate (AONR; nitrogen fertilizer rate required to maximize grain yield) differences observed between biological treatments. Farmland, IN 2024.

Proven40 OS	Agronomic Optimum	
(Seed-applied)	Nitrogen Rate (AONR)	
	lbs N/ac	
Yes	206	
No	239	

^{*} AONR values calculated by quadratic plateau regression analysis.

2025: This season research trial was again established following the same treatment and location distribution as 2024.

Key Findings So Far:

- 1. Nitrogen fertilizer rate was the main driver of yield increases at all locations.
- 2. At five of six sites, biological products did not significantly change yield response to applied N.
- **3.** At DPAC (Farmland, IN, 2023–24), Proven40 reduced the AONR from 239 to 206 lbs N/ac while maintaining yield, suggesting potential savings of 30+ lbs N/ac in that environment.

Take-home message

Asymbiotic N-fixers show promise, but results from Purdue research remain mixed. Here's what we've learned so far:

- 1. Some potential for reducing N needs: In a few site-years, certain products lowered the optimum nitrogen fertilizer rate without hurting yield, suggesting they can improve efficiency under the right conditions.
- 2. Often no added benefit: Across most trials, yield responses were similar to standard nitrogen management, with little to no advantage from adding a bioinoculant.
- **3.** More research underway in 2025: With 2025 trials underway, stay tuned for updates as we continue to explore how asymbiotic N-fixing biologicals fit into corn production systems.

What Should Farmers Do?

- 1. Be cautiously optimistic. These products may eventually find a role in reducing N fertilizer needs, but they are not yet a consistent replacement.
- **2. Test on your own farm.** Try them on small acres first, side-by-side with standard practices.
- **3. Watch the research.** As more data accumulates, we'll better understand where, when, and how these products can work.

Quick Take: Purdue Bioinoculant Research

- 1. Main driver of yield = N fertilizer. Across 8 site-years, nitrogen rate explained most of the yield response.
- 2. Mixed results with biologicals. At 5 of 6 locations, bioinoculants did not change yield response. At one site (DPAC, 2023–24), Proven40 reduced the optimum N rate by ~30 lbs/ac while maintaining yield.
- **3. Still early days.** Colonization was confirmed in some cases, but activity and yield benefits were inconsistent.
- **4. Farmer tip:** Try products on a small scale and side-by-side within a field and with current practices before adopting widely.

🖟 Apple Vision Pro for Agriculture

(Pedro Cisdeli, Gustavo Santiago, German Mandrini, Ignacio Ciampitti - Ciampitti Lab, Department of Agronomy and IDAAS)

The Apple Vision Pro (Figure 1) is a device that provides an Augmented Reality (AR) environment for its users. Rather than looking at a computer or phone screen, users wear the device like a pair of goggles, keeping their surroundings in view while accessing digital tools directly in front of them.



Figure 1. PhD. student Gustavo Santiago (Ciampitti Lab) wearing the vision pro headset while collecting data on wheat plots.

Figure 2 illustrates the AR environment. The Vision Pro projects the digital menu into the user's field of view, giving the impression that it floats in midair, while the crops remain visible.



Figure 2. Example of the Vision Pro interface projecting a digital menu in thin air.

Potential on the Farm

While analyzing this device's capabilities for agriculture, we have to consider its initial stages of development. We are on the way to providing new case studies on how to use this device for the future of agriculture. Improvement is still needed for this type of device to be widely used in field settings, but it is already a significant achievement in moving away from conventional screens. This raises the most relevant question: what can it actually do on a farm today?

The Vision Pro can already integrate many existing apps, such as Microsoft Excel and Google Maps, into the AR space. This means that most daily tasks performed on an iPad or iPhone can easily be transitioned to the Vision Pro. This <u>video</u> demonstrates how this devise was used during a field scouting process to look for plots that had already reached R1 and annotate this data in an Excel file.

The Apple Vision Pro stands out for its array of cameras and sensors. These can be used to run automated digital phenotyping pipelines, which we discussed in Issue #20 of this newsletter ("A Faster Way to Predict Corn Yields Using Ear Images Before Harvest"). The device's hardware can gather measurements such as plant height and leaf area without the need for additional equipment. Additionally, the Vision Pro's cameras and sensors can help perform on-device 3D scene reconstruction by simply walking around a plant while looking at it with the goggles. Doing this type of data collection in a temporal basis can be used to automatically monitor crop growth.



Figure 3. Example of the object detection performed directly by the Apple Vision Pro. The AI model draws boxes and labels each one of them based on what it predicts that the object is.

Our Progress So Far

Our team has been developing a custom app for the Vision Pro that focuses on agricultural capabilities. The app will aid in scouting and perform digital plant phenotyping, among other things. We plan to transition most of our existing research methods and artificial intelligence models to this device.

The app is already able to display field-specific data overlaid directly onto the physical environment, show interactive field maps to help researchers navigate and locate themselves within large experimental areas, and read QR codes to quickly access plot information during trial evaluations.

Additionally, as shown in Figure 3, our app supports on-device object detection. With reliable plant and object recognition capabilities running directly on the headset, we can implement automated measurement tools, disease detection, and real-time yield estimation directly in the field. This eliminates the need to collect images and process them later on another device.

For more technical details about the development process, challenges, and specific implementation methods, you can follow the <u>developer log</u> (from Pedro Cisdeli). The goal is to keep records of the process of

exploring and adapting this unique device for agricultural use throughout this journey.

Explore the New cli-MATE: Your self-service Portal to U.S. Climate Data, Maps, and More

(Austin Perason)

The Midwestern Regional Climate Center (MRCC) has launched a new version of cli-MATE, its main online portal for United States climate data, analyses, statistics, maps, graphics, and other information. For over 40 years, MRCC has provided climate data to the public—initially through printed reports and later digitally as web access grew. The latest redesign of cli-MATE builds on this history, offering streamlined access to US climate data.

Through cli-MATE, users can explore weather and climate data at multiple time scales (hourly, daily, monthly, seasonal, and annual) from reporting stations across the country. The platform serves a wide array of users. For instance:

- TV meteorologists use the platform to compare current data to historical records.
- Researchers rely on cli-MATE for climate model verification and enhancement.
- Consulting meteorologists use it to confirm storm damage and support casualty investigations.
- Emergency managers turn to the platform to guide search and rescue operations.
- Agronomists monitor crop growth progress with various degree day offerings.
- State agencies incorporate cli-MATE data into hazard mitigation strategies.



While new features had been added steadily over the

past 15 years, the prior version of cli-MATE faced growing challenges as advances in web and software

technology began to outpace system updates. Thanks to financial support from NOAA's National Centers for Environmental Information (NCEI), the MRCC undertook a multi-year effort to overhaul the back-end code and front-end design for an improved user experience.



The result is a portal that reflects both modern data needs and user feedback. The updated cli-MATE offers a cleaner interface with enhanced styling for a more straightforward and intuitive user experience, along with faster and more dependable performance, and revamped products. The MRCC design team set out to build a system both powerful and accessible, ensuring cli-MATE offers deep analytical capabilities for experts while remaining approachable for first-time users.

If you're unsure how to start with cli-MATE, check out the help page, which offers step-by-step instructions for exploring the platform. The cli-MATE homepage includes a Product Exploration section that describes each available tool. Additionally, a Product Guide is available with detailed navigation information for various products. While cli-MATE provides significant improvements over its predecessor, the MRCC continually updates the system and introduces new products. Map products currently return users to the legacy cli-MATE interface, but will soon be replaced with newer, high-resolution mapping products in the updated environment.

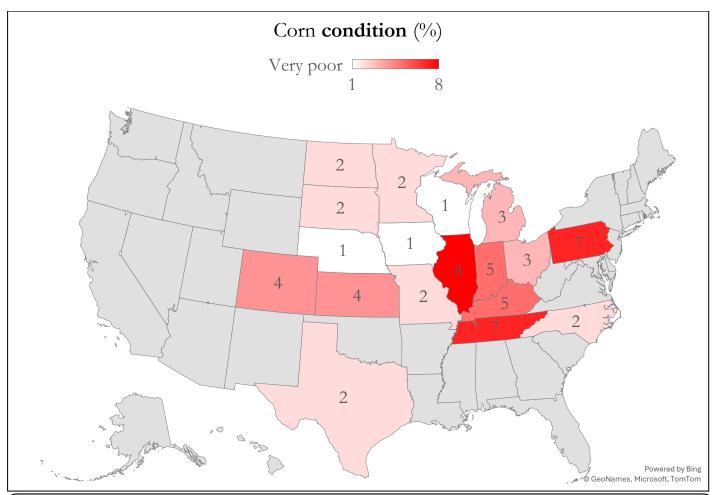
If you have feedback, the MRCC wants to hear about it! Submit your comments <u>here</u>. Also, please don't hesitate to email <u>mrcc@purdue.edu</u> with any questions.

Acknowledgments

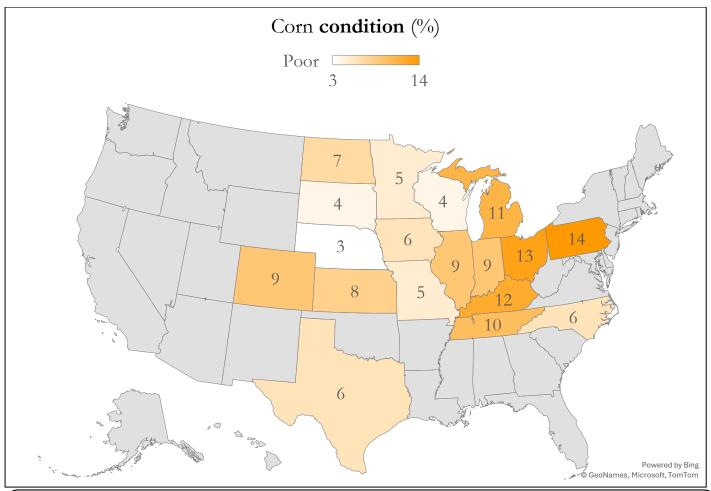
The authors greatly appreciate the feedback and contributions of all growers, county agents, consultants, and corn industry stakeholders.

Proudly supported by:

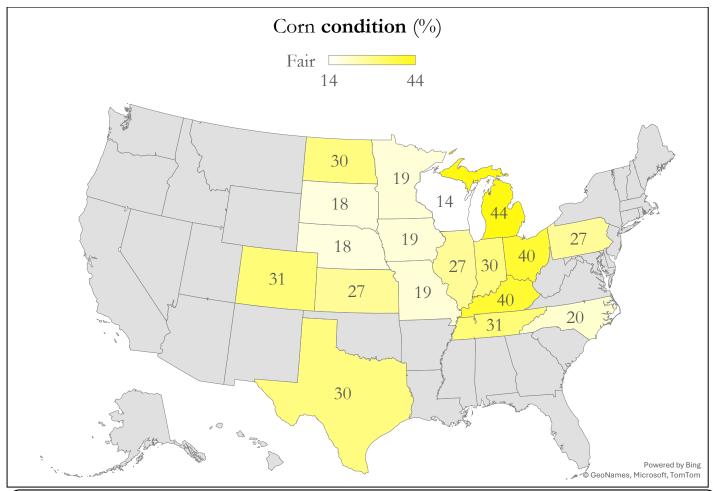




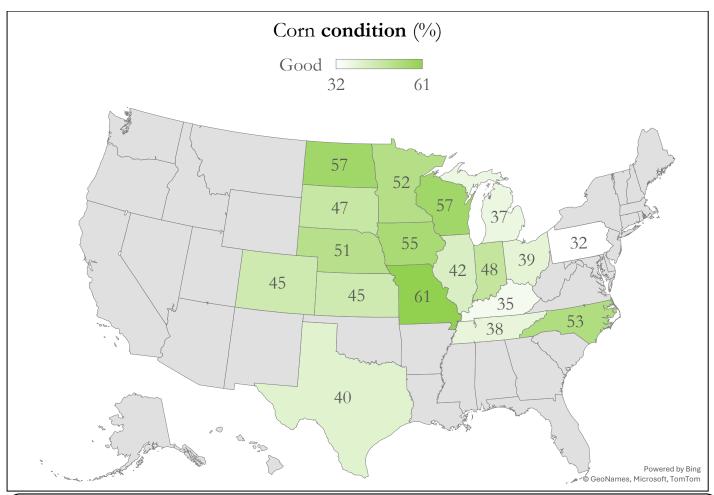
Interactive Maps 1. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Sep 21st. Very Poor Fair Good Excellent Back to page 2



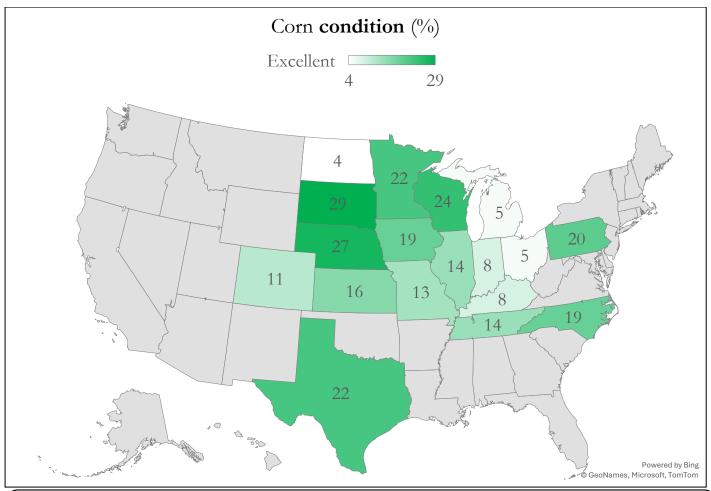
Interactive Maps 1. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Sep 21st. Very Poor Fair Good Excellent Back to page 2



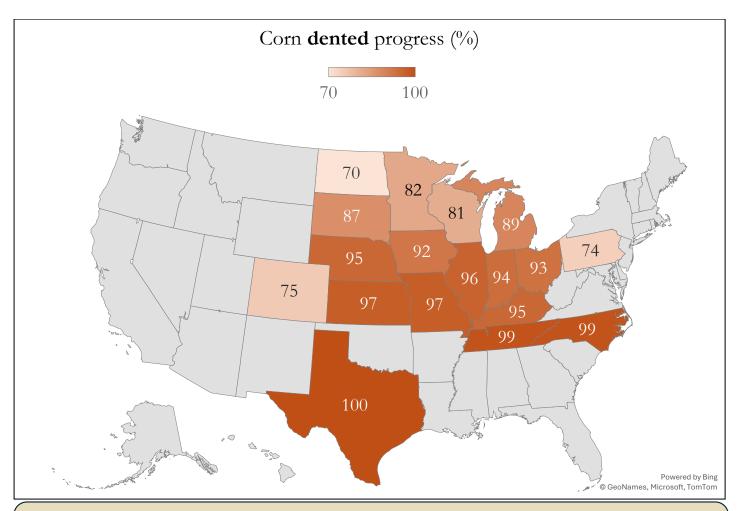
Interactive Maps 1. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Sep 21st. Very Poor Poor Fair Good Excellent Back to page 2



Interactive Maps 1. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Sep 21st. Very Poor Poor Fair Good Excellent page 2



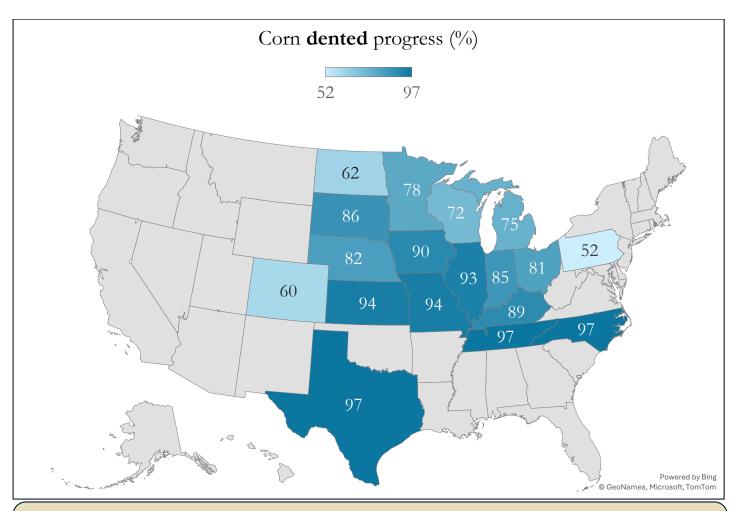
Interactive Maps 1. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Sep 21st. Very Poor Poor Fair Good Excellent Back to page 2



Sep 21, 2024 Sep 14, 2025

Sep 21, 2025

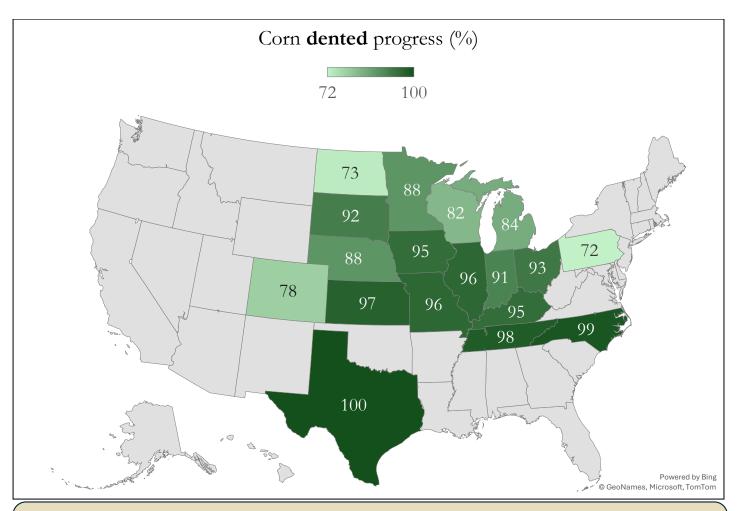
Average (2020-2024)



Sep 21, 2024

Sep 14, 2025 Sep 21, 2025

Average (2020-2024)

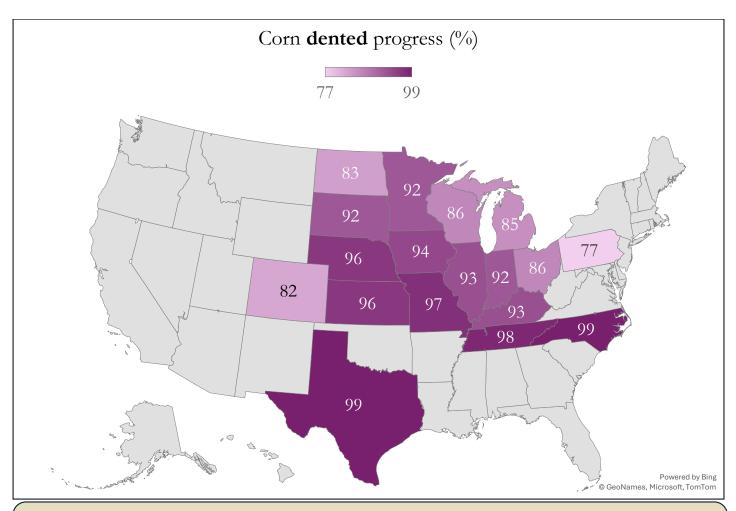


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

Average (2020-2024)

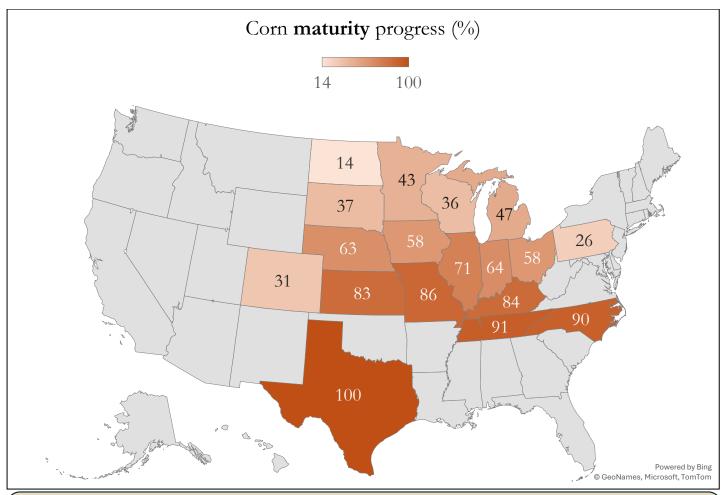


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

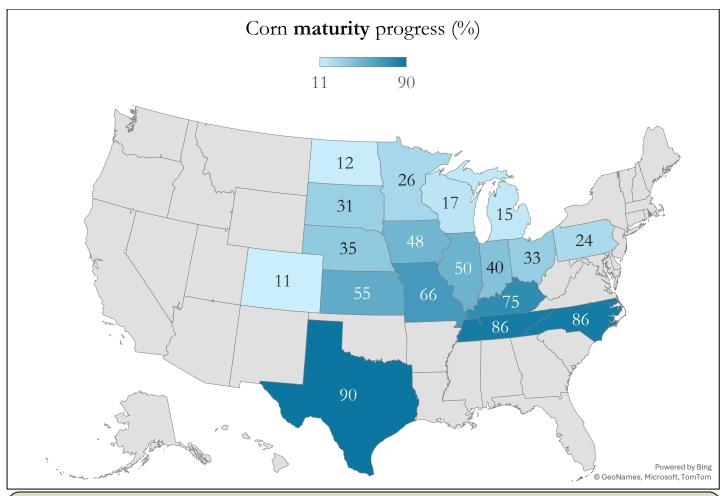
Average (2020-2024)



Sep 21, 2024 Sep 14, 2025

Sep 21, 2025

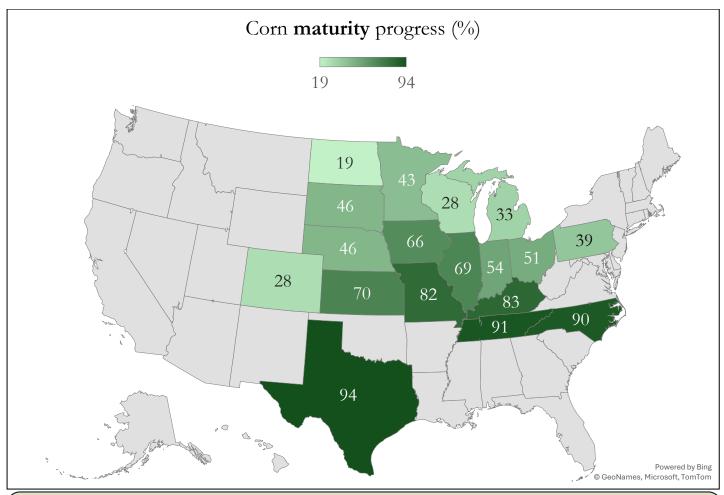
Average (2020-2024)



Sep 21, 2024

Sep 14, 2025 Sep 21, 2025

Average (2020-2024)

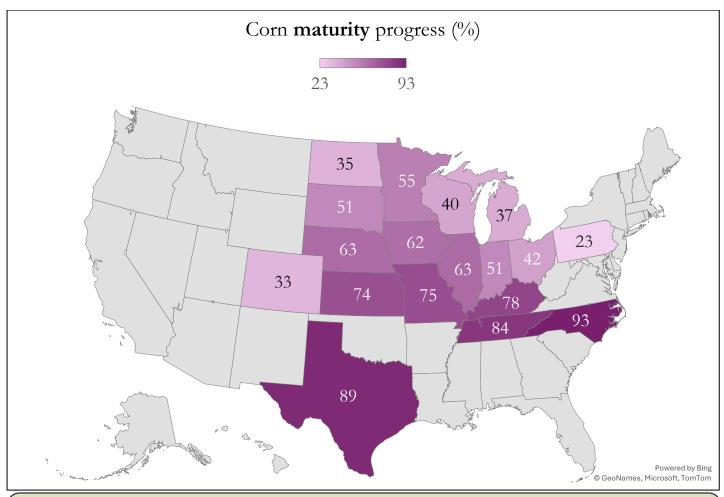


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

Average (2020-2024)

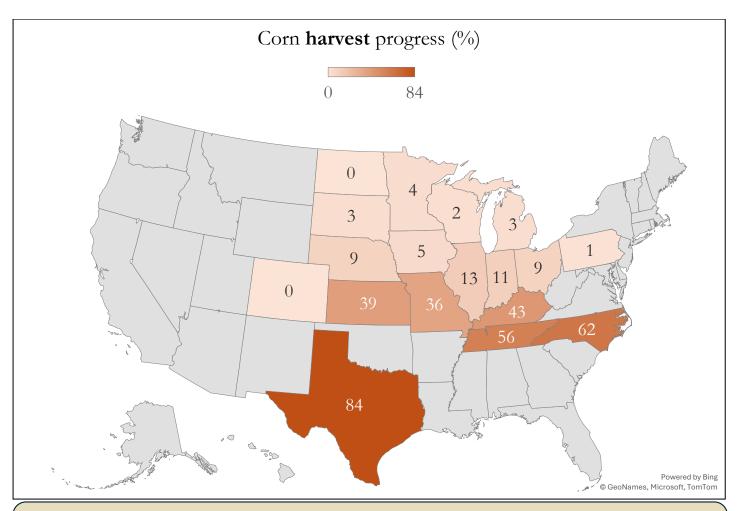


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

Average (2020-2024)

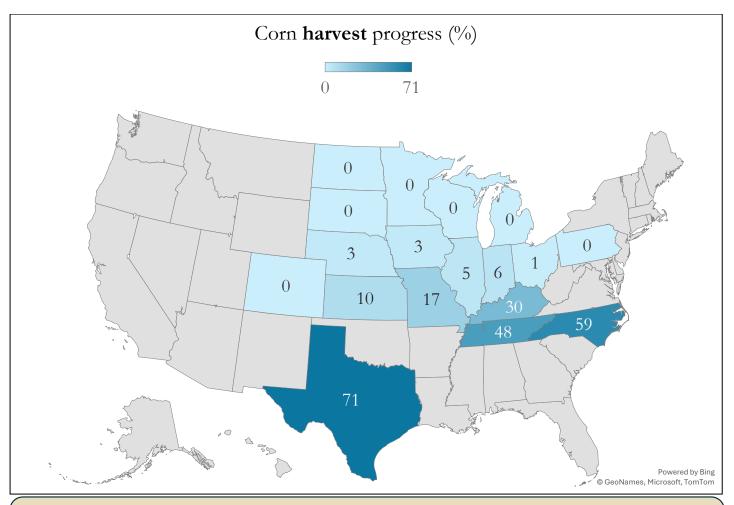


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

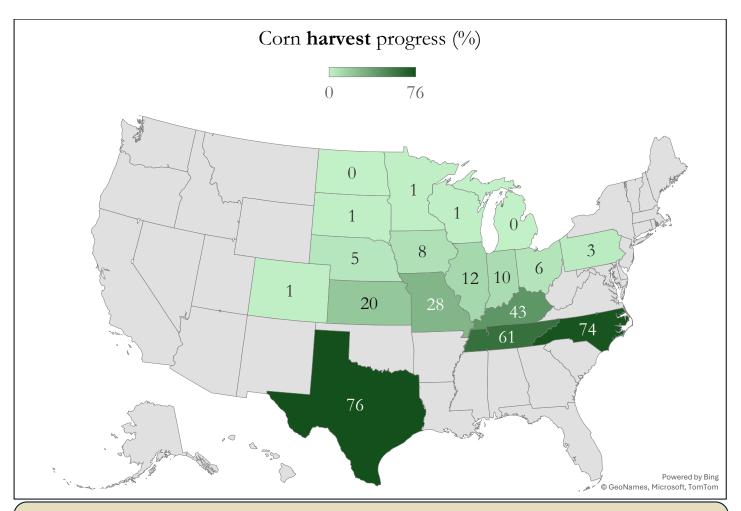
Average (2020-2024)



Sep 21, 2024

Sep 14, 2025 Sep 21, 2025

Average (2020-2024)

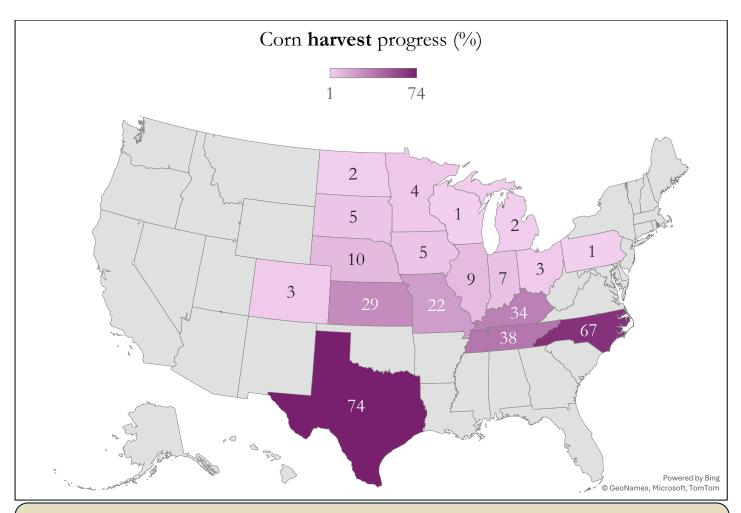


Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

Average (2020-2024)



Sep 21, 2024

Sep 14, 2025

Sep 21, 2025

Average (2020-2024)