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From South to North: Indiana's Corn Progress Update

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

Corn Silking

Silking in Indiana is nearly complete at 96%, just shy of the 5-year average of 98%. Illinois (99%) and Iowa (98%) are essentially finished, while states like South Dakota, Tennessee, and Texas have already reached 100%. Across the 18 tracked states, silking averages 97%, right on pace with normal progress. See more in interactive maps 1.

Corn Dough

Indiana's crop is **69% in the dough stage**, matching its 5-year average of 70% and showing steady advancement. Illinois (81%) and Iowa (78%) are also

moving along well. The 18-state average sits at **72%**, just 1 point below the historical trend. See more in interactive maps 4

Corn Dented

Denting is starting to pick up in Indiana, now at **20%**, a few points above the state's 5-year average of 17%. Illinois is at 34% and Iowa at 27%, while southern states such as Tennessee (66%) and Texas (72%) are much further along. The 18-state average stands at **27%**, right on trend.

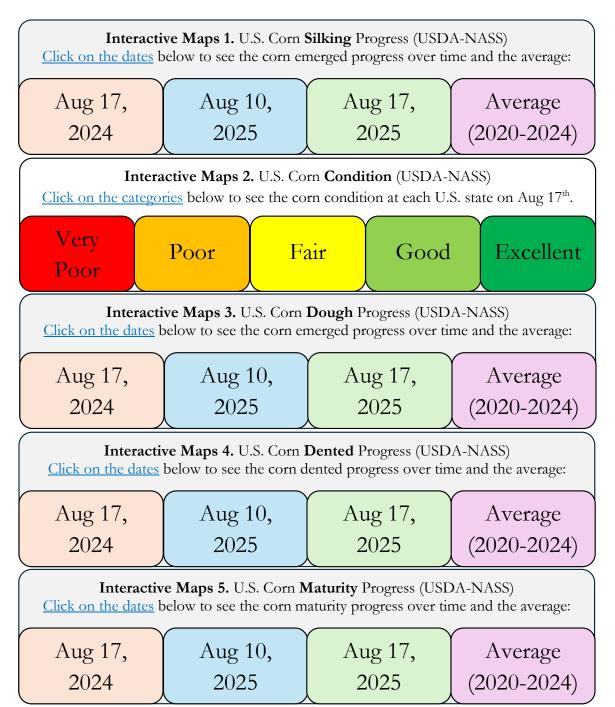
Corn Maturity

As expected, maturity is still minimal in the Midwest. Indiana reports **0% mature** so far. North Carolina (52%) and Texas (65%) lead maturity progress, while the 18-state average is **3%**, in line with historical norms.

Corn Condition

Indiana's crop condition ratings show 52% good, 11% excellent, 26% fair, and 11% poor to very poor combined. This balance points to mostly stable conditions with some localized stress. Iowa has one of the strongest outlooks, with 56% good and 30% excellent. Across the 18 states, condition ratings are 50% good and 21% excellent, nearly identical to last year at this point.

Let us know if we can help.



Family Farms Still Dominate U.S. Agriculture

(Jeferson Pimentel & Daniel Quinn)

The U.S. Department of Agriculture (USDA) released its 2022 Census of Agriculture Farm Typology report, and the results show that family farms continue to dominate American agriculture. According to the report, 95% of all U.S. farms are family-owned, underscoring the central role that families play in

producing the nation's food, fiber, and fuel. While agriculture has grown increasingly global and industrial in scale, the backbone of farming in America remains the family farm.

USDA's report highlights that small family farms, those with less than \$350,000 in annual farm income, make up 85% of all U.S. farms. These farms operate nearly 40% of the nation's farmland and contribute 14% of the total value of agricultural products sold. Although they generate less income than larger operations, these farms are critical for sustaining rural communities,

keeping land in agricultural use, and connecting directly with consumers through local markets.

The USDA data also shows that large-scale family farms, with over \$1 million in annual farm income, make up fewer than 4% of all U.S. farms but are responsible for producing 51% of the nation's agricultural output. This growing divide reveals how a smaller share of farms produces the majority of food, even as small farms remain vital for land stewardship and community ties. Since the last census in 2017, the number of family farms overall has fallen by 8%, or nearly 159,000 operations. Small farms bore the brunt of this decline, shrinking by 7 to 10%, while mid-size and large farms expanded; very large farms grew by an astonishing 65%.

USDA's report also explores how specialization varies by farm size. More than half of small farms are concentrated in cattle production (31%) or hay and forage (25%). Mid-size farms are dominated by grains and oilseeds, with 55% of them producing crops like corn and soybeans. Large-scale farms, by contrast, tend to be more diverse in their production strategies. Small farms stand out in one area in particular: direct-to-consumer sales. They are responsible for 44% of all direct sales to households and local markets, compared to just 18% for mid-size farms and 19% for large-scale operations, demonstrating how essential they are in providing fresh, local food to families.

According to the USDA, who runs these farms is also changing the story. Producers on small family farms are more likely to be women, over the age of 65, or veterans. They are also more likely to live on the farm, work off-farm jobs, and be new or beginning farmers with 10 years or less of experience. These farms are not just businesses; they are households, traditions, and pathways into agriculture for future generations. The release of this USDA report makes it clear: family farms, whether small or large, remain at the core of U.S. agriculture. While consolidation has shifted much of the production toward fewer, larger farms, small family farms still carry enormous weight in shaping rural life, caring for the land, and connecting with consumers. USDA's findings remind us that the strength of American agriculture lies in supporting both ends of the spectrum; helping small farms stay viable while enabling larger farms to feed a growing world. **Full details, maps, and data are available through** USDA's National Agricultural Statistics Service at nass.usda.gov and the NASS Quick Stats portal.

The Next & Final Growth Stage: R6 Corn or Physiological Maturity

(Bruno Scheffer & Daniel Quinn)

Since the corn across Indiana is now at the **R5** growth stage, commonly known as the "dent stage", the next and final stage is the **R6** or physiological maturity.

The R6 (Figure 2) marks the final developmental phase for corn, signifying the point at which the kernel has accumulated its maximum dry weight. This crucial stage typically occurs approximately 55 to 65 days after silking (R1) and indicates that the kernels are now considered safe from frost (Nielsen, 2021). Understanding R6 is vital for farmers and agronomists, as it directly impacts harvest timing, grain quality, and



Figure 1: Corn at R5 growth stage at West Lafayette, IN.

yield. Physiological maturity is precisely identified by two key internal kernel changes. Firstly, the kernel milk line disappears. During the preceding R5 (Figure 1), or "dent stage", agronomists and farmers monitor this distinct boundary within the kernel, which separates the solid, starchy endosperm from the liquid, milky portion. As the kernel matures and dehydrates, this line progressively moves down toward the cob. The complete disappearance of this milk line is a strong indicator of approaching R6 (Abendroth et al., 2011).

Secondly, and occurring shortly after the milk line vanishes, is the formation of a thin black layer at the tip (base) of the kernels. This "black layer" is composed of placental cells that die and collapse, effectively acting as a physiological "door closure," halting the transport of any additional photosynthate (sugars) to the kernel. The appearance of this layer progresses from a thinning, olive-colored layer, to a thinner brown layer, and finally to a thin black layer (Purdue Corn & Soybean Field Guide, 2025).

At physiological maturity, the kernel moisture content averages around 30 percent, although this can fluctuate between 25 and 40 percent depending on the specific hybrid and prevailing growing conditions (Nielsen, 2021). Importantly, once R6 is reached, severe stress, such as disease or drought, has little to no effect on final grain yield, unless the physical integrity of the stalk or ear is compromised by factors like European corn borer damage or stalk rots (Purdue Corn & Soybean Field Guide, 2025). However, severe stress occurring before normal maturation can lead to premature kernel black layer development and yield reduction.

Beyond R6: Harvest Maturity and Grain Drydown

While R6 signifies maximum dry weight, it is not necessarily the ideal time for mechanical harvest. Harvest maturity is a distinct concept, defined as the grain moisture content where harvest can occur with minimal kernel damage and mechanical harvest loss. This is generally considered to be near 21 percent grain moisture (Alkazaali, 2016).

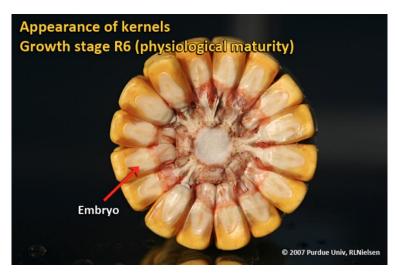


Figure 2: Corn at R6 growth stage. Photo from Nielsen, 2007.

In Indiana, typical field drydown rates during mid to late September range between **0.5** and **1.0** percentage points per day. As temperatures cool in early to mid-October, these rates decrease, often falling to between 0.25 and 0.5 percentage points per day. By early to mid-November, field drydown rates can slow considerably, sometimes reaching zero moisture loss per day (Nielsen, 2018b). Tools like the online corn drydown calculator provided by Iowa State University can help predict grain drydown for specific regions of the Corn Belt (Martinez-Feria et al., 2021).

Therefore, while R5 focuses on critical grain filling and quality establishment, R6 represents the physiological endpoint of these processes, marking the completion of dry matter accumulation and the beginning of the natural field drydown period leading to harvest.

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ℰ Effects Of Severe Stress During Grain Filling In Corn

(Bob Nielsen)

Yield potential in corn is influenced at several stages of growth and development. Ear size potential (number of potential kernels) is determined quite early (Nielsen, 2023), from about leaf stage V6 to V15 (knee-high to about shoulder-high). The next influential period for the corn crop is pollination (Nielsen, 2025b). The period following successful pollination and finishing at kernel black layer is defined as the grain filling period in corn and represents the final important yield determination period. See Nielsen (2021a) for descriptions and images of grain fill stages in corn.

Perfect conditions for ear size determination and pollination can be negated if severe stress occurs during the grain fill period. Yield loss during grain fill can occur from 1) stand loss, 2) incomplete kernel set, 3) decreased kernel weight, and 4) premature plant death.

Stand Loss During Grain Fill

Significant reductions in plant population are not as likely after pollination compared to earlier in the season. Loss of plants after pollination can occur as a result of severe storms (wind, hail, flood, ponding), animal damage (raccoons, deer, cattle), errant ATVs or agronomists wandering the field. However, yield loss

due to late season stand loss is usually greater than that which occurs earlier in the season because ear number per plant and potential kernel number per ear are already determined, i.e., there is no opportunity for surviving plants to compensate by increasing these yield components. With late season stand loss, surviving, adjacent plants respond to the lesser plant competition primarily by increasing kernel weight.

Incomplete Kernel Set in Corn

The term "kernel set" refers to the degree to which kernels have developed up and down the cob. Incomplete kernel set is not always apparent from "windshield" surveys of a corn field. Husks and cob will continue to lengthen even if kernel set is incomplete. A wonderfully long, robust-looking, healthy green ear of corn can completely mask even a 100 percent failure of pollination or severe kernel abortion.

TECHNICAL TRIVIA:

Pollination is the movement of pollen from the tassels to the silks.

Fertilization is the actual union of the male and female gametes once the pollen tube reaches the ovule.

One of the causes of incomplete kernel set is unsuccessful fertilization of the ovules during pollination. Unsuccessful fertilization results in ovules that never develop into kernels and, subsequently, ears with varying degrees and patterns of incomplete kernel set. Many factors can cause incomplete pollination and distinguishing between them can be very difficult. See my related article (Nielsen, 2025a) for more discussion about unsuccessful fertilization.

Another cause of incomplete kernel set is **abortion of fertilized ovules** early in the grain filling period. Aborted kernels will be shrunken, mostly white, often with the yellow embryo visible; compared to normal plump yellow kernels. Unfertilized ovules, on the other hand, will result in visibly blank areas on the cob.

Kernels are most susceptible to abortion during the first 2 weeks following pollination, particularly kernels near the tip of the ear. Tip kernels are generally last to

be fertilized, less vigorous than the rest, and are most susceptible to abortion. Once kernels have reached the dough (R3) stage of development, further yield losses will occur mainly from reductions in kernel dry weight accumulation.



Kernel abortion can be caused by any stress that greatly limits photosynthetic rates and, thus, photosynthate availability during or shortly following pollination...

- Severe drought stress.
- Excessive heat stress.
- Severe nutrient deficiencies (especially nitrogen).
- Extensive loss of green leaf tissue by foliar diseases like gray leaf spot (*Cercospora zeae-maydis*), northern corn leaf blight (*Exserohilum turcicum*), or tar spot (*Phyllachora maydis*).
- Extensive loss of green leaf tissue from severe hail damage.
- Consecutive days of heavily overcast, cloudy conditions.

Decreased Kernel Weight

Severe photosynthetic stress during dough (R4) and dent (R5) stages of grain fill reduces kernel weight and can cause premature kernel black layer formation. Decreased kernel weight can result from severe

drought and heat stress during grain fill; extensive European corn borer tunneling (especially in the ear shanks); loss of photosynthetic leaf area by nutrient deficiency, hail, insects, or disease during grain fill; and killing fall frosts prior to normal black layer development.



Once grain has reached physiological maturity (R6), severe stress will have no further physiological effect on final grain yield per se. However, severe stress prior to R6 can weaken stalk tissue and predispose the plants to the development of stalk rots (Nielsen, 2021b). Weakened or rotted stalks combined with postmaturity damaging wind storms can easily result in significant mechanical harvest losses and, thus, less grain in the bin.



Premature Plant Death

A killing fall frost prior to physiological maturity can cause premature leaf death or whole plant death. Premature death of leaves results in yield losses because the photosynthetic "factory" output is greatly reduced. The plant may remobilize stored carbohydrates from the leaves or stalk tissue to the developing ears, but yield potential will still be lost. Approximate yield losses due to premature death of leaves, but not stalks, range from 36, 31, and 7% when the leaf death occurs at R4 (dough), R5 (full dent), and half-milkline stages of kernel development, respectively (Afuakwa & Crookston, 1984).

Premature death of whole plants results in greater yield losses than if only leaves are killed. Death of all plant tissue prevents any further remobilization of stored carbohydrates to the developing ear. Whole plant death that occurs before normal black layer formation will cause *premature* black layer development, resulting in incomplete grain fill and lightweight, chaffy grain. Grain moisture will be greater than 35%, requiring substantial field drydown before harvest. Approximate yield losses due to premature whole plant death range from 50, 39, and 12% when the whole plant death occurs at R4 (dough), R5 (full dent), and half-milkline stages of kernel development, respectively (Afuakwa & Crookston, 1984).

A common misconception is that kernel black layer formation sometimes fails to occur following a frost or other late-season severe stress. Not true. FAKE NEWS! The kernel black layer always develops. Any severe stress that occurs during the grain fill period will cause premature kernel black layer formation and is related to the reduction in or termination of sucrose (photosynthate) availability to the developing kernels (Afuakwa et al., 1984).

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Super cool & super dry for August's end: How the weather tables have turned (Jacob Dolinger)

With brute and sudden force, the atmosphere is doing its job: acting like a fluid. Weather is not a precise science, which means the atmosphere is constantly shifting. There tends to be some sort of pattern shift come mid-late August, and it looks like it's just about here. Temperatures are on their way down, as the National Weather Service's Climate Prediction Center (CPC) predicts a nearly 100% chance of sustained below-normal temperatures 6-10 days out from writing, so August 26-30 (Figure 1). We're talking lows in the upper 40s in certain spots across northern Indiana—brr! Cities like Fort Wayne, Lafayette, South Bend, and Valparaiso could be seeing these temperatures. The last time minimum temperatures dropped below 50°F in Lafayette and South Bend was on June 2.

This is all welcome news for anyone who has worked outdoors and has not enjoyed what has been an incredibly humid summer. The Lafayette area has had the second-highest number of dew points greater than 70°F this summer. For reference, dew points of 65°F-70°F are generally considered humid, while dew points above 70°F are very humid. Dew points can also reach above 75°F, as they have on several occasions this summer, and that is considered oppressive humidity. We're going to see some very low dew points through the end of the month, but that doesn't mean the humidity has left for good. Some models indicate a major warm-up again around Labor Day

Weekend—another example of the atmosphere acting as a fluid, with all of its highs and lows.

Even with all the dramatic swings in temperatures and humidity, we will at the very least have sunshine. In fact, maybe too much sunshine, as below-normal precipitation is also quite likely in the 6–10-day outlook (Figure 2). We tend to get a bit drier in Indiana in August and September, but this period is expected to be drier than normal, which means anyone with stakes in agriculture may want to monitor soil moisture closely.

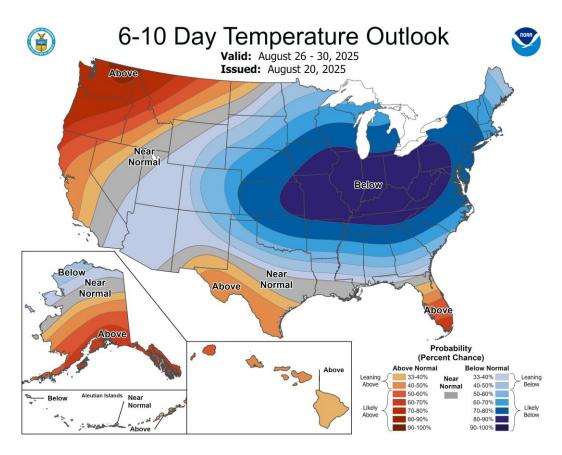


Figure 1. The CPC indicates a nearly 100% chance of below normal temperatures over much of the Midwest.

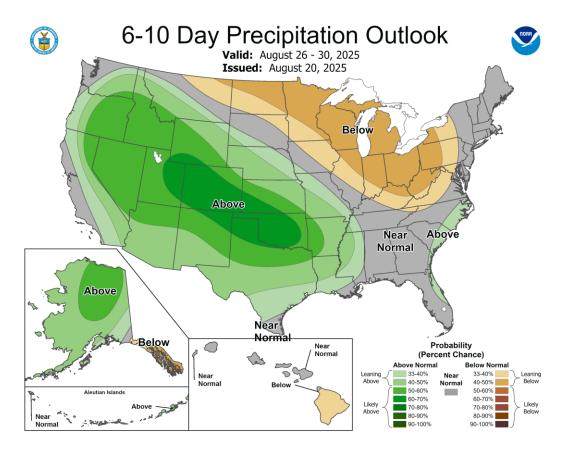
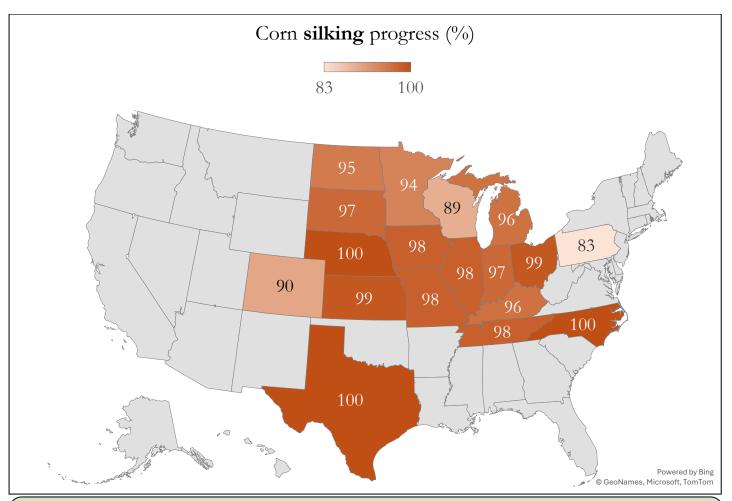


Figure 2. The CPC indicates a likely chance of below normal precipitation across the Midwest.

Acknowledgments

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

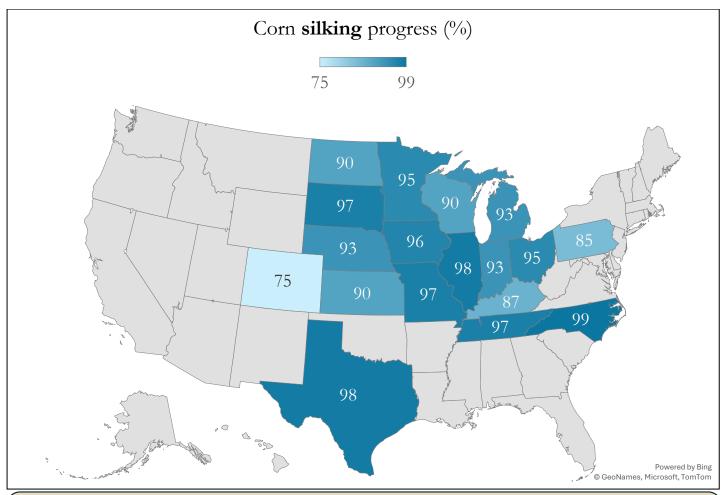
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Aug 17, 2024 Aug 10, 2025

Aug 17, 2025

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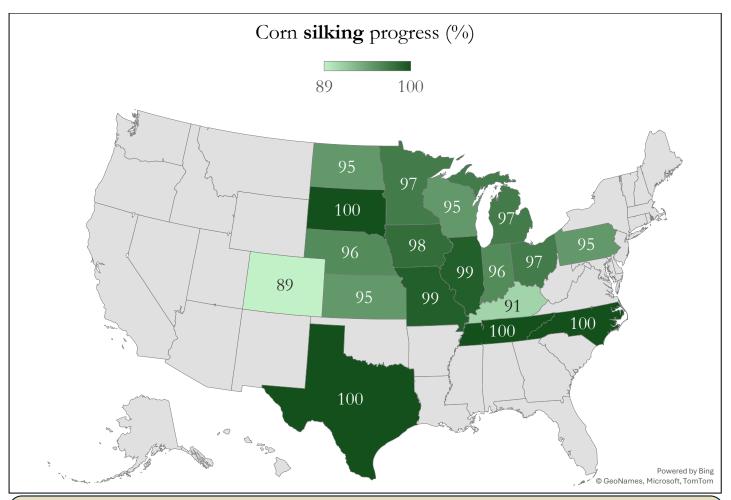


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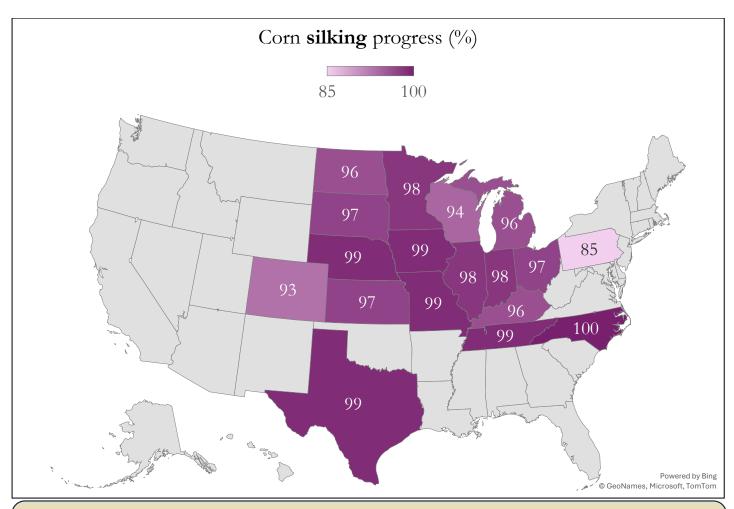


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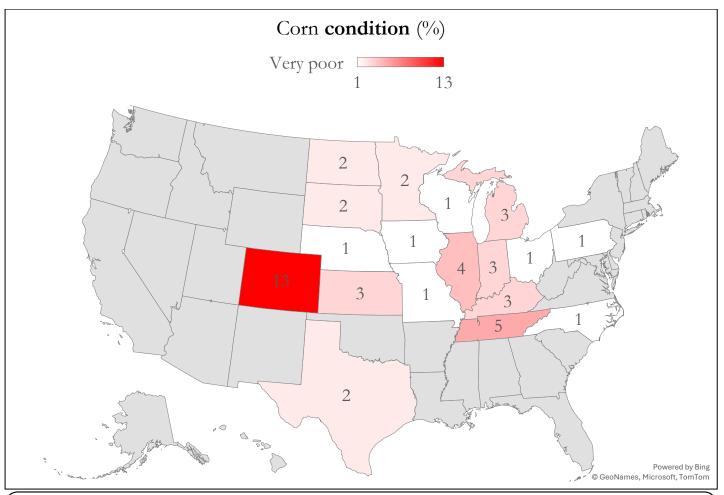


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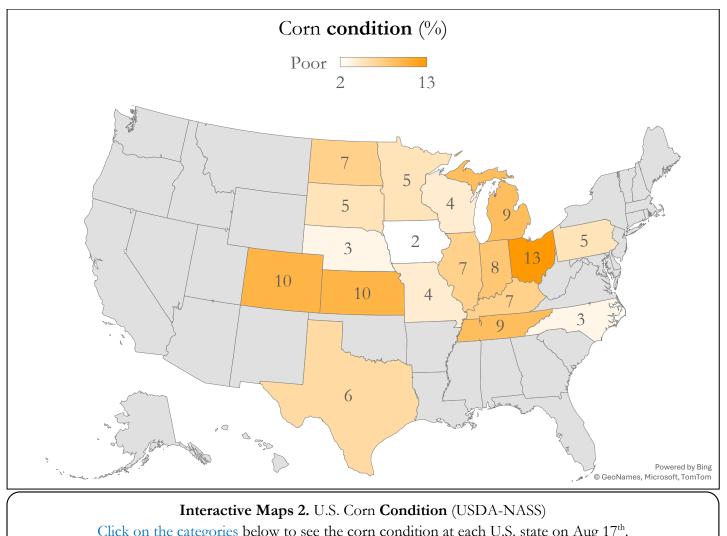
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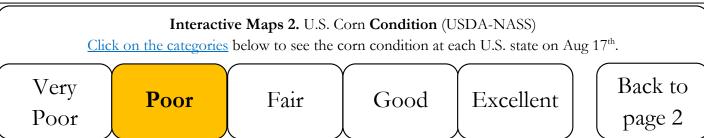
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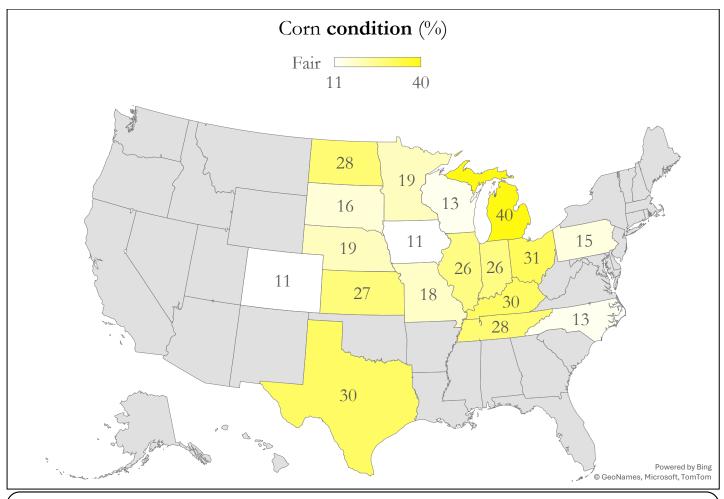
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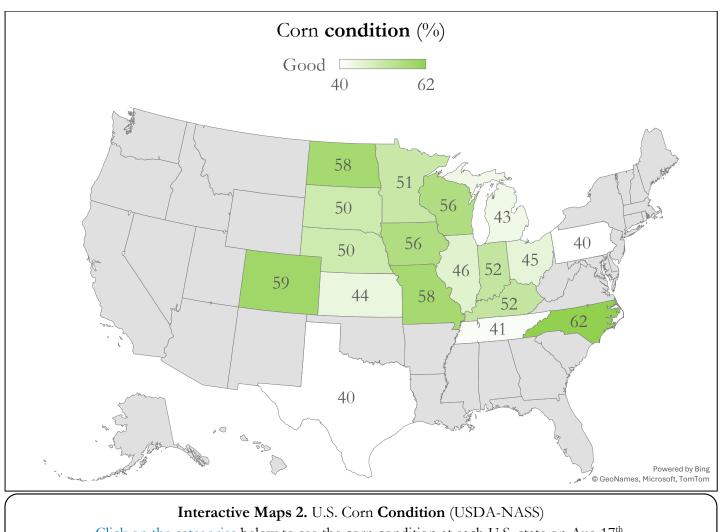
Interactive Maps 2. U.S. Corn Condition (USDA-NASS) Click on the categories below to see the corn condition at each U.S. state on Aug 17th. Very Poor Poor Fair Good Excellent Back to page 2



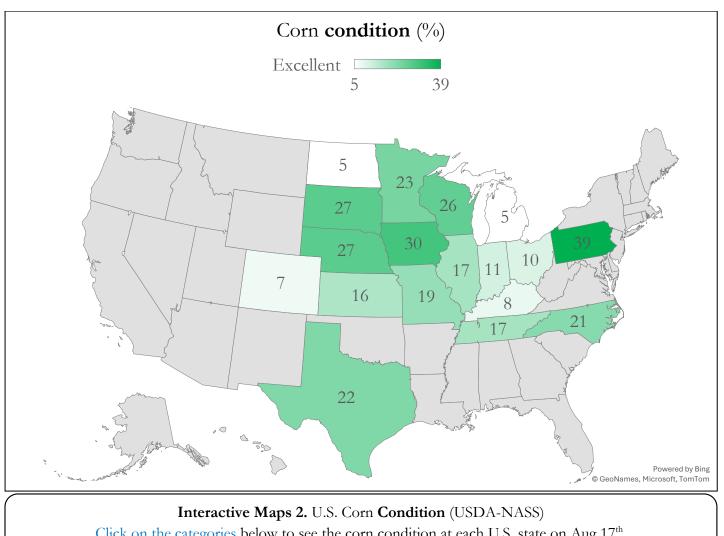




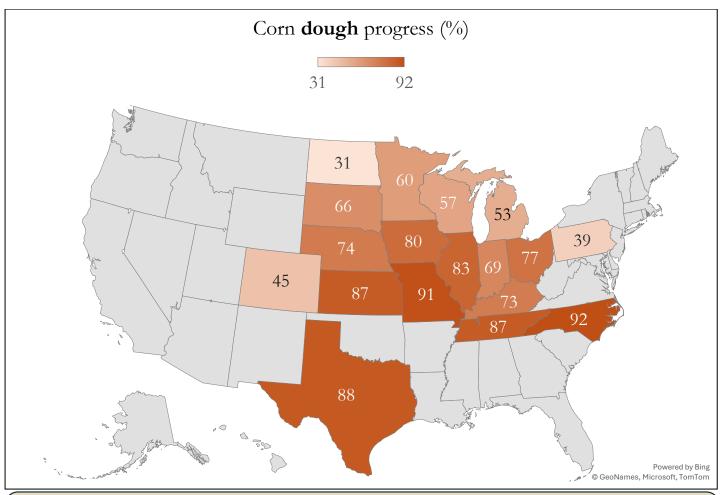
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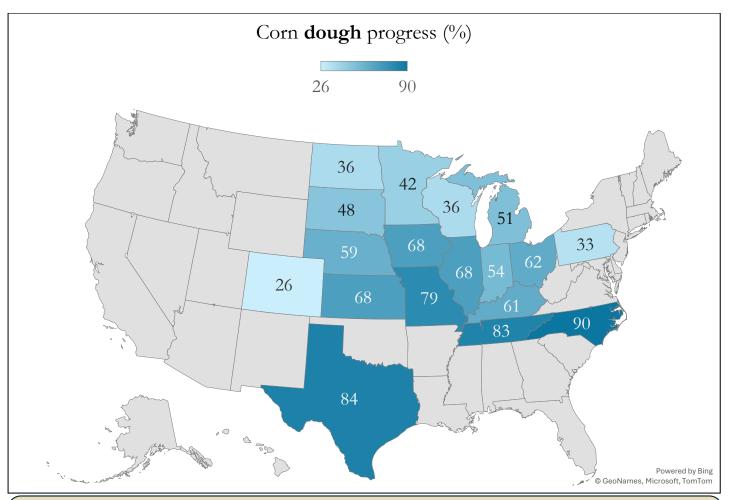


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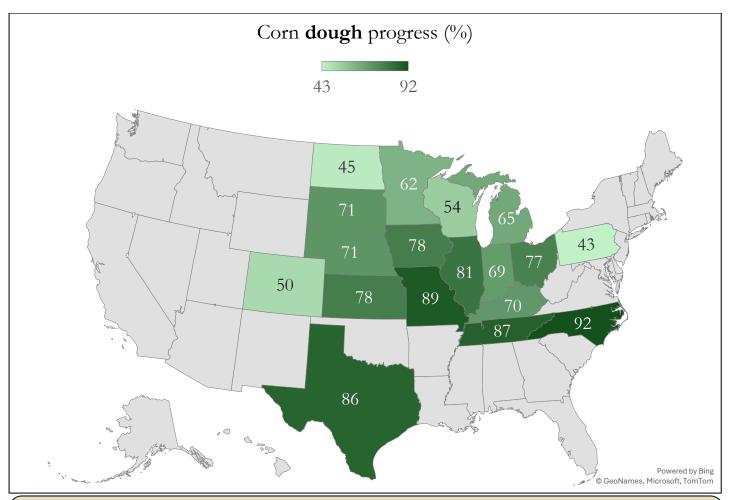


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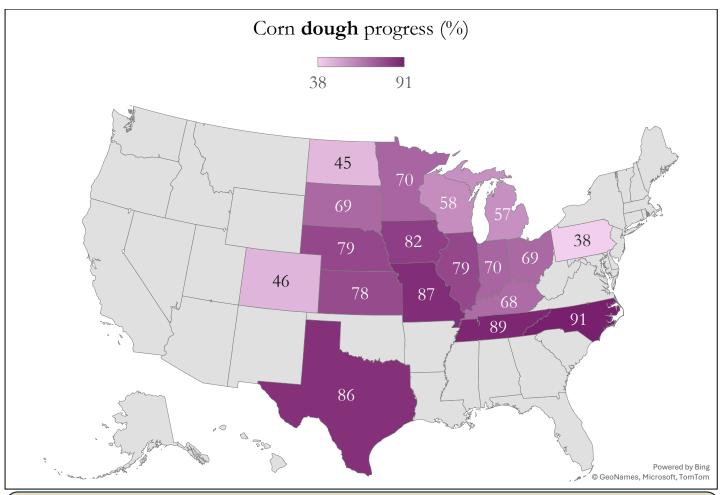


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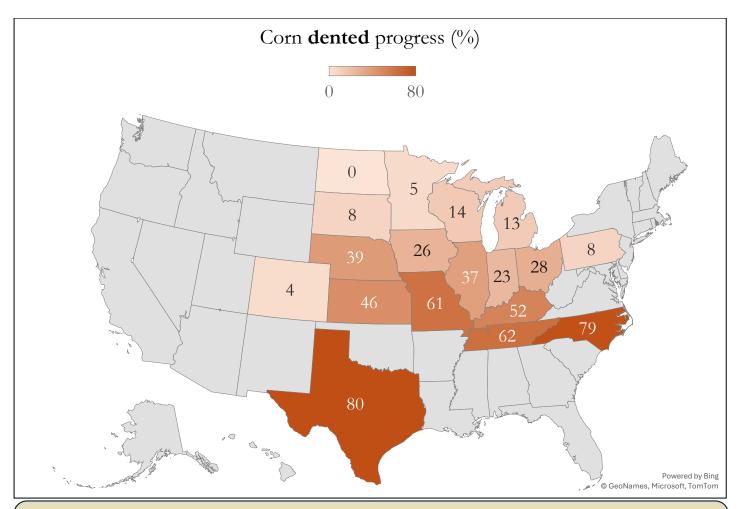


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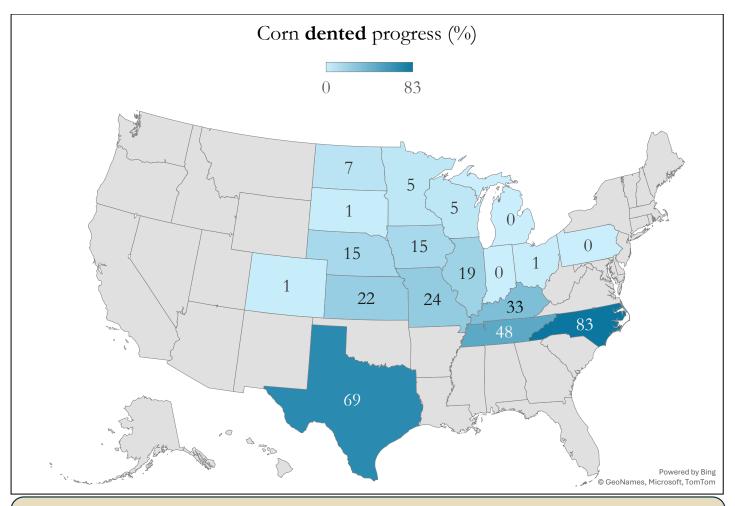


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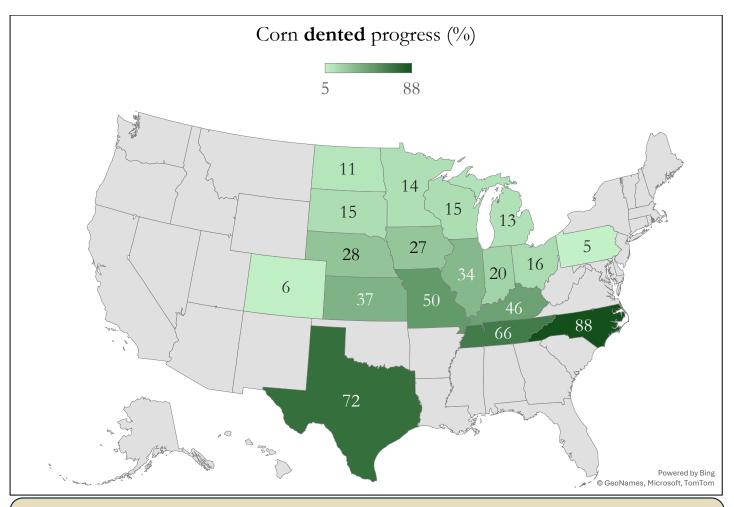
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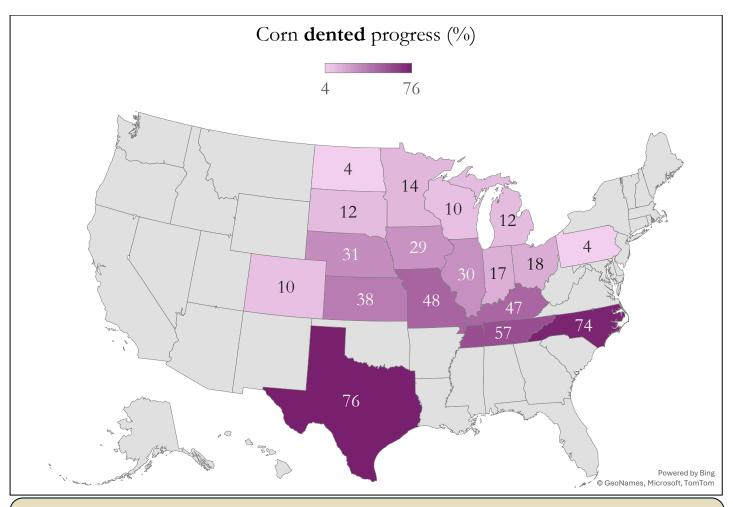
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Aug 17, 2025 Average (2020-2024)

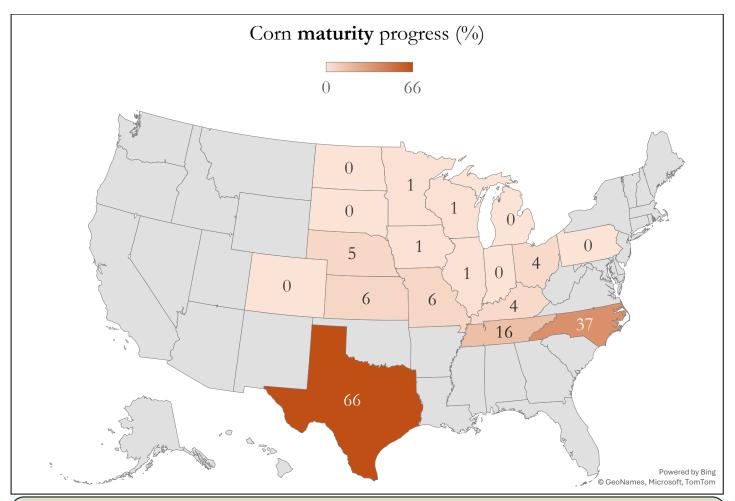


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Average (2020-2024)



Interactive Maps 5. U.S. Corn Maturity Progress (USDA-NASS)

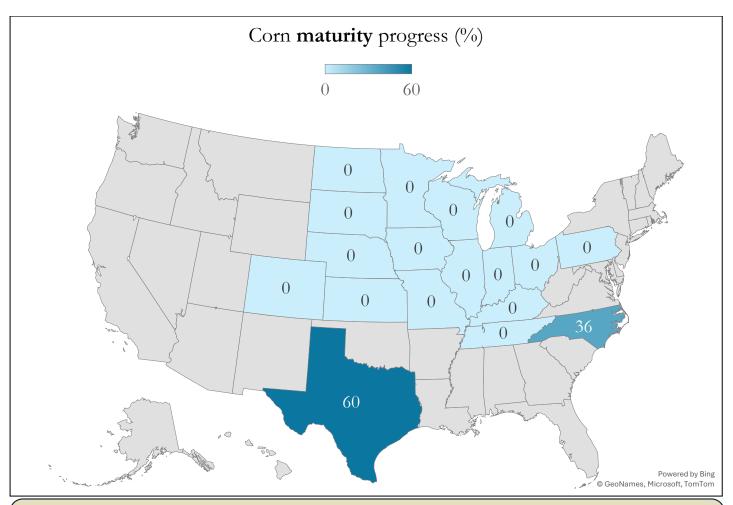
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Aug 17, 2025

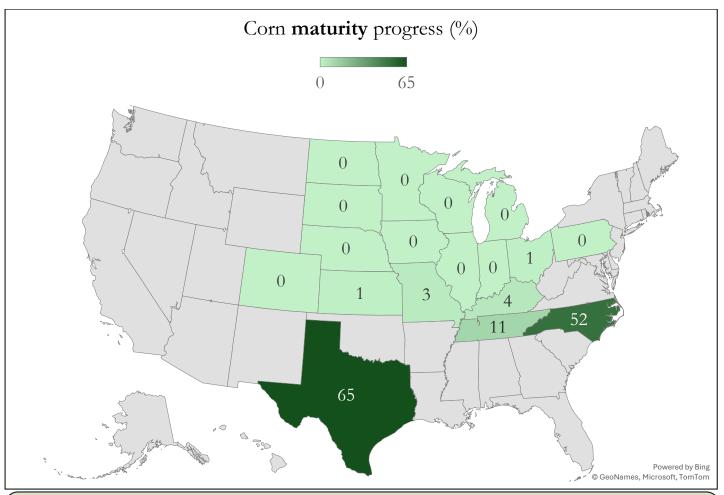
Average (2020-2024)



Aug 17, 2024

Aug 10, 2025 Aug 17, 2025

Average (2020-2024)



Interactive Maps 5. U.S. Corn Maturity Progress (USDA-NASS)

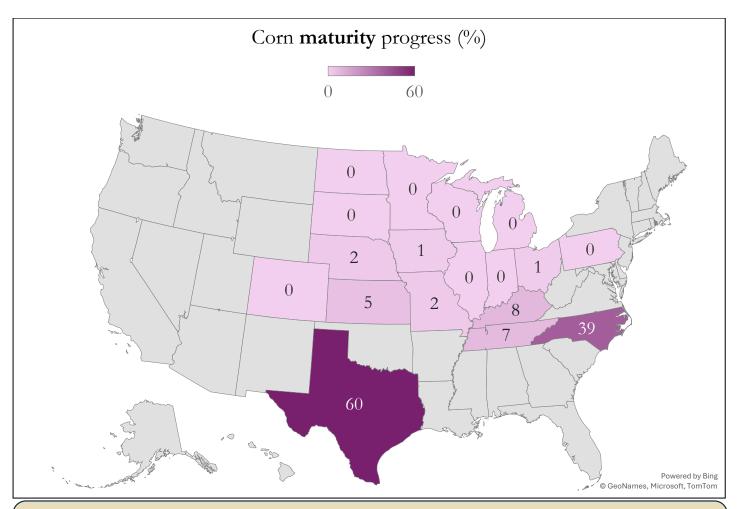
Click on the dates below to see the corn maturity progress over time and the average:

Aug 17, 2024

Aug 10, 2025

Aug 17, 2025

Average (2020-2024)



Aug 17, 2024

Aug 10, 2025

Aug 17, 2025

Average (2020-2024)