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In This Issue

Armyworm Pheromone Trap Report – 2022

(John Obermeyer)

County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11
Dubois/SIPAC Ag Center	0	0	120	21	8	2	2	12	35	72	17
Jennings/SEPAC Ag Center	0	0	10	2	2	5	0	0	2	8	47
Knox/SWPAC Ag Center	0	5	58	24	65	10	12	15	6	10	4
LaPorte/Pinney Ag Center	0	24	11	44	12	16	9	19	5	14	8
Lawrence/Feldun Ag Center	4	31	31	163	306	154	40	150	157	158	189
Randolph/Davis Ag Center	0	0	0	0	23	35	10	43	10	0	0
Tippecanoe/Meigs	0	5	19	70	58	84	3	35	10	25	28
Whitley/NEPAC Ag Center	0	0	15	17	23	155	276	35	18	61	53

Wk 1 = 4/1/22-4/6/22; Wk 2 = 4/7/22-4/13/22; Wk 3 = 4/14/22-4/20/22; Wk 4 = 4/21/22-4/27/22; Wk 5 = 4/28/22-5/4/22; Wk 6 = 5/5/22-5/11/22; Wk 7 = 5/12/22-5/18/22; Wk 8 = 5/19/22 – 5/25/22; Wk 9 = 5/26/22-6/1/22; Wk 10 = 6/2/22-6/8/22; Wk 11 = 6/9/22-6/15/22

“Rootless” Or “Floppy” Corn Syndrome

(Bob Nielsen)

Factors that contribute to a high risk for “rootless” or “floppy” corn syndrome in 2022 include…

- Late May or later planting,
- Shallow planting,
- Dry surface soils, and
- Multiple, consecutive days of extreme heat (upper 90s)

Excessive drying of the upper soil profile is conducive for the development of what some of us affectionately call the “rootless corn” or “floppy corn” syndrome. The problem illustrates a classic example of the importance of the timing of stress relative to stage of plant development.

Seminal roots, but no upper nodal roots.

The permanent (aka nodal) roots of a corn plant initially elongate from nodes near the crown area of the young plant (approximately 3/4 inch below the soil surface) and first become visible between leaf collar stages V1 and V2 (Nielsen, 2020). The young roots develop in individual sets or “whorls”, beginning with the lowermost node of the stalk and progressing sequentially over time in an acropetal fashion up to Node #6 or so. The main growing point or meristem of a root is located just behind the tip of the root and must remain alive in order for the root to develop normally.

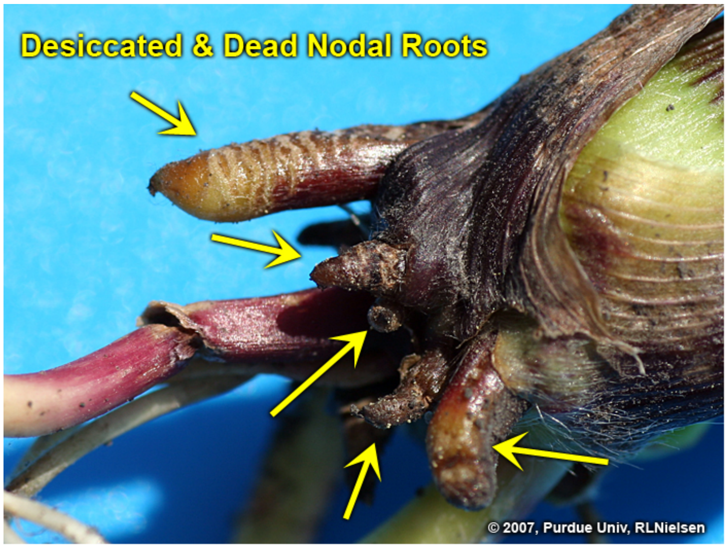
Roots elongate downward primarily in response to gravity (i.e., a positive gravitropic response). There is evidence that roots also respond to soil moisture gradients (hydrotropism) by elongating toward soil regions with more favorable moisture levels (Eagen et al., 2005; Rodríguez and Cassab, 2021). However, the overarching determinant of roots’ downward growth is likely gravity.

If nodal roots begin their initial elongation in bone-dry surface soil but elongate downward to adequate soil moisture at deeper depths before the meristematic root tip desiccates, then the root will survive and proliferate. If the root tip (and its accompanying meristem) desiccates prior to reaching soil moisture, the entire young nodal root often dies. This is particularly true if the axillary meristems along the length of the root (that eventually produce the adventitious branch roots) have not yet differentiated or become active.

The desiccating effect of bone-dry surface soils on young, newly elongating nodal roots is exacerbated by sunny weather and hot temperatures. Dry soil warms more quickly, and dramatically, than wet soil. On a warm, sunny day with air temperatures in the high 80s to low

90s F, soil temperature at the 3/4 inch or depth can exceed lethal levels for young roots. This is especially true for residue-free, conventionally-tilled fields.

The appearance of desiccated roots is what one would imagine; they are shriveled and discolored. This symptom is unlike that of any other lethal root stress, including salt injury from fertilizer. These symptoms are **NOT** like any associated with herbicide injury or insect feeding.



Desiccated & dead nodal roots.

An entire set or "whorl" of nodal roots can emerge and die within the course of a few days. If this happens to the first set of roots (Node #1) as they begin to elongate (between leaf stages V1 and V2), the young plant survives on what's left in the kernel reserves and what the seminal roots offer in terms of moisture and nutrient uptake until the next set of nodal roots develop and become established. If subsequent sets of nodal roots die in the same manner, the plant continues its dependence on the kernel and seminal root support.

In fact, it is amazing to me how the aboveground appearance of a plant whose nodal roots are desiccating and dying can appear fairly normal up until the fateful windy day when the mesocotyl simply can no longer support the plant and it literally flops over to the ground. "Floppy" corn plants are **NOT** technically root-lodged; they are simply broken over at the mesocotyl below the crown area of the plant. Obviously, the health of the mesocotyl and the seminal roots determine whether an affected plant can "hang on" until a decent "soaker" of a rain occurs to replenish soil moisture levels.

I began this article by telling you that the "Floppy Corn" Syndrome is a classic example of the importance of the timing of stress versus stage of plant development. Rooting of young plants is most vulnerable to the effects of dry surface soils up until the nodal root system has been fairly well-established (about V5 or V6). Consequently, "Floppy Corn" is more likely to occur in a field of younger, recently-planted corn than an adjacent field of older, earlier-planted corn whose nodal root development is farther along.

CORNY TRIVIA:Sometimes when several sets of nodal roots desiccate and die, the crown of the young plant may "appear" to be at or above the soil surface. That appearance is an optical illusion except in a few cases (Nielsen, 2004).

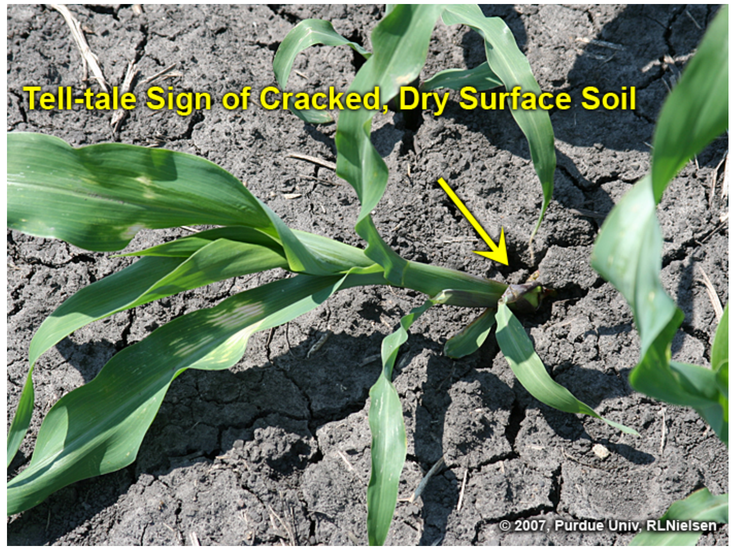
What Can Be Done to Alleviate the Problem? Unfortunately, very little can be done to prevent the situation from becoming worse. Row cultivation may encourage new nodal root development if moist soil is thrown around the base of the plants. However, if the soil is dry enough to be causing the problem in the first place, there's probably very little moist soil shallow enough to be brought up by row cultivation. The ultimate solution to the problem is a good soaking rain or at least enough of a rain to sustain new nodal root development long enough to allow the roots to reach deeper and hopefully wetter soil conditions before the upper soil dries again.

"Slightly shallow" seeding depth.

'Hindsight" Reminders or Foresight Advice.

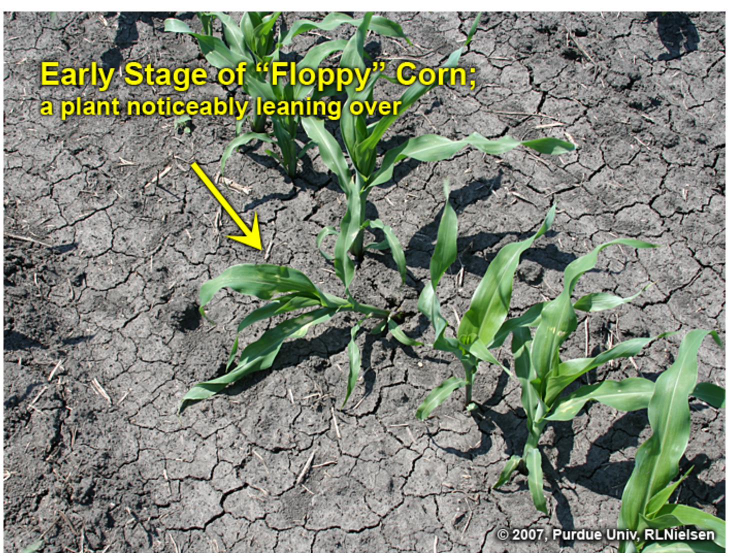
- "Rootless" corn develops more easily with extremely shallow seeding depths that results in nodal root initiation beginning closer to the soil surface than at the usual approximate 3/4 inch depth. This is one of several reasons that growers should avoid choosing seeding depths shallower than about 1 to 1-1/2 inches.
- Conversely, unusually deep planting (more than 2 inches) does not result in unusually deeper initial root elongation because the light-mediated elongation of the mesocotyl during emergence results in the crown of the seedlings being at roughly the same depth (3/4 inch) below the soil surface.
- Furrow erosion after planting, as a result of heavy rains, can create "shallow planted" seed as a consequence of removing topsoil.
- Shallow soil compaction from shallow tillage of fields that are "just a little on the wet side" can restrict initial nodal root development to the shallow, and often dry, soil above the compacted layer.
- Open seed slots resulting from no-till planting "on the wet side" can contribute to the desiccation and death of initial nodal root development if the initial nodal roots desiccate before they successfully penetrate through the furrow sidewalls.

Corn at V5 to V6.

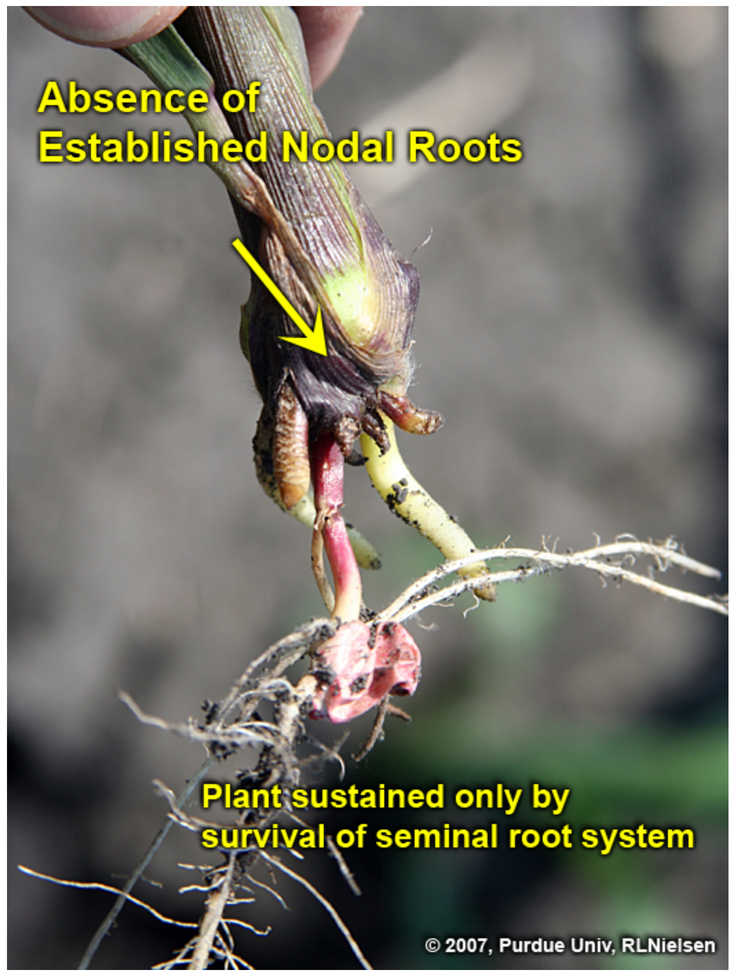


Early stage of “floppy” corn.

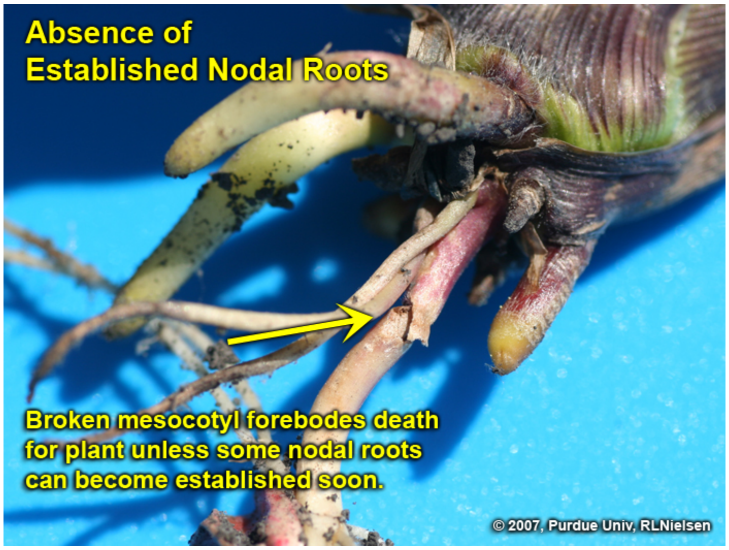
Root system of “normal” plant.



Early stage of “floppy” corn.



Absence of established nodal roots.



Broken mesocotyl.

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Tar Spot Of Corn: What To Know And New Research

(Dan Quinn) & *(Darcy Telenko)*

What is Tar Spot?

Due to its relatively recent U.S. discovery and its ability to cause significant production and economic losses, tar spot is often a topic of angst and anxiety amongst corn farmers and agronomists in Indiana. For example, a severely infected field can reach yield losses upwards of 60 bushels per acre! Yield losses are often a result of reduced photosynthetic capacity (green leaf area) of the corn plant during grain fill resulting in poor grain fill, kernel abortion, and reduced kernel weight. In addition, severe infection can reduce corn stalk integrity and cause significant lodging later in the season. Tar spot was first confirmed in northwest Indiana in 2015 and the first significant yield-reducing event of the disease was observed in 2018. Similarly, severe outbreaks and large areas of infection of this disease were observed in Indiana in 2021. Tar spot is caused by the fungus known as *Phyllachora maydis* and can be identified by small, raised black and circular spots present on corn leaves, stalks, and husks (Figure 1). These black and circular spots are known as fungal fruiting structures called stromata, each of which can produce thousands of spores. Overall, tar spot infection and severity can vary based on environmental conditions, the total amount of the pathogen present in the field, and corn hybrid chosen.

Figure 1. Tar spot infection presence on a corn leaf during 2022. (*Photo Credit: Dan Quinn*)

What Conditions Cause Tar Spot?

Tar spot pressure in corn is fueled by cool (60-70 degrees F), humid conditions (>75% relative humidity) and prolonged leaf wetness (>7 hours). Therefore, tar spot pressure is typically higher in areas such as those closer in proximity to the great lakes (e.g., Northwest Indiana), river bottoms, and irrigated corn acres. Furthermore, it is also important to note that previous research has found that the pathogen that causes tar spot can overwinter on infested corn residue on the soil surface, thus causing crop infection risks in the following year(s).

How do I manage Tar Spot?

Crop Scouting and Diagnosis – In order to properly manage problems in *your* fields, it is important to identify which specific problems are present in *your* fields. Proper diagnosis and early detection of tar spot is critical for successful management of the disease. Tools such as the Tar Spot Distribution map (https://corn.ipmpipe.org/tarspot/) and the Tar Spotter app (https://ipcm.wisc.edu/apps/tarspotter/) are useful tools for tracking the presence of tar spot in your specific county and recognizing conditions conducive for tar spot development.

Fungicide Use – Currently, there are multiple fungicides from multiple companies that work to help control tar spot in corn. The fungicide efficacy chart available through the Crop Protection Network (https://cropprotectionnetwork.s3.amazonaws.com/CPN2011_FungicideEfficacyControlCornDiseases_04_2022-1650470887.pdf) is a useful tool for fungicide selection based on disease presence in the field. However, fungicide efficacy is often largely controlled by fungicide timing. In most instances, a fungicide application between the VT growth stage (tassel emergence) and R2 growth stage (blister) is the most effective for controlling tar spot. Furthermore, a mixed-mode-of-action fungicide product is often more effective than a single-mode-of-action product. In severe tar spot situations, as what was observed in certain areas in 2021, two fungicide applications may be required. However, this is often dictated by history of severe disease and conducive environmental conditions in a field, and reiterates the importance of tracking the disease and field scouting.

Hybrid Selection – At the moment there are no corn hybrids with complete resistance to tar spot. However, different hybrids show different levels of partial resistance which can be effective in reducing tar spot severity. It is important to work with your seed company and examine local hybrid trials for proper hybrid selection to help with tar spot control. In addition, if you have tar spot in your fields, scout and pay attention to the different hybrids planted across your farm later in the season and at harvest for noticeable differences in tar spot severity and yield.

Cultural Practices – Practices that help reduce infested corn residue and reduce the survival of tar spot fungal structures can help reduce tar spot presence in corn fields. The two common practices for reducing disease inoculum include crop rotation and tillage. Rotation away from corn to soybeans allows for further breakdown of infested corn residue. In addition, tillage can help bury infested corn residue and reduce fungal spore movement. However, these practices can produce mixed results and are not the sole solution for preventing tar spot.

New Research

Starting in 2022, Drs Telenko and Quinn will begin examing the role of corn planting date, corn hybrid relative maturity date, and fungicide use on tar spot severity, corn growth, grain fill potential, and yield. Planting date and corn hybrid relative maturity are two strategies that can be used to manipulate the timing corn reaches critical growth stages (e.g., pollination) and physiological maturity (e.g., black layer) during the season. Previous research has identified the optimum fungicide application in most years for tar spot control to occur at growth stage VT/R1 (tassel emergence/silking) to R2 (milk), with minimal yield responses to a later fungicide application at the R4 growth stage (dough) and beyond. Therefore, can the combination of earlier planted corn and/or shorter-season hybrids be used to reach critical growth stages earlier, thus causing tar spot infection to occur later in the corn growth cycle and reduce yield loss and fungicide dependence? Stay tuned for updates from this research trial coming soon.

Additional Resources

Purdue University Plant and Pest Diagnostic Laboratory – https://ag.purdue.edu/department/btny/ppdl/

Purdue University Field Crops Pathology – https://extension.purdue.edu/fieldcroppathology/

Purdue University Corn Agronomy – https://thekernel.info

Tar Spotter App – https://ipcm.wisc.edu/apps/tarspotter/

Crop Protection Network – https://cropprotectionnetwork.org

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Overgrazing During Hot And Dry Weather Has Long Term Consequences

(Keith Johnson)

This week, high late-spring temperature occurred in the Midwest. A brief respite from the heat is predicted to occur, but high temperature quickly comes back again with no rain predicted to happen. Cool-season grasses will likely begin being in a dormant state. For the well being of the forage, do not graze cool-season grasses and legumes to a height less than 4 inches. Meristems are where cell initiation, continued division, and elongation occurs. When close grazing happens, meristems cannot produce what would be the next growth to graze. In time, less productive plants that can take close grazing (examples: Kentucky bluegrass and white clover) will become more dominant. This happens because the meristems are at or slightly below the soil surface. Troublesome weeds may begin to appear and become dominant, too, when overgrazing occurs. Another measure to consider is if more than ten percent of the area is visible soil, that is an indication that the stand is either thin or overgrazing is happening.

Watch and listen carefully. Your forages may be crying out “Don’t overgraze if you want to see us next year!”.

If plants could cry out, they would yell "Stop" when overgrazing begins to occur. Note the visible manure in the upper center and the crushed aluminum can in the lower center of the photograph. If the pasture was properly grazed, the manure and aluminum can would not have been visible at the distance that the photograph was taken. (*Photo Credit: Keith Johnson*)

The Scoop On Poop In A Changing Climate

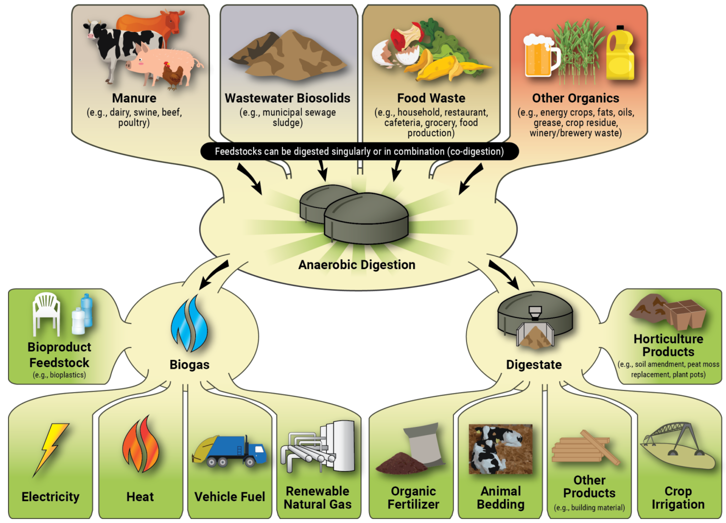
(Dr. Jeffrey Dukes), *(Beth Hall)*, *(Melissa Widhalm)*, *(Hans Schmitz)* & *(Austin Pearson)*

Farming for a Better Climate

In pastoral agricultural days, and on some farms around the state today, cattle, pigs, turkeys, and chickens roamed the countryside, held in relative place using fencing or a centralized food source. Their manures were deposited on the pastures they roamed, and nutrients therein fertilized those soils. Today, these animals in particular tend to grow in confined operations, be they buildings or feedlots. One result of this management practice is the need to control and position waste that falls on dirt or concrete floors rather than pastures. The way in which those manures are handled have a big effect on the emission of greenhouse gasses into the atmosphere.

As was mentioned in a prior article, the emission of methane in agriculture is majority-caused by rumen digestion out of the mouth of cattle, sheep, goats, and others with four stomachs. However, methane emissions from manure management are second in rank across research studies. Generally, manures from livestock management are channeled away from the animals and placed into pits, lagoons, composted, or hauled off site for spread onto agricultural fields. Greenhouse gas emissions, no matter the management practice, can be reduced by using some practical and often economically viable steps.

Anaerobic digesters on confined feeding operations are one expensive yet potentially lucrative option for controlling animal waste. Waste is fed into a closed system where bacteria break down the excrement into biogas and digestate. The biogas contains concentrated methane, carbon dioxide, hydrogen sulfide, and other trace gasses. This biogas can then be converted to natural gas and reused for fuel. Although not completely clean from a greenhouse gas perspective, anaerobic digestion does create an opportunity to reduce total emissions through reuse. The EPA has an excellent primer on digesters.



The figure illustrates the flow of feedstocks through the anaerobic digestion system to produce biogas and digestate. SOURCE: U.S. EPA

If planning to spread manures on agricultural fields, incorporation of those manures into dry soils at or very shortly after application makes a huge difference in the amount of gasses that enter the atmosphere. As Hristov et al. found in 2011, referenced in the Sustainable Dairy Fact Sheet Series, incorporation of manure can reduce ammonia emissions from those manures by 70 percent. Nitrous oxide emissions can likewise be reduced by ensuring that manures are applied and incorporated into dry soils, as moisture enhances the conversion into nitrous oxide gas.

Lagoons provide an open storage structure for liquid and solid waste, with their cleanout occurring on timed intervals and lagoon wastewater applied to nearby agricultural fields. When possible, use of a lagoon cover digester provides significant reduction in greenhouse gas emissions. Recent research into lagoon additives also shows some promise in reducing emissions, and many different kinds are currently being marketed. In the absence of a cover digester, just getting the lagoon covered can reduce gas emissions. Finally, aeration of the lagoon turns anaerobic conditions into aerobic conditions, which may increase carbon dioxide emissions, but reduces methane, hydrogen sulfide, and nitrous oxide emissions.

However manure is managed, using current best management practices to keep greenhouse gases out of the air and in forms best turned into a profit through conversion to nutrients or natural gas, helps keep agriculture running at maximum efficiency.

Farming for a Better Climate is written in collaboration by the Purdue Extension, the Indiana State Climate Office, and the Purdue Climate Change Research Center. If you have questions about this series, please contact in-sco@purdue.edu.

Heat Wave And Mugginess

(Beth Hall)

This week has made me long for the time when I lived in Reno, Nevada. Further north and higher in elevation than Las Vegas, the climate was absolutely beautiful – particularly if you are not into green vegetation, bugs, and drink coasters. Reno was never quite as hot as Las Vegas, but still had the dry heat that made 90-degree days quite enjoyable, particularly when they were followed by 50-degree nights begging for jackets and a sweatshirt. This Midwest mugginess certainly brings out the bugs (window screens are mostly used for child protection and not bugs in the west) and did you know drink coasters aren't necessary in dry environments? That is because there is not enough moisture (humidity) in the air to condense around a cold drink. In a previous article, I mentioned how dew-point temperature is one of the best indicators of how humid the air is. Those dew-point temperatures have passed 80°F again this week and we're seeing evidence of this on our fogged-up windows (assuming you're running your air conditioning below 80°F) and eyeglasses when coming indoors. This week, not only have we experienced consecutive days with dew-point temperatures over 80°F, but our nights have not been cooling off well, either. This can cause significant heat stress on humans, livestock and other animals, and our energy bills!

The climate outlooks are showing strong confidence that these hot temperatures will continue for a while. Precipitation outlooks, on the other hand, are favoring the probability for below-normal precipitation. However, that does not always translate to lower humidity. As we have seen over the last few days, rain does not always correspond with high humidity. Therefore, if the atmospheric flow continues to pull moisture in from the Gulf of Mexico, these high dew-point temperature days are likely to continue! The July climate outlooks continue to favor above-normal temperature (Figure 1) and below-normal precipitation (Figure 2), but the confidence is slightly weaker for that period compared to the confidence for both conditions to continue for the rest of June. The precipitation forecast over the next 7 days (Figure 3) is predicting less than 0.5" of rain across Indiana, with the greater amounts focused on southwest Indiana. There are early concerns of a rapid intensification of drought ("flash drought") occurring over the next few weeks, so keep an eye on those forecasts and start preparing now for that potential to occur.

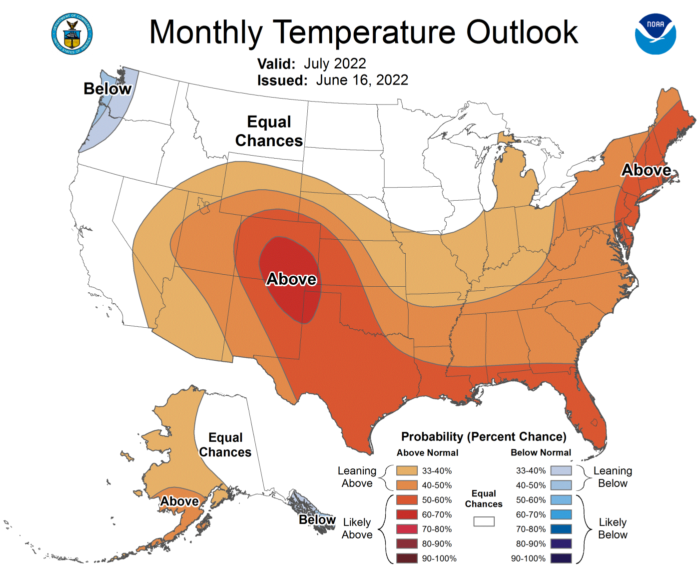


Figure 1. Temperature outlook for the July 2022. These are produced by the national Climate Prediction Center and illustrate confidence of favoring above- or below-normal conditions.

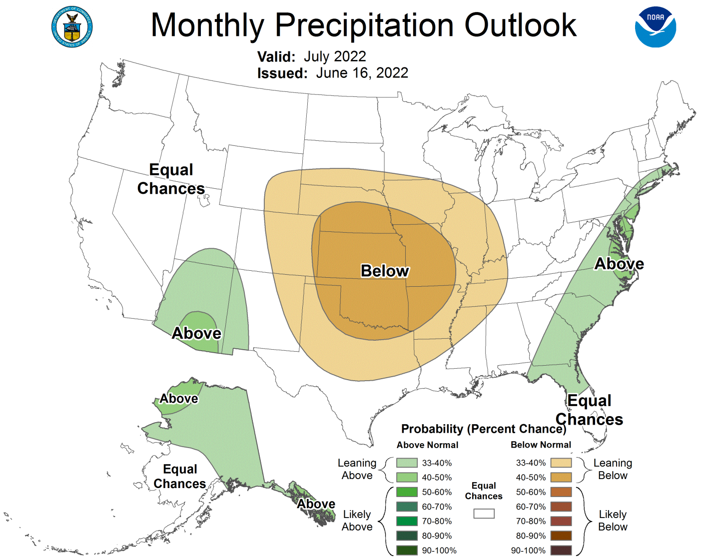


Figure 2. Precipitation outlook for the July 2022 period. These are produced by the national Climate Prediction Center and illustrate confidence of favoring above- or below-normal conditions.

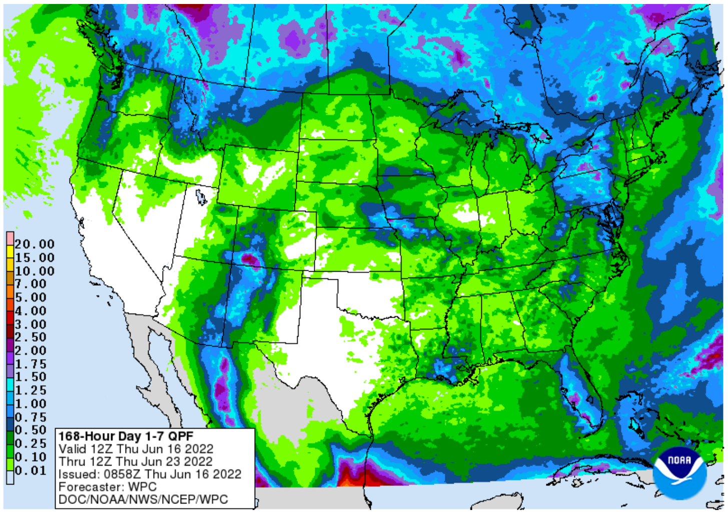


Figure 3. Quantitative precipitation forecast (in inches) for June 16-23, 2022. Source: National Weather Service.

Modified growing degree-day values continue to accumulate (Figure 4). When considering a start date of April 15th, the southern two-thirds of Indiana is 20 to 80 units ahead of the 1991-2020 climatological normal (Figure 5).

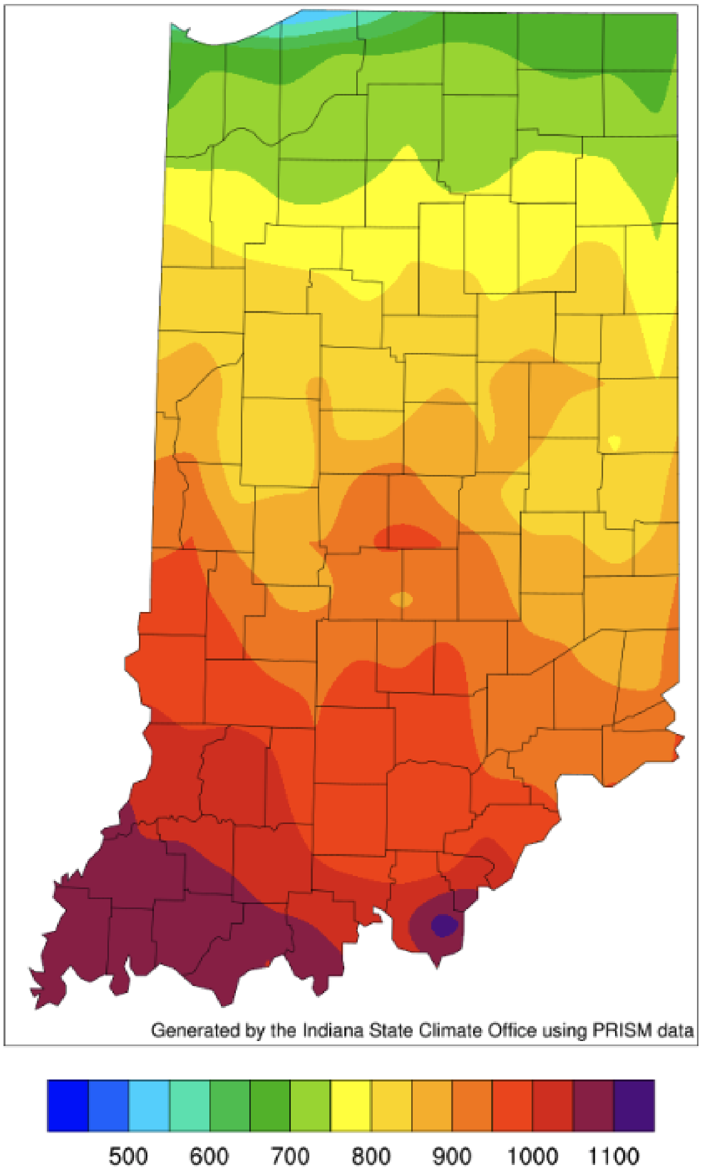


Figure 4. Modified growing degree day (50°F / 86°F) accumulation from April 15-June 15, 2022.

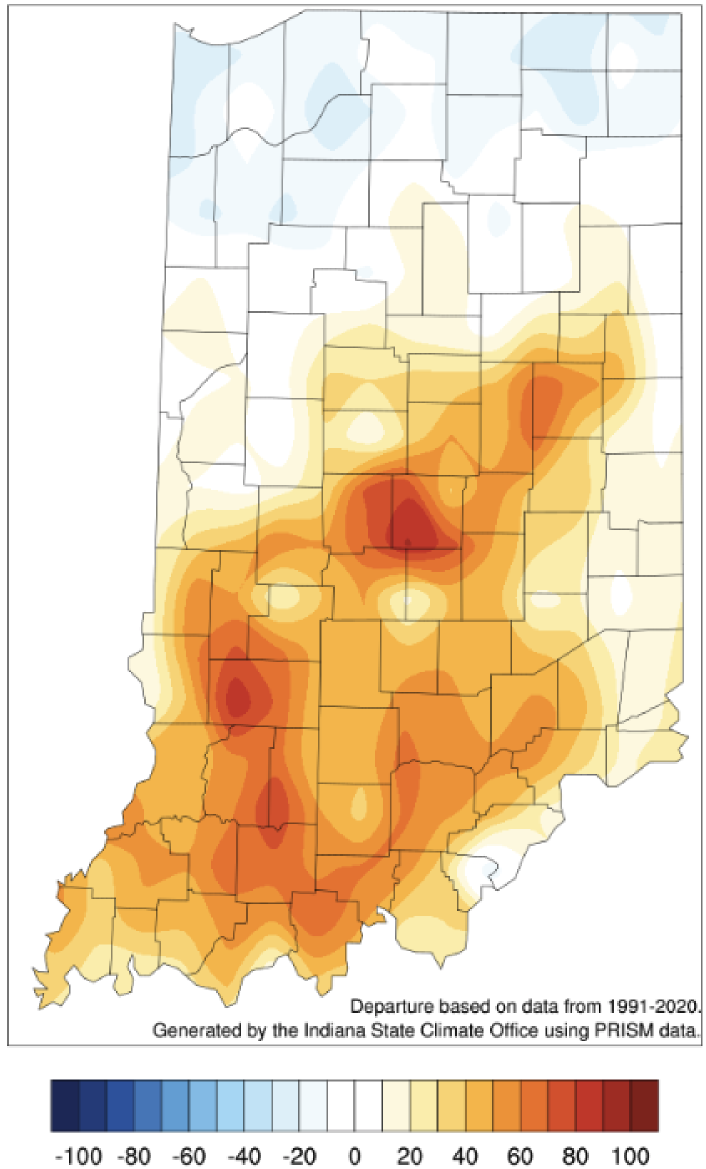


Figure 5. Modified growing degree day (50°F / 86°F) accumulation from April 15-June 15, 2022, represented as the departure from the 1991-2020 climatological average.

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