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In This Issue

Do Insect Pests Get Diseases?

(Christian Krupke) & *(John Obermeyer)*

Many black cutworm trappers have captured large numbers of moths, see "Black Cutworm Pheromone Trap Report." In trying to find levity during the Covid-19 pandemic, there have been various quips during their reports about this pest's lack of adherence to our social distancing guidelines! These Hoosiers are not "hunkering down," as the governor has ordered. In fact, insects are subject to many diseases, sometimes decimating local populations. Like human diseases, high population density has a strong predictive effect on disease prevalence and spread. Unfortunately, these diseases, called epizootics in insect populations, often occur when populations are extremely dense and well after damage has been done to our crops.

FUNGAL epizootics in insects/mites are relatively common during periods of high temperatures and humidity. Often, without us even noticing, threatening populations of soybean aphid, two-spotted spider mite, potato leafhopper, to name a few, are kept in check by these pathogens. Less common are VIRUS epizootics, the most recent vivid example was with the "great outbreak" of armyworm in 2001. Days after "armies" of caterpillars had eaten through grass hay and cornfields, limp and listless armyworm were being seen up on the stems of denuded plants and picked off easily by hungry flocks of birds. It wasn't insecticides that finally brought this nemesis to rest, but rather mother nature…a virus! The following information on nuclear polyhedrosis viruses is from the Midwest Institute for Biological Control, circa 1997:

"Insect larvae infected with nuclear polyhedrosis viruses (NPV) usually die from 5 to 12 days after infection depending on viral dose, temperature, and the larval instar at the time of infection. Just before dying, larvae often crawl to the tops of plants or any other available structure where they die and decompose. Millions of polyhedra are contained in the fluid mass of the disintegrating larvae and fall into feeding zones (leaves, leaf litter) where they can be ingested by other conspecific larvae. NPV epizootics are very impressive and, although they are important as naturally occurring mortality factors for many insect species, they often occur after the pest insect has exceeded the economic injury level. This is especially true when the crop that is being damaged by this insect has a relatively low economic threshold."

There have been many efforts over the years to deliver these viruses to the field as targeted insecticides – they offer many advantages over chemical insecticides: they are highly specific (often affecting only one insect species), offer high mortality, and, unlike chemical insecticides, offer the possibility of horizontal transmission (in other words, one infected insect can infect many others). However, these efforts have had mixed results at best – viruses are not hardy in the field and keeping them viable in sprays and baits remains the key challenge. UV light, heat, and other environmental stressors reduce their efficacy and longevity in the field.

The good news, yes, insect pests do get diseases, both fungal and viral. The bad news is that large populations need to be present to spread the pathogen throughout, so they are not something that pest managers can count on to help protect their crops.

Flaccid armyworm larva infected with a virus, hanging from a midrib.

2020 Black Cutworm Pheromone Trap Report

(John Obermeyer)

County	Cooperator	BCW Trapped Wk 1 4/2/20-4/8/20	Wk 2 4/9/20-4/15/20	Wk 3 4/16/20-4/22/20	Wk 4 4/23/20-4/29/20	Wk 5 4/30/20-5/6/20	Wk 6 5/7/20-5/13/20	Wk 7 5/14/20-5/20/20
Adams	Roe/Mercer Landmark	12	17*	15*	19*			
Allen	Anderson/NICK	1	1	1	5			
Allen	Gynn/Southwind Farms	2	3	0	6			
Allen	Kneubuhler/G&K Concepts	6	2	4	9			
Bartholomew	Bush/Pioneer Hybrids	6	28*	39*	28*			
Clay	Mace/Ceres Solutions/Brazil	2	2	4	3			
Clay	Fitz/Ceres Solutions/Clay City	0	4	3	10			
Clinton	Emanuel/Boone Co. CES	26*	18	28*	72*			
Dubois	Eck/Dubois Co. CES	1	13	18*	16*			
Elkhart	Kauffman/Crop Tech	7	12	5	10			
Fayette	Schelle/Falmouth Farm Supply Inc.	46*	23	25	15			
Fountain	Mroczkiewicz/Syngenta	0	8	3	4			
Fulton	Jenkins/Ceres Solutions/Talma	0	0	1	2			
Hamilton	Campbell/Beck's Hybrids	15	10	16	23*			
Hendricks	Nicholson/Nicholson Consulting	0	8	3	5			
Hendricks	Tucker/Bayer		28*	15*				
Howard	Shanks/Clinton Co. CES		2	0	1			
Jasper	Overstreet/Jasper Co. CES	0	0	0	4			
Jasper	Ritter/Dairyland Seeds	12	11	12	2			
Jay	Boyer/Davis PAC	19*	28*	16*	28*			
Jay	Shrack/Ran-Del Agri Services	19*	20	20*	36*			
Jennings	Bauerle/SEPAC	16	29*	17	82*			
Knox	Clinkenbeard/Ceres Solutions/Freelandville	0	0	0	0			
Knox	Butler/Ceres Solutions/Vincennes	0	0	0	6			
Lake	Kleine/Rose Acre Farms	60*	35*	26*	38*			
Lake	Moyer/Dekalb Hybrids/Shelby	4	22*	6	8			
Lake	Moyer/Dekalb Hybrids/Scheider	5	21*	6	10			
LaPorte	Rocke/Agri-Mgmt. Solutions	6	9	23*	14			
Marshall	Harrell/Harrell Ag Services							
Miami	Early/Pioneer Hybrids	0	7	2	7			
Montgomery	Delp/Nicholson Consulting	2	18*	33*	51*			
Newton	Moyer/Dekalb Hybrids/Lake Village	0	4	4	1			
Porter	Tragesser/PPAC		1	0	6			
Posey	Schmitz/Posey Co. CES	1	5	2				
Pulaski	Capouch/M&R Ag Services			4	11			
Pulaski	Leman/Ceres Solutions	31*	28	38*	32*			
Putnam	Nicholson/Nicholson Consulting	8	9	5	5			
Randolph	Boyer/DPAC	13*	13	11*	8			
Rush	Schelle/Falmouth Farm Supply Inc.	1	3	15	6			
Shelby	Fisher/Shelby County Co-op		0	7	21*			
Shelby	Simpson/Simpson Farms	0	32*	37*	65*			
Stark	Capouch/M&R Ag Services							
St. Joseph	Carbiener, Breman	9	0	11				
St. Joseph	Deutscher/Helena Agri-Enterprises	2	19	1	48*			
Sullivan	Baxley/Ceres Solutions/Sullivan	0	8		11			
Sullivan	McCullough/Ceres Solutions/Farmersburg	0	0	10*	14*			
Tippecanoe	Bower/Ceres Solutions	3	6	14*	29*			
Tippecanoe	Nagel/Ceres Solutions	36*	38*	86*	88*			
Tippecanoe	Obermeyer/Purdue Entomology	0	0	2	30*			
Tippecanoe	Westerfeld/Bayer Research Farm	0	2	6	13			
Tipton	Campbell/Beck's Hybrids	0	6	8	19			
Vermillion	Lynch/Ceres Solutions/Clinton	0	0	0	0			
White	Foley/ConAgra	5	1	4	5			
Whitley	Richards/NEPAC/Schrader		7		28			
Whitley	Richards/NEPAC/Kyler		13		40			

* = Intensive Capture…this occurs when 9 or more moths are caught over a 2-night period

Armyworm Pheromone Trap Report – 2020

(John Obermeyer)

County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Dubois/SIPAC Ag Center	724	84	4	28						
Jennings/SEPAC Ag Center	60	75	11	15						
Knox/SWPAC Ag Center	1162	308	56	168						
LaPorte/Pinney Ag Center	115	65	0	21						
Lawrence/Feldun Ag Center	974	347	57	741						
Randolph/Davis Ag Center	117	207	16	51						
Tippecanoe/Meigs	225	wind dmg.	6	54						
Whitley/NEPAC Ag Center		9		38						

Wk 1 = 4/2/20-4/8/20; Wk 2 = 4/9/20-4/15/20; Wk 3 = 4/16/20-4/22/20; Wk 4 = 4/23/20-4/29/20; Wk 5 = 4/30/20-5/6/20; Wk 6 = 5/7/20-5/13/20; Wk 7 = 5/14/20-5/20/20; Wk 8 = 5/21/20 – 5/27/20; Wk 9 = 5/28/20-6/3/20; Wk 10 = 6/4/20-6/10/20; Wk 11 = 6/11/20-6/17/20

New And Updated Disease Monitoring Resources For Field Crops

(Darcy Telenko)

Planting has begun to ramp up here in Indiana. I want to remind you of a few resources for monitoring field crop diseases. Some are updated and others are new this spring. In addition, the field crop pathology team will be tracking diseases across Indiana and will add updates here in Pest & Crop and on the Purdue Field Crop Pathology Extension site. You can also follow me on Twitter @DTelenko.

There are national field crop pathology programs in place to track and/or predict risk for some the more economically important diseases in the Unites States, such as Fusarium head blight in wheat; wheat stem, stripe, and leaf rust; corn rust and tar spot; and soybean rust. The Crop Protection Network site hosts unbiased, collaborative outputs on important issues affecting field crops in the United States and Canada; this site has numerous resources and fungicide efficacy tables for corn, soybean, and wheat.

General resources for all field crops:

Purdue Field Crop Pathology Extension site: https://extension.purdue.edu/fieldcroppathology/

Crop Protection Network: https://cropprotectionnetwork.org/

(Fungicide efficacy tables are found in the resources section)

Wheat:

Fusarium head blight risk map: http://www.wheatscab.psu.edu/

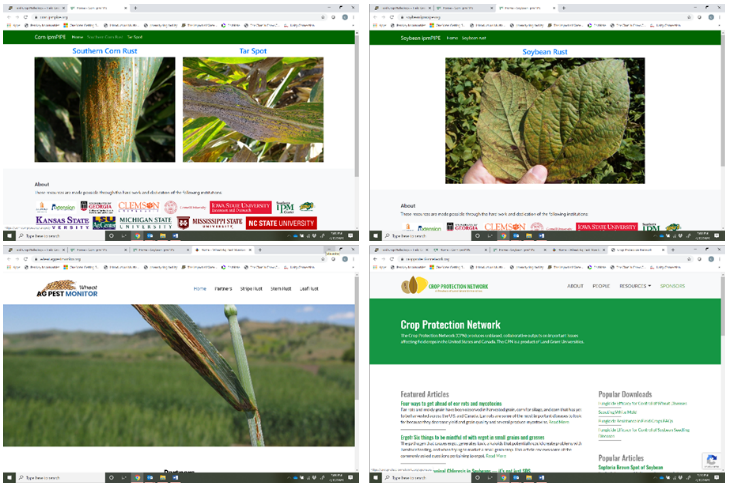
National wheat rust tracking: https://wheat.agpestmonitor.org/

Corn:

National corn rust and tar spot tracking: https://corn.ipmpipe.org/

Soybean:

National soybean rust tracking: https://soybean.ipmpipe.org/



Poison Hemlock

(Marcelo Zimmer) & (Bill Johnson)

Every spring we receive phone calls and emails with concerns of the presence of poison hemlock (*Conium maculatum* L.) in pastures, fencelines, and field edges (Figure 1). This plant can be noticed very early in the spring every year, as it is typically one of the first weeds to green up, usually in late February to early March if temperatures are favorable. The appearance of poison hemlock on roadsides and fence rows of Indiana is not new as we can find articles in the Purdue Weed Science database dating back to 2003. The largest threat of this weed is the toxicity of it's alkaloids if ingested by livestock or humans, but it can also reduce aesthetic value of landscapes and has been reported to creep into no-till corn and soybean fields as well.

Figure 1. Poison hemlock infestation on roadside. (*Photo Credit: Travis Legleiter*)

Biology and Identification

Poison hemlock is a biennial weed that exists as a low growing herb in the first year of growth (Figure 2) and bolts to three to eight feet tall in the second year, when it produces flowers and seed (Figure 3). It is often not noticed or identified as a problem until the bolting and reproductive stages of the second year. The alternate compound leaves are pinnate (finely divided several times) and are usually triangular in outline. Flowers are white and occur in an umbel inflorescence. Poison hemlock is often confused with wild carrot but can be distinguished by its lack of hairs and the presence of purple blotches on the stems.

Figure 2. Poison hemlock rosette. (*Photo Credit: Travis Legleiter*)

Flowering poison hemlock plant. (*Photo Credit: Purdue Plant and Pest Diagnostic Lab*)

Toxic Properties

Poison hemlock contains five alkaloids that are toxic to humans and livestock and can be lethal if ingested. The plant's alkaloids may also be absorbed through the skin, so if you find yourself hand pulling poison hemlock, it would be a good idea to wear gloves. All parts of the plants contain the toxic alkaloids with levels being variable throughout the year. Symptoms of toxicity include nervousness, trembling, and loss of coordination followed by depression, coma, and/or death. Initial symptoms will occur within a few hours of ingestion.

Cases of poisoning due to poison hemlock ingestion are rare as the plants emit a mousy odor that makes it undesirable and unpalatable to livestock and humans. Consumption and toxicity in animals usually occurs in poorly managed or overgrazed pastures where animals are forced to graze poison hemlock because of lack of desirable forage.

Control

Control of poison hemlock with herbicides is most effective when applied to plants in the first year of growth or prior to bolting and flowering in the second year. The closer to reproductive stages, the less effective the herbicide. In roadside ditches, pastures, and waste areas, herbicides containing triclopyr (Remedy Ultra, Garlon, numerous others) or triclopyr plus 2,4-D (Crossbow) are most effective in controlling poison hemlock. Other herbicides that provide adequate control when applied at the proper timing are dicamba (Clarity, numerous others), metsulfuron-methyl (Escort XP), metsulfuron-methyl plus dicamba plus 2,4-D (Cimarron Max) and clopyralid plus 2,4-D (Curtail). For no-till fields, mixtures of 2,4-D plus dicamba will be most effective for fields going to soybean. Be sure to pay attention to preplant intervals when these herbicides are used in the spring. Preplant intervals will vary based on the soybean herbicide-resistance trait to be planted and whether or not 2,4-D and dicamba were used together to control the weed. For fields going to corn, mesotrione (Callisto™ and other names) and mesotrione premixes + 2,4-D or dicamba have been effective in reducing infestations along field edges.

For further information on toxic plants in Indiana refer to the Purdue University Weed Science Guide to Toxic Plants in Forages (https://www.extension.purdue.edu/extmedia/WS/WS_37_ToxicPlants08.pdf).

Close Grazing, Close Mowing And Grazing/Mowing Too Often Makes A Forage Stand Weak

(Keith Johnson)

The 2020 grazing season has recently started and hay harvest is going to begin soon. As the pasture gets grazed and the forage growing in the field is mown, make sure to evaluate grazing and cutting height so perennial plants have better persistence.

A few years ago, I was called out to several pastures being grazed by horses to give recommendations regarding the improvement of the forages in the pastures. These are pastures that I travel by often. On any given day of the year my observations had been that the pastures looked more like a golf course putting green that it did a pasture for livestock. My first recommendation to the owner didn't include soil fertility, weed control or improved forage species. The recommendation I did provide was to reduce the number of horses being grazed or to buy more land. In other words, reduce the stocking rate so overgrazing would be avoided.

Horses grazing a dominant Kentucky bluegrass pasture to a low plant height.

Another common happening is to start a pasture with higher yielding forages like alfalfa, orchardgrass, and red clover and over the course of many years the stand transitions to Kentucky bluegrass, white dutch clover and weeds. Why does this occur? Over grazing reduces the growth and development of the improved forages because meristems, where growth and development begins, find their way to the mouth of the close-grazing livestock and never have a chance to differentiate into leaves and stems. This is especially a concern when pastures are continuously grazed. Preferably, pastures would be broken into paddocks so rotational grazing can occur. Plants within a paddock would preferably be grazed to a 4-inch height and then livestock would move on to the next paddock where more growth exists. This provides necessary rest within the recently grazed paddock so plant vigor is improved. Kentucky bluegrass and white dutch clover meristems are so close to the soil surface that they can avoid being damaged by continuous close grazing. Similarly, a Kentucky bluegrass lawn can be mowed often at a three-inch height without loss of turf quality but the objectives are much different than when grazed by livestock. Kentucky bluegrass may persist better than many other forages when closely grazed, but it is not very drought tolerant and doesn't have the carrying capacity of higher yielding forage options. Likewise, Kentucky bluegrass isn't as productive when continuously closely grazed as compared to being in a properly stocked rotational grazing system.

Close grazing and mowing, as well as a hay harvest interval that is too short, essentially starves the plant. By removing too many leaves too often, photosynthesis can't occur in the time frame needed to keep a plant vigorous. Photosynthesis is the process in the plant factory, specifically located in the chloroplasts, that ultimately results in the transport of sucrose through the phloem, an internal plumbing network, to locations in the plant where energy is needed for respiration, growth or storage.

There have been many reports of orchardgrass decline after harvest of alfalfa-orchardgrass mixtures. Alfalfa meristems within crown buds are located very close to ground level. Alfalfa meristems avoid being harvested with a mower, even if cutting at a 2-inch height.

An alfalfa plant with crown buds circled can avoid being cut with a 2-inch mowing height.

Orchardgrass tillers, on the other hand, have elevated stem bases that are the storage organs where carbohydrates are stored and necessary to initiate regrowth. To illustrate the concern over scalping orchardgrass, two orchardgrass plants were clipped at 4 inches or ½ inch on July 6. I came back to monitor regrowth of the same plants on July 9 and 13. As the pictures aptly show below, the scalping of orchardgrass is a deleterious practice as compare to cutting at the 4-inch height.

Two orchardgrass plants unclipped on July 6.

Same plants clipped to 4-inches and 1/2-inch on July 6.

Same two orchardgrass plants on July 9.


Same two orchardgrass plants on July 13.

As you manage pastures and hay fields, remember to avoid overgrazing and cutting too low so the forage has great persistence for many years.

Heat Unit Concepts Related To Corn Development

(Bob Nielsen)

Growth and development of corn are strongly dependent on temperature. Corn develops faster when temperatures are warmer and more slowly when temperatures are cooler. For example, a string of warmer than normal days in late spring will encourage faster leaf development than normal. Another example is that a cooler than normal grain filling period will delay the calendar date of grain maturity. The phrases "string of warmer than normal days" and "cooler than normal grain filling period" can be converted mathematically into measures of thermal time by calculating the daily accumulations of heat using temperature data. Commonly used terms for thermal time are Growing Degree Days (GDDs), Growing Degree Units (GDUs), or heat units (HUs).

Different methods exist for calculating heat units depending on a) the crop or biological organism of interest and b) the whim or personal preference of the researcher. The GDD estimation method most commonly used throughout the U.S. for determining heat unit accumulation relative to corn phenology was first evaluated by Gilmore & Rogers (1958) and termed "Effective Degrees". Barger (1969) later proposed that the same method, which he termed "Modified Growing Degree Days", be adopted as the standard heat unit formula by the National Oceanic and Atmospheric Administration.

This Modified GDD method calculates daily accumulation of GDD as the average daily temperature (°F) minus 50. The "modification" refers to the limits imposed on the daily maximum and minimum temperatures allowed in the calculation. Daily maximums greater than 86°F are set equal to 86 in the calculation of the daily average temperature. Similarly, daily minimums less than 50°F are set equal to 50 in the calculation.

Example 1:
If the daily maximum temperature was 80°F and the minimum was 55°F, the GDD accumulation for the day would be ((80 + 55) / 2) – 50 or 17.5 GDDs.

Example 2 (Illustrating the limit on daily maximums):
If the daily maximum temperature was 90°F and the minimum was 72°F, the GDD accumulation for the day would be ((86 + 72) / 2) – 50 or 29 GDDs.

Example 3 (Illustrating the limit on daily minimums):
If the daily maximum temperature was 68°F and the minimum was 41°F, the GDD accumulation for the day would be ((68 + 50) / 2) – 50 or 9 GDDs.

In late April to early May, normal daily GDD accumulations for central Indiana are about 10 GDDs. By late July, the normal daily accumulation rises to about 23 GDDs. For a typical corn growing season in central Indiana, say from late April to late September, the total seasonal accumulation of GDDs is about 2800 GDDs.

NOTE: Calculation of GDD for corn is not limited to the use of air temperatures. From planting until roughly V6, germination and development of young seedlings respond more directly to soil temperature than air temperature. Soil temperature does not precisely mirror air temperature. Consequently, it is appropriate during that time frame to calculate GDD using soil temperatures. Ideally, one would use soil temperature recorded in the upper two inches of soil because that depth corresponds best to seed placement and initial growing point position. Realistically, however, most available online sources of soil temperature data are based on standard NWS-NOAA 4-inch soil depth measurements. That's okay, though, because corn development still correlates well with soil GDD based on 4-inch temperatures.

There are a number of sources of daily temperature data, both air and soil. There are increasingly more commercial sources of weather and climate data available to everyday consumers. One source of weather and climate data for those with Indiana interests is the Indiana State Climate Office, located on the campus of Purdue University. A range of types of data are available for a number of locations around the state (https://ag.purdue.edu/indiana-state-climate/data).

Specifically for corn, the **Useful to Usable (U2U)** multi-state research and Extension project, originally funded by USDA, developed a useful GDD decision support tool (HPRCC, 2020) that estimates county-level GDD accumulations (based only on air temperatures) and corn development dates for the states of North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Ohio, Kentucky, and Tennessee. The **GDD Tool** uses current and historical GDD data plus user selected start dates, relative hybrid maturity ratings, and freeze temperature threshold values. The GDD and corn development predictions are displayed graphically and in tabular form, plus the GDD accumulation estimates can be downloaded in a Comma Separated Value (.csv) format for you to work with in your own spreadsheet program.

Figure 1 shows a screen capture from the **GDD Tool** in which I selected "Tippecanoe Co., IN", a start date (aka planting date) of Apr 20, a relative hybrid maturity rating of 111 "days", and a freeze temperature threshold of 28°F. The tool automatically adds estimated GDD values from planting to silking and black layer based on the "corn maturity days" you enter, but each is customizable if you know the GDD values specific to your hybrid. The tool displays estimates of actual cumulative GDD from planting to today's date, then estimates of cumulative GDD for the remainder of the season. Estimates of silking and black layer dates are displayed, as well as the early and late ranges of those estimates. When you are viewing the actual graph on the Web site, estimates of GDD accumulations at specific dates "pop up" when you hover your computer mouse over parts of the line graph.

- For more information on how to use GDD to make hybrid maturity decisions, see my accompanying article (Nielsen, 2019b)
- For information on how to predict corn leaf stage development using GDD, see my accompanying article (Nielsen, 2019c).

Related References

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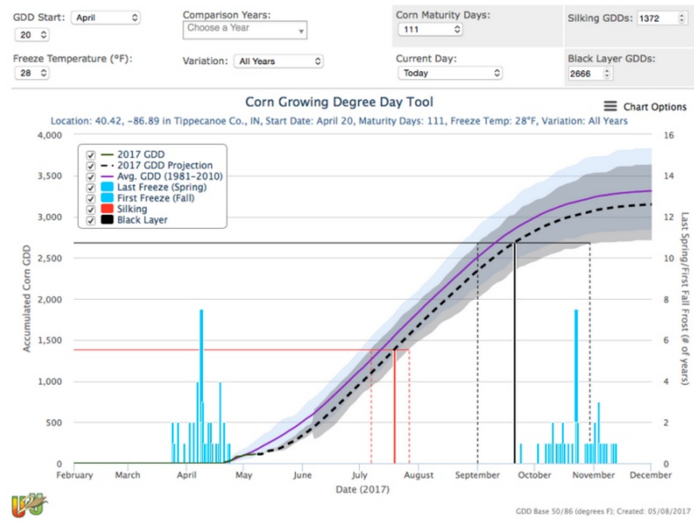

Fig. 1. Screen capture of U2U GDD Tool graphical display of historical and estimated future GDD accumulations and predicted corn development stages for a 111-day hybrid planted Apr 20 in Tippecanoe County, IN.

Historical Corn Grain Yields In The U.S.

(Bob Nielsen)

- Corn grain yields in the U.S. have steadily increased since the late 1930's.
- Only two major shifts in U.S. corn yield trends have occurred since statistics were first published in 1866.
- Year-to-year departures from trend yield are influenced primarily by year-to-year variability in growing conditions.

Historical grain yields offer us a glimpse of yields yet to come, although like the stock markets, past performance is no guarantee of the future. The historical yield data for corn in the U.S. illustrate the positive impact of improved crop genetics and crop production technologies.

American farmers grew open-pollinated corn varieties until the rapid adoption of hybrid corn began in the late 1930's. From 1866, the first year USDA began to publish corn yield estimates, through about 1936, yields of open-pollinated corn varieties in the U.S. were fairly stagnant and only averaged about 26 bu/ac (1.6 MT/ha) throughout that 70-year period. Amazingly, the historical data indicate there was no appreciable change in productivity during that entire time period (Fig. 1), even though farmers' seed-saving practices represented a form of plant breeding that one would have expected would result in small increases in yield over 70 years.

Rapid adoption of double-cross hybrid corn by American growers began in the late 1930's, in the waning years of the Dust Bowl and Great Depression. Within a very few years, the national yield statistics indicated that the first "miracle" of corn grain yield improvement had occurred. The annual rate of yield improvement, which heretofore had been about zero, increased to about 0.8 bushels per acre per year from about 1937 through about 1955 (Fig. 1). This dramatic improvement in yield potential must have seemed like a miracle to American farmers.

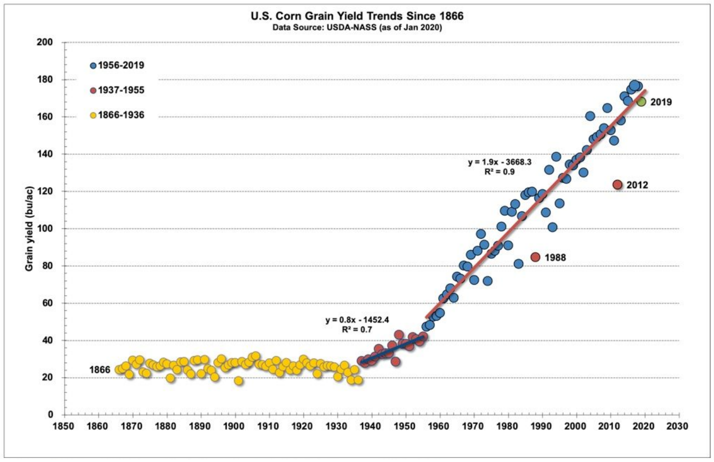

Fig. 1. Annual U.S. Corn Grain Yields and Historical Trends Since 1866. Data derived from annual USDA-NASS Crop Production Reports.

Trend Line Trivia: Historical trend lines can be a useful way to visualize changes over time. The historical trend yield lines shown in Fig. 1 are technically linear regression lines and represent the best "fit" method for describing the changes in U.S. corn yields over time. The equation associated with the trend line that begins in the 1950s can be used to predict U.S. corn yield for the current cropping year under "normal" growing conditions. Year-to-year departures (changes) from the trend line are caused primarily by year-to-year variability in growing conditions. However, significant changes in the trend line itself (i.e., the slope of the line) are usually caused by significant changes in the adoption of farming technologies (e.g, hybrids, pest control, soil management, mechanization, precision ag. technologies).

The second "miracle" of corn grain yield improvement began in the mid-1950's in response to continued improvements in genetic yield potential and stress tolerance plus increased adoption of N fertilizer, chemical pesticides, and agricultural mechanization (Fig. 1). The annual rate of corn yield improvement more than doubled to about 1.9 bushels per acre per year and has continued at that steady rate ever since, sustained primarily by continued improvements in genetics and crop production technologies (Fig. 1).

Some speculate that a third "miracle" of corn grain yield improvement is "on the horizon", in part due to the advent and adoption of transgenic hybrid traits (insect resistance, herbicide resistance) beginning in the mid-1990's. However, the USDA-NASS yield data show little to no evidence that yield trends of the past 25 years have deviated from the long-term 1.9 bushels per acre per year trend line (Fig. 1). These data reinforce the fact that currently available transgenic hybrid traits do not literally increase genetic yield potential above and beyond "normal" genetic improvements in corn hybrids. Rather, these traits simply protect the inherent yield potential of modern hybrids while potentially reducing farmers' reliance on chemical pesticides. A true third "miracle" of corn yield improvement remains "on the horizon".

Annual corn yields continually fluctuate above and below the historical trend line (Fig. 2), primarily in response to variability in growing conditions year to year (weather, pests). The Great Drought of 2012 certainly resulted in dramatic and historic reductions in corn grain yield relative to trend yield (-22%), but the greatest negative departure from trend yield actually occurred more than 100 years earlier during the Great Drought of 1901 (-30%). Conversely, the greatest single positive departure from trend yield occurred in 1906 when the corn crop that year yielded 23% higher than expected trend yield. The magnitude and range of annual departures from trend yield since the mid-1950's reinforce the evidence from Fig. 1 that the advent and adoption of transgenic hybrid traits beginning in the mid-1990's has not resulted in yields unusually higher than the long-term yield trend.

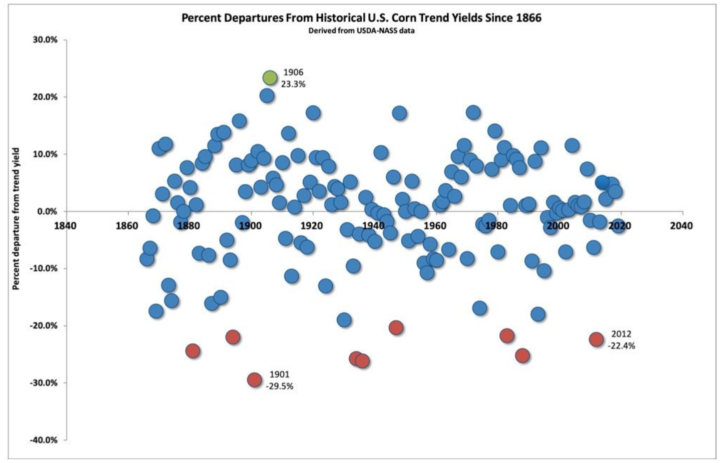

Fig. 2. Annual percentage departures from historical U.S. corn trend yields since 1866. Data derived from annual USDA-NASS Crop Production Reports.

Bottom Line

The GOOD NEWS is that corn grain yields in the U.S. have been steadily increasing since the 1950's at almost 2 bushels per acre per year. The SOBERING NEWS is that, in order to support the ever-burgeoning world population in the years to come, a third "miracle" in the annual rate of corn yield improvement will be required.

Related Reading

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Schnitkey, Gary. 2019. The Geography of High Corn Yields. farmdoc daily (9):2, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. https://farmdocdaily.illinois.edu/2019/01/the-geography-of-high-corn-yields.html [URL accessed Apr 2020].

USDA-NASS. 2020. Quick Stats. United States Dept. of Agr – Nat'l Ag. Statistics Service, Washington, D.C. URL: https://quickstats.nass.usda.gov [URL accessed Apr 2020].

Ward, Robert De C. 1901. Some Economic Aspects of the Heat and Drought of July, 1901, in the United States. Bull. Amer. Geog. Soc. 33(4):338-347. DOI: 10.2307/198424. https://www.jstor.org/stable/pdf/198424.pdf [URL accessed Apr 2020].

May Climate Outlook Predicting Cooler Temperatures

(Beth Hall)

On April 30, 2020, the national Climate Prediction Center released its monthly outlook for May (Figure 1). There is slight confidence that temperatures will be below normal and the northern half of Indiana will be drier than normal. The probabilities are only slightly significant, so there could be a lot of variability throughout the month. The 8-to-14-day outlook (representing May 7 – 13, 2020) indicates a very strong probability of below normal temperatures, so after a brief warming over the next week, expect temperatures to become unseasonably cooler. With each day that passes, the climatological risk of freezing temperatures decreases so hopefully cooler temperatures will only result is reduced evapotranspiration rates and accumulated growing degree days. Speaking of growing degree days, the modified growing degree days (50F/86F) are running about 30 to 70 units below normal across the state with the greatest departures to the south (Figure 2 and 3).

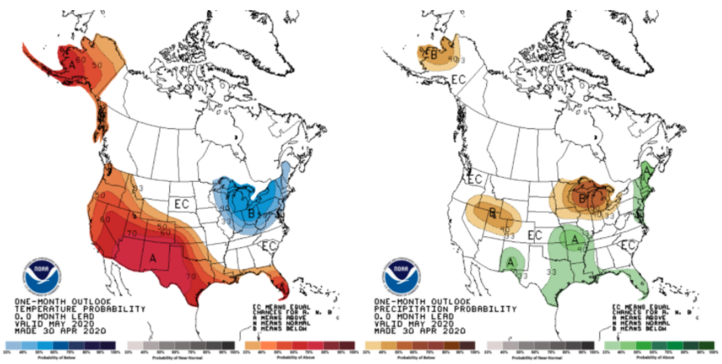

Figure 1. Climate outlooks of temperature (left) and precipitation (right) for May in the probabilistic confidence of having above- or below-normal conditions over the month.

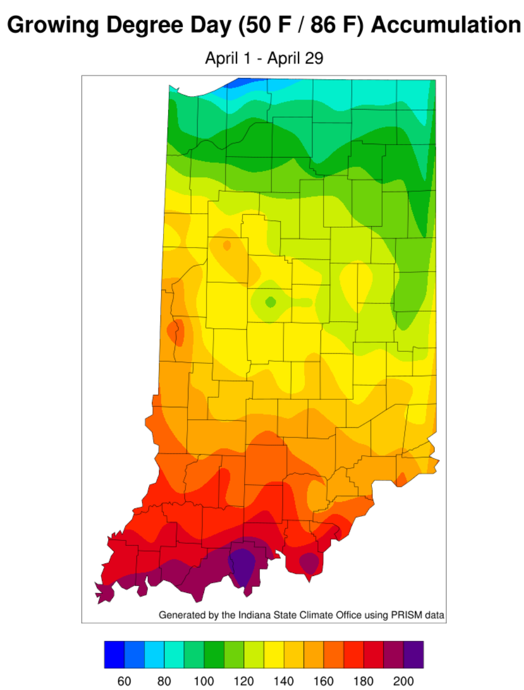

Figure 2. Modified growing degree day accumulations from April 1-29, 2020.

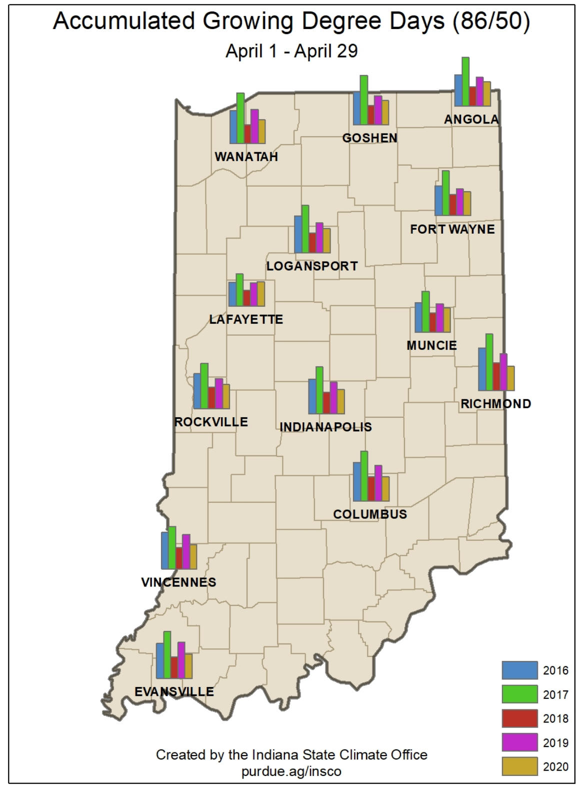

Figure 3. Modified growing degree day accumulation for April 1-29 by year for 2016 through 2020.