Corn & Soybean News

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COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT

Grain and Forage Center of Excellence

University of Kentucky

Conditions favorable for seedling disease in corn

Corn planting in Kentucky was off to a fast start in 2023, with many farmers able to plant in early-mid April. However, cool weather and low soil temperatures have delayed emergence and increased the risk of seedling disease in Kentucky corn fields.

Figure 1. Corn plants affected by seedling disease may have poor emergence within a row or an area in the field. Photo by Kiersten Wise, University of Kentucky.

Seedling diseases are caused by several soil or seed-inhabiting fungi or fungal-like organisms which are favored by cool, wet soil conditions during and after planting. Cool, wet soils also slow plant growth and development and give pathogens more time to infect and damage the seedling. Standard corn fungicide seed treatments provide a short window of protection against seedling diseases. However, corn that was planted several (or more) weeks ago may also be at increased risk of seedling disease, since seed treatments typically protect seeds and seedlings only for a few weeks. Two of the most common seedling diseases of corn in Kentucky are caused by Pythium and Fusarium species, but other fungi can occasionally cause seed and seedling issues.

Figure 2. Severe stand reduction due to seedling disease. (Photo by Kiersten Wise, University of Kentucky)

Symptoms of seedling diseases can be observed after emergence and in the early vegetative stages of growth. Farmers should look for areas in the field with poor emergence, patchy stands, and/or stunted plants (Figure 1). Often these symptoms are observed first in poorly drained or ponded areas of the field, and areas with heavy or compacted soils. Infected seeds may rot after germination, preventing emergence and leading to the patchy appearance of plants in a field. Infected plants that do emerge may be yellow, stunted, and have discolored roots. In severe cases, large areas of plants may die leading to reduced stand (Figure 2). It is very difficult to accurately determine the specific organism responsible for a suspected seedling disease issue in the field. Submitting samples through a County Agent to the University of Kentucky Plant Disease Diagnostic Laboratory can help with obtaining an accurate diagnosis.

The risk of corn seedling disease decreases when corn is planted into dry soils with soil temperatures above 50 F. These conditions allow seeds and seedlings to germinate and emerge rapidly. However, it is often necessary to plant into less than ideal soil conditions, and diagnosing seedling disease issues if they occur can improve management in future years. Obtaining an accurate diagnosis is important because fungicide active ingredients work against specific organisms, and efficacy of a given product can vary for seedling blight organisms. Higher rates of specific products may be needed in fields that have a history of severe loss due to a specific seedling disease.

More information on corn seedling blights can be found in the University of Kentucky Extension Publication, “Seedling Diseases of Corn.” https://plantpathology.ca.uky.edu/files/ppfs-ag-c-02.pdf

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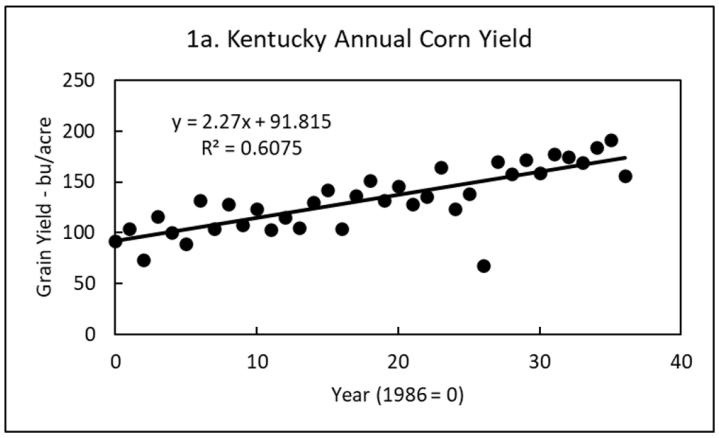
Crop Condition Ratings: Are They Related to Yield?

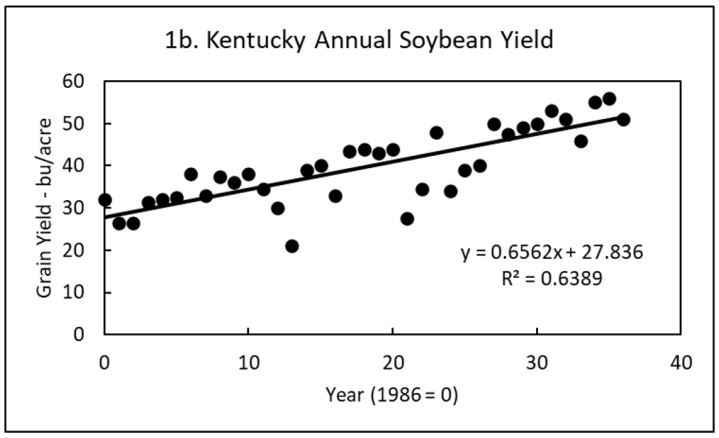
Newly published work [1] found that crop condition ratings were of reasonable value in predicting seasonal changes in statewide corn yield. The ratings are submitted weekly during the production season and have been made/published for nearly 40 years. Agronomists and other field scientists have made little use of these 'testimonial' observations. A significant remaining question is whether the aggregated state level data are useful to individual growers. That said, the previous work did not find a good relationship between corn condition ratings and yield in all states [1]. That work covered over a dozen Corn Belt states but did not include Kentucky. Soybean crop condition ratings were not evaluated.

I wanted to find out if Kentucky corn and soybean condition ratings were related to statewide seasonal yield changes. I downloaded weekly corn and soybean crop condition ratings [2] and average annual corn and soybean yields for 37 years (1986 to 2022). The weekly data consists of an aggregate group assessment of the percentage of the corn or soybean crop area that is in "Excellent (E)", "Good (G)", "Fair (F)", "Poor (P)" or "Very Poor (VP)" condition. Each weekly set of condition data was combined into a single Crop Condition Index (CCI) value [3], between 0 and 100, as follows:

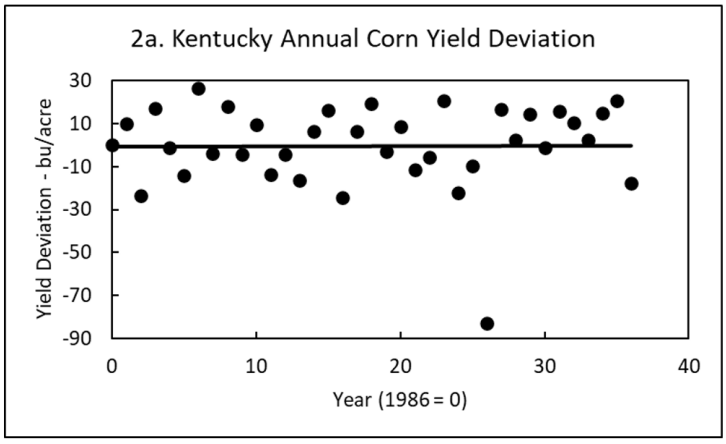
$$\%E(1.0) + \%G(0.75) + \%F(0.50) + \%P(0.25) + \%VP(0.0) = CCI$$

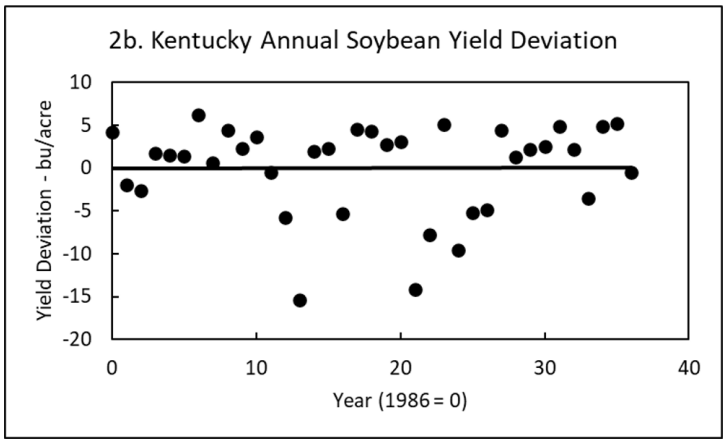
I first determined the long-term linear yield trend in corn (Fig. 1a) and soybean (Fig. 1b) yield. Kentucky's average annual corn and soybean yields have increased by about 2.3 and 0.66 bushels per acre per year between 1986 and 2022. The long-term linear yield trends are likely due to improvements





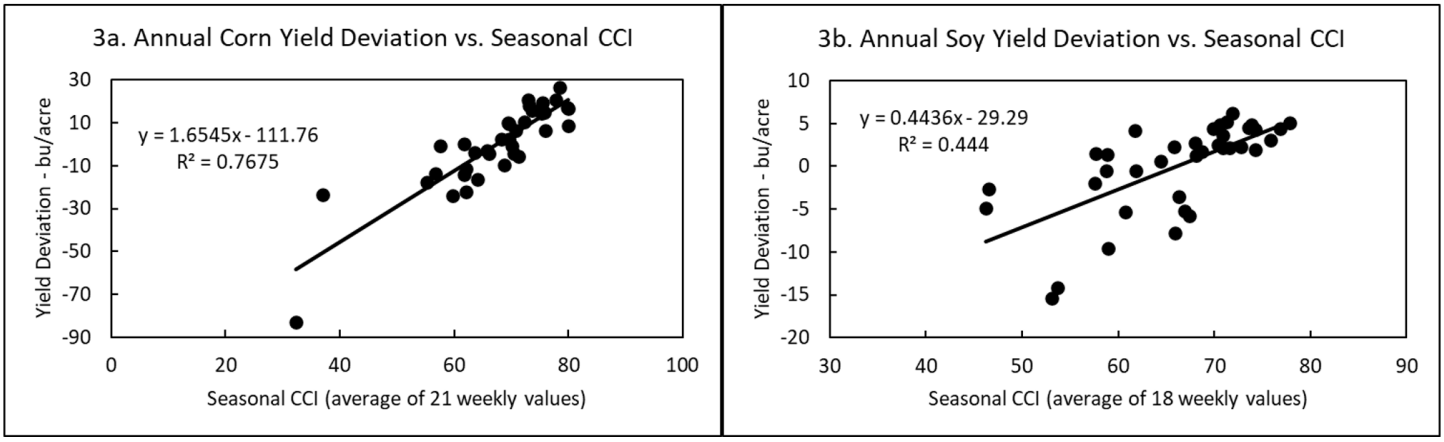
in crop genetics and management. To focus on seasonal yield changes linear yield trends were removed, leaving the annual seasonal deviation in corn (Fig. 2a) and soybean (Fig. 2b) yield – deviations due mostly to seasonal weather differences. With corn, annual yield deviations ranged within 25 bushels per



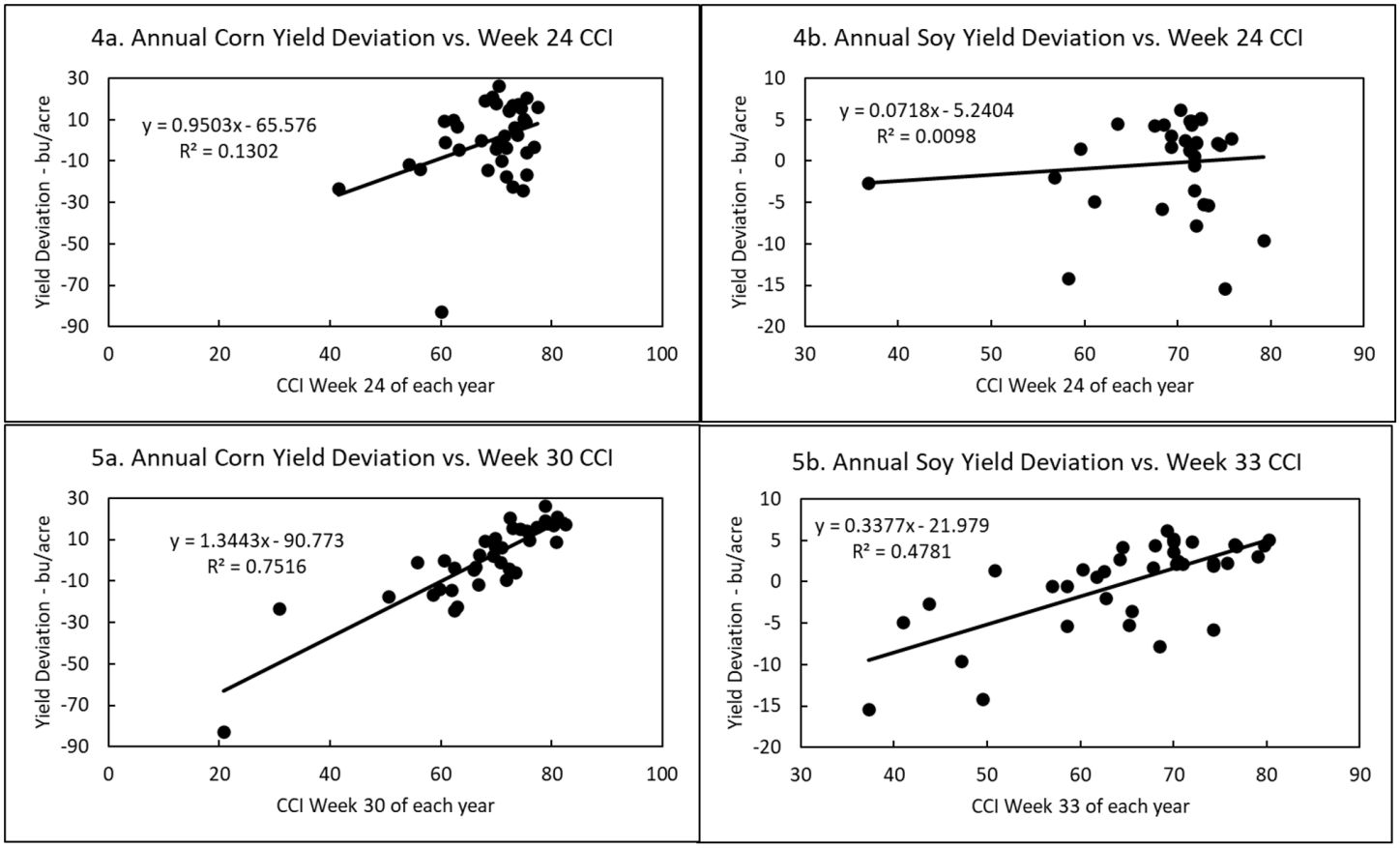


acre of the yield trend line, though the 2012 (year 26) season was a notable exception, falling about 83 bushels per acre. Annual soybean yield deviations ranged between -15 and +6 bushels per acre, with the 1999 and 2007 seasons resulting in particularly significant negative deviations from the yield trend line.

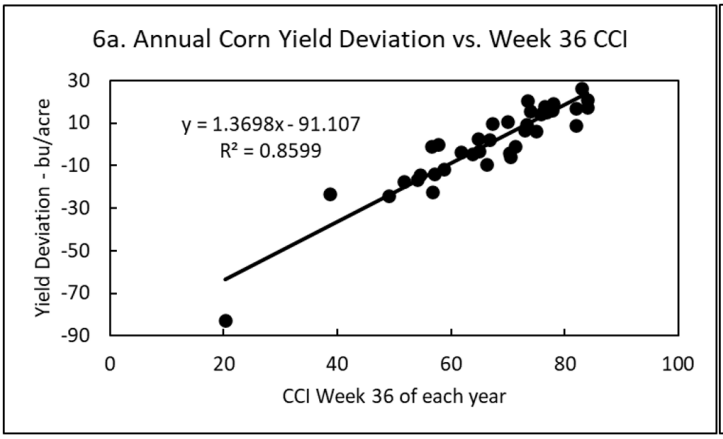
Over the 37-year period, there were typically 21 weekly CCI values for corn and 18 for soybean. Annual corn (Fig. 3a) and soybean (Fig. 3b) yield deviations from the yield trend line were plotted against their respective season-average weekly CCI values. About 77% of the corn yield deviation was explained by the seasonal corn CCI values, but only 44% of soybean yield deviation was explained by seasonal soybean CCI values. The generally positive relationships shown in Figure 3 are encouraging, but a major question is when, during the season, does the weekly CCI value begin to explain the final crop yield?

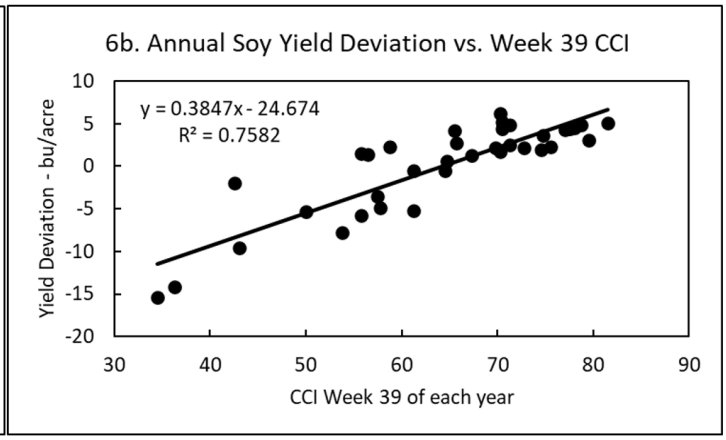


As expected, annual corn (Fig. 4a) and soybean (Fig. 4b) yield deviations were poorly related (low R^2)



to early season, week 24 (2nd to 3rd week in June), CCI values. Later in the season, annual corn (Fig. 5a) and soybean (Fig. 5b) yield deviations were as well related to week 30 (4th week in July) corn and week 33 (3rd week in August) soybean CCI values, respectively, as they were to seasonal average CCI values (Fig. 3). Relationships between annual yield deviations and weekly CCI values were even better later in the season, week 36 (1st to 2nd week in September) for corn and week 39 (last week in September) for soybean.





Generally, soybean crop condition ratings started 2 to 3 weeks later than those for corn each year. The relationships between annual yield deviations and weekly CCI readings were stronger (greater R2), and peaked earlier in the year, for corn than for soybean. The lower R2 value in the soybean relation- ships may be due to the fact that annual soybean yield, annual soybean yield deviation and the weekly soybean CCI value consider, and are confounded by, both full season and double crop soybean.

The overall quality of the relationships between annual crop yield deviations from the yield trend and crop condition ratings, aggregated as CCI values, was quite good. The collective, qualitative, human as- sessment of crop condition is sensitive to the seasonal factors that also influence crop yield. Next month I'll discuss how we might use these relationships during the coming 2023 summer season.

References

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[2] USDA. 2023. National Agricultural Statistics Service: Quick stats. USDA. https://www.nass.usda.gov/Quick_Stats/

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Molluscicide Bait to Manage Slugs & Snails on Soybeans in KY is Registered under Section 24©

Figure 1. Snail feeding on a soybean cotyledon (Photo: Raul Villanueva, UK)

Slugs & Snails

During the last couple of years, slugs and snails have become serious pests of soybeans in many areas of the North Central U.S., including Kentucky, Illinois, Indiana, Ohio, and West Virginia. These mollusks feed on germinating seeds until the V_0 to V_4 growth stages of soybean plants. Typically, cotyledons (Figure 1) and unifoliate leaves are damaged; however, when the apical meristem is destroyed, the plant growth is totally thwarted causing plant death (Figure 2). Outbreaks of mollusks can reduce plant densities, and there is no rescue treatment when this occurs. Replanting is the only option for commercial soybean farmers when damage to plant stands is severe. However, if farmers scout in the spring, they can use metaldehyde baits as a preventative control management practice.

Figure 2. Six soybean plants with the apical meristem completely consumed by slugs (red arrows); the only plant that will produce beans is on the left side of the picture (Photo: Raul Villanueva, UK).

Metaldehyde Baits & Scouting

Recently, Deadline® M-Ps™ (metaldehyde) was registered in Kentucky to be used in soybeans under FIFRA 24(c) special local needs (SLN). Although there is no threshold for slugs, scouting should be conducted before spreading the metaldehyde baits. Scouting for mollusks may be conducted after rains and on foggy days with cool temperatures in order find slugs or snails early in the morning, or scout just before or after sunset. The applications of baits should follow the manufacturer's directions.

Rates and Directions

Baits may be applied as soil surface treatment. May be broadcast by air or ground equipment. I should not be mixed with any seeds prior to application. For best results, apply in evening.

Crop*	Growth Stage	Maximum Single Application Rate (lbs. Product/A)	Total Nº of application /season**	Re-application Interval (days)	Preharvest Interval	Application Information
Soybean	Up to V4	10	3	7	0	Broadcast or Ground directed
Soybean	V4 - R1	10	3	7	0	Broadcast or Ground directed
*Livestock may not graze in the treated fields. Applications must be completed prior to pod formation. **The maximum number of application per crop per season is 3						

The EPA SLN label for Deadline® M-Ps™ is located here or in the following link: http://www.cdms.net/ldat/ld2GN005.pdf

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Are Corn Yields Increasing Faster Than Soybean Yields?

Corn and soybean yields increased steadily since the beginning of the high-input era of agriculture in the 1940s and '50s. Improved varieties (hybrids) and better management practices drove these increases. Many producers believe that corn has benefited more from improved technology than soybean. Are corn yields increasing faster than soybean yields?

The fact that these two crops are very different lends credence to this observation. Corn is a grass of tropical origin with C4-type photosynthesis that produces a high starch seed. Soybean originated in northern China; it is a legume with C3-type photosynthesis that produces a seed containing high levels of oil and protein. Corn responds readily to N fertilizer; soybean, as a legume, makes is own N. The C3-type photosynthesis in soybean responds to higher CO_2 concentrations in the air, corn does not. Historically more breeding effort has been allocated to corn than to soybean. Given these differences, it would not be surprising if there were differences in the rate of yield improvement. The evidence, however, suggests that the rates are about the same for both crops.

One way to look at this question is to evaluate changes in the ratio of corn yield to soybean yield over time. The ratio will increase if corn yield is increasing faster than soybean yield. This ratio, calculated from average U.S. yields (after conversion from bushels/acre to pounds/acre), did not change from 1980 through 2019 (Figure 1). Yields of both crops increased steadily during this period, but the relative rate of increase was the same. Dr. Jim Specht at the University of Nebraska also found no difference in relative growth rates between the two crops.

The ratio in Figure 1 fluctuated from year to year as the weather and growing conditions affected the yield of the two crops differently. In some years, corn was favored (higher ratio), in other years, soybean was favored (lower ratio), but, on the average, the ratio did not change.

If we go farther back in time, back to the beginning of the high-input era of agriculture, the ratios (using average state yields from Indiana, Illinois, Iowa, Kentucky, Tennessee, and Missouri) increased steadily from 1950 (when the ratio was approximately 2.0) through the late 1970s (high-yield states) or 1980s (low-yield states) before they plateaued at approximately 3.0. During this early period, corn yields were increasing faster than soybean yields, so the ratios increased, but after they plateaued, there was no further change in the ratio through 2019, except for Iowa, where it increased very slowly (but significantly).

Yield ratios did not change from 1972 through 2015 in most of the counties in Kentucky and Nebraska (irrigated only). However, 30 of 47 counties in Iowa showed small, but significant, increases in the ratio, but they were usually less than 0.002 ratio units per decade. Four of the six counties in Kentucky with most of the soybeans double cropped after wheat also showed significant increases in the

ratio over time, reflecting the lower rate of yield growth of the late planted double-cropped soybeans.

Why do so many producers have the perception that corn yields are rising faster than soybean yields? First, I think comparing absolute growth rates (bushels/acre/year) confuses us. Corn has a much higher absolute growth rate than soybean, by virtue of its higher yield. The correct comparison is the relative growth rate (percent per year) which is evaluated by the ratio. Secondly, a 10% yield increase for 250-bushel corn (25 bushels) is much larger and more obvious than the same increase for 60-bushel beans (6 bushels). These illusions incorrectly suggest that corn yields are more responsive to new technologies than soybean yields.

Perceptions can be misleading and the perception that corn yields are increasing faster than soybean yields is not correct. Careful evaluation of the numbers at national, state and county levels shows us that, by and large, yields are increasing at the same relative rate for both crops with only a few minor exceptions. The formula for increasing yields for either crop is the same – select the best varieties (hybrids), use good management practices that include providing adequate soil fertility, good weed, disease and insect control, and pray for rain.

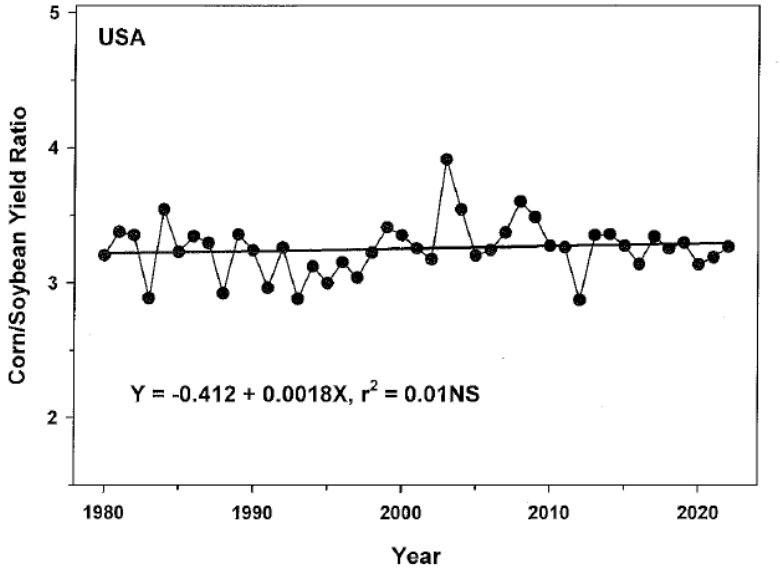

Figure 1. Ratio of US corn yield to US soybean yield from 1980 to 2022. Yields were converted from bushels per acre to pounds per acre before calculating the ratio. Adapted from Egli, D.B. 2021. Applied Crop Physiology. Understanding the Fundamentals of Grain Crop Management. CABI. 178 pp.

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Potential Effect of Weekend Freezes on Corn and Soybean

The following article was first released on April 25, 2023, after the freeze.

Freezing temperatures were recorded across Kentucky Monday morning, April 24, 2023. The coldest temperatures were mostly in central and eastern Kentucky, but freezing temperatures were as far west as Trigg and Webster counties. Temperatures fell to or slightly below freezing in the following counties from Sunday to Monday: Butler, Caldwell, Carroll, Christian, Crittenden, Graves, Grayson, Hardin, Logan, Meade, Ohio, Taylor, and Webster counties (Table 1, at the end of this article). Webster and McLean County were the coldest at 30°F. Frosts likely occurred west of these counties. The good news is that soil surface temperatures likely stayed in the low 50's to mid-40's. This is based on soil surface temperatures measured at UKREC in Princeton, KY.

About 36% of corn acres and 20% of soybean acres were planted as of April 23, 2023, according to the USDA-NASS.

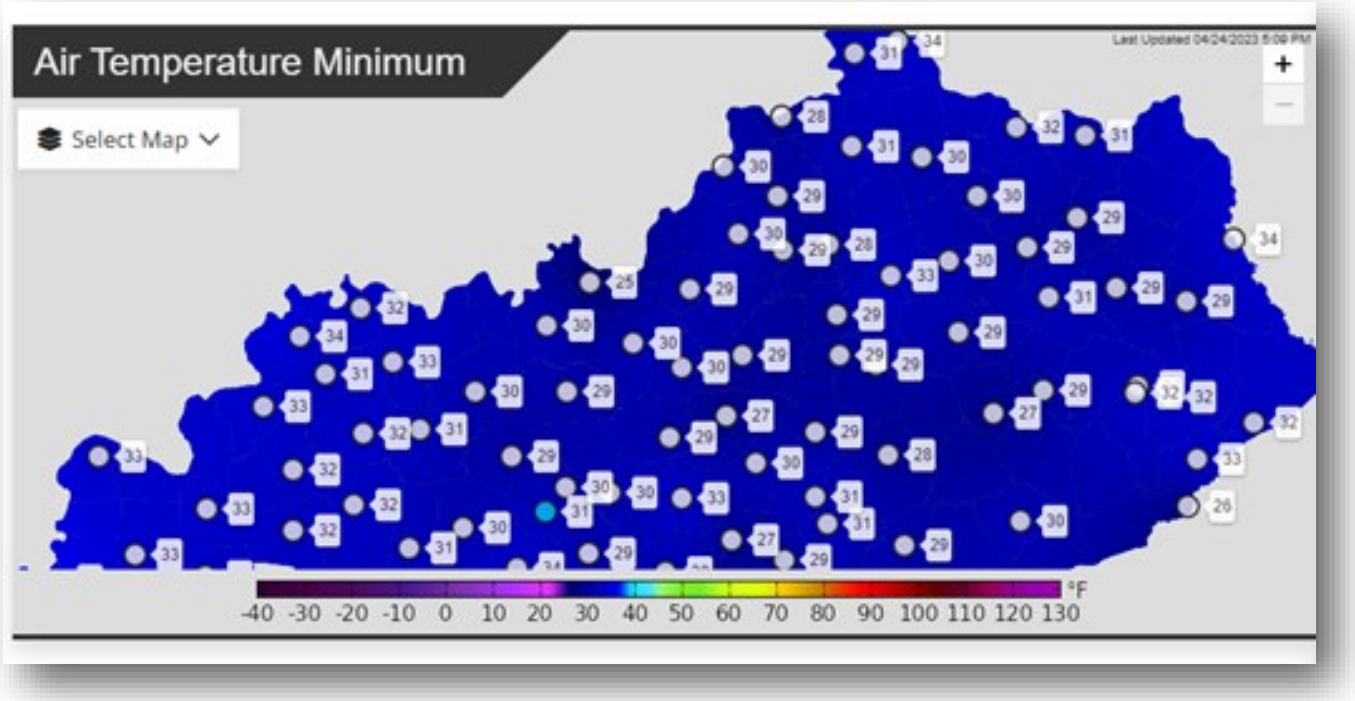

Figure 1. Kentucky Mesonet recordings of lowest air temperatures since midnight April 24, 2023.

Corn and Soybeans at Risk

Corn and soybeans are at more risk to death from the freeze events at specific growth stages and in certain conditions. The following scenarios go from greatest risk to least risk of plant death from the freeze events.

Soybeans at the "crook" stage where the stem is emerged and bent over like a shepherd's crook were the most susceptible to the freeze (Figure 1). These plants were most likely to be killed by the freeze or frost. At crook stage, typical damage is along the stem with some yellowing of the cotyledon. This will be followed by plants snapping off where damage was observed (Figures 2 and 3).

Figure 2. (above) Soybean plants at the 'crook' stage. Stems are fully exposed, but cotyledons have not moved above soil surface yet. (Soybean images by Conner Raymond and Carrie Knott)

Figure 3. (above) Early signs of freeze damage observed on a soybean plant after 3-4 days of active growth. When freeze damage occurs at crook stage, yellowing of cotyledon and stem damage are visible. (Soybean images by Conner Raymond and Carrie Knott)

Figure 4. (left) Final stage of crook freeze damage to plant appears after 7-10 days of active growth. Top portion of plant has broken off at site of damage (Soybean images by Conner Raymond and Carrie Knott)

Figure 5. Emerged corn seedling with freeze damage at the very top of the emerged seedling, but no damage closer to the soil surface or below it. (Image by Chad Lee)

Corn and soybean seeds and seedlings in furrows that were not fully closed are at risk of being killed by the freeze.

Corn or soybean seeds that were planted shallow had a slight risk of freeze damage, although plant death from the freeze is unlikely.

Corn plants emerged may have tissue above the soil surface die off from the freeze, but the growing points should have been insulated beneath the soil surface. Those corn plants should recover well. No yield loss is expected.

Soybean plants that have FULLY emerged and are at the VE growth stage (emergence) should survive the freeze event, based on observations during freeze events in late April 2021 and early May 2020. If the soybean cotyledons survive, the soybean plants will survive, and no yield loss will occur. If the cotyledons do not survive, the plant will not survive, either.

Corn and soybean seeds at proper planting depths are at very little risk from the freeze. Corn and soybean radicles (the shoots emerging from the seeds) that are still below the soil surface likely were insulated and will survive.

We need about 5 days of warm weather before symptoms are easy to see. Based on current forecasts, it may take six or seven actual days to get the 5 days of good growing conditions. Plants or plant parts that have turned black or brown and have lost turgor pressure are easy to identify.

Corn plants need to be examined from the seed upward. We are assuming that the roots are deep enough to not be a concern. Dig up some corn plants and look for any signs of brown/black areas from the seeds upward. If plants are white to yellow beneath the soil and turgor pressure is good, then the seedlings are likely to survive.

Maybe Just a Chill

Corn and soybean seeds that are in the process of germinating during the freeze are at risk of taking in cold water (imbibitional chilling) within the first 24 to 48 hours after planting. If the soil temperatures were below 50F for an extended period during those 24 to 48 hours, then the seeds are more likely to be damaged. There is some debate about how long the soils need to stay below 50F before severe damage is done from the imbibitional chilling. We can say those seeds are at risk. At this point, either the seeds were damaged, or they were not from imbibitional chilling. Emergence will be slower in these fields. The fields can be scouted in about five days or so to determine the health of germinating seeds and/or emerged plants.

Table 1: Low temperatures recorded across the state from 4/21/23 through 4/24/23. Freezing temperatures are highlighted in light blue. Weather data from the Kentucky Mesonet.

KY Mesonet Site	Low Temperature °F			3 Day Average Low Temperature
	4/21-22	4/22-23	4/23-24	
Adair	48	41	34	41
Allen	49	41	35	41
Ballard	42	38	35	38
Barren	49	40	34	41
Bath	54	43	37	45
Boone	46	37	34	39
Boyle	47	42	33	41
Breathitt	58	46	38	47
Breckinridge	46	39	33	39
Bullitt	47	39	34	40
Butler	45	38	32	38
Caldwell	42	35	32	36
Calloway	42	39	35	38
Campbell	47	40	35	40
Carroll	47	36	32	38
Casey	48	42	33	41
Christian	43	38	33	38
Clark	48	42	36	42
Clinton	48	41	34	41
Crittenden	43	35	32	37
Cumberland	49	41	34	41
Fayette	48	41	35	41
Franklin	47	38	35	40
Fulton	42	39	36	39
Graves	42	36	33	37
Grayson	45	39	32	38
Hardin	47	39	32	39
Harrison	48	37	33	40
Hart	47	39	35	40
Henderson	47	38	36	40
Hopkins	45	37	34	38
LaRue	47	41	34	41
Lewis	46	45	36	42
Lincoln	47	41	34	41
Logan	46	36	32	38
Madison	51	44	36	43
Marion	47	41	33	40
Marshall	43	36	33	37
Mason	52	39	36	42
McLean	48	38	34	40
Meade	47	35	30	37
Mercer	48	41	34	41
Metcalfe	47	40	35	41
Monroe	49	42	37	43
Morgan	56	47	35	46

KY Mesonet Site	Low Temperature °F 4/21-22	4/22-23	4/23-24	3 Day Average Low Temperature
Muhlenberg	45	36	32	38
Nicholas	49	41	36	42
Ohio	45	38	31	38
Oldham	46	38	35	40
Owen	45	37	35	39
Owsley	50	44	34	43
Pike	55	42	35	44
Pulaski	49	42	34	42
Rowan	52	43	38	45
Shelby	47	35	35	39
Simpson	48	39	37	41
Taylor	48	42	32	40
Todd	43	37	34	38
Trigg	43	38	34	38
Union	45	37	34	38
Warren	48	39	36	41
Wayne	49	44	36	43
Webster	43	35	30	36

Resources

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Save the Date

July 25, 2023

Corn, Soybean & Tobacco Field Day

UKREC Farm, Princeton KY

KATS
Kentucky Agriculture Training School

College of Agriculture, Food and Environment

2023
Field Crop Scouting Clinic

Ideal for agriculture interns, new and experienced producers, as well as a great refresher for others

- Corn and soybean diseases and growth staging
- Scouting for insect pests of corn and soybeans
- Weed ID
- Soil nutrients and their influence on crop growth

Credits pending

May 18, 2023

9:00 am to 4:00 pm

University of Kentucky
Research and Education Center
Princeton, KY 42445

Pre-registration is required and will close on May 16.

https://2023KATScropscoutingclinic.eventbrite.com

$105 registration fee *Lunch will be provided*

KENTUCKY Small Grain GROWERS' ASSOCIATION

For more information contact Lori Rogers
270-365-7541 ext. 21317
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University of Kentucky

2023 Pest Management Field Day

at the UKREC Farm

June 29, 2023

Location: 1205 Hopkinsville St., Princeton, KY 42445
Time: 8:30 a.m. to 12:30 p.m. CDT — Sign-in begins at 8 a.m. CDT

Pre-registration is highly recommended by June 22, 2023 by either scanning QR Code, clicking web link, or by telephone.

https://uky.az1.qualtrics.com/jfe/form/SV_4PjveAuq6mK9rXU

Or contact the UKREC at (270) 365-7541, ext. 22569.

Topics and Speakers

• **Palmer amaranth and Waterhemp control**	***Travis Legleiter***
• **Weed Control in early planted soybean**	
• **Weed Control in corn**	
• **Italian ryegrass Research Update**	
• **Herbicide Resistant Johnsongrass**	***JD Green***
• **Weed Management utilizing cover crops**	***Erin Haramoto***
• **Corn Disease Research Update**	***Kiersten Wise***
• **Entomology Research Update**	***Raul Villanueva***

Continuing Education Units for Certified Crop Advisors and Kentucky pesticide applicators available

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UPCOMING EVENTS

May 18, 2023	**KATS Crop Scouting Clinic**
June 7-8, 2023	**KATS Drone Pilot Certification Prep Course**
June 29, 2023	**Pest Management Field Day - Princeton (IPM-Grain Crops)**
July 13, 2023	**KATS Spray Clinic**
Jul 25, 2023	**UK Corn, Soybean and Tobacco Field Day**

Cooperative Extension Service
Agriculture and Natural Resources
Family and Consumer Sciences
4-H Youth Development
Community and Economic Development

LEXINGTON, KY 40546