Kentucky Field Crops News

Spanning 5 departments and 120 counties

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Martin-Gatton College of Agriculture, Food and Environment
Grain and Forage Center of Excellence

UK Wheat Science Group
UK Corn & Soybean Science Group

In This Issue

Boron Deficiency – Associated with Tassel Wrapping in Corn?

Dr. John H. Grove, UK Soils Research & Extension

My friend and former UK colleague, Dr. Greg Schwab, recently posted an interesting item on Linked In (www.linkedin.com/feed/update/urn:li:activity:7356749391921074176/). He writes that corn tassel wrap, and associated poor pollination, could be due to boron (B) deficiency. I think he might be right. I looked at my B deficiency photo collection. Several of the usual – photos of corn ears with various degrees of poor pollination, ranging from lightly to heavily barren 'tip back' (Figure. 1) or medium to heavy erratic patterned kernel loss (Figures. 2 and 3). By the time that you see these symptoms it is too late to do anything. Foliar symptoms are less well known but include a crinkling/zipper deformation of leaves (Figure. 4) and pale interveinal areas that can become chlorotic, pale yellow to white (Figure. 5).

Figure 1. Photo by Brandt, Inc.

Figure 2. Photo by Beck's Hybrids.

Figure 3. Photo by Beck's Hybrids.

Figure 4. Photo by US Borax.

I also found an older International Plant Nutrition Institute photo (Fig. 6) posted by my friend and former student, Dr. Jose Espinosa, that shows the leaf crinkling/interveinal chlorosis, and also a malformation occurring in the upper portion of corn plants prior to pollination. Could this be a precursor to tassel wrap?

Ear symptoms of B deficiency can be confounded with other challenges, especially nitrogen (N), phosphorus (P), potassium (K) deficiencies and drought stress. In most crops, B impacts sugar transport in the plant, especially important to stimulation of root and shoot development – proper growth of meristematic/younger tissues. Boron is not very mobile within the plant, so deficiency symptoms tend to be found in the youngest/newest plant tissues. With corn, proper B nutrition is associated with better water use efficiency, drought tolerance and plays a significant role in pollination. Boron deficiency impacts tassel and silk formation and function, (pollen germination, silk tube growth and seed formation), possibly tassel-sink synchrony, and particularly when heat/moisture stress are coincident with silking and pollination. Finally, B deficiency negatively impacts movement of plant sugars from leaves to ears.

Figure 5. Photo by Brandt, Inc.

Figure 6. Photo by Dr. Jose Espinosa, IPNI.

The largest soil B reservoirs are organic matter and tourmaline, a primary borosilicate soil mineral of very low solubility. Older, well weathered soils, low in organic matter, are more likely to be B deficient. Plant available B occurs as soluble boric acid/borate anions (H_3BO_3/$H_2BO_3^-$). Soluble borates are mobile in the soil – are not retained well by the soil and tend to leach. Boron's mobility in the soil can be linked to a greater possibility of B deficiency in 2025 Kentucky corn. Greater spring rainfall likely drove greater leaching, reduced root exploration (greater compaction is corn fields) and resulted in lower B uptake. Soil moisture, high temperatures and adequate N availability likely accelerated corn growth rates, further diluting tissue B concentrations.

Boron deficiency is known to occur in Kentucky. AGR-1 (https://publications.ca.uky.edu/agr-1) gives B recommendations for alfalfa and tobacco. Recently, language on B for wheat was added to the latest version of ID-125 (A Comprehensive Guide to Wheat Management in Kentucky, (url not yet available) as follows: "Boron (B) has recently been found to limit wheat yield in field research. Soil testing for B will help wheat producers decide when to apply B. Hot water extractable B levels lower than 0.8 lb B/acre indicate a need for B addition. Mehlich III extractable B was also evaluated and was not usable as an indicator of wheat B need. When a need for B fertilization is indicated, the recommended rate is 1 lb B/acre." The UK soil test lab uses hot water extraction.

The B nutrition of corn and soybean in Kentucky has been the subject of a few studies, beginning in the late 70's. Then, the incidence/severity of B stress was relatively low – not much was found until several field studies were conducted between 2008 and 2011 in Russell County (Grove and Schwab, 2010). Both corn and soybean were studied, and other nutrients (P, zinc and copper) were also evaluated. Soils were Sango and Lonewood silt loams, low in organic matter and formed in thin loess over old Cumberland Plateau parent materials. Soil test B was determined using Mehlich extraction and ranged between 0.5 and 1.0 lb B/A. The soybean and corn B response data is summarized in Table 1. Only 2009 soybean data are shown.

Table 1. 2009 and 2010 corn and soybean R1 leaf tissue composition and grain yield response to added B in Russell County trials.

Year	**Crop**	**Rate** lb B/A	**Leaf B** ppm	**Yield** bu/A
2009	soybean	0	24.0 b*	64.6 a*
		1	41.9 a	64.8 a
2009	corn 1	0	3.8 a	144 a
		1	5.3 a	162 a
	corn 2	0	4.3 b	147 a
		1	6.3 a	160 a
2010	corn 1	0	3.4 b	111 b
		1	13.4 b	164 a
	corn 2	0	3.1 b	161 a
		1	13.3 a	165 a

*Mean values within a column, by crop-year, followed by the same letter are not significantly different at the 90% level of confidence.

Generally, R1 leaf tissue B concentrations responded positively to B addition. The R1 leaf tissue B sufficiency concentration range, from AGR-92 (https://publications.ca.uky.edu/agr-92), is 20 to 60 ppm B for soybean and 5 to 25 ppm B for corn. So, without added B these crops evidenced either insufficient (corn) or borderline insufficient (soybean) B nutrition. Yields were generally good, but yield responses were mixed, despite the generally low level of tissue B, especially for corn. Taken together, the corn yield response to B addition was very significant on these soils. We observed a good deal of poor pollination in association with the large yield responses. ***We did not observe tassel wrapping, but we weren't looking for it.*** The 2010 corn 2 yield response was complicated by a B by zinc interaction, where zinc addition raised yield potential and caused a much stronger yield response to B that was not evident in the absence of zinc. Soybean did not give a yield response to added B in 2009, nor in 2010 (data not shown). That said, soybean tissue analysis might serve as a 'canary in the coal mine', allowing earlier detection of B insufficient fields intended for corn in the next season.

Now – Consider evaluating this year's tassel-wrapped corn for B nutrition stress by taking leaf tissue samples. ***But those leaves need to be green.*** Take them as close to the node with the uppermost ear as you can but move upward if you must in order to get green leaf tissue. Given the immobility of B in the corn plant, if tissue B was low before, it will still be low in the upper green leaves. If all leaves are brown/dead, wait until your next soil test results are available.

Prevention – Start with your soil testing program. Soil testing isn't perfect, but it is a good place to start. The critical corn soil test B (STB) value (the value triggering a B application) isn't well understood for Kentucky soils. Our previous experience with alfalfa, wheat and tobacco suggests the likely critical STB level is around 0.5 to 1.0 lb/A (0.25 to 0.50 ppm B) and this also depends on the extraction procedure (there are several). If your soil test B value is low, then apply 1 to 2 lb actual B/A. There are several good dry B products (boric acid, Granubor, etc.) available to use as part of a dry fertilizer blend. Needed B may also be sold co-granulated with potash (usually KCl, potassium muriate) or phosphate (usually MAP, monoammonium phosphate). These can work if you need the potash or phosphate, respectively. Spring, rather than fall, application is favored because of B's tendency to leach with excessive rainfall.

Soluble B sources (borax, Solubor, etc.) are available. These can be applied at any time, pre-plant, and both pre- and post-emergence, but probably tend to be used later in the season. Soluble B that falls on the soil is less likely to be "fixed", chemically, than some other spray-applied nutrients. Soluble B products are often compatible with pesticides (herbicides, fungicides, insecticides) that are sprayed over corn at different times, but careful jar testing is strongly recommended. One application of 0.5 to 1 lb actual B/A should be enough for the season.

Detection – Use plant tissue analysis to monitor/diagnose B nutrition status. At present, AGR-92 (https://publications.ca.uky.edu/agr-92) gives a B sufficiency range of 5 to 25 ppm B regardless of the corn stage of growth. Yield response-wise, even less is known about using plant tissue analysis and then a later timing of foliar B. Though it is likely that earlier sampling is better, it is also probable that earlier sampling is less likely to detect deficiency of a soil mobile/plant-immobile nutrient like B (i.e. tissue B levels are fine until the soil B reservoirs run dry).

In summary, I'm not entirely sure that B deficiency is the cause of corn tassel wrapping, but there is some coincidence between symptoms and poor pollination outcomes and what is known about corn B deficiency. I don't believe in coincidences. As our future corn production seasons might more often be a combination of wetter springs and warmer summers, I do think that paying more attention to corn B nutrition is warranted. Please share your own observations. I'd be pleased to learn more.

References

Grove, J.H., and G.J. Schwab. 2010. Micronutrient nutrition for corn and soybean: Emerging issues in Kentucky. Proc. 40th North Central Extension-Industry Soil Fertility Conference. 17-18 Nov. Des Moines, IA. 7 pp.

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Corn Leafhopper Detected in Kentucky Corn in 2025

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Current Status

Corn leafhopper has been confirmed in Kentucky corn as of mid-July 2025. The corn leafhopper, *Dalbulus maidis* (Hemiptera: Cicadellidae), has become a major pest in corn fields across South and Central America due to its ability to transmit plant pathogens. It is the primary vector of corn stunt spiroplasma (*Spiroplasma kunkelii*), maize bushy stunt (MBS) phytoplasma, and maize rayado fino virus (MRFV), which are associated with the disease corn stunt.

Corn leafhopper was first detected in 2024 in a suction trap at the University of Kentucky's Research and Education Center in Princeton (western Kentucky). In 2025, corn leafhoppers have been identified on yellow sticky traps and direct visual inspections in commercial fields in Caldwell, Christian, and Trigg counties. However, corn leafhoppers *have not been found* in yellow sticky traps placed in commercial fields in Daviess, Henderson, and Wayne counties so far this year.

Corn Leafhopper Description

Adult corn leafhoppers are about 1/8 inch long and range in color from pale yellow to white. A key distinguishing feature which helps differentiate them from other leafhopper species commonly found in corn is the presence of two dark spots surrounded by whitish halos, located between the eyes (Figure 1). Corn leafhoppers will have white veins on their wings, light abdomens and no facial markings.

Figure 1. Corn leafhopper, with two distinctive dark spots (surrounded by a whitish halo) between eyes (Photos: F. Batista, UK).

Damage to Corn


Figure 2. Corn stunt symptoms. Picture courtesy of Maira Duffeck, Oklahoma State University

Corn leafhoppers are sap feeding insects, and they can cause significant direct damage if populations are high. However, the main issue is that corn leafhopper is capable of transmitting the pathogens that cause corn stunt. **Although the corn leafhopper has been confirmed in Kentucky, the disease corn stunt has not yet been confirmed in 2025.** In fact, although corn leafhoppers have been detected across southern and mid-south states, corn stunt has only been confirmed in one county in Arkansas. https://cropprotectionnetwork.org/maps/corn-stunt-pathogens

Symptoms of corn stunt include stunted plants and malformed or small ears. Leaves of affected plants can appear reddish in color (Figure 2). Corn stunt is easy to be confused with other corn disorders, including drought stress and nutrient deficiencies. Ear damage or other issues that prevent sugar accumulation in the ear will result in anthocyanin accumulation or red discoloration of the leaves, which can be also confused with corn stunt.

The combined effects of corn leafhopper feeding and the transmission of plant pathogens can cause substantial losses in corn productivity and quality. In central Brazil, where corn leafhoppers are prevalent, 10 to 60% of plants showing disease symptoms—predominantly due to maize bushy stunt phytoplasma—were observed in non-irrigated corn fields. In irrigated fields, 65 to 100% of corn plants were infected, leading to total yield loss in some areas in 1998.

Management

In Kentucky, management of corn leafhopper and corn stunt are not needed at this time. Due to Kentucky's cold winters, the presence of corn leafhoppers in the state is usually the result of migration from states to our south. Migration of the corn leafhopper can be annually monitored at the corn leafhopper map: https://cropprotectionnetwork.org/maps/corn-leafhopper (Figure 3). This map reports the date corn leafhoppers were reported in each state and allows stakeholders to track the northward movement of the leafhopper from May in Texas to western Kentucky in mid-July. (late July). By the time corn leafhoppers reached Kentucky in mid-July, corn planted within the regular planting window (around April–May) in Kentucky would be unlikely to experience major yield loss from corn leafhoppers and corn stunt.

Corn leafhoppers and corn stunt are more concerning when detected in late-planted or young corn. Infections that occur in vegetative (V) stages are more likely to result in yield loss. Therefore, monitoring corn leafhoppers during the early growth stages (up to V8–V10) is one of the most important steps in disease management. If the corn leafhopper is detected before V8-V10 insecticide application(s) may be necessary.

The University of Kentucky Entomology and Plant Pathology programs are collaborating with other universities across the United States in a project to track corn leafhoppers and detect the pathogens that cause corn stunt, and assess their potential impact in Kentucky. If corn stunt is suspected, submit samples to your County Extension Agent for submission to the Plant Disease Diagnostic Laboratory.

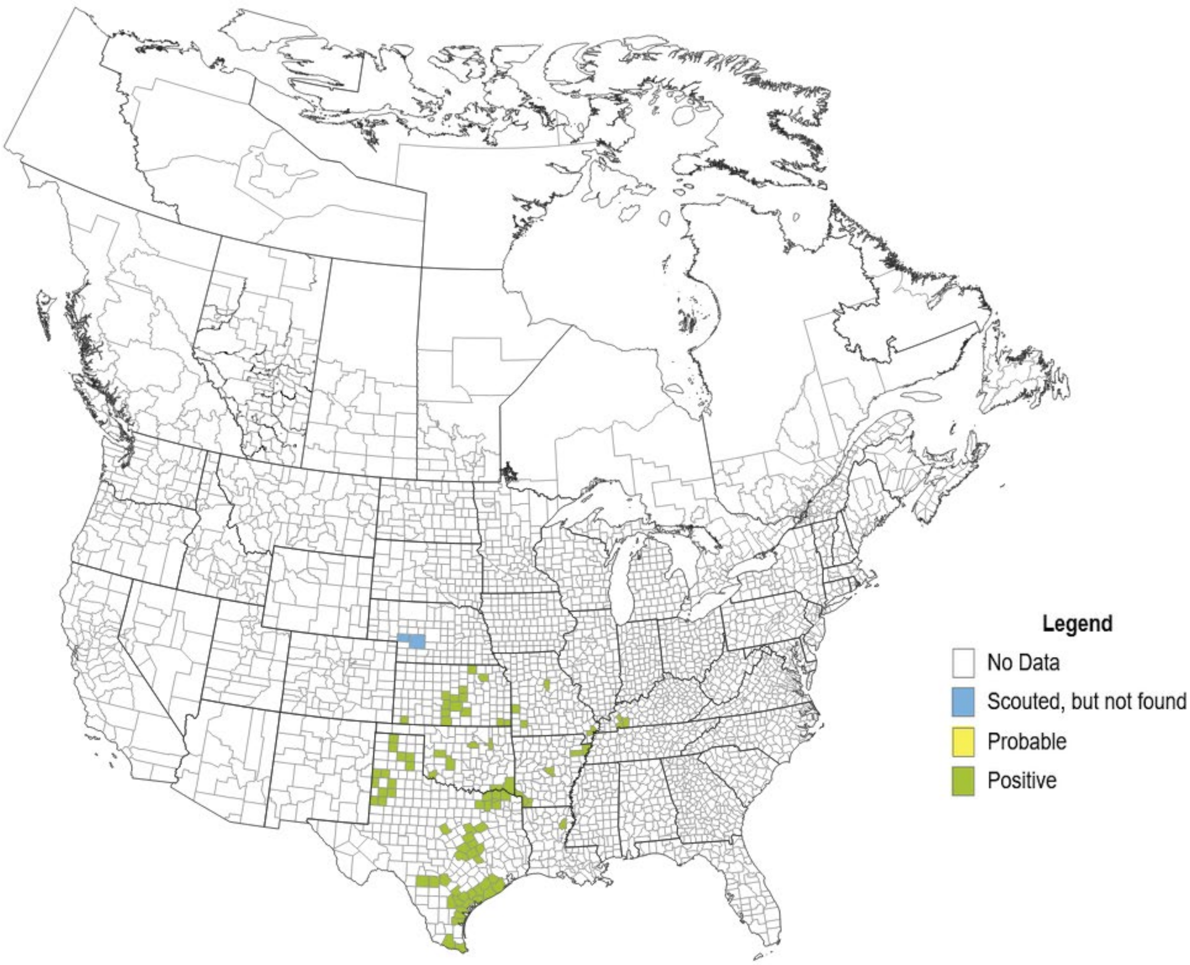

Figure 3. Map showing counties where corn leafhoppers were detected in different states of the U.S. The website reports state, county, and date of identification of the insect. (Map source: Crop Protection Network).

More Information

- Biology and Management of Corn Leafhopper (University of Missouri)
- Corn Stunt: Identification, Distribution and Management (CPN)
- Corn Leafhopper Leads to Corn Stunt Disease Across Oklahoma (Oklahoma State University, August 12, 2024)
- Lagos-Kutz, D.M., et al. 2025. First Report of Corn Leafhopper (Hemiptera: Cicadellidae) in the USA Midwest Suction Trap Network. 2025. Insecta Mundi 1110: 1–10. Published: February 28, 2025.

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Well-Filled Ears and High Corn Yields

Dr. Dennis B. Egli, Professor Emeritus

We've all seen advertisements for corn hybrids that show a row of corn with an ear on every plant that is filled to the tip. The implication is that well-filled ears are an indication of high yield.

This makes sense because ears that are filled to the tip are an indication of good growing conditions during pollination and kernel set. Good growing conditions mean high yields.

Much of the variation in corn yield is related to kernels pr acre. Many kernels usually means high yields. The number of kernels is, in turn, related to the productivity of the crop during pollination and kernel set (around growth stages VT/R1). Any stress, such as high temperatures or a lack of water or both, during this critical period will interfere with pollination or cause abortion of immature kernels reducing kernel number and yield potential. Well-filled ears may be an indication of a lack of stress during this critical period and potentially high yields.

Are well-filled ears always an indicator of high yields? Unfortunately not! Well-filled ears can also be an indication that the population was too low, and yield was left in the field. How can that be?

A basic problem with corn is that over the years it lost its flexibility – it lost much of its ability to adjust the number of kernels per plant in response to changes in productivity of the environment. Most modern corn hybrids produce only a single ear even though the wild species (Teosinte) that gave rise to modern corn produced ear-bearing tillers and multiple ears per plant – it was very flexible. Over the years corn breeders got rid of this flexibility and limited the ability of the plant to increase kernel numbers in response to increases in plant productivity. Producers have to supply flexibility by adjusting population.

In comparison, soybean is a very flexible plant, that can easily adjust the number of seeds to match changes in productivity. Soybean plants branch and increase flowers per node to produce more seeds.

The size of the ear (florets per ear) and ears per plant sets the maximum number of kernels the corn plant can produce. If the productivity of the environment exceeds that capacity, the number of kernels will limit yield. The plant had enough photosynthesis to produce more kernels but there weren't enough florets, in other words, the plant was limited by the number of kernels and yield was left in the field. This situation can be avoided by increasing population which increases the number of florets and the number of potential kernels per acre and yield will no longer be limited by kernel number.

This relationship explains why corn populations increased from roughly 8000 plants per acre when producers were growing open-pollinated varieties in the 1930's to 30,000 plants per acre or more today. As breeders developed higher-yielding hybrids, they did not necessarily increase ear size. So, populations had to increase to provide enough florets to match the increase in productivity and prevent the number of kernels from limiting yield. In contrast, soybean populations remained the same or decreased as yield increased. The difference is just a matter of flexibility.

If the population in a particular field is too low relative to productivity, all the ears will be filled to the tip and the number of kernels will limit yield. These well-filled ears are not an indication of high yield, instead they signify unrealized yield. There weren't enough florets to translate all the productivity of the plant into yield. Increasing population would have increased yield.

Well-filled ears can be an indication that yield has been left in the field because the population was too low or an indication of no stress during tasseling and silking which sets the potential for high yields. One indicator but two outcomes – now isn't that a kick in the head.

How should we respond to this dilemma? If last year's population resulted in a field of well-filled ears, instead of celebrating high yields, the prudent approach may be to increase population to capture lost yield by avoiding a limitation by the number of kernels per plant. On the other hand, a field of unfilled ears may be a cause for rejoicing; we got the population right and maximized yield. Of course, it may also be an indication of stress during pollination and seed set that reduced yield. All that can be done then is to hope for better weather next year. Unfortunately, ears don't tell the whole story. As Abraham Lincoln (1809 – 1865, 16th President of the U.S.) once said "We can complain because rose bushes have thorns, or we can rejoice because thorn bushes have roses".

Adapted from Egli, D.B. 2021. Applied Crop Physiology. Understanding the Fundamentals of Grain Crop Management, pp. 103-111. CABI.

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Damage by Pillbugs on Soybean Seedlings under Laboratory Conditions

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Introduction

Pillbugs, or roly-polies, are land-dwelling crustaceans—not insects. They are commonly found in moist environments with decaying organic matter and are generally considered decomposers. However, under favorable conditions, pillbugs can sometimes feed on live plant tissue, particularly during the early growth stages of crops like soybeans. They may damage cotyledons or even kill entire seedlings in areas with heavy residue and high moisture. These early signs of injury are often mistaken for slug or cutworm damage, which can lead to misidentification and ineffective management strategies (Figure 1). Injuries caused by pillbugs have been observed in commercial soybean fields in Nebraska and Kansas. Although this type of injury has not been reported in soybean fields in Kentucky, the entomology laboratory at the Research and Education Center (REC) in Princeton conducted a test to evaluate the potential damage of this organism.

Figure 1. (Left) Pillbugs and slugs seen together in a soybean field with abundant organic matter in Monticello, KY (Photo by Z. Viloria, UK) and Pillbugs and snails collected in a soybean field in Caldwell Co. (Photo by R. Villanueva).

Evaluation of Pillbug Damage in Laboratory and Results

A short observation trial was set up to evaluate pillbug damages to germinating soybean seedlings. Seedlings were grown in moist conditions in a plastic container, and pillbugs were introduced for 10 days (Figures 2A and 2B). Feeding damage was assessed at the end of the period.

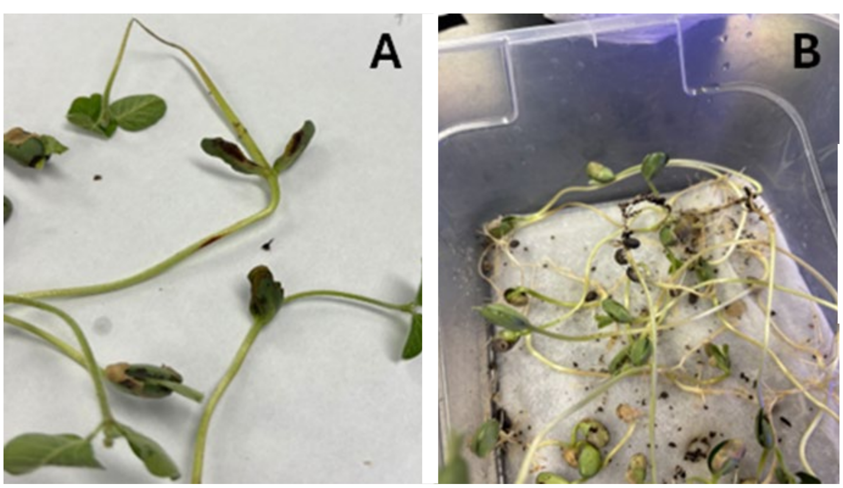

Figure 2. (A) Closeup view of cotyledon damage done by pillbugs and (B) pillbugs feeding set up arena on soybean seedlings in a moist container (Pictures by S. Adhikari, UK)

Figures 3 and 4 illustrate injuries caused by pillbugs to soybean seedlings. Figure 3 shows that nearly two-thirds of the seedlings were injured in this study when pillbugs had no alternative food sources, such as organic matter or other materials. Figure 4 demonstrates that cotyledon damage was significantly more common than leaf damage, occurring in 78.95% and 21.05% of the seedlings, respectively. This suggests that pillbugs primarily target soybean cotyledons during the early growth stages.

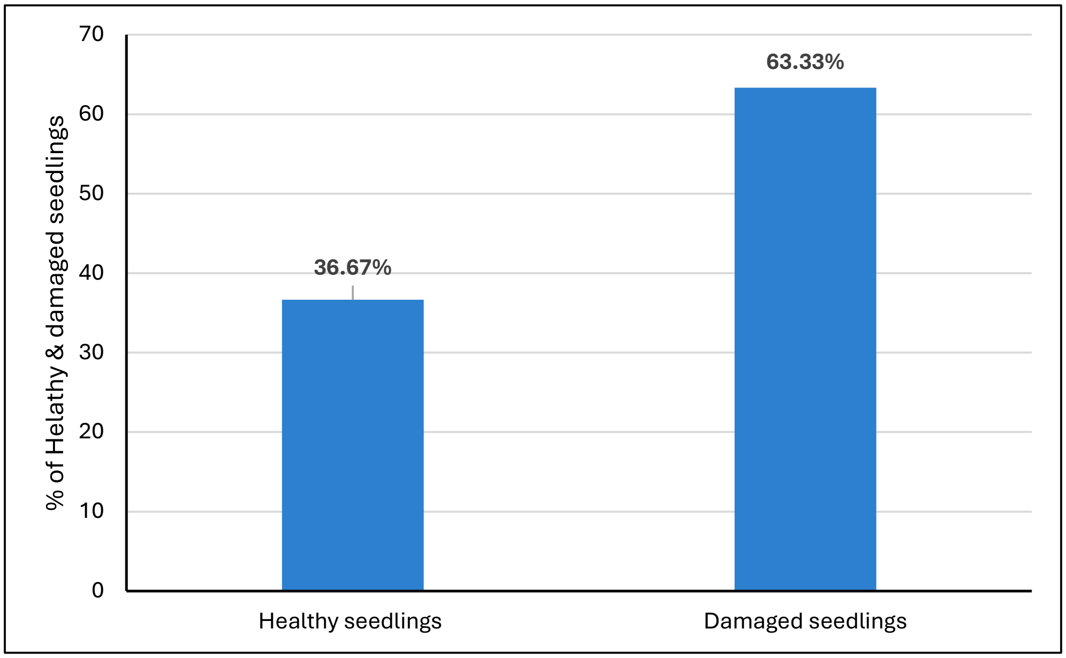

Figure 3. Percentages of healthy and damaged soybean seedlings after 10 days of pillbugs exposure.

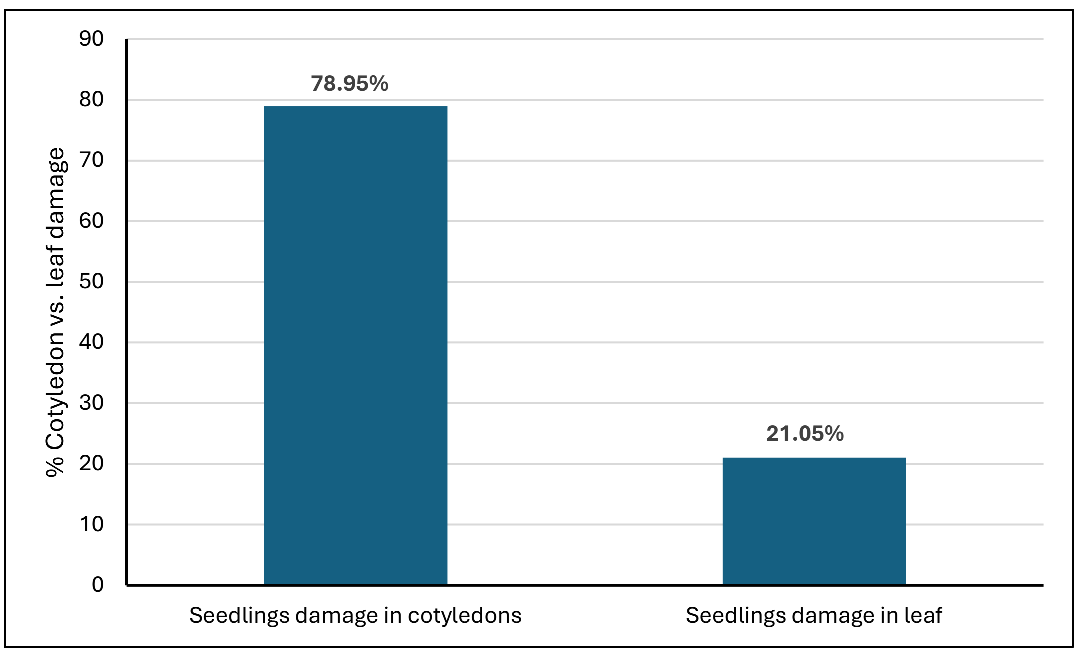

Figure 4. Percentages of seedlings damage showing cotyledon vs. leaf damage.

Conclusion

Although pillbugs are primarily known as decomposers, they can cause significant damage to soybean seedlings under favorable conditions-especially in moist, no-till fields with heavy residue. In our test, more than 60% of seedlings were damaged in a simple observational study, with cotyledons being the most affected. This type of damage may be mistaken for slug or cutworm injury; therefore, proper pest identification is essential. Farmers should monitor early-planted soybeans in high-residue field systems and be aware that pillbugs may also be a major factor in early stand losses.

More Information

- University of Nebraska Lincoln: Pillbugs Causing Injury to Soybean Crops in Nebraska
- Kansas State University: Pillbugs
- University of Kentucky: Sowbugs & Pillbugs

Citation: Villanueva, R., Adhikari, S., 2025. Damage by Pillbugs on Soybean Seedlings under Laboratory Conditions. Kentucky Field Crops News, Vol 1, Issue 8. University of Kentucky, August 15, 2025.

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Corn is Not Making your Days more Humid

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(This article originally appeared on the University of Kentucky Marton-Gatton website.)

When it gets very hot and very humid, people see the fields of tall, green corn and point the finger at these fields. Corn is not making your days more humid unless you are walking in corn fields all day.

The very short answer is that corn will transpire around 4,000 to a peak of 8,000 gallons of water per acre per day. But, in these current conditions, there is about 160,000 gallons of water in the air already. So, any water coming from a field of corn is negligible to the total amount of water in the air.

Corn, like all plants, transpires water and oxygen to help maintain plant functions. Once the corn plant leaves cover the rows and intercept most of the sunlight, most water loss from the cornfield comes from the transpiration. Water loss from transpiration is influenced by water availability in the soil, water amount in the plant, relative humidity (which is water in the air), air temperature, cloud cover and windspeed.

If the relative humidity (RH) is high, then transpiration (water loss) from the plants is low. Some estimates in Nebraska place peak water loss from a cornfield at about 0.33 inches per acre per day. That equals 8,960 gallons of water per acre per acre per day for about 20 days. Other estimates east of the Missouri River suggest corn will transpire about 4,000 gallons per acre per day. If RH is 50%, and corn plants are at maximum water demand, corn in the region likely loses closer to the 5,000 gallons per day.

While that is a large amount of water for any household to use in a day, it is very small number compared with what is in the air already.

We can calculate the water in the air by calculating the weight of dry air above one acre, using a psychrometric calculator, and using 86 F and 50% RH at our elevation. With these parameters in the Bluegrass Region of Kentucky there is about 0.0136 pound of water (H2O) per pound of dry air. That comes to about 160,000 gallons of water above one acre, whether that acre is corn, a football field, or houses in town. See the resources at the end of this publication to double check this math and work out scenarios where you live.

To add more perspective to the volumes of water being discussed, 1-inch of rainfall is 27,184 gallons per acre. The Kentucky Mesonet at Spindletop Farm in Lexington is at 3.1 inches of rainfall for July, which is 84,270 gallons of water per acre that has fallen to soil. If the atmosphere is holding 160,000 gallons of water at 50% RH and 86 degrees Fahrenheit, and all that water decided to fall to earth in a day, that is equivalent to about 5.9 inches of rainfall per acre.

An acre of corn could remove 35,000 pounds of carbon dioxide (CO_2) per acre and release about 25,000 pounds of oxygen (O_2) per acre over the growing season.

If someone walks into a cornfield, that corn will block airflow. As that corn transpires, a person will perspire. Inside of that cornfield, it will feel more humid. But, outside of the cornfield in this region of the country, it is unlikely that corn (or soybeans, sudangrass, or other crops fully closing the rows) will transpire enough water to dramatically affect the humidity in the neighborhoods, towns, and cities.

Acknowledgements

Corn agronomist colleagues Dan Quinn, Alex Lindsey and Osler Ortez helped with the though processes and calculations. A larger conversation was held among corn agronomists across the country about this topic.

Resources

Calculators

Psychrometric calculator: https://daytonashrae.org/psychrometrics/psychrometrics.shtml

Weight of air: https://www.engineeringtoolbox.com/air-density-specific-weight-d_600.html

Publications

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Upcoming Events

Sept. 10, 2025	**KATS Soil Pit**	**EKU, Richmond, KY**
Jan. 15, 2026	**KY Commodity Conference**	**Bowling Green, KY**
Feb. 3, 2026 ***(tentative)***	**Winter Wheat Meeting**	**TBA**
Feb. 5, 2026	**2026 Kentucky Crop Health Conference**	**Bowling Green, KY**
May 12, 2026	**UK Wheat Field Day**	**Princeton, KY**
Jul. 21, 2026 ***(tentative)***	**UK Corn, Soybean & Tobacco Field Day**	**Princeton, KY**

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