Issue 853

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Extension Agronomy

eUpdate

05/06/2021

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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1. Early-season weed control in cotton

Cotton can be slower to canopy and therefore less competitive early in the growing season than other crops, which makes early-season weed control especially important (Figure 1). Weeds not only compete with cotton for water, nutrients and sunlight during the growing season, but also contribute to trash and discoloration of the lint at harvest, resulting in major dockage in quality grades and reduced value of the lint.

Figure 1. Residual herbicides applied at planting are needed to prevent early-season weed competition in cotton. Photo by Stu Duncan, K-State Research and Extension.

Start clean. Tillage is often used to provide a 'clean slate' for early-season weed control. However, the majority of Kansas cotton acreage is in conservation tillage systems, so effective herbicides are needed prior to planting.

Glyphosate is often used in burndown herbicide applications in combination with other products. Group 14 herbicides such as flumioxazin (Valor, others) and saflufenacil (Sharpen) can be applied before planting and have some residual activity, as well as 14 to 42 day pre plant intervals. Paraquat (Gramoxone, others) and glufosinate (Liberty and others), which only control actively growing weeds, are also effective for pre-plant burndown herbicide applications.

If dicamba-resistant cotton is planted, approved dicamba formulations (XtendiMax, Engenia, or Tavium) can be used in a burndown program with no waiting period before planting. There is a 21 to 28-day waiting period if non-dicamba-resistant cotton is planted and/or other labeled dicamba formulations are used. Similarly, the 2,4-D formulations Enlist One and Enlist Duo may be applied pre-plant with no waiting period in 2,4-D-resistant cotton, but there is a 30-day waiting period if non-2,4-D-resistant cotton and/or other labeled 2,4-D formulations are used.

Stay clean. Residual herbicides applied at planting are the foundation of any good weed management program. Not only are they necessary to prevent yield loss, they are also recommended to manage or delay the development of herbicide resistant weed populations.

Some effective residual herbicides for early-season use in cotton include Group 15 herbicides like acetochlor (Warrant, others), S-metolachlor (Dual, others), dimethenamid-P (Outlook), and pyroxasulfone (Zidua). One drawback of these herbicides is their requirement for about ½ inch or more of rainfall for maximum activity. Group 5 herbicides like diuron (Karmex), fluometuron (Cotoran), and prometryn (Caparol) do not have this requirement. However, these herbicides do have some limitations in terms of rotation restrictions to crops like corn, grain sorghum, and wheat. Similarly, pyrithiobac-sodium (Staple) will prevent rotation to grain sorghum in the following year. This restriction, along with the prevalence of ALS-resistant weeds has resulted very little Staple use in Kansas.

Group 15 herbicides can also be applied over-the-top of cotton in a layered residual approach, if the maximum application rate for the season is not exceeded at planting. Layered residual herbicides can be especially important in cotton because it is slow to canopy (Figure 2). It is important for these, and all herbicide applications to be made when cotton is at a growth stage allowed on the herbicide label. Post-emergence applications of dicamba (XtendiMax, Engenia) in dicamba-resistant varieties can also provide some residual control without the requirement for activating rainfall.

Figure 2. Residual herbicides applied post-emergence prevent late-season weed competition in cotton. Photo by Stu Duncan, K-State Research and Extension.

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The use of trade names is for clarity to readers and does not imply endorsement of a particular product, nor does exclusion imply non-approval. Always consult the herbicide label for the most current use requirements.

2. 2021 Kansas wheat plot tours to start on May 10

After over a year of virtual events, the Department of Agronomy and K-State Research and Extension will host several face-to-face winter wheat variety plot tours in different regions of the state, starting May 10, 2021. Make plans to attend a plot tour near you to see and learn about the newest available and upcoming wheat varieties, their agronomics, and disease reactions. A preliminary list of plot tour locations, dates, times, and directions is provided below. Stay tuned to the eUpdate in the coming weeks as this list is updated.

Plot	Agent	Date	Time	Directions
Ark City	Kelsey Nordyke	5/10	2:00 PM	From Ark City, 2 miles north on Hwy 77, 1 1/2 miles west on 242 Rd. Plot on the south side of the road.
Belle Plaine	Randy Hein	5/10	6:00 PM	Meal location—1459 E. 60th Avenue North Southeast of Belle Plaine. Plot location— 1/2 mile East, 1/2 mile South of address, West side of road
Andale	Jeff Seiler	5/11	8:30 AM	From Goddard, 3 miles west until S 247th street west, one mile north until 6th street S, 1/4 mile east (plot on north side)
Clearwater	Jeff Seiler	5/11	10:30 AM	From Clearwater, 3 miles west on 103rd street, 1 mile south on 183rd, and 1 1/4 mile west on 111th. Plot is on the south side of the road, by the shed.
Caldwell	Randy Hein	5/11	6:00 PM	From Caldwell, 1 1/2 miles east on Hwy 81, plots on the north side of the road.
Harper	Jenni Carr	5/12	8:30 AM	From Harper, 2 miles east on 160, 3/4 mile south on Murdock Road, plot on the east side of the road.
Harvey	Ryan Flaming	5/12	4:30 PM	From 135 at Newton, go west 2 miles, south 2 miles on south ridge road, west 1/4 mile on SW 36th street, plot on the south side of the road.
Harvey	Ryan Flaming	5/12	6:00 PM	Supper at 6 at Camp Hawk then DeLange Plot. Plot on Meridian between SW36th and SW48th.
Pratt Co	Jodi Drake	5/13	5:30 PM	From Hwy's 281 and 54, travel West to 60th Ave, then turn right and go north 1 mile and the plot is on the west side of the road
Sumner Co	Randy Rein	5/17	6:00 PM	Meal location — 922 West 140th Ave. North, Conway Springs. Plot location— From Conway Springs, go north to 140 Ave N, East 1 mile, South 1/8 mile, Plots on East side of road
Parsons	Gretchen Sassenrath	5/19	8:30 AM	Parsons Research Station

Marion	Rickey Roberts	5/21	8:00 AM	Hillsboro plot is located on Hwy 56 about two miles E of town on South side of road where the large grain holding facility was built
McPherson	Shad Marston	5/21	11:00 AM	Patrick plot Marquette. North East side of intersection Marquette & Hwy 4
McPherson	Shad Marston	5/21	3:00 PM	Inman plot; 4th Ave and Cheyenne, quarter mile east.
McPherson	Shad Marston	5/21	1:00 PM	Galle plot, Moundrige: 1/4 mile north of intersection 23rd Ave and Cheyenne
Marion	Rickey Roberts	5/24	8:00 AM	The Tampa plot cooperator is John Hajek. Plot is located on 320th just East of Old Mill Rd intersection, North side of the road.
Lorraine	Craig Dinkel	5/24	11:00 AM	From Lorraine, go south 1 mile on 10th road, then 3 miles west on avenue W. Plot is located on the intersection of Ave W & 7th road
Barton Co	Stacy Campbell	5/25	8:30 AM	On the ground across from the Expo. Center on HWY. 56 west of Great Bend.
Ellis Co	Stacy Campbell	5/25	6:00 PM	From I-70 take Victoria exit, go N. 2.5 miles on Cathedral Rd. turn W. onto Fairground Rd. go 1 mile, turn S. onto 330th Ave. about ¼ mile on E. side of road
Post Rock - Smith	Sandra Wick	5/26	10:00 AM	1/4 mile S of Smith Center right on Hwy. 281 on the west side of the highway.
Post Rock - Jewell	Sandra Wick	5/26	10:30 AM	Off of highway 14 in Jewell then east on Hwy 28 to 230 Road (4 mi.), then north ¾ mi. on the east side of the road.
Post Rock - Osborne	Sandra Wick	5/26	1:30 PM	Off of highway 24, south on "Sale Barn Road" or 115th Avenue about ¼ mile on the west side.
Post Rock - Lincoln	Sandra Wick	5/26	1:30 PM	½ mile west of Barnard to 240th Road and then ½ mile north on the east side.
Post Rock - Mitchell	Sandra Wick	5/26	4:30 PM	10 miles south of Beloit on 14, 8 miles east on S road, plots are on the south side of the road
Riley	Greg McClure	5/26	6:30 PM	14401 Bodaville Rd, Randolph, Ks. From Randolph – 4.2 miles west on Green-Randolph Road, turn north on County Road 875 and continue for about 11 miles, then turn east on Bodaville Rd. The Fancy Creek Church is at the corner of Ober Road (875) and Bodaville Rd. The plot is ½ mile east on Bodaville Rd.
Walnut Creek - Rush	Chris Long	5/27	8:00 AM	from LaCrosse, go 7 miles west on Hwy 4, then continue another 1 1/2 miles on Road L, on south side
Walnut Creek - Ness	Chris Long	5/27	11:00 AM	from Ness City, go 7 miles south on Hwy 283 to 60 Rd, west 7 miles to L Rd, south 1 1/4 lines on east side
Walnut Creek - Lane	Chris Long	5/27	5:00 PM	from Dighton, go west on 96 for about 7 miles, turn south, go 2 miles, turn west 1/4 mile, on south side of road

Mentor	Jay Wisbey	5/28	8:30 AM	Mentor Location just West of Town (Mentor) on the Northside of the road. 38.74031909188133, -97.60479299765356
Solomon	Jay Wisbey	5/28	11:00 AM	Tom and Pat Ryan Plot: Take old 40 highway West of Solomon then south on N Gypsum Valley Road 2.5 Miles just over the river bridge on the East side of the road.
Minneapolis	Jay Wisbey	5/28	2:30 PM	From Minneapolis, take 106 HWY south just past the Salt creek bridge and go west 2 miles to 90th road. North ¼ of a mile west of his irrigation circle.
Edwards Co	Marty Gleason	6/1	12:00 PM	From Offerle, 9 1/2 miles north on 20th avenue. Plots are north of intersection with I road.
River Valley - Stunkle	Rebecca Zach	6/1	3:30 PM	From Palmer, 5 miles south on Liberty road, then 5 1/2 miles east on Parallel/County Line road, plots on the south side of the intersection of County line Rd and Quivira Rd.
River Valley - Ohlde	Rebecca Zach	6/1	5:30 PM	From Linn, go northeast about 3.5 miles on 15 until intersection with 9, turn west on 10 th road for a mile until Prairie Rd., go north about 1/2 mile. Plots on the west side of the road.
Pawnee	Kyle Grant	6/1	6:00 PM	From Larned go K-19 South to Zook Blacktop east 5 or 6 miles to 70 Ave than north 1 ¼ miles.
River Valley - Belleville	Rebecca Zach	6/2	1:00 PM	2 miles west of Belleville, on the north side of the road at the KSU experiment field.
River Valley - Peyton Frybarger	Rebecca Zach	6/2	4:00 PM	2330 Elm Road, Munden, KS
River Valley - Polansky	Rebecca Zach	6/2	6:00 PM	2 miles west of Belleville on 36, 1.25 miles south on 15. Plot is on the west side of the road.
Kingman	Kallie Turner	6/3	9:00 AM	7681 SW 80th Avenue, Kingman KS. Plot is on the north side.
Phillips-Rooks	Cody Miller	6/3	TBD	From Phillipsburg- Travel North on HWY 183 to E. Osage, Turn East and travel about 1/16 of a mile. Plot is on the South side of the road
Phillips-Rooks	Cody Miller	6/3	TBD	From Stockton- Travel North on HWY 183 to E. Road, Turn East and travel to 21 Road. The plot is on E. Road about ½ a mile East of 21 Road on the North Side of the Road. (If you get to Riffels mailbox you have gone too far.)
Abilene	Rickey Roberts	TBD	TBD	The third plot is with Steve Hoover. That plot is located on Hwy 15 N of Abilene at the intersection of Hwy 15 & 18.
Ford Co - Dodge City	Andrea Burns	TBD	TBD	Highway 50 Bypass & 116 Road Across from Koch Nitrogen Plant, Dodge City
Thomas Co	Emily Bennigsdorf	TBD	TBD	Solomon Creek Farms located 4 1/2 miles

				south of Levant/I-70 Interchange on County Road 11
Sunflower	Jeanne Faulk Jones	TBD	TBD	TBD
Sunflower	Jeanne Faulk Jones	TBD	TBD	TBD
Sunflower	Jeanne Faulk Jones	TBD	TBD	TBD
Sunflower	Jeanne Faulk Jones	TBD	TBD	TBD
Twin Creeks	Keith VanSkeikke	TBD	TBD	From Dresden, KS travel South on 23 then at the #9 and 23 intersection go east on #9 to 2000th Road on the North side of the road. GPS: 39.568082, -100.36731
Twin Creeks	Keith VanSkeikke	TBD	TBD	Travel on HWY 36 west of Oberlin, KS about 2.5 miles. GPS coordinates: 39.828330, -100.584228
River Valley - LeClair	Rebecca Zach	NA	NA	From Clifton, 6 1/4 miles north on Eagle road, plots on the west side of the road north of 6th.
Barber Co (Isabel)	Justin Goodno	Virtual	Virtual	Intersection of Main St and Hwy 42 on Isabel.
Barber Co (Kiowa)	Justin Goodno	Virtual	Virtual	HYW 281 / HWY 2 intersection on the north side of Molz shop and grain bins.
Wild West District	Ron Honig	NA	NA	SE 17-31-34. Go 6 miles NE of Hugoton on Hwy 56 to Rd V (County RD 16), then east 12 miles to Rd B, then 5 miles north and then 1/2 mile east on field road.

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3. Wheat disease update - May 6, 2021

With wheat heading and flowering in southern Kansas and moving into the flagleaf and boot stages in other parts of the state, it is an important time to scout for wheat diseases. Here we recap the reports that have been coming in throughout the state and expected disease development given recent weather.

Stripe rust

Stripe rust has continued to advance north, although incidence is trace in northern Kansas counties with no reports in the upper canopy (Figure 1) We have updated the stripe rust risk map to include favorable weather conditions over the past week (Figure 2). This integrated risk incorporates stripe rust observations, favorable weather conditions (including moisture and temperature), and crop area. Counties in south-east, east-central, and south-central Kansas remain at the highest risk for stripe rust development in the upper canopy. In last week's eUpdate, we walked through important considerations for [fungicide applications to control stripe rust](#).

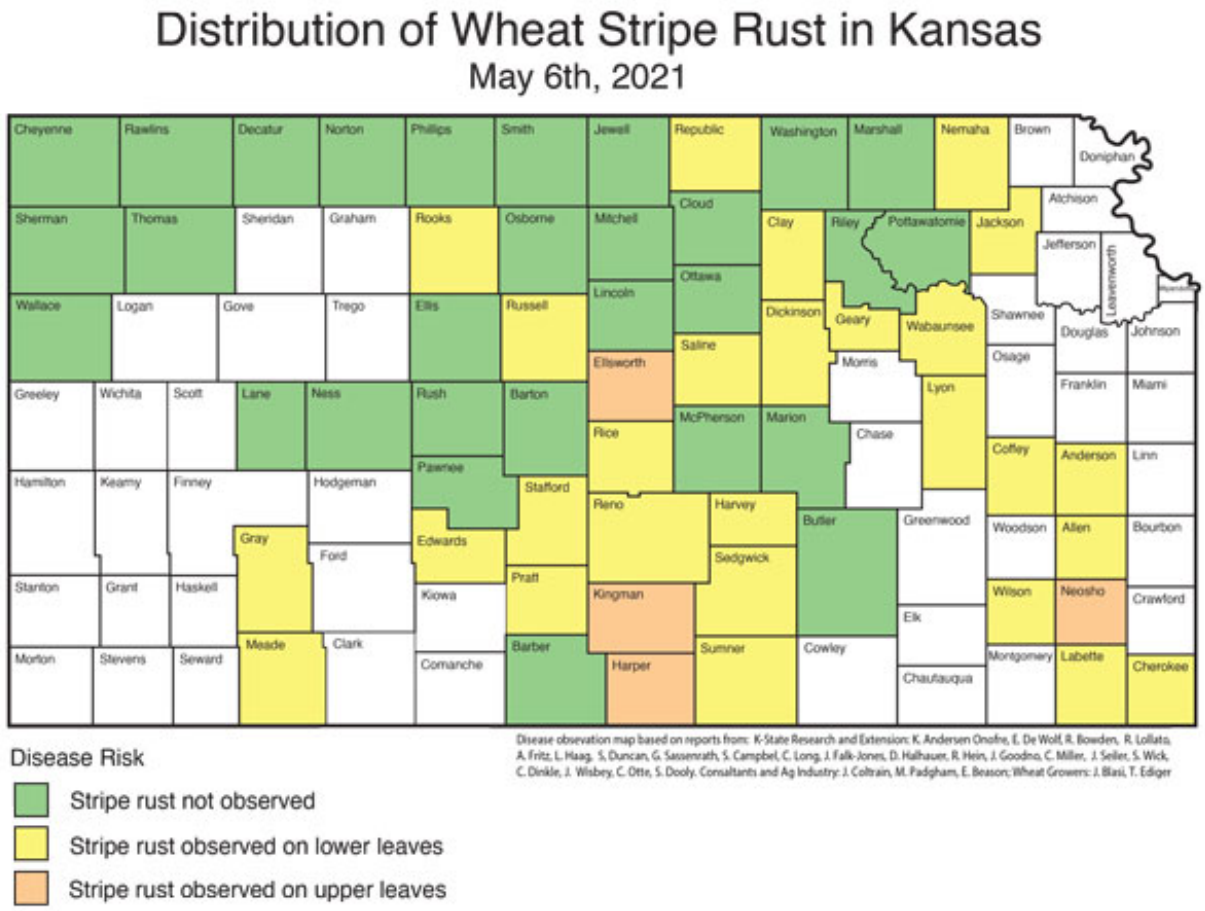

Figure 1. Distribution of stripe rust in Kansas as of May 6, 2021. Map is based on observations of K-State Research and Extension, crop consultants, and wheat producers in the state. Map created by Kelsey Andersen Onofre, K-State Research and Extension.

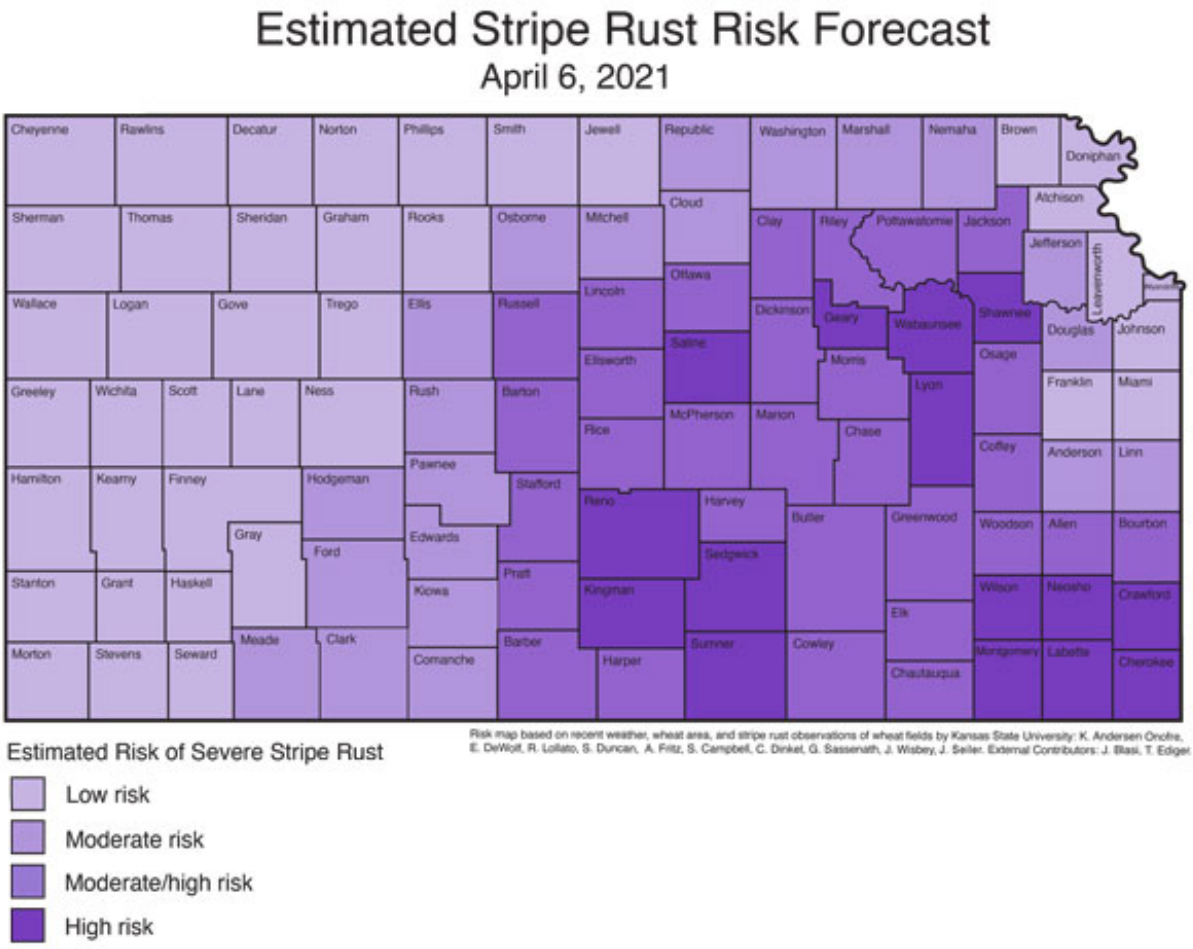

Figure 2. Estimated risk of severe stripe rust as of May 6, 2021. Map takes into account the current wheat growth stage, stripe rust observations, and recent weather conditions. Map created by Kelsey Andersen Onofre, K-State Research and Extension.

Leaf rust

Leaf rust has been confirmed at very low levels in Kansas as of this week (Figure 3). Leaf rust can be distinguished from stripe rust by spore color and pustule distribution on wheat leaves. Leaf rust spores are typically brown (unlike the characteristic bright orange for stripe rust) and also do not develop in "stripes" on leaves (Figure 4). It is not uncommon in Kansas to see both of these rusts on

the same plant, or even leaf. Many fungicides that are excellent for stripe rust control are also excellent for leaf rust control. Please review the following document for more information on fungicide efficacy: http://www.bookstore.ksre.ksu.edu/pubs/EP130.pdf. It is a good idea to review variety resistance to these two diseases because some varieties that are more resistant to stripe rust are less resistant to leaf rust https://bookstore.ksre.ksu.edu/pubs/MF991.pdf.

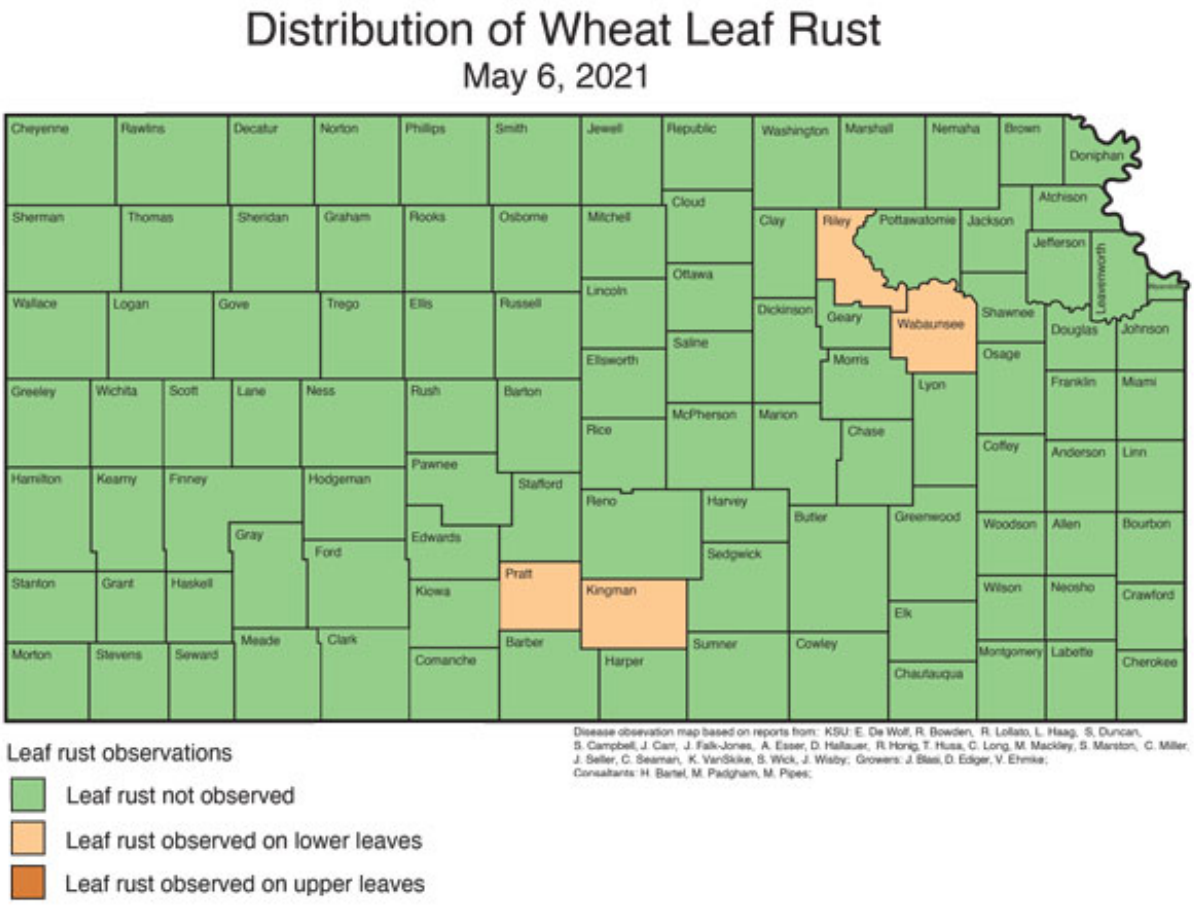

Figure 3. Distribution of leaf rust in Kansas as of May 6, 2021. Map is based on observations of K-State Research and Extension, crop consultants, and wheat producers in the state. Map created by Kelsey Andersen Onofre, K-State Research and Extension.

Figure 4. Classic symptoms of leaf rust (leaf panel) and stripe rust (right panel).

Wheat streak mosaic virus

There have been an above average number of fields with wheat streak mosaic virus this year (Figure 5), mostly in the central and western portions of the state. It is important to remember that fungicide will not provide any control for viral infections. Even for the highly trained eye, it can be difficult to differentiate symptoms of wheat viruses. Wheat streak mosaic virus symptoms can be easily confused with other viruses, such as barley yellow dwarf virus. Multiple viruses can also be present in the same plant. Samples can be submitted to the K-State Plant Diagnostic Clinic for verification of viral diseases.

Figure 5. Classic symptoms of wheat streak mosaic virus. Photo: Kelsey Andersen Onofre, Kansas State Research and Extension.

Fusarium head blight

The flowering window is the critical time to consider a fungicide application for Fusarium head blight (Figure 6). Fusarium head blight development is favored by rainy weather in the week prior to flowering and during the flowering period. A convenient risk tool is available (http://www.wheatscab.psu.edu/) which provides current risk for head blight across the United States.

Fungicide applications for Fusarium head blight control should be made at the start of flowering for optimal control, but research has found that applying a few days after early flowering can still provide adequate control when there is high disease pressure. Fungicide is most effective when applied to varieties that are known to be susceptible. Currently Caramba 0.75 SL, Proline 480 SC, Prosaro 421 SC, and Miravis Ace SE are labeled for control of Fusarium head blight and have performed well in independent tests conducted by Kansas State University and collaborating institutions.

More information about these and other products can be found here:
https://bookstore.ksre.ksu.edu/pubs/EP130.pdf

It is important to review not only how well a fungicide works against a disease of concern, but also label restrictions. Many fungicides have harvest restrictions and cannot be applied past a certain growth stage (for example, Feekes 10.5.4) or a certain number of days prior to harvest (pre-harvest interval). Please review all label recommendations before application to ensure compliance.

Figure 6. Symptoms of Fusarium head blight typically are visible at the soft dough stage of development. This photo was taken during the 2020 season. Photo: Kelsey Andersen Onofre, Kansas State Research and Extension.

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4. Inoculating soybeans is a good insurance policy

When planting soybeans in Kansas, it may be a good insurance policy to inoculate the seed. The *Bradyrhizobium* bacteria forms nodules on soybean roots, and these nodules fix nitrogen from the atmosphere and supply it to the plants. Neither soybeans nor *Bradyrhizobium japonicum* are native to the United States, so there will be no *Bradyrhizobium japonicum* in the soil unless it was introduced at some time in the past by inoculated soybean seed.

Why do we need to inoculate soybeans?

1. To promote good nodulation
2. To improve nitrogen (N) fixation
3. To help ensure a stable yield

Soybeans are big users of nitrogen. For example, a soybean yield of 60 bushels per acre requires 300 lbs N per acre in the plants, removing about 3-4 lbs of N per bushel of seed (Fig. 1). Most of the N required by a soybean plant is supplied via biological nitrogen fixation that takes place in nodules on the soybean roots. The nodules, when well established, can provide from 40-80 percent of the soybean plant's N needs for the year. The actual contribution of biological N fixation to the N requirement of soybeans can be influenced dramatically by the amount of residual or mineralized N available in the soil profile or by stress conditions affecting the plant such as drought and heat, inhibiting N fixation due to the cost of maintaining the N fixation process.

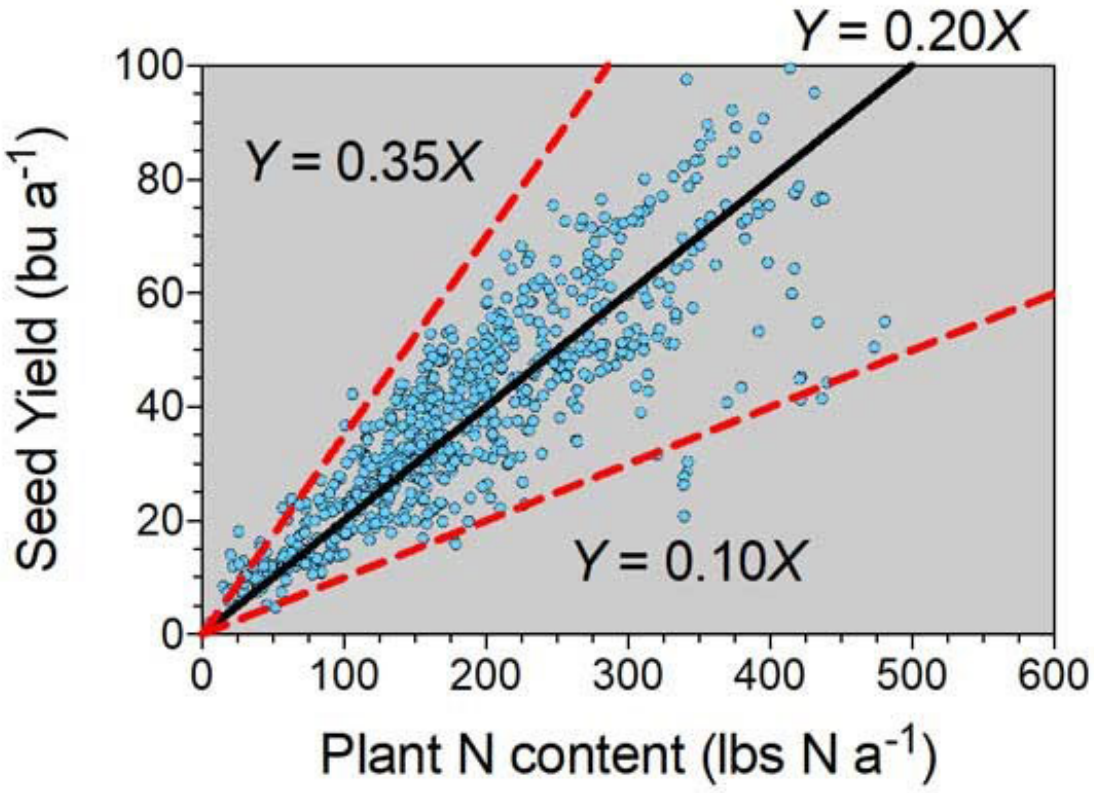

Figure 1. Soybean yield and plant nitrogen uptake relationship. Data reviewed and

synthesized by Dr. Ciampitti, K-State Research and Extension – from Ciampitti and Salvagiotti, 2018, Agronomy Journal.

Yield responses to inoculation have been quite variable in Kansas and other surrounding states. However, the cost of buying pre-inoculated seed, or inoculating the seed or soil yourself, is low and the potential yield loss from poor inoculation can be significant unless available soil N levels are high. Soybeans that are poorly nodulated will have to take up most of the N they need from the soil, just like corn, sorghum, wheat, or any non-legume crop. Because N fertilizer is generally not applied for soybeans, a crop that is poorly nodulated will quickly use up the available N in the soil and become chlorotic (yellow) from N deficiency. For poorly nodulated soybeans, N deficiency is usually evident later in the growing season as the nutrient demand increases (Figures 2, 3).

Figure 2. The soybeans in the part of the field at left in this photo had good nodulation. The area of the field on the right had poor nodulation and exhibited nitrogen deficiency symptoms. Photo by Tom Maxwell, K-State Research and Extension.

Figure 3. Well-nodulated soybean plants (left) compared to plants without nodulation. Photo by Kraig Roozeboom, K-State Research and Extension.

Why is the yield response to inoculation so variable?

There are several reasons for the variability in yield response to inoculation. For one thing, if soybeans have been grown on the field in previous years, there may be enough *Bradyrhizobium* bacteria in the soil to nodulate the soybeans adequately, in which case an inoculant may not benefit the crop. But if there is not enough *Bradyrhizobium* in the soil, the inoculant may increase yields by 2 bushels per acre or more on fields that have had soybeans in the recent past. On fields where soybeans have never been grown, the inoculant can often increase yields by 10 bushels per acre or more (Table 1).

Table 1. Effect of soybean inoculant on land with no prior history of soybeans

	Kansas River Valley Experiment Field, Rossville	**Southwest Research-Extension Center, Garden City**
Treatment	Soybean yield (bu/acre)	
None	56.9	33.9
Seedbox inoculant	57.8	39.6
Seed-applied inoculant	66.4	43.5
LSD (.05)	9.8	3.6

Source: C.W. Rice and L.D. Maddux, Kansas Fertilizer Research 1992, K-State Report of Progress 670; C.W. Rice and M. Witt, Kansas Fertilizer Research 1991, K-State Report of Progress 647.

Even on fields with no history of soybean production, inoculation may increase nodulation but still have no effect on yields – especially if the yield environment is low and soils have enough available N

to supply the crop's needs.

Yield response to inoculants can also depend on soil pH, environmental conditions, and other factors. For instance, if lack of precipitation limits yields to less than 30 bushels per acre, poor nodulation may not impact yield. However, if rainfall is favorable, and yield potential is high, poor nodulation could result in a substantial N deficit and reduced yield.

Based on previous information, inoculation is most likely to increase soybean yield when:

1. Soybean has not been planted in the past 3 to 5 years
2. Soil pH is below 6.0
3. Soil has a high sand content
4. Field has been flooded for more than a week, creating anaerobic conditions, when nodulation was supposed to become established
5. Early-season stress conditions (e.g. heat) affects plant-bacteria establishment

Producers should be aware that inorganic soil N will reduce nodulation and N fixation by *Bradyrhizobium japonicum* bacteria. Where soil N levels are 40-60 lbs per acre or more, soybean plants may look fine, yet have reduced nodulation. At very high N levels, such as where the field was fertilized for corn but the producer decided to plant soybeans instead, there may be little or no nodulation. Depending on soybean yield and amount of residual N, this may be enough to carry the soybean crop for much of the seasons, but it may end up being N deficient during seed fill. In most cases, up to 20 lbs N per acre can be applied as a starter fertilizer to help get the soybeans started without having any detrimental effect on nodulation during the growing season (unless the upper layer of soil is already rich in inorganic N at planting time).

Soybean inoculation is basically "cheap insurance" against a potential N deficiency problem. Even if soybeans have been planted in the field recently, it doesn't cost much to inoculate the seed.

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5. Several factors affect successful soybean inoculation and nodulation

If soybean plants are chlorotic (yellow) and nitrogen (N) deficient despite being inoculated, that probably indicates the inoculant has failed.

Assessing nodulation in the field

Crush or slice nodules from several soybean plants to assess their condition. In general, a pink or reddish internal color indicates the rhizobia is actively fixing N. On the other hand, a dark gray or whitish color indicates the rhizobia is not effectively fixing N. This color will be difficult to see in very young or very old nodules. From the standpoint of nodule number and size, a few large nodules along the tap root are more effective at fixing N than small nodules along the lateral roots. Nitrogen fixation slows down, and nodules begin to senesce (deteriorate) during seed fill as the plant directs most of its resources to reproduction.

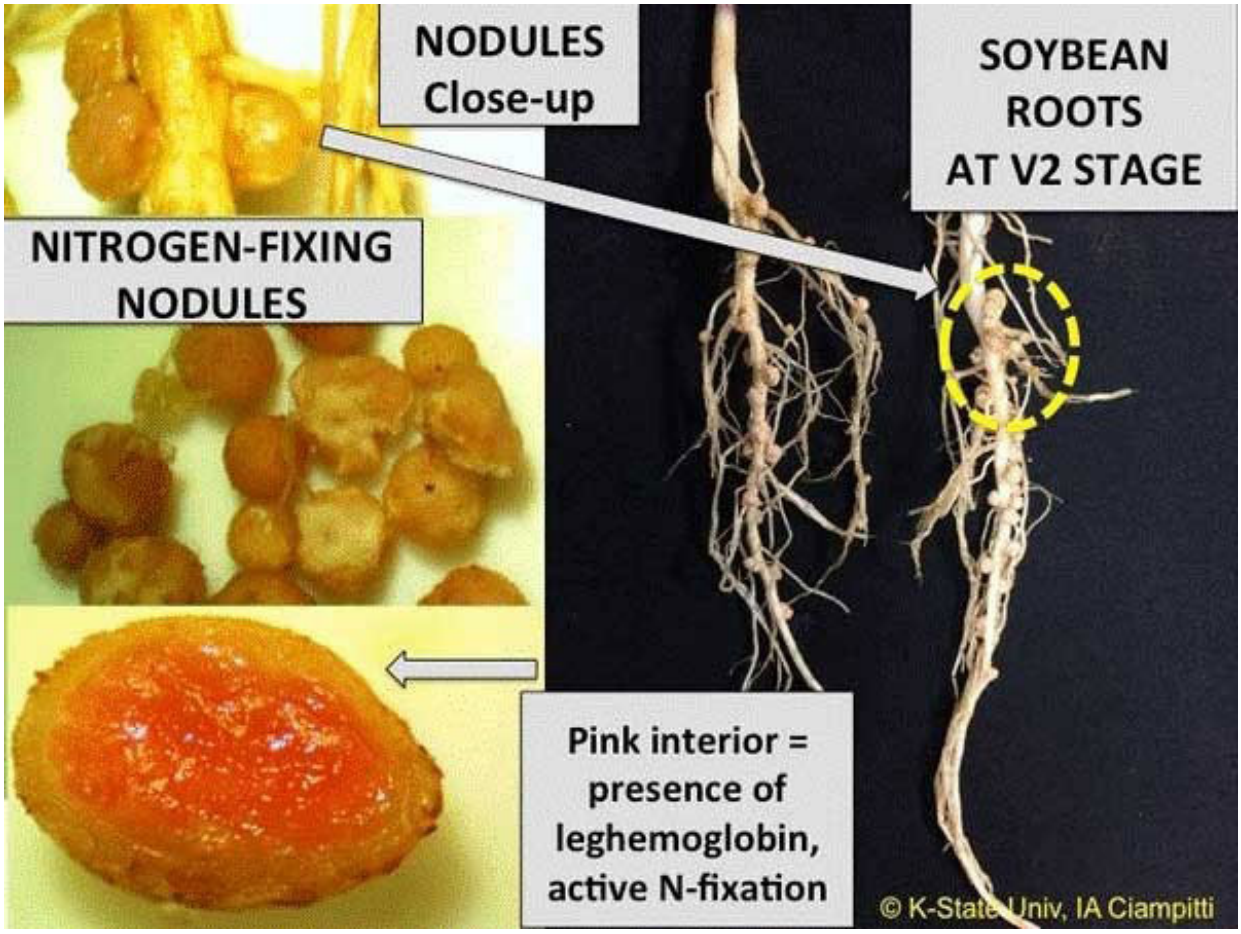

Figure 1. Close-up of soybean nitrogen-fixing nodules. Photos by Ignacio Ciampitti, K-State Research and Extension.

What factors affect inoculation response?

Several factors can result in poor nodulation or failure of inoculation:

1. Poor or inadequate coverage of the seeds by the inoculum during inoculation.
2. Contamination of inoculant with foreign materials.
3. Lack of competitiveness of the introduced *Bradyrhizobium* strain compared to the indigenous *Rhizobia strains.*
4. Lack of persistence in the soil: The introduced *Bradyrhizobium* should be able to grow and remain viable in the soil between soybean crops without undergoing mutation.
5. Low soil phosphorus (P): Legumes need adequate P for proper growth and pod development. Low P can result in poor nodulation and reduced N fixation. Phosphorus deficiency can negatively affect seed development and pod formation leading to low yield.
6. Soil pH: This is an important environmental factor. Most legumes grow and nodulate well at pH 5.6 to 6.7. The best soil pH for *Bradyrhizobium* lies between pH 6 to 7. Low pH soils require liming. In general, legume responds well to liming. Low pH (< 5) causes aluminum (Al) and manganese (Mn) toxicity, and results in P deficiency.
7. Soil nitrate and ammonium levels: High inorganic N (ammonium and nitrate) levels in the soil inhibit nodulation and N fixation. The effectiveness and competitiveness of *Bradyrhizobium* are negatively affected by high inorganic nitrogen.
8. Molybdenum (Mo): Soils deficient in Mo can have reduced nitrogen fixation. Mo, an essential micronutrient, is needed for the formation and function of the nitrogenase enzymes. Legumes also need other micronutrients such as iron, boron, and copper.
9. Stress, in the form of drought, excessive soil moisture, or high temperatures can reduce nodulation.

If the inoculation has failed, producers may need to apply N to their soybean crop. Depending on the projected yield potential, producers may need to apply as much as 120-180 lbs. N/acre.

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6. Identification and control of buckbrush and western snowberry in Kansas

Buckbrush, also known as coralberry (*Symphoricarpos orbiculatus*) and western snowberry, also known as wolfberry (*Symphoricarpos occidentalis*) are native rhizomatous shrubs found in Kansas. Both species occur on rangelands and as an understory species in woodlands. Buckbrush occurs in the eastern 2/3 of Kansas, whereas western snowberry grows in western and northcentral Kansas. These two species are known to grow together in northcentral Kansas (Figure 1).

Figure 1. Western snowberry (left) and buckbrush (right) growing side-by-side in northcentral Kansas. Photo by W.H. Fick, K-State Research and Extension.

Vegetatively, these two species can be difficult to distinguish. Both species have somewhat ovate-shaped leaves, but the leaves of western snowberry are larger (Figure 2). In the fall, buckbrush produces a red fruit, whereas the fruit of western snowberry is white. Buckbrush is taller, up to 6 feet in height, and produces stolons (runners).

Figure 2. Western snowberry (left) and buckbrush (right). USDA Plant Database

Buckbrush and western snowberry are generally considered undesirable in areas being grazed by cattle. Sheep, goats, and deer are more likely to browse these two species. The fruit and seeds are eaten by birds and small mammals. Dense colonies of buckbrush can shade out more desirable species used for grazing.

Control options

Top removal of buckbrush and western snowberry after the plants have leafed out and the nonstructural carbohydrates stored in the roots are at a low level can be an efficient control. A single mowing is apt to cause resprouting, thus multiple cuttings at the appropriate time (generally early to mid-May) is required for control. Prescribed burning for 2-3 consecutive years is also effective.

Herbicides can also be used to control buckbrush and western snowberry. The best time to spray occurs after the plants are fully leafed out, but before the leaves are too mature (generally mid-May to early June). A number of herbicides can be used, but 2,4-D low volatile ester formulations at 1.5 to 2 lbs/acre are usually quite effective. Chaparral can be used alone at 3 oz/acre, but I prefer adding 2 pint/acre 2,4-D to 2 oz/acre Chaparral. Grazon P+D can also provide acceptable control. Caution should be used if treating cool-season grasses with Chaparral. Grazon P+D is a restricted use pesticide. Remember, always read the label when considering the use of herbicides.

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7. Does a quiet April mean a quiet tornado season in Kansas?

After a very slow storm season in 2020 with only 17 tornadoes (NCEI Storm Database), the 2021 storm season is following suit. Only two tornadoes have been reported thus far and none occurred in April. There was one land spout in Cheyenne County and one EF-0 in Johnson County, both in March. A quiet April is notable since the three core severe weather months in Kansas are April, May, and June. However, this wasn't the first time that no tornadoes have been reported for the April. In fact, this has happened 14 times previously (Figure 1). Note that before 1990, record keeping was less reliable. However, recent years such as 2020, 2018, 2004 and 1996 recorded zero tornadoes for April. While this doesn't occur often, it definitely is possible.

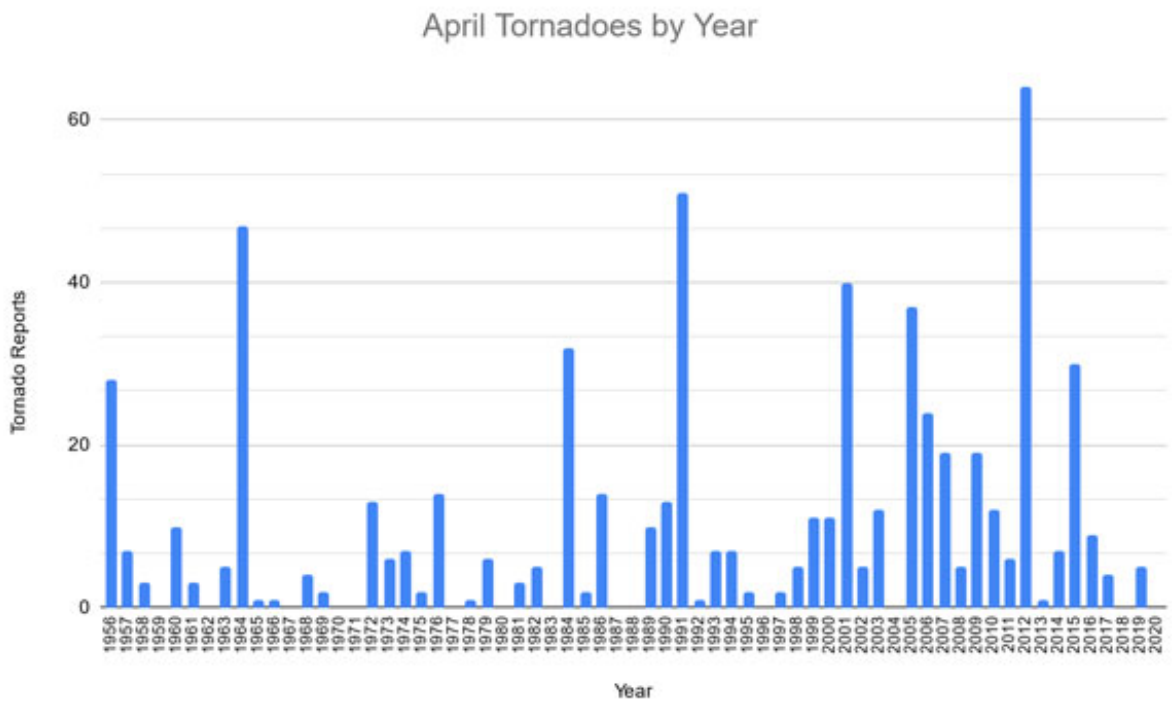

Figure 1. April reported tornadoes since 1956 (Data from NCEI Storm Database).

What does a quiet April mean for the rest of the severe weather season?

Kansas tornado season peaks in May, averaging 27 tornadoes across the state. That is just shy of half the yearly average of 67 over the last 65 years. These small scale events rely on daily to weekly weather patterns and with only small implications from preceding weather in the months before. While the prior months still influence the tornado season, it isn't an accurate indicator of what will come. Of the 14 years of which there were no April tornadoes, the following Mays totals ranged from 66 in 2004 to 1 in 1967. The average May tornadoes following a quiet April fall about five tornadoes shy of the typical May average (23, Table 1). However, normally the overall tornado count for the entire year is much less than average by over 20 tornadoes. Very active Aprils (11+ tornadoes) yield

the same average tornado count as below normal but closer to average Aprils (1-10). However, the final tornado counts for the year are over 20 more than the 65-year average.

Table 1. Average tornadoes for April, April count, and the May/yearly totals for those respective years (Data from NCEI Storm Database).

		April	May	Year
65-Yr Average		10	27	67
April Tornado Count	**Zero**	0	23	44
	One to Ten	5	28	61
	Eleven Plus	26	28	93

Lastly, one of the big factors that meteorologists mention going into a new season is the overall global weather influencers - the biggest being the El Niño-Southern Oscillation. This includes the eastern Pacific Ocean temperatures which often have warm/dry and wet/cool impacts for the United States in the Fall/Winter/Spring. This winter consisted of a La Niña (-0.5°C, cooler-than-normal waters at the surface). While many other "destructive" or interfering patterns existed which reduced La Niña impacts across the Central Plains this winter, it is still a significant factor considered going into spring. Recent research indicated that La Niña events yielded an increase in both tornadoes and hail occurrences in the southeast part of the state (https://www.climate.gov/news-features/blogs/enso/enso-and-tornadoes).

Examining the NCEI Storm Database, with La Niña conditions in place from December through February, April tornadoes are usually just slightly above normal (13, Table 2) with May tornadoes ever so slightly below normal. Interestingly enough, La Niña typically sees more tornadoes than either Neutral or El Nino conditions in April. May however, typically favors neutral conditions for above normal tornado reports. All conditions still yield near average annual tornado counts. That is most likely the result of ENSO conditions usually changing (slowly) through the year as summers typically favor Neutral conditions.

Table 2. ENSO conditions and April, May, and yearly tornado averages for Kansas (Data from NCEI Storm Database and Climate Prediction Center).

Kansas Tornadoes and ENSO (DJF)			
	April	**May**	**Year**
Average	10	27	67
La Nina (-0.5)	13	24	67
Neutral	7	29	66
El Nino (+0.5)	8	27	67

In conclusion, evidence doesn't show that quiet Aprils result in quiet Mays. However, they do often imply overall below-normal tornado numbers for the year. Factors that influence tornado

occurrences usually result from dynamic storm systems that bring outbreak-type events and/or a long duration persistent severe weather events. Thus far in 2021, we haven't seen that. This spring, drought conditions have expanded and abnormally dry now stretches across most of southern Kansas. Another concern resides in the southwest with persistent extreme drought. Strong storm systems move that dry air to the northeast over the Central Plains (Figure 2). This results in warm/dry air above the surface in the mid-levels of the atmosphere. It can contribute to increased instability but it also aids in "capping" or subsidence just above the surface. Stronger caps usually prevent storm development. This could help suppress storm activity but can also aid in severe weather. Should a storm develop, they are often isolated in nature and result in more severe weather over a localized area - possibly increasing tornado concerns. Lastly, this type of pattern requires an active jet-stream with strong systems in the western US. So far this year though, high pressure has been persistent in the west and not allowed development of these dynamic systems.

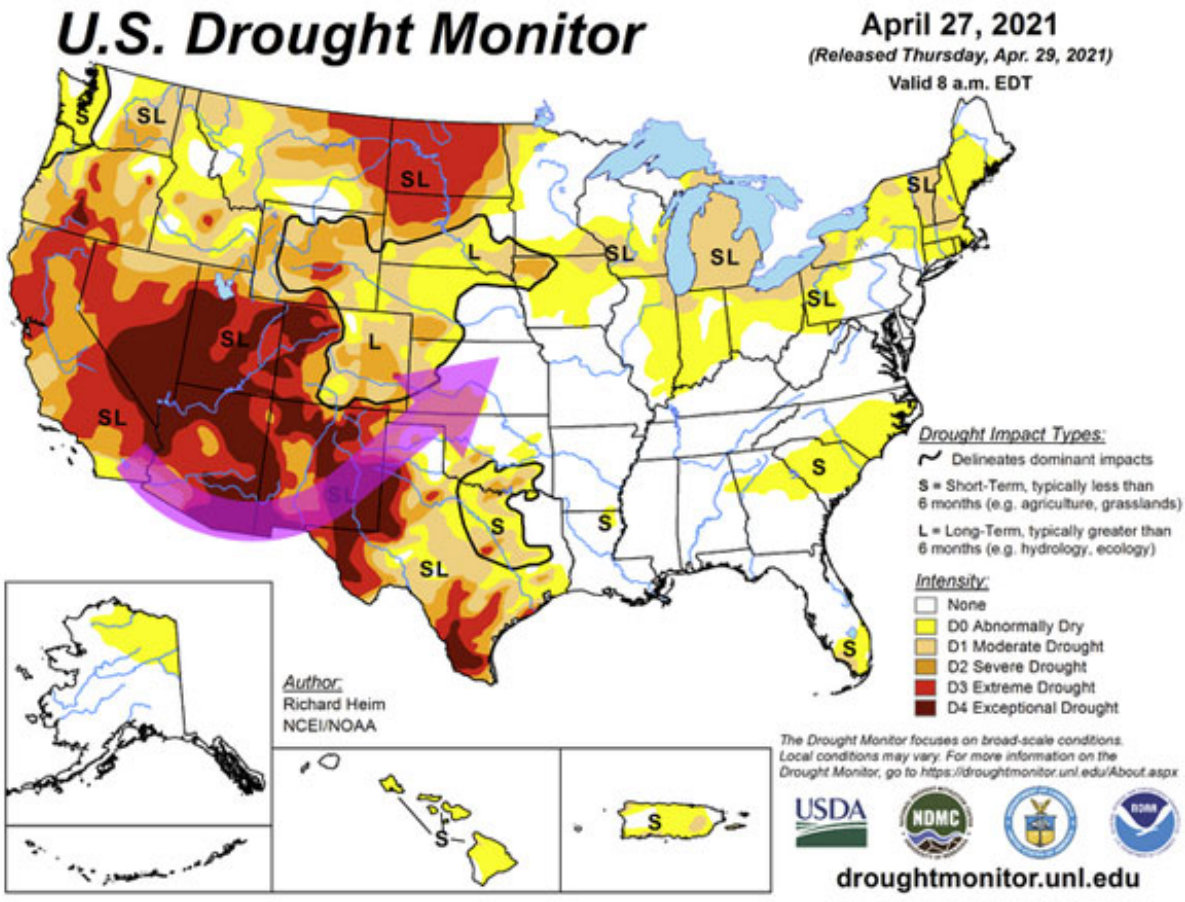

Figure 2. Current drought monitor and favorable atmospheric flow for severe weather in the Central Plains (Drought Monitor).

All we can hope for in May is a more favorable pattern for moisture without tornadoes and severe weather. That combination is hard to get in spring but one can always hope!

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8. Spring Crops Field Day in Parsons on May 19

After months of hosting educational events virtually because of COVID-19, K-State Research and Extension will host its Spring Crops Field Day in person on Wednesday, May 19 at the Southeast Research and Extension Center, 25092 Ness Road in Parsons.

Registration is 8:30-9 a.m. for the program, which includes:

- Tour of Wheat Variety Plots (41 varieties) – Allan Fritz, K-State wheat breeder, Lonnie Mengarelli, K-State research assistant, and seed company representatives.
- Fusarium Head Blight Control: Timing and Formulation – Kelsey Andersen Onofre, K-State plant pathologist.
- Cover Crops, Soil Health, and Weed Control – Anita Dille, K-State weed ecologist.
- Pasture Fertility and Weed Control – Bruno Pedreira, K-State regional agronomist.

Numerous sponsors will have displays and representatives available to answer questions about products and services. A sack lunch will be served after the field tours.

In case of rain, the program will be held indoors. More information and advance registration is available by contacting the K-State Wildcat Extension District Altamont office at 620-784-5337 or the Southeast Research and Extension Center at 620-820-6131.

Spring Crops Field Day

MAY 19

KSU Southeast Research and Extension Center
25092 Ness Road, Parsons, KS

Registration 8:30-9:00 a.m.

TOUR OF WHEAT VARIETY PLOTS (41 VARIETIES)

Dr. Allan Fritz, Wheat Breeder
Lonnie Mengarelli, Research Assistant, Southeast Res & Ext.
Seed Company Representatives

FUSARIUM HEAD BLIGHT CONTROL: TIMING AND FORMULATION

Dr. Kelsey Andersen Onofre, Plant Pathologist

COVER CROPS, SOIL HEALTH, AND WEED CONTROL

Dr. Anita Dille, Weed Ecologist

PASTURE FERTILITY AND WEED CONTROL

Dr. Bruno Pedreira, Regional Agronomist

IN CASE OF RAIN, THE PROGRAM WILL BE HELD INSIDE

Lunch provided by sponsors:

MID-WEST FERTILIZER · PRAIRIELAND PARTNERS · FRONTIER FARM CREDIT · BARTLETT CO-OP · McCune Coop · Producers Coop · Delange Seed · Beachner Grain, Inc. · AgChoice Farm Credit · THOMAS · WHEAT ALLIANCE

For more information or to register, please contact K-State Research and Extension Wildcat District Altamont Office at (620) 784-5337 or the KSU Southeast Research and Extension Center at (620) 820-6131

K-STATE Research and Extension

9. Winter Canola Field Day on May 13 in Kingman County

The latest research, variety, and production information on winter canola will be featured at a K-State Research and Extension field day on May 13 in Kingman County.

The field day is an opportunity to see winter canola variety trials and a producer's field. New varieties will be on display and attendees will learn about K-State's hybrid parent line development program.

With harvest season approaching, harvest management options are also on the agenda. Producers will have opportunities to get their questions answered about making winter canola a viable rotation option in Kansas.

K-State canola breeder Mike Stamm notes that 2021 was another interesting production year, most notably the bitter cold in February. The crop survived those conditions in great shape, so we want to discuss improvements in winter survival. Favorable spring weather has the canola crop poised for a good harvest.

The field day will be held in Kingman County south of Norwich at 11:00 a.m. From the KS-2 and SE 160th Avenue intersection, drive 1.5 miles south. The plots are on the east side of the road.

Premade sandwiches will be provided. **Please RSVP by May 12** to Kallie Turner at kalliet@ksu.edu or by calling the Kingman County extension office at 620-532-5131.

For more information, contact Mike Stamm at 785-532-3871 or mjstamm@ksu.edu.