Issue 837

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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. Topdressing wheat with nitrogen

Current conditions of the wheat crop and N considerations

Conditions of the 2020-2021 winter wheat crop in Kansas are quite variable. Some fields were sown relatively early (mid- to late-September 2020) and capitalized on available soil moisture, resulting in good stand establishment and early development. For the majority of the state, however, fields planted in October did not emerge until sometime in November or later, due to a lack of precipitation and extremely dry soil conditions. In south central Kansas, a few scattered rainfall events during the late fall and winter helped with wheat development even in these late-emerged fields. However, conditions since sowing have deteriorated for northern and western portions of the state due to virtually no rainfall, and the wheat crop might be in critical condition for some growers. These different crop conditions across the state result in contrasting yield potentials, which should be taken into consideration when managing N rate.

For the most part and regardless of crop conditions, now is a good time to start planning for topdressing nitrogen (N). Some key elements that need to be considered when deciding on the exact program you plan to use include: timing, N source, application method and N rate. Ideally, the N in topdress applications will be moved into the root zone with precipitation well before jointing begins in order to be most efficiently utilized by wheat. With some of the small wheat out there with limited tillers, having adequate N available to support spring tillering when it breaks dormancy will be important. Also, the potential number of kernels per head is determined right after spring green-up and prior to jointing; thus, having available N in the root zone can help ensure a good yield potential. Some combination of fall pre-plant or at-seeding N, and/or early topdressed N, is also normally needed to supply adequate N to support head differentiation. This article will discuss some of the issues to consider when making topdressing decisions.

Timing

The most important factor in getting a good return on topdress N is usually timing. It is critical to get the N on early enough to have the maximum potential impact on yield, especially in a year with limited fall tillering. While waiting until spring just prior to jointing can be done with success, this can be too late in some years, especially when little or no N was applied in the fall. For the well-drained, medium- to fine-textured soils that dominate our wheat acres, the odds of losing much of the N that is topdress-applied in the winter is low. For these soils, topdressing can begin anytime now, and usually the earlier the better. For wheat grown on sandier soils, earlier is not necessarily better for N applications. On these soils, there is a greater chance that N applied in the fall or early winter could leach completely out of the root zone if precipitation is unusually heavy. Waiting until closer to spring green-up to make topdress N applications on sandier soils will help manage this risk.

On poorly drained and/or shallow claypan soils, especially in south central or southeast Kansas, N applied in the fall or early winter would have a significant risk of denitrification N loss. Waiting until closer to spring green-up to make topdress N applications on these soils will help minimize the potential for this N loss.

Keep in mind that N should not be applied to the soil surface when the ground is deeply frozen and especially when snow covered. This will help prevent runoff losses with snow melt or heavy precipitation. Additionally, once the soils start to melt, they will likely be too wet for any field work.

Therefore, every field should be considered for characteristics such as slope, N source, tillage system, and the short-term forecast for temperature and precipitation.

On both sandy soils subject to leaching and poorly-drained soils prone to denitrification, split applications may be a strategy to consider. This would involve applying enough N in the fall at or prior to planting to give good support for fall growth and tillering -- generally 20-30 pounds of N. Then follow up with an additional application of about 20-30 pounds of N in late winter or early spring to support spring tillering, possibly applied with herbicides. This late-winter/early-spring application becomes especially important when stands are thin due to poor emergence, as many fields are this year. Finally, come back around jointing or a few days later with a final application to support heading and grain fill. This strategy can also provide flexibility in a year like this with poor fall growth, allowing to hold back part of the N for later in the spring as we have a better idea of soil moisture and weather conditions for the season.

Application method

Most topdressing is broadcast applied. In high-residue situations, this can result in some immobilization of N, especially where liquid UAN is used. If no herbicides are applied with the N, producers can get some benefit from applying the N in a dribble band on 15- to 18-inch centers. This can minimize immobilization and may provide for a more consistent crop response.

Nitrogen source

The typical sources of N used for topdressing wheat are UAN solution and dry urea. Numerous trials by K-State over the years have shown that both are equally effective. In no-till situations, there may be some slight advantage to applying dry urea since some of it will fall to the soil surface (Figure 1) and be less affected by immobilization than broadcast liquid UAN, which tends to get hung up on surface residues.

Figure 1. Urea broadcast to tillering wheat in a topdress application. Photo by Romulo Lollato, K-State Research and Extension.

Dribble (surface band) UAN applications would also avoid some of this tie-up on surface crop residues. However, if producers plan to tank-mix with an herbicide, they will have to use liquid UAN and broadcast it.

Controlled-release products such as polyurethane coated urea (ESN) might be considered on very sandy soils prone to leaching, or poorly-drained soils prone to denitrification. Generally, a 50:50 blend of standard urea and coated urea will provide some N immediately to support tillering and head development, and also continue to release some N in later stages of development. This would work best in settings with high loss potential.

Nitrogen rate

Producers should have started the season with a certain N recommendation in hand, ideally based on a profile N soil test done before the crop is planted and before any N has been applied. If a soil sample was taken at sowing, profile nitrate-N can help determine the rate to be applied based on the yield goal. However, it is not too late to use the profile N soil test if taken in late winter/very early spring before green-up. While it will not be as accurate as when sampled in the fall, it can still identify fields or areas in fields with high levels of available nitrate N. Unfortunately, it is not reliable in measuring recently applied N. So if a high rate of N has already been applied, a late winter profile sample probably shouldn't be taken. Remember that topdressing should complement or supplement the N applied in the fall and the residual soil N present in the soil. The total N application, planting and topdressing, should equal the target recommended rate.

If the wheat was grazed this fall and winter, producers should add an additional 30-40 lbs N/acre for

every 100 lbs of beef weight gain removed from the field. If conditions are favorable for heavy fall and/or spring grazing, additional N maybe necessary, especially for a grain crop.

Some fields may also benefit from an application of sulfur and chloride. Like N, these nutrients are mobile in the soil, and a topdress application before jointing is considered an effective application time. Sulfur and chloride topdress applications should be made based on soil test and history of response. For more information on sulfur fertility, please see the recent eUpdate article, "Sulfur deficiency in wheat", in Issue 830, December 4, 2020.

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2. Is spring wheat a viable option for northwest Kansas?

Spring wheat is a cool-season grain crop that in adapted areas of production (typically the Northern Great Plains) usually produces a higher protein and higher quality grain for milling and baking purposes. Spring wheat can be produced in northwest Kansas and adjoining areas. Yields will be lower than summer fallow winter wheat. Grain quality will be an important component of marketability. The long-term ability to produce quality spring wheat in northwest Kansas, and its economic viability, has yet to be demonstrated.

Management

Traditionally, spring wheat has not been a recommended crop in northwest Kansas. However, if spring wheat is planted, the K-State recommendation is to plant from February 25 through March 15. Particular emphasis should be given to the ending date relative to the starting date for minimizing heat stress, which will be the yield limiting factor in most years. In research plots at Colby, dormant seeded spring wheat in December has shown to be viable in stand establishment. Seeding rates significantly higher than those typically used in winter wheat will be necessary due to the reduced window for initiating productive tillers. In addition, heat stress will be exceptionally detrimental to tillers of spring wheat as compared to winter wheat, making the density of main stems even more important to achieving yield potential.

K-State does not have any current data regarding appropriate seeding rates for spring wheat but limited experience would suggest 1.3 to 1.8 million seeds per acre to be an appropriate range. The first year of a seeding rate study was conducted at Colby in 2020 with rates ranging from 750k to 2M live seeds per acre. There was no response to seeding rate, however this was with yield levels in the 20-25 bu/ac range. With respect to nitrogen management, growers should consult the recommendations offered by North Dakota State University in the publication SF712, "Fertilizing Hard Red Spring Wheat and Durum". Spring wheat will reach physiological maturity and be harvested slightly later than winter wheat in our region.

Experimental data on yield of spring wheat

Spring wheat has been evaluated at several points in time in northwest Kansas. From a historical context, during a 35-year study at Colby (1915-1950), spring wheat grown on fallow averaged slightly less than ½ of winter wheat grown (also on fallow). Additional research in the 1970's demonstrated a similar relationship. More modern research was conducted in 2001 through 2005 in which spring wheat averaged 49% of winter wheat (Table 1).

Table 1. Summary of grain yields for spring wheat vs. winter wheat from 2001-2005 at Colby, KS.

Colby Kanas Spring Wheat and Winter Wheat, 2001-2005

Year	Winter Wheat Mean of Top LSD Group	Spring Wheat Mean
	-- Grain Yield, bu ac^{-1} --	
2001	82.1	46.0
2002	43.2	12.1
2003	78.7	42.4
2004	60.1	30.3
2005	78.2	37.5
Average	68.5	33.7

R. Aiken, 2008. unpublished data.

In response to producers' questions regarding spring wheat, spring wheat variety trials were conducted in northwest KS beginning in 2019. Table 2 shows individual year and across-years means for spring wheats evaluated at Colby, Kansas. There is a distinct difference in yields between the two years. The first year of the trial was seeded into chemical-fallow ground while the second year of the trial was seeded into fresh corn stalks harvested the prior fall. While adequate stands were attained in both years, the cooler temperatures during grain fill and increased soil moisture due to the previous fallow period resulted in greater yield potentials in 2019. Table 3 contains the full dataset for varieties evaluated in the 2020 trial. There was a very small range in yields, with most varieties producing yields that are statistically equivalent. Proteins in 2020 were quite high due to the high rate of N application for the yields that were achieved.

Table 2. Across-years yield performance for spring wheats evaluated at Colby, Kansas, 2019-2020.

K-State Thomas County, Kansas dryland spring wheat variety trial

Variety	2019	2020	2-Year Average
		Grain Yield, bu ac^{-1}	
LCS Cannon	**55.9**	**23.6**	**39.8**
WB7589	47.7	.	
WB9590	47.4	**24.3**	35.8
WB9479	46.1	**21.6**	33.9
LCS Trigger	46.0	21.0	33.5
WB7202CLP	44.6	**22.5**	33.6
MS Barracuda	43.8	**22.6**	33.2
MS Chevelle	43.1	**23.5**	33.3
SY Valda	43.1	18.8	31.0
LCS Rebel	42.4	20.6	31.5
WB9719	41.7	**21.7**	31.7
SY Rustler	41.3	19.0	30.2
MS Camaro	40.1	**21.2**	30.6
WB7328	38.0	.	
MS Stingray	37.7	.	
WB9668	36.7	.	
SY Ingmar	.	**22.4**	
WB7696	.	**21.9**	
WB9606	.	**22.9**	
P>F	<0.0001	0.0404	<0.0001
LSD (0.05)	3.7	3.2	3.1

Yields in bold represent the top statistical group
2019 was seeded into chem-fallow
2020 was seeded into corn stalks harvested the prior fall

Table 3. 2020 Thomas County Dryland Spring Wheat Performance Test Results.

2020 Thomas County, Kansas Dryland Spring Wheat Variety Performace Test

Company	Variety	Grain Yield	Moisture	Test Weight	Protein	Heading Date	Seeds/Lb
		bu/ac	%	bu/ac	%	DOY	bu/ac
WestBred	WB9590	**24.3** a	12.1	54.0 abcd	17.94	6/3 defg	21551 efgh
Meridian Seeds	MS Ranchero	**23.6** ab	13.1	52.9 cd	17.64	5/31 h	23366 abcd
Limagrain	LCS Cannon	**23.6** ab	12.2	55.9 ab	17.51	6/1 gh	24445 ab
Meridian Seeds	MS Chevelle	**23.5** ab	12.2	56.6 a	16.59	6/3 de	22541 cdefg
WestBred	WB9606	**22.9** ab	12.2	54.6 abc	16.93	6/4 cd	23033 abcde
Meridian Seeds	MS Barracuda	**22.6** ab	12.2	54.9 abc	17.71	6/2 efgh	21006 gh
WestBred	WB7202CL	**22.5** ab	12.0	51.7 d	17.47	6/1 fgh	24846 a
Syngenta AgriPro	SY Ingmar	**22.4** ab	12.8	55.8 ab	18.43	6/8 a	23389 abcd
WestBred	WB7696	**21.9** abc	12.0	53.3 bcd	17.94	6/2 efgh	23120 abcde
WestBred	WB9719	**21.7** abc	11.9	53.1 cd	17.68	6/5 bc	20499 h
WestBred	WB9479	**21.6** abc	12.3	53.6 bcd	18.00	6/3 de	21321 fgh
Meridian Seeds	MS Camaro	**21.2** abc	12.1	56.1 ab	17.66	6/4 cd	22089 cdefgh
Limagrain	LCS Trigger	**21.0** abc	12.0	55.2 abc	17.75	6/5 bc	22016 cdefgh
Limagrain	LCS Rebel	20.6 bc	12.4	56.4 a	19.00	6/3 defg	21809 defgh
Syngenta AgriPro	SY Rustler	19.0 c	12.2	53.2 abcd	17.36	6/3 def	23653 abc
Syngenta AgriPro	SY Valda	18.8 c	13.4	52.2 cd	17.87	6/6 ab	22774 bcdef
	P>F	**0.0404**	0.0839	**0.0165**	0.1350	**<0.0001**	**0.0002**
	LSD (0.05)	3.2	NS	2.8	NS	1.5727	1737

Bold yields represent the top yield group at LSD (0.05)
Spring wheat was seeded into fresh (2019 crop) dryland corn stalks
Seeded 3/12/2020 on 10" row spacing at 1.5M live seed/acre
130 lb/ac N applied as UAN topdress prior to joint
Different letters represent statistical differences at LSD=0.05.

Data would show a significant reduction in yield potential for spring wheat relative to winter wheat when both are grown on fallow. Yields are likely to be more similar when grown immediately following a row crop. However, it is important to note, yield is not the lone determining factor for the viability of the practice. Differences in cost structure and revenue could very well make spring wheat an economically feasible fallow alternative, provided that quality grain can be raised and marketed at a premium to winter wheat.

Marketing

Producers should be aware that hard red and hard white spring wheats are different market classes than hard red or hard white winter wheats. While small quantities are likely being blended off without notice, any concentration greater than 2% would be considered a mixing of classes that could result in the rejection of shipments. A local delivery point did exist in northwest Kansas in 2020 and has plans to receive spring wheat again in 2021. Additionally, a producer may have success using on-farm storage to allow proper segregation, time to perform necessary testing of grain quality, and then direct marketing to a mill.

Take home message

Spring wheat can be produced in this region. Producers should have marketing plans in place prior to production and manage the crop to ensure quality. Yields will likely be less relative to winter wheat due to heat stress during grain fill. However, there are still many unknowns regarding the production of spring wheat and its long-term viability in northwest Kansas and adjacent areas.

The spring wheat variety performance test results are available to view and download on the Northwest Area Agronomy website: www.northwest.ksu.edu/agronomy

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3. Topdressing canola: How to maximize the benefits

To maximize the yield potential of winter canola, producers should topdress with nitrogen (N), sulfur (S), and possibly boron in the winter. Producers should make topdress applications with consideration for the environmental conditions, the nutrients needed, and the application method.

Environmental conditions

The best time to topdress winter canola is during the rosette stage when the canola is dormant. Usually this can easily be accomplished by topdressing in January or February, since temperatures are cold enough to keep canola at the rosette stage. Current soil moisture conditions for most of central Kansas might limit topdressing until the ground freezes up or dries out. If N is applied as a liquid when canola is green and physiologically active, be careful that the rate applied does not cause leaf burn. Both dry and liquid fertilizers are effective products.

In general, above normal temperatures have reduced the amount of leaf loss that we typically see over winter. A few producers have reported greater purpling in the leaf tissue than in recent years as a result of anthocyanin build up. This is caused by a number of stresses, but could likely be from a lack of N fertility, large diurnal fluctuations in temperatures above and below freezing, or saturated soils (south central Kansas). A degree of plant purpling is common in overwintering canola, and properly timed topdress applications should help alleviate the situation.

Producers should check their fields for surviving plants before applying a topdress application even if there is no concern for poor winter survival (Figure 1). Where stand thinning is greatest, it may be advisable to wait until canola is actively growing again before topdressing. This will ensure that there is adequate spring stand to take to harvest.

Figure 1. Canola beginning to break dormancy at the appropriate time for topdressing. Photo by Mike Stamm, K-State Research and Extension

Nutrients

A combination of nitrogen and sulfur can be used in the topdressing blend.

Nitrogen. About two-thirds of the total N needed by the canola crop should be applied as a winter topdress. This can be done at dormancy or as plants begin to show increased growth, but before the plants bolt. The reason is that N uptake increases rapidly before bolting. Topdress applications should be based on an updated assessment of yield potential, less profile residual N, and the amount of N applied in the fall.

Suggested N rates for five yield levels and a soil with 2 percent organic matter and varying residual nitrate-N levels is shown in Table 1.

For soils with 1 percent organic matter, add 15 pounds N for each yield and nitrate level. For soils with 3 percent organic matter, subtract 15 pounds N for each yield and nitrate level.

Table 1. Total nitrogen fertilizer needs for canola as affected by yield potential and soil test nitrogen levels in the southern Great Plains (from Great Plains Canola Production Handbook: http://www.ksre.ksu.edu/bookstore/pubs/mf2734.pdf

Profile N test	Canola yield potential				
lb/acre	lb/acre				
	1,500	2,000	2,500	3,000	3,500
0	75	100	125	150	175
20	55	80	105	130	155
40	35	60	85	110	135
60	15	40	65	90	115
80	0	20	45	70	95
100	0	5	25	50	75

Either solid or liquid forms of N can be used in the early spring. Once the weather warms and growth begins, applications using streamer bars or solid materials are preferred for broadcast applications to prevent/avoid leaf burn.

Controlled-release products such as polymer-coated-urea (ESN) might be considered on very sandy soils prone to leaching, or poorly drained soils prone to denitrification. Generally, a 50:50 blend of standard urea and the coated urea -- which will provide some N immediately to support bolting and flowering and also continue to release some N in later stages of development -- works best in settings with high loss potential.

Sulfur. If canola is deficient in S, the consequences can be very serious because the crop needs S to produce protein in the seed. For this reason, soils having less than 20 lb/acre sulfate-S in the upper 24 inches should receive supplemental S. A good rule to follow is to keep S-to-N availability at a ratio of about 1 to 7. Another simple guideline is to apply 20 lb S per acre, which will be sufficient for low and medium yield levels. Sulfur can be applied in the fall and incorporated into the seedbed or surface-applied with N in the winter topdressing. Canola growers may consider using elemental S, or sulfate forms (e.g. ammonium sulfate, or liquid ammonium thiosulfate). Since elemental S must oxidize to become plant available, it should only be applied in the fall. Ammonium thiosulfate or ammonium sulfate can be applied in the spring or fall, but thiosulfate should not be topdressed directly on green tissue or placed with seed to avoid short-term phytotoxicity.

Boron. If deficient, boron is one micronutrient that can have negative consequences on canola yield. Typically, boron deficiency is not something we have seen in Kansas. However, if there are micronutrients that could influence yield, then boron would be one of them. The most important thing is to know what your soil sample states. Applying boron may help to reduce flower abortion and enable efficient pod filling. However, there is not much room for error when comparing adequate boron fertility levels and toxic levels that might result from over application. Because of this, application rates of boron are often 1.0 lb per acre or less. Soil and foliar applications of boron are effective. Foliar applications can be made with herbicides, and soil-applied boron can be either broadcasted or banded. Make sure applications are uniform across the field to avoid toxicity, and avoid contact with the seed for band-applied boron.

Application method

It is important to avoid crushing winter canola with wide applicator tires. Crushed plants will lodge and maturity will be delayed, which can slow harvest and increase the risk of shattering losses. For this reason, applicators with narrow tires are preferred. As for the question of whether broadcast or banding is best -- if temperatures are cold and the plants are dormant, topdress fertilizer can be broadcast. If temperatures are mild enough that the canola plants have resumed active growth, it

may be best to use streamer bars or some other form of banded application to avoid foliar burn.

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4. Pre-plant herbicide applications for kochia control

Now is the time to finalize plans for kochia control. Recent research suggests that kochia can begin emerging in early February with most kochia emerging by early April. Kochia seedlings emerge in dense populations that make adequate herbicide coverage difficult (Figure 1). In addition, glyphosate-resistant kochia is prevalent across western Kansas, making kochia control even more challenging. For these reasons, it is important to apply pre-emergence herbicides in late winter or early spring to control this weed before it emerges. This article will be the first in a series discussing specific options for various cropping scenarios.

Figure 1. Untreated kochia seedlings amid residue. Photo by C. Thompson, K-State Research and Extension.

Herbicide program components to effectively manage kochia at germination

To successfully manage kochia, a herbicide program needs two components:

1. a very soluble and effective herbicide that can be incorporated with very little precipitation, such as dicamba; and
2. a herbicide that has longer residual activity, which will require perhaps 0.75 inches or more precipitation for adequate incorporation, such as atrazine.

Precipitation events during late winter are often too small to activate longer residual herbicides, but dicamba may control kochia for 4 to 6 weeks until the longer residual herbicide is incorporated.

The best timing to apply herbicides for kochia control is generally January through the first week of March but **prior** to kochia emergence, which can vary depending on weather conditions. Later applications, for example, at the time of burndown, are more likely to occur after kochia emergence, which increases the risk of control failure (Figure 2). Fall-applied treatments can help ensure timely application, however, they are not likely to effectively control later flushes of kochia (Figure 3).

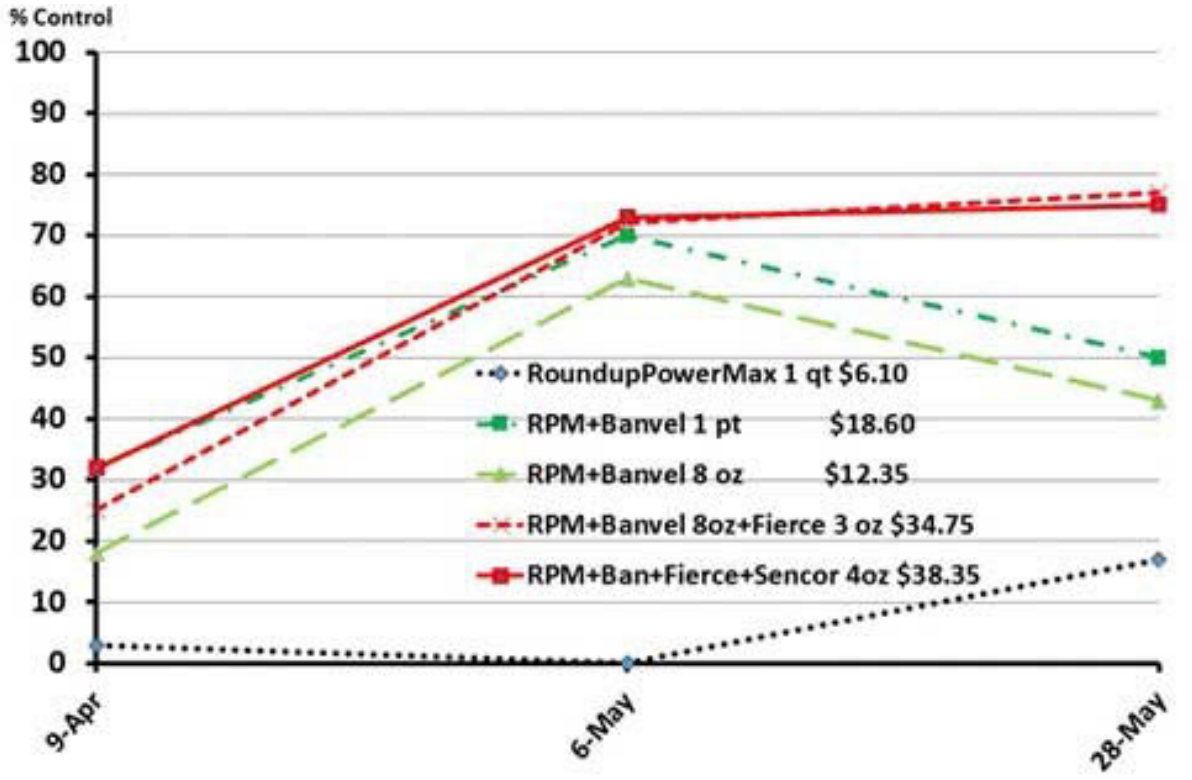

Figure 2. EPP/POST herbicides applied March 10, 2015 for kochia control at Tribune, KS. Kochia at cotyledon stage. Graph by C. Thompson, K-State Research and Extension.

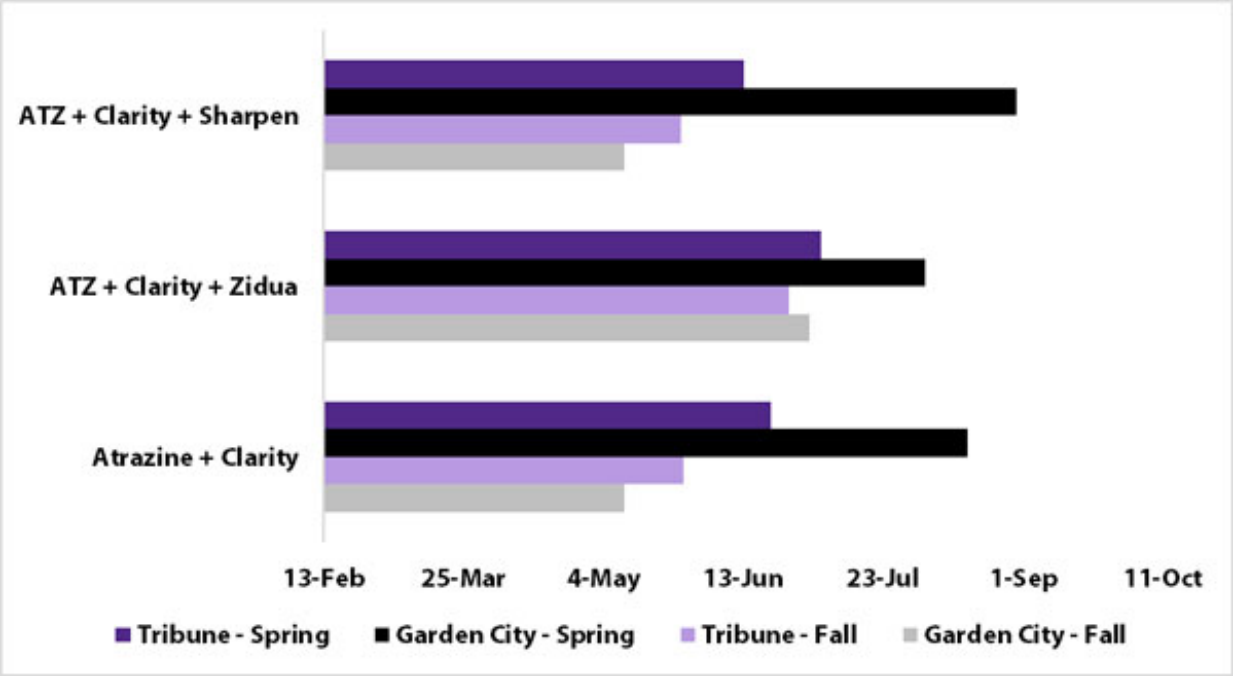

Figure 3. Duration of anticipated kochia control greater than 80% following fall (December 4) and spring (February 23) herbicide applications at two locations during 2015. Data from Vipan Kumar, K-State Research and Extension.

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5. Metabolism-based herbicide resistance in a 6-way resistant Palmer amaranth

A six-way herbicide-resistant Palmer amaranth population was the subject of a study recently published by K-State weed scientists. The Palmer amaranth population was collected from a 45-year old tillage study maintained in continuous sorghum. A variety of herbicides were used in the research trial, with 2,4-D and atrazine used most frequently. However, when plants from this population were studied in the greenhouse, they survived applications of group 2 herbicides Glean (chlorsulfuron), Harmony (thifensulfuron), Beyond (imazamox), Pursuit (imazethapyr); group 14 herbicides Cobra (lactofen) and Flexstar (fomesafen); the group 27 herbicides Callisto (mesotrione) and Laudis (tembotrione), metribuzin (group 5); and glyphosate (group 9); as well as atrazine (group 5) and 2,4-D (group 4). The only herbicides in the study that provided 100% control were Liberty (glufosinate) and Gramoxone (paraquat; Figure 1).

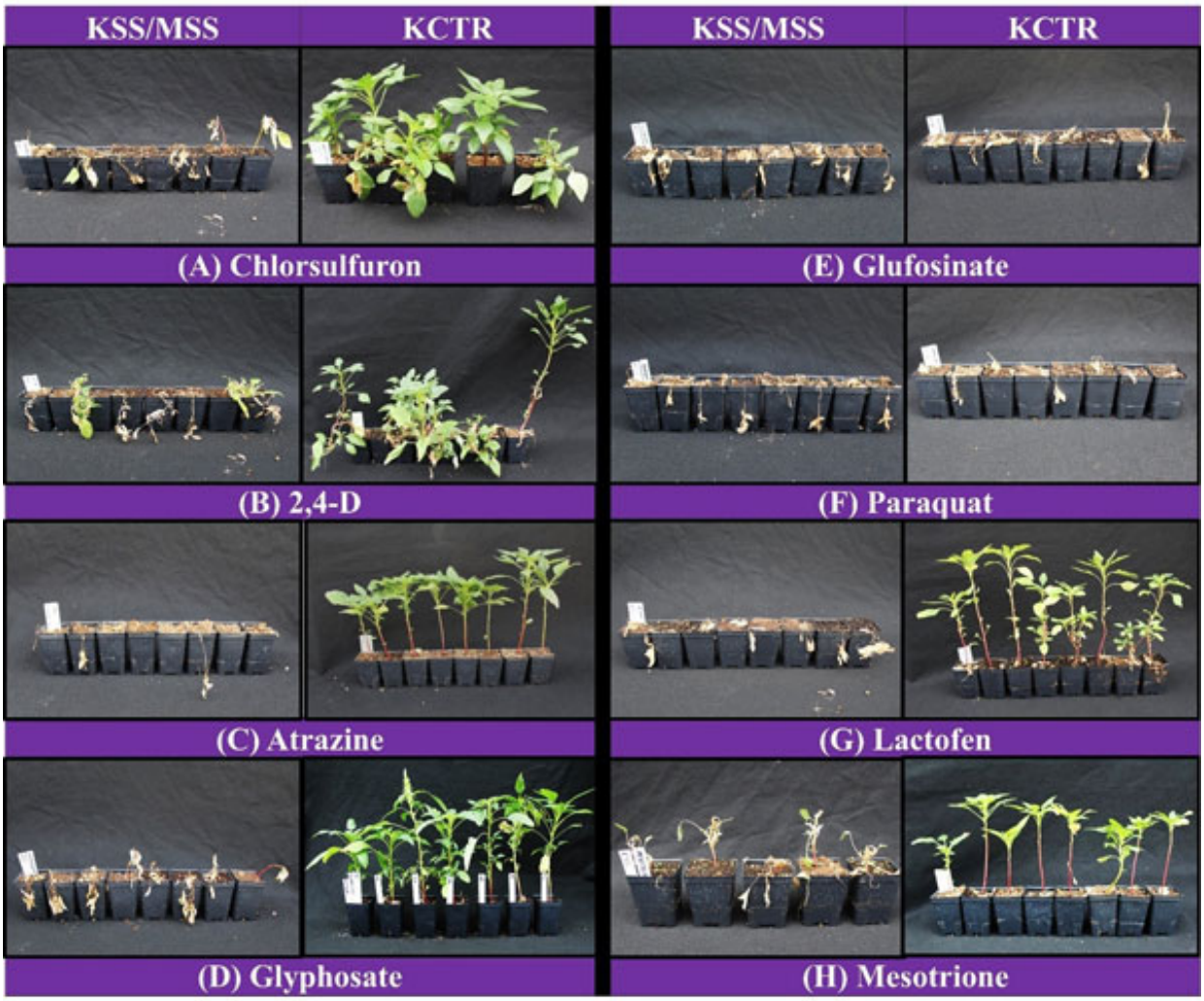

Figure 1. Susceptible (KSS/MSS) and resistant Palmer amaranth 2-4 weeks after treatment with the listed herbicides.

One of the key findings of this research is that metabolism-based resistance (MBR; Table 2) was found for five of the six sites of action. A weed with MBR converts the herbicides to inactive forms before the plant can be killed, often due to the activity of two groups of enzymes: cytochrome P450s and glutathione S-transfersases. These enzymes provide selectivity to many of the herbicides used in crops.

Table 2. Resistance mechanisms in a Kansas Palmer amaranth population (Shyam et al., 2021).

Herbicide group	Resistance type[1]	Suspected mechanism
2	MBR	Cytochrome P450
4	MBR	Cytochrome P450
5	MBR	Glutathione GST
9	TSBR	Gene amplification
14	MBR	Cytochrome P450
27	MBR	Cytochrome P450

[1]MBR = Metabolism-based resistance; TSBR = Target site-based resistance

Prior to about 2013, target site-based resistance (TSBR) was the most common mechanism identified in research and much of our thinking was based on these reports. As more is learned about MBR, it is forcing us to rethink many of our assumptions regarding herbicide resistance development. This research clearly demonstrates the greatest threat associated with MBR is that a single resistance mechanism can provide resistance to multiple herbicide groups. While mixing and rotating herbicides with multiple effective sites of action can slow the evolution of resistance, cross-resistance associated with MBR greatly reduces the effectiveness of this strategy. Minimizing the weed seed bank and adopting alternative management strategies is essential to protect the value of existing and future herbicides.

Reference: Shyam, C., E.A. Borgato, D.E. Peterson, J.A. Dille and M. Jugulam. 2021. *Predominance of metabolic resistance in a six-way resistant Palmer amaranth population*. Frontiers in Plant Science 11:1-12.

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6. Arctic weather is coming - Monitor livestock conditions using Cattle Comfort Tool

The winter of 2020-2021 has been mild thus far but much colder conditions are in the forecast. These much colder conditions will likely result in negative impacts on cattle, particularly calves. A cattle comfort tool on the Kansas Mesonet can be found at https://mesonet.ksu.edu/agriculture/animal. This tool can help identify how harsh conditions are and aid in decision management.

Actual animal response to temperature stress will be dependent on a number of factors not accounted for in the index. Those include, but are not limited to: age, hair coat (winter vs summer; wet vs dry), health, body condition, micro-environment, and acclimatization.

Users can access this tool from either the main Mesonet page at the link above or by selecting from the drop down menu, Agriculture, and then Comfort Index (Figure 1).

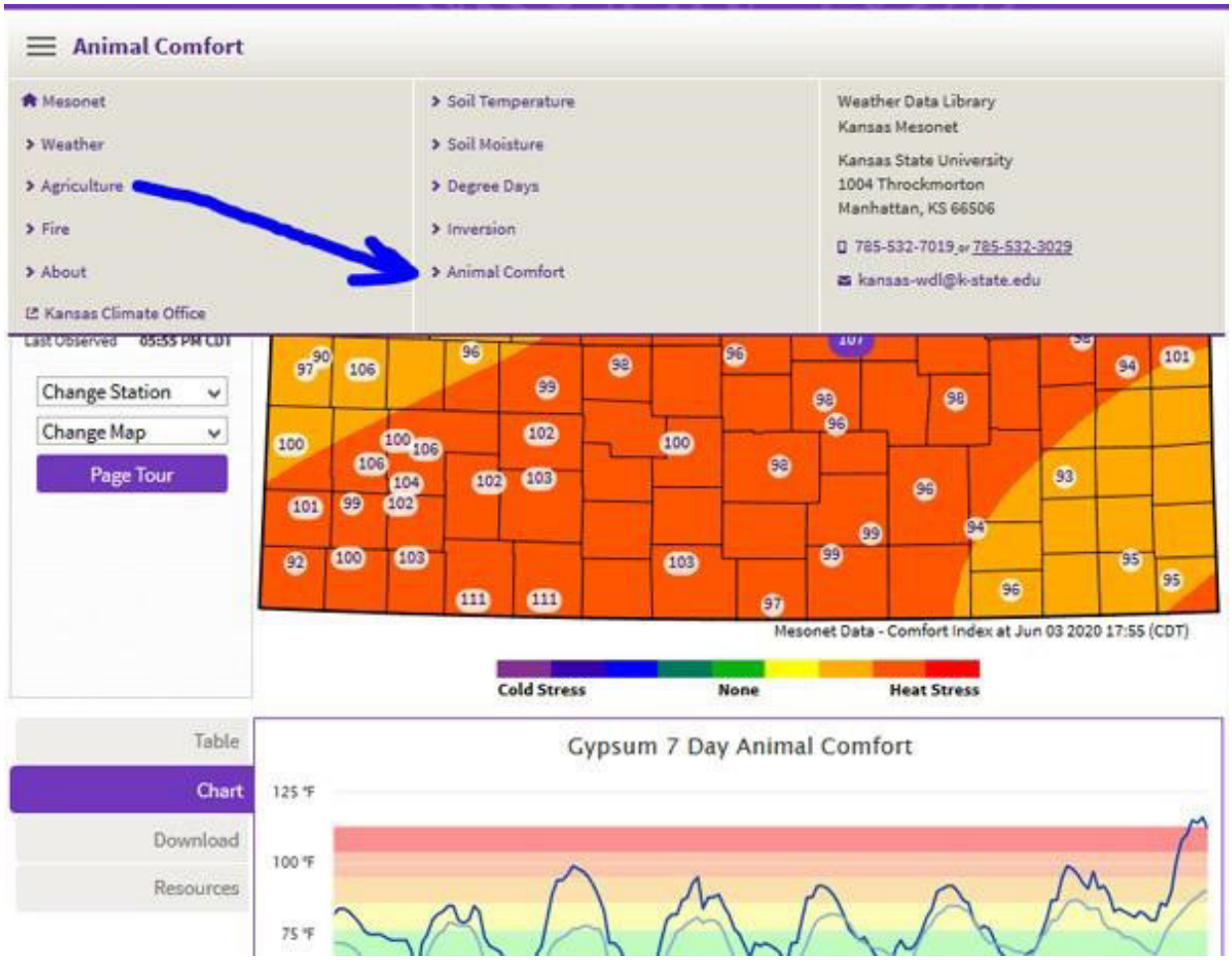

Figure 1. Screenshot of the menu path to the Comfort Index page on the Kansas Mesonet.

Understanding the Comfort Index

Building on the Comprehensive Comfort Index, produced at University of Nebraska, this tool

illustrates the impact of both extremes of hot and cold. The index includes: air temperature, relative humidity, wind speed and solar radiation. Development and validation of the index used data from both beef and dairy cattle and can have applications on all fur covered animals. The map indicates where current conditions fit on the scale.

Under the "Resources" tab, there are descriptions of the scale and their potential impact (Figure 2). There is also a link to the publication used to produce the page. For more information on navigating this resource, users can select a "Page Tour" option located at the top (or left of on a big screen) of the featured map.

Heat and cold stress level categories for the cattle comfort advisor:

Comfort level	Map indicator	Index Value, °F	General Interpretation
Heat Danger		> 105	Animal deaths may exceed 5%
Heat Caution		> 95 to 105	Decreased production, 20% or more Reduced conception , as low as 0%
Heat Caution		> 85 to 95	Decreased production, 20% or more Reduced conception , as low as 0%
Comfortable		77 to 85	
Comfortable		32 to 77	
Comfortable		15 to 32	
Cold Caution		< 15 to -20	18 to 36% increase in dry matter intake
Cold Danger		< -20 to -40	
Cold Danger		< -40	

Figure 2. Cattle comfort ranges. Graphic from Kansas Mesonet.

Tracking conditions

A particularly useful resource is the chart feature. This allows you to monitor how conditions have fluctuated over the past week (Figure 3). Since stress impacts can be cumulative, having this feature allows producers to evaluate management requirements.

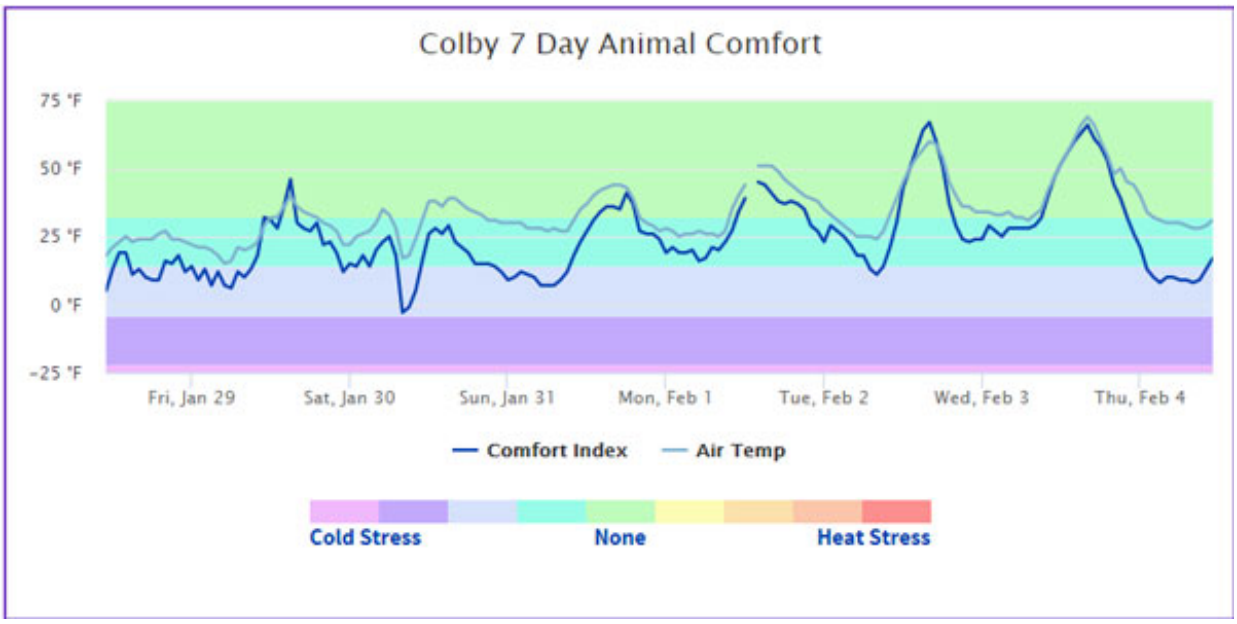

Figure 3. Animal Comfort index history at Colby Mesonet station. Graphic from Kansas Mesonet.

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Mary Knapp, Weather Data Library
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7. Kansas Ag-Climate Update for January 2021

The Kansas Ag-Climate Update is a joint effort between our climate and extension specialists. Every month the update includes a brief summary of that month, agronomic impacts, relevant maps and graphs, 1-month temperature and precipitation outlooks, monthly extremes, and notable highlights.

January 2021: Wide swings in both temperature and precipitation

January was much wetter than normal. It ranked as the 12th wettest January since 1895. There were 143 daily record precipitation events during the month. An eastern bias to the distribution was notable, with all central and eastern divisions averaging above normal. The Southwest Division was the driest with 62 percent of normal. This resulted in continuing drought in the west and reducing drought in the east. The drought in the west resulted in a number of wildfires and some dust storms (Figure 1).

Temperatures were above normal. The statewide average for January was 3.2 degrees warmer than normal. There were no reports of tornadoes, hail, or damaging wind, although there was a tornado reported just over the state line in northeast Oklahoma. The major event was the end-of-month winter storm that brought heavy snow to North Central and Central Kansas. There were 43 daily snowfall records established during the month.

Figure 1. Wildfire in Lane County that occurred during January 2021. Photo by the Kansas Forest Service.

View the entire January Ag-Climate Update, including the accompanying maps and graphics (not

shown in this short article), at http://climate.k-state.edu/ag/updates/.

8. Save the Date - Great Plains Cotton Conference, February 23 & 24

Following a very successful meeting in 2020, the 2021 Great Plains Cotton Conference is scheduled for **February 23 and 24, 2021**. Due to COVID restrictions, the meeting will be held virtually using the Zoom platform this year. Presentations will be focused on all things cotton, including stand establishment, early season management, pest and nutrient management, varieties, harvest-aids, post-harvest management, economics, and cotton industry updates related to the Great Plains. Nationally recognized speakers from OK, KS, TX, and TN will be presenting. Seed companies will be presenting on their latest varieties and traits as well. Two KDA CEUs will be offered. CCA credits have been requested but not confirmed.

Presentations will go from 7:30 am to 12:00 pm on February 23 **and** 7:30 am to 12:00 pm on February 24.

More information on the speakers and a detailed agenda will be shared in next week's Extension Agronomy eUpdate.

Interested individuals are asked to RSVP by February 19 to:

- email: Penny Adams at padams@ksu.edu Please provide your name, phone #, email address, address, and Pesticide Applicator Lic. # in the email.

- phone: Shelley Heinrich at 806-670-3250 or sheinrich@cottonboard.org

Registered attendees will receive a Zoom invitation on February 22.

9. Soybean cyst nematode webinar series starting February 11

Wondering how to manage Soybean Cyst Nematode (SCN) in Kansas? SCN is one of the most important diseases in Kansas and has been detected in many counties across the state (Figure 1). Tune in to a three-part webinar series organized by our colleagues, Dr. Kaitlyn Bissonnette at the University of Missouri, and Dr. Carl Bradley at the University of Kentucky.

Registration for each webinar is required, so make sure you get signed up.

The webinar dates, titles, and registration links are outlined below.

Part 1 – February 11, 2021 (12:00-1:00 PM CST)

Soybean Cyst Nematode Basics and Distribution

Register for Part 1 at: https://zoom.us/webinar/register/WN_mfHUvAkwSHCts2X5AFBU8w

Part 2 – February 18, 2021 (12:00-1:00 PM CST)

Soybean Cyst Nematode Management: Variety Resistance and Crop Rotation

Register for Part 2 at: https://zoom.us/webinar/register/WN_3uoRUzAeQcOHqxCbWmXtow

Part 3 – February 25, 2021 (12:00-1:00 PM CST)

Soybean Cyst Nematode Management: Seed Treatments and Sampling

Register for Part 3 at: https://zoom.us/webinar/register/WN_A2tRdecwSV2g1hdDsz1t6A

Need help collecting a SCN sample?

Contact your local K-State Extension Office. They will work with you on best practices for sample collection and will send samples to the K-State Plant Diagnostic Clinic.

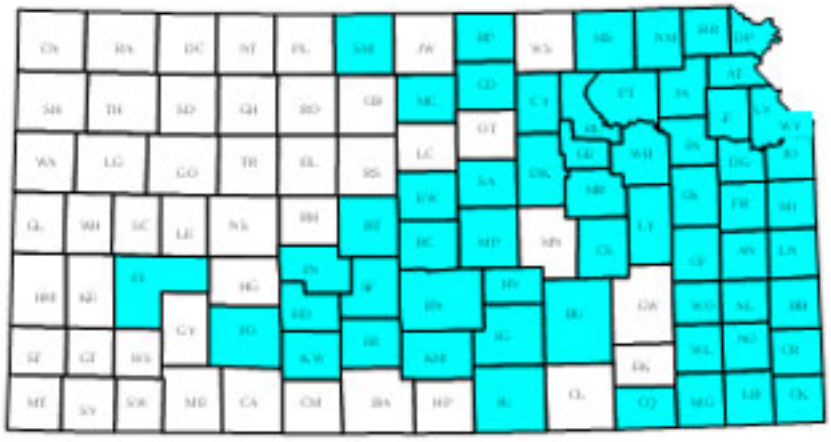
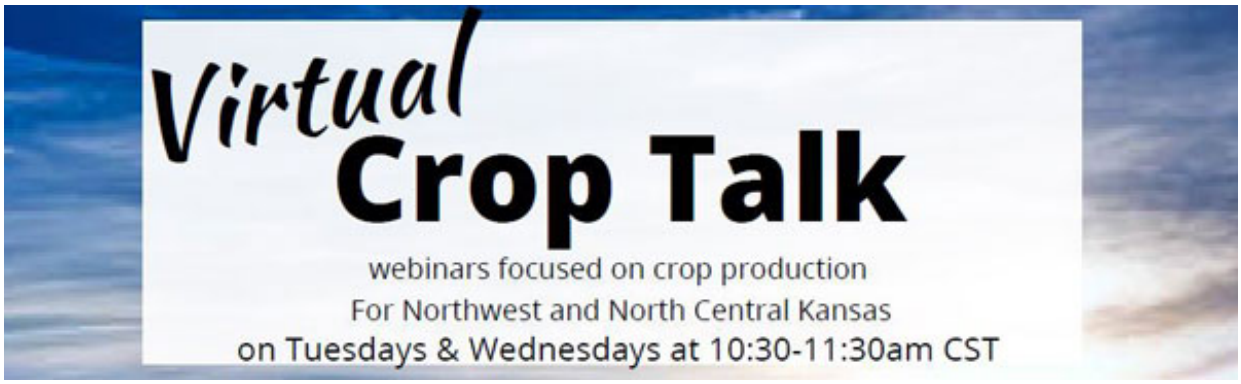


Figure 1. As of January 1, 2020, SCN was identified in 59 Kansas counties that produce >85% of Kansas soybeans. Map courtesy of Timothy Todd, K-State Research and Extension.

Rodrigo Onofre, Plant Pathologist
onofre@ksu.edu

10. New Crop Talk webinar series for northwest and north central Kansas



A new series of hour-long webinars is set to begin in early February. This series will be focused on agronomic topics targeted for northwest and north central Kansas. Topics range from soil fertility, weed management, insect management, and dryland corn dynamics. Continuing education credits have been applied for and will vary based on the subject area of each webinar. Each webinar will begin at 10:30 am (CST) and last until 11:30 am, beginning with the first one on Tuesday, February 2.

Upon registration, participants will receive an email with instructions to attend via Zoom or YouTube. These webinars are open to all and there is no cost. Visit the K-State Northwest Research and Extension Center's website to register: https://www.northwest.k-state.edu/events/crop-talk-series.

Please contact any local KSRE extension office in north central or northwest Kansas for any questions.

A complete list of webinars, with dates, topics, and speakers is detailed below.

February 2 - **Soil Fertility Questions from Growers for the 2021 Season (focused for Northwest Kansas)**
Dorivar Ruiz Diaz, K-State Soil Fertility Specialist

(1 Soil Fertility CCA Credit)

February 3 - **Soil Fertility Questions from Growers for the 2021 Season (focused for North Central Kansas)**
Dorivar Ruiz Diaz, K-State Soil Fertility Specialist

(1 Soil Fertility CCA Credit)

February 9 - **Weed Management and that Pesky Palmer Amaranth (focused in Northwest Kansas)**
Sarah Lancaster, K-State Weed Scientist
Vipan Kumar, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 10 - **Weed Management and that Pesky Palmer Amaranth (focused in North Central**

Kansas)
Sarah Lancaster, K-State Weed Scientist
Vipan Kumar, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 16 - **Corn Insect Resistance: Rootworm & Western Bean Cutworm**
Julie Peterson, UNL Entomologist

(1 Integrated Pest Mgmt CCA Credit)

February 23 - **Grain Sorghum Weed Control: Start Clean, Stay Clean**
Sarah Lancaster, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 24 - **Sorghum Insects: Aphids, Headworms and Chinch Bugs.. Oh My!**
J.P. Michaud, K-State Entomologist

(1 Integrated Pest Mgmt CCA Credit)

March 2 - **Alfalfa Management and Weevil Update**
Romulo Lollato - Wheat & Forage Specialist
Anthony Zukoff, K-State Extension Entomology Associate

(1 Crop Mgmt CCA Credit)

March 9 - **Dryland Corn Dynamics**
Lucas Haag, K-State NW Regional Agronomist

(1 Crop Mgmt CCA Credit)