

# **Extension Agronomy**

# eUpdate

# 04/24/2020

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. Preliminary wheat injury assessment from the April 13-17 freeze events in Kansas

The cold temperatures experienced in week of April 13-17 caused freeze injury to the 2020 wheat crop at varying degrees. The level of freeze damage depends on the region in the state, primarily because the wheat in different regions was at distinct growth stages (with varying levels of susceptibility to cold damage) and also because the different regions recorded minimum temperatures ranging from 8 to over 30 degrees F. Within a given region, factors that impacted the level of freeze damage included cropping system (which affected residue cover and sowing date), wheat variety selection, and position in the landscape.



Preliminary Assessment of Wheat Freeze Injury April 24, 2020

Figure 1. Preliminary assessment of the freeze damage resulting from the cold temperatures that occurred April 13-17. The risk is based on observations of fields and information provided by wheat growers. Conditions vary significantly among fields and are influenced by cropping system, wheat variety, and position in the landscape. Map created by Erick DeWolf, K-State Research and Extension.

#### **North central Kansas**

The region encompassing Republic, Smith, Phillips, and Rooks counties showed a varying, but considerable, amount of freeze damage to the wheat crop. In general, the damage was more

apparent in the western portion of this region; although some fields in Republic county also showed considerable damage. Fields that were planted at the optimum time such as those after a long fallow period were showing less leaf damage, but a large number of primary heads destroyed by the freeze (Figure 2). Many times, as many as 40 to 60% of the primary heads were lost. While secondary heads were mostly still alive, the crop needs moisture soon to help with recovery potential. In this region, freeze damage was accentuated by dry topsoil conditions, which currently gives the plants a desiccated appearance and very light weight. For those fields that were sown late, usually after a soybean crop in this region, the combination of freeze and dry topsoil caused considerable dry back of leaves and tillers, with as many as half or two thirds of the tillers killed by the freeze event (Figure 3).



Figure 2. Wheat field sown at the optimum time, likely after a fallow period, in north central Kansas. These fields usually showed some level of leaf burn, and a considerable amount of tiller loss, evidenced by new leaves coming out of the whorl already discolored and mushy/brownish heads. Some primary tillers were not damaged, such as shown on the upper right corner. Photos by Romulo Lollato, Extension Wheat and Forage Specialist with Kansas State University.



Figure 3. Late-sown fields in north central Kansas, usually following a soybean crop, showed severe leaf and tiller damage from the recent freeze events. This was worsened by a combination of freeze and dry topsoil conditions. Photos by Romulo Lollato, Extension Wheat and Forage Specialist with Kansas State University.

#### **Central and west central Kansas**

Fields in the region between Saline and Ellis counties showed, again, varying degrees of freeze damage, with at least the same but potentially more freeze damage than in the north central region. The trends observed in the north central region were also true for this region (primary tiller loss in early sown fields, severe leaf and tiller damage to late-sown fields, Figure 4). However, because the wheat crop was further along in development in this region, it was at a greater risk for freeze damage. This region had slightly more soil moisture, which should help the crop compensate for the potential yield loss through secondary tillers.



Figure 4. Leaf burn symptoms to wheat sown after wheat in Ellis Co, KS (left and center panels). About 40-60% of the heads were showing damage as depicted in the right panel. Favorable soil moisture conditions can help wheat recover and produce yield from the secondary tillers and remaining primary tillers. Photos by Romulo Lollato, Extension Wheat and Forage Specialist with Kansas State University.

#### South central Kansas

As we moved from Saline County to McPherson and Reno counties, there were fewer fields showing leaf burn symptoms, so that there was essentially no sign of freeze damage in Sumner Co. Evaluation of the wheat heads near Hutchinson suggested that maybe 5-10% of the primary tillers could have suffered some damage level, especially in the early-sow fields (Figure 5). While there is still potential that the emerging heads might be trapped in the boot, the freeze damage in this region was much less dramatic than in the central or north central regions.



Figure 5. Leaf burn symptoms to the wheat in Reno Co, KS, but emerging leaf and head still healthy. There is potential for head trapping in the boot, but yield losses would likely be limited. Photos by Romulo Lollato, Extension Wheat and Forage Specialist with Kansas State University.

#### **Northwest Kansas**

The wheat crop in the northwestern portion of Kansas was also affected by the freeze temperatures. The wheat crop was not as far along development relative to other areas of the state, with many fields tillering and early jointing stages of growth at the time of the cold temperatures. This area of the state experienced that coldest temperatures (often less 15 degrees) and dry soil conditions predisposed plants to injury. Overall, the damage was less severe in the Northwestern region than in central KS but some areas in Thomas, Gove and Trego Counties likely experienced significant damage (Figure 6). In many cases, the severely damaged fields turned yellow and eventually brown as the tissue declined and desiccated this week. The wheat in these fields will likely produce new tillers to compensate for potential yield loss, but rain is needed to help the crop recover.





Figure 6. Wheat in northwest Kansas with symptoms of severe injury to leaves and stems resulting from freezing temperatures on April 13-17. Photos by Erick DeWolf, K-State Research and Extension.

#### Wheat variety effect on potential for freeze damage

We also saw a considerable difference among varieties in their response to the recent freeze events. It is important to note that these differences do not reflect a variety's winterhardiness. Instead, they seem to be more related to when varieties were released from winter dormancy and started their spring growth. Varieties that began to grow early are showing more freeze damage than varieties that were released from dormancy later, regardless of sowing date (Figure 7). Remember that wheat's tolerance to freezing temperatures is at its peak during the winter, and then decreases as the crop begins its spring growth – thus, the further away from the depths of the winter, the less a given variety is able to tolerate cold temperatures. In most cases, varieties that released earlier from winter dormancy (for example, WB4458, Paradise, TAM114, Zenda) were showing much more freeze damage than varieties that were released later (for example, WB Grainfied, Rock Star, LCS Chrome, Joe).



Figure 7. Wheat varietal differences in response to freeze damage. Upper panel shows wheat demonstration plots sown at the optimum time after a fallow period in Rooks County. Right variety had earlier release from winter dormancy than left variety. Lower panel shows wheat demonstration plots sown late, after soybeans, in Phillips county. Left variety had earlier

# release from winter dormancy than right variety. Photos by Romulo Lollato, K-State Research and Extension.

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# 2. Options and management strategies for freeze-damaged wheat

Producers whose wheat has suffered severe freeze damage have some difficult decisions to make. The most difficult is whether to keep the crop or to destroy it. There is no sure answer, unless it is obvious that the crop is almost completely damaged and not coming back strongly enough to produce more than a minimal yield. In most cases, there is still plenty of time before the crop has to be destroyed in order to plant grain sorghum, soybeans, or if plans are to plant wheat again this fall. But if the crop is obviously lost, it should be killed as soon as possible, keeping crop insurance considerations in mind. As long as it is still at least partially alive, the freeze-damaged crop will take up soil moisture and nutrients needed for the following crop. Producers who have forward contracted much of their anticipated production will probably want to wait longer if there is any doubt about whether the crop will recover.

If producers do plan to terminate their wheat crop, there are several possible options for managing the field, depending on circumstances. There are some basic questions to ask before deciding on what to do.

#### **Basic questions to ask**

#### 1. Was a long-residual sulfonylurea herbicide used on the wheat crop?

\* **YES**. Options are limited. Producers must check the product labels for rotational restrictions. For more on these restrictions, refer to the accompanying eUpdate article in this issue, "**Herbicide** carryover considerations when re-cropping damaged wheat".

\* **NO**. More options are available.

a. Cut the failed wheat for forage or graze it out, then re-crop to any row crop or plant back to wheat in the fall.

b. Terminate wheat with herbicides or tillage, then plant a summer crop allowed by rotation restrictions.

<u>Additional comments</u>: The wheat should be tested for nitrate levels before cutting for forage or grazing, especially if a recent top-dress application was made ahead of the freeze. Tilling the wheat under could cause erosion problems, and may be restricted by farm program compliance requirements.

#### 2. Is the crop insured?

- \* YES. Three key points:
- -- Talk to your crop insurance agent before doing anything

-- It's very important that producers get their insurance company's consent before cutting the crop for forage, grazing it out, or killing it. The insurance company must have a chance to appraise and release the acres before the crop is destroyed. If the company cannot make an accurate appraisal, or the producer disagrees with the appraisal at the time the acreage is to be destroyed, the company and producer can work out representative strip areas to be left intact for future appraisal purposes before cutting the crop for forage, grazing it, or otherwise destroying it.

-- For non-irrigated acreage, especially in western Kansas, this spring's decisions on failed wheat may have insurance implications for the 2021 wheat crop. If the failed wheat crop had been planted on acreage qualifying as summer fallow in the fall of 2019, it would qualify as summer fallow acreage for 2021 **ONLY IF**:

a. the failed wheat was terminated by JUNE 1, AND

b. any later growth controlled by mechanical or chemical means, AND

c. you did not harvest (e.g. bale) the failed wheat.

\* NO. Producers can take action as soon as the soil has dried out.

#### **Re-cropping considerations**

If producers want to re-crop this spring, planting through the old wheat crop may pose a challenge. Probably the biggest issue to deal with is the residual effect of whatever herbicide was applied on the wheat. Certain herbicides are persistent and have significant re-cropping guidelines (refer to the accompanying eUpdate article "Herbicide carryover considerations when re-cropping damaged wheat").

Planting of glyphosate-resistant corn or soybeans could be done prior to termination of the wheat; however, if planting grain sorghum, producers should ensure that the wheat has been fully terminated before planting as there are very limited herbicide options for controlling grass in established sorghum.

Planters equipped for no-till (appropriate residue managers, furrow closers, and starter fertilizer applicators) should have no difficulty effectively placing seed through wheat residue and establishing good stands. The amount of residue moved out of the row ahead of the furrow opener can vary considerably depending on planter capability and grower preference. There are advantages to leaving as much residue as possible in the furrow area without hair pinning residue in the seed zone. Sharp opening disk and appropriate downforce settings will improve performance. In some field scenarios, producers may be better off not using residue managers/row cleaners depending on the condition of the terminated wheat and the previous crop residue,

Seed needs to be firmed in the bottom of the furrow. Various after-market closing wheels may be useful when planting in these conditions to avoid compacted furrow side walls and achieve good seed coverage.

For corn or sorghum, the practice of placing starter fertilizer near or in the furrow at planting may be important, depending on soil fertility level and planting date. A follow-up band application of the remaining N requirement can be made based on anticipated soil residual N and crop potential.

Volunteer wheat control later in the season should be much less of an issue because of the wheat crop will be terminated before grain has been produced.

For producers with high accuracy (RTK) guidance and wider spaced wheat (10 or 12"), they may be able to split the existing wheat rows with their row crop planter. If that is not possible, the row crop should be planted with a heading slightly angled to the existing wheat rows (5-10 degrees). This will result in better handling of the residue by the planter, better ride quality for the planter row units, and more consistent depth and placement of the seed.

#### Insurance considerations

Producers who wish to destroy the wheat crop and go to a second crop have the following options after they talk to their crop insurance agents:

#### 1. Plant, but not insure, a second crop.

a. The insured will collect 100% of the indemnity for the first crop after the loss adjuster confirms the loss.

b. Written notice must be provided that the insured elects not to insure the acreage of a second crop

#### 2. Plant and insure a second crop.

- a. The insured will collect 35% of the wheat indemnity
- b. The insured will pay 35% of the wheat premium

c. If there is no loss on the second insured crop, the insured can request the remaining 65% of the wheat indemnity

d. If there is a loss on the second crop, the insured may:

i. Waive the indemnity on the second crop and collect the remaining indemnity on wheat (also pay remaining premium)

ii. Collect the loss on the second crop and keep the 35% wheat indemnity. There are a couple of exceptions to this rule.

A key, for crop insurance purposes, is whether the wheat had reached the headed stage at the time it is destroyed and planted to second non-irrigated crop, which has no occurred in the majority of the area affected by freeze this year. You and your crop insurance agent should check the Actuarial Documents in your county for the second non-irrigated crop. If the second non-irrigated crop is not insurable, the producer would need to keep any production on that crop separate from his or her other acres of the crop.

In several counties in southeast Kansas insurance is available for FAC soybeans. In those counties, the rules for planting another non-irrigated crop after failed or harvested wheat are different. RMA has posted a Frequently Asked Questions (FAQ) document on their website that addresses *Following Another Crop and Not Following Another Crop (NFAC) Cropping Practices*. The FAQ is located at

In summary, if you have a failed wheat crop, there may be some options available to you on that acreage. However, it is important to review your county Actuarial Documents and consult your crop insurance agent, which should aid you in developing a plan for that acreage that best fits your farming operation.

Lastly, some general advice for wheat farmers is to order wheat seed for this fall early.

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# 3. Herbicide carryover considerations when re-cropping damaged wheat

Growers who decide to terminate their wheat crop because of poor stands or weather-related damage need to consider the persistence of herbicides applied to the wheat. Many wheat herbicides have fairly long crop rotation restrictions. Selected herbicides and rotation intervals to certain crops are listed in Table 1.

Herbicide dissipation is affected by many factors, so be sure to check herbicide labels for specific information for your fields, particularly for the intervals marked with an asterisk in Table 1. Additionally, some labels allow shorter intervals in the case of catastrophic crop failure, as long as the producer is willing to accept the risk of crop injury. Supplemental herbicide labels may further complicate your decision.

# Table 1. Minimum rotation intervals for key summer crops following application of selected wheat herbicides.

	Minimum rotation interval				
	(conventional varieties/hybrids)				
Herbicide (active ingredient)	Grain sorghum	Corn	Cotton	Soybean	Sunflower
Aggressor (quizalifop)	120 d	120 d	None	None	None
Agility (dicamba, thifensulfuron, tribenuron, metsulfuron)	4 m*	4-12 m*	10-34 m*	4-34 m*	10-22 m*
Ally, others (metsulfuron)	4-10 m*	12 m*	10-34 m*	4-34 m*	22 m*
Axial XL (pinoxaden)	90 d	90 d	90 d	90 d	90 d
Beyond ( <i>imazamox</i> )	9 m	0-8.5 m*	9 m	None	0-9 m*
Everest 3.0 (flucarbazone)	9-18 m*	9-18 m*	6-12 m*	4-12 m*	4-9 m*
Express (tribenuron)	14-21 d*	14-21 d*	14-21 d*	1-14 d*	0-45 d*
Glean (chlorsulfuron)	4-48 m*	Bioassay	Bioassay	4 m*	Bioassay
Harmony (thifensulfuron)	None	None	7 d	None	45 d
Huskie (pyrasulfotole, bromoxynil)	7 d	4 m	Bioassay	4 m	9 m
Olympus (propoxycarbazone)	6 m*	18 m*	12 m*	4-12 m*	12 m*
Orion (florasulam, MCPA)	3 m	3 m	12 m	9 m	9 m
Osprey (mesosulfuron)	90 d	90 d	90 d	90 d	30 d
Outrider (sulfosulfuron)	3 m	3 m	3 m	3 m	3 m
Peak (prosulfuron)	1 m	0-1 m*	10-22 m*	10-22 m*	22 m
PowerFlex HL (pyroxsulam)	3-9 m*	9 m	3-9 m*	3-5 m*	3-9 m*
Quelex (haluxifen, florasulam)	45 d-3 m*	45 d-3 m*	45 d-3 m*	45 d-3 m*	3 m
Rave (triasulfuron, dicamba)	14-24 m*	14-36 m*	4 m*	11-36 m*	24 m*
Starane Ultra (fluroxypyr)	None	None	120 d	120 d	120 d
WideMatch (fluroxypyr, clopyralid)	10.5 m	None	10.5 m	10.5 m	10.5 m

Abbreviations: d=day, m=month

\*Consult herbicide label for geographic, soil, precipitation, application rate, or other conditions associated with this crop rotation interval.

Another important factor to consider is the availability of herbicide-resistant varieties or hybrids. Many of the herbicides listed in Table 1 are ALS-inhibiting herbicides that are associated with resistance in certain varieties or hybrids. Some examples are Clearfield sunflowers, which can be planted following Beyond, or Bolt soybeans which have a shorter rotation interval following sulfonylurea herbicides such as Ally.

In general, it would be best to wait as late as possible before planting sensitive crops to allow for maximum herbicide dissipation. Tilling the soil to try to "dilute" the herbicide residue likely will not have a great benefit. Lowering residue managers on planters so that an inch or two of topsoil is thrown out of the rows could help get the seed into soil with lower herbicide levels. If you are in doubt about your decision, consider conducting a *field bioassay* to determine if it is safe to plant the crop you are considering. A field bioassay is simply a short strip of crop planted across the direction of the herbicide application. Plants in the strip are monitored for herbicide injury as they emerge.

#### Terminating the wheat crop

Another consideration at this time is how to kill the wheat crop. Wheat that has been injured but is not yet dead may be hard to kill with glyphosate because of reduced absorption and movement through the plant. Producers should wait until wheat is actively regrowing before applying glyphosate. Paraquat is not a good alternative as it burns back the treated leaves, and is not translocated to the crowns and lower buds, thus the wheat plant often can regrow from these structures. You can also consider a 'planting green' strategy, which is employed in some cover cropped fields.

Sarah Lancaster, Extension Weed Science Specialist slancaster@ksu.edu The Chemical Weed Control Guide is one of the most used K-State Extension publications, but we are always looking for ways to make the information more user-friendly. Extension Agronomy wants to hear from you! We are asking you to complete a short survey related to the Chemical Weed Control Guide. It can be completed in just a few minutes using a computer or mobile device.

To start the on-line survey, you can scan the QR code or visit the web address listed below. If you have questions or want to request a paper copy of the survey, please contact Extension Weed Science Specialist, Dr. Sarah Lancaster at <u>slancaster@ksu.edu</u>.



https://kstate.gualtrics.com/jfe/form/SV\_4Z1gPg8wfpnkJrT

# 5. K-State recommendations for soybean planting dates and maturity group

After considering the effects of genetic yield potential and the environment, planting date is one of the primary management practices under the farmer's control that can highly influence soybean yields. In recent years, Kansas producers have been planting soybeans slightly earlier -- at the rate of about one-third-of-day per year. The past growing seasons, however, the "50% planting date" mark was achieved at a similar time (first week of June) statewide – with exception of the last growing season (2019) that was marked by extremely wet and late planting conditions.

#### Kansas planting dates and maturity groups

Soybeans can be planted over a wide range of dates (Figure 1, upper panel) with adequate soil moisture conditions, although germination and emergence could be reduced and/or delayed in cool soils (less than 60 degrees F). The recommended maturity varies across Kansas by area (Figure 1, lower panel).





Figure 1. Recommended soybean planting dates (upper panel) and suggested maturity groups (bottom panel) across Kansas. Maps from K-State Research and Extension.

#### Recommendations

- Ultimately, weather patterns dictate soybean yields, especially under dryland conditions. There is no guarantee that any certain planting date will always work out the best when it comes to soybean yields in Kansas. In fact, the distribution and amount of rainfall and the day/night temperature variations around flowering and during the grain filling periods have large impacts on defining soybean yield potential. Thus, when the risk of drought stress during the growing season is high, diversifying planting dates may be a good approach to consider.
- When planting early, seed should be treated with a fungicide and insecticide. Selecting varieties with resistance to soybean cyst nematode and sudden death syndrome is advisable. Do not plant into soils that are too wet. Also, do not plant until soil temperatures are close to 60 degrees F. If planted into soils cooler than 60 degrees F, seedlings may eventually emerge but will have poor vigor.
- In drier areas of Kansas and on shallow soils, yields have been most consistent when planting soybeans in late May to early June. By planting during that window, soybeans will bloom and fill seed in August and early September, when nights are cooler and the worst of heat and drought stress is usually over.

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# 6. Soybean seeding rates and optimum plant populations

The optimum seeding rate is one of the most influential factors for increasing soybean profitability as seed cost is one of the most expensive inputs. Soybean seeding rate, row spacing, and planting date are all tied together. The final number of seeds per linear foot of row decreases as row spacing narrows. For example, at a target population of 105,000 plants per acre and 85 percent germination, 30-inch rows will need twice the number of seeds per linear foot as 15-inch rows (6 vs. 3 seeds per linear foot). Seeding rate will need to increase at later planting dates to compensate for the reduction in the growing season since more plants are needed to increase early light interception and biomass production.

#### Seeding rates for high-yielding soybeans: A case study

Information gathered from the Kansas Soybean Yield contest shows that maximum yield (more than 90 bushels per acre) could be achieved with seeding rate ranging from 120,000 to 180,000 seeds per acre (Fig. 1). Note: most of the yields ranged from 60 to 90 bushels per acre.



Figure 1. Relationship of soybean yield versus seeding rate for Kansas Soybean Yield Contest data. Graph by Ignacio Ciampitti, K-State Research and Extension.

Yield potential for each environment should be consider when deciding soybean seeding rates. Yield potential is primarily defined by weather conditions (before and after planting), genetic potential, soil type, fertility program, and use of best management practices for producing the crop (proper weed, insect, and disease control from planting until harvest). Before deciding the seeding rates, it is necessary to consider potential soil and weather conditions that could affect the success of the final stand establishment, to achieve the proper plant density required for each yield environment (YE).

#### Summary of a recent plant density study

Recent economic and productive circumstances have caused interest in within-field variation of the agronomic optimal plant density (minimum number of plants in a per-unit-area basis required to maximize yield) for soybean. A recent study by Carciochi, Ciampitti and collaborators from Corteva published in Agronomy Journal presented a new insight about the optimal plant density by yield environment. For that study, a soybean database evaluating seeding rates ranging from 69,000 to 271,000 seeds per acre was collected, including final number of plants and seed yield. The data was classified in yield environments: **low** (LYE, <59.6 bu per acre), **medium** (MYE, 59.6-64.1 bu per acre), and **high** (HYE, >64.1 bu per acre).

The main outcomes from this study were:

- Optimum plant density decreased by 24% from low (127,000 plants per acre) to high (97,000 plants per acre) yield environments (Fig. 2).
- Optimal density (50% interquantile) ranged between 109,000 144,000 plants per acre for the low, from 77,000 to 114,000 plants per acre for the medium, and 76,000 to 117,000 plants per acre for the high yield environment (Fig. 3).
- Greater optimal density for the low yield was not related to a low plant survival rate.
- Less precipitation during the reproductive period was one of the main causes for the need to increase the plant density in low yield environments to overcome a possible reduction in the crop reproductive ability.



Figure 2. Relationship between seed yield and plant density for low (LYE, <59.6 bushels per acre, A), medium (MYE, 59.6-64.1 bushels per acre, B), and high yield environments (HYE, >64.1 bushels per acre, C). Models were fitted using hierarchical Bayesian models. Graphs by Ignacio Ciampitti, K-State Research and Extension.

This is valuable information for site-specific management strategies, such as variable seeding rate. Thus, within a field, yield variation could be better related to the adjustment of seeding rate for soybeans, improving both the productivity and net return for farmers.



Figure 3. Cumulative probabilities (%) of agronomic optimal plant density (AOPD, plants per acre) (A) and AOPD range to achieve the maximum yield for the seed yield-to-plant density relationship for the low (LYE, in yellow), medium (MYE, in green), and high yield environment (HYE, in blue) (B). For panel B, box plots portray the 25th (bottom edge of the box) and the 75th (top edge of the box). The solid line within the box represents the median and the circles referred to outliers.

In summary, adjusting seeding rates reduces risks of yield losses due to suboptimal densities in a low yield environment, while limiting higher seed costs due to supra-optimal densities, especially for medium and high yield environments. Moreover, soybean plant density levels above the optimal plant density increase the risk of lodging and disease development without adding a yield benefit.

For more information about the optimal soybean seeding rates and optimal plant densities, please consult this new publication from KSRE prepared by Drs. Ciampitti, Carciochi, and Schwalbert: <u>https://bookstore.ksre.ksu.edu/pubs/MF3460.pdf</u>

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## 7. Effect of row spacing on soybean yield

There are still many questions about row spacing for soybean production. Research from K-State has found that narrow rows (15-inch or 7.5-inch) result in equal or greater yields compared to 30-inch rows when the yield environment is greater than 45-50 bushels per acre (regardless of planting date, seeding rate, or maturity). Below this yield threshold level, narrow rows tend to result in yields about equal to or slightly below (depending on the water status) yields in 30-inch row spacing. Narrow rows have several benefits such as early canopy cover, better light capture, improved weed control, and reduced erosion. Poor stands, however, are more common with narrow row spacing versus wider row spacing.

For the 2015-16 seasons, on-farm studies (collaboration between K-State, Kansas Soybean, and the United Soybean Board - USB) showed slight yield improvement (+2 bushels per acre) on narrow rows (15-inch; Figure 1) with yields averaging 48 bushels per acre.

#### **Overall Summary**





#### narrow (15-inch) configuration. Graph by Ignacio Ciampitti, K-State Research and Extension.

For the 2017 season, two studies (collaboration between K-State, Kansas Soybeans, North Central Soybean Research Program) were conducted comparing 15 vs. 30-inch rows. The first study was located in Franklin County, Kansas (Figure 2) and the second one was located in Riley County, Kansas (Figure 3).



Yield Average for All	15 inch	30 inch	Yield Difference	A randomization test suggested no
Individual Treatments (bu/acre)	54.09	53.92	0.17	evidence of a significant yield difference.

Figure 2. Soybean yield (bushels per acre) by row spacing for conventional (30-inch) versus narrow (15-inch) configuration, in Franklin County, Kansas. K-State Research and Extension.



Yield Average for All	15 inch	30 inch	Yield Difference	A randomization test suggested
Individual Treatments (bu/acre)	51.31	45.50	5.82	some evidence of a significant yield difference.

# Figure 3. Soybean yield (bushels per acre) by row spacing for conventional (30-inch) versus narrow (15-inch) configuration in Riley County, Kansas. K-State Research and Extension.

Overall, narrow rows provided a yield response ranging from -0.6 to +5.0 bu/acre. An additional benefit for narrow rows was enhanced early light interception and improved weed control.

For more information visit: <u>http://www.iasoybeans.com/USB/DataViewer/index.htm</u>

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# 8. Become a volunteer weather reporter in Kansas - Join the CoCoRaHS Network

Have you wondered how much rain or snow has fallen? Have you noticed that what was reported at the official National Weather Service Cooperative site does not match what you observed at your location? There is a volunteer organization that is working to answer both questions: CoCoRaHS. Now is a great time to join this network as Kansans are spending more time at home due to COVID-19.

#### What is CoCoRaHS?

CoCoRaHS is an acronym for the Community Collaborative Rain, Hail and Snow Network. CoCoRaHS is a unique, non-profit, community-based network of volunteers of all ages and backgrounds (Figure 1) working together to measure and map precipitation (rain, hail, and snow). By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, the aim is to provide the highest quality data for natural resource, education, and research applications. CoCoRaHS has been active in Kansas since 2004. More observers are always very welcome.



Figure 1. Two young scientists in the making! Weed Science Specialist, Sarah Lancaster, sent in this photo of her two sons reading their CoCoRaHS rain gauge following a rain event in late April. Photo by Sarah Lancaster, K-State Research and Extension.

Each time a storm -- rain, hail, or snow -- crosses your area, volunteers take measurements of precipitation from as many locations as possible. These precipitation reports are recorded on the website, <u>https://cocorahs.org/</u>. The data are then displayed and organized for the end users to analyze and apply to daily situations ranging from water resource analysis and severe storm warnings to neighbors comparing how much rain fell in their backyards. For example, Manhattan was able to document the highest rainfall amount during the Labor Day 2018 flood, thanks to a CoCoRaHS observer (Figure 2).



#### Figure 2. Riley County, KS CoCoRaHS reports for September 3, 2018.

#### No rain is still an important observation

Volunteers also report when it DOES NOT rain. Documenting the fact that a part of the county missed a precipitation event helps improve our understanding of drought conditions. That information is also useful in improving radar and satellite rainfall estimates.

#### Who uses the CoCoRaHS data?

CoCoRaHS is used by a wide variety of organizations and individuals. The National Weather Service, other meteorologists, hydrologists, emergency managers, city utilities (water supply, water conservation, storm water), insurance adjusters, USDA, engineers, mosquito control, ranchers and farmers, outdoor & recreation interests, teachers, students, and neighbors in the community are just some examples of those who visit the website and use the data.

One of the neat things about participating in this network is coming away with the feeling that you have made an important contribution that helps others. By providing your daily observation, you help to fill in a piece of the weather puzzle that affects many across your area in one way or another.

To join CoCoRaHS, just go to the website <u>CoCoRaHS.org</u> and click "Join Now".

If you have questions about the program, contact Mary Knapp at Kansas State University by email at <u>mknapp@ksu.edu</u> or phone at 785-313-1562.

Mary Knapp, Assistant State Climatologist <u>mknapp@ksu.edu</u>

### 9. Resources for weather education at home - All ages and skill levels

School classrooms are closed. The spring Storm Spotter trainings were cancelled. How can we get our weather education fix? The National Weather Service has a number of products available for a wide range of age groups, interest levels, and expertise.

A nice feature of all of these sites are that they are advertisement free and have been reviewed for scientific accuracy. The following are websites included in this overview and have an accompanying description.

#### **Skill level - Resource:**

Children's resources - SciJinks

Annual spotter talk - NWS Memphis Youtube

Beginner for weather enthusiasts - JetStream

Very advanced for the weather savvy - Comet MetEd

#### **Children's resources - SciJinks**

If you are interested in a playful resource geared for kids, check out SciJinks at <u>https://scijinks.gov/</u>. This is a resource developed by the National Oceanic and Atmospheric Agency (NOAA). In addition to explanations of various weather and atmospheric phenomena, there are also a number of interactive games to play (Figure 1).



#### Figure 1. SciJinks games page (NOAA)

In addition to the games, the SciJinks site has multimedia links covering various topics. There is also a sub-section for educators, with resources covering everything from standards to science fair project ideas and class room activities that are possible to do at home.

#### Annual spotter talk - NWS Memphis YouTube

Really missing that annual spotter talk from the great folks at the National Weather Service? No need to worry, there are multiple YouTube videos of recent (and previous) spotter talks addressing a range of subjects. One particular good refresher is from the National Weather Service in Memphis (though still very much applies to Kansas – storms don't understand geographic boundaries after all!) – found here: <a href="https://www.youtube.com/watch?v=JLM0U\_86sMQ">https://www.youtube.com/watch?v=JLM0U\_86sMQ</a>

#### Beginner for weather enthusiasts - JetStream

Want to focus on a particular topic and not watch a two hour video? One option is JetStream -- <u>https://www.weather.gov/jetstream/</u>. This landing page has a number of modules which allows you to divide your study into manageable pieces (Figure 2).

# JetStream - An Online School for Weather

Become weatherwise with NOAA



#### JetStream's Topics

The Atmosphere The Ocean Global Weather Clouds The Upper Air Upper Air Charts Synoptic Meteorology Thunderstorms Lightning Derechos **Tropical Weather** Doppler Radar Satellites Tsunamis The National Weather Service Appendix

#### About JetStream

The National Weather Service understands the critical value of fast, accurate weather information. We know that

#### Figure 2. JetStream home page. Source: National Weather Service

From there you can pursue a topic of interest, like clouds. Following that link will give you another set of options, from cloud identification to how clouds are formed (Figure 3).

# The Four Core Types of Clouds

While clouds appear in infinite shapes and sizes they fall into some basic forms. From his Essay of the Modifications of Clouds (1803) Luke Howard divided clouds into three categories; cirrus, cumulus and stratus.



#### Cirro-form

The Latin word 'cirro' means curl of hair. Composed of ice crystals, cirro-form clouds are whitish and hair-like. There are the high, wispy clouds to first appear in advance of a low-pressure area such as a mid-latitude storm system or a tropical system such as a hurricane.

#### Cumulo-form

Generally detached clouds, they look like white fluffy cotton balls. They show vertical motion or thermal uplift of air taking place in the atmosphere. They are usually dense in appearance with sharp outlines. The base of cumulus clouds are generally flat and occurs at the altitude where the moisture in rising air condenses.



From the Latin word for 'layer' these clouds are usually broad and fairly wide spread appearing like a blanket. They result from non-convective rising air and tend to occur along and to the north of warm fronts. The edges of strato-form clouds are diffuse.

#### Nimbo-form

Howard also designated a special rainy cloud category which combined the three forms Cumulo + Cirro + Stratus. He called this cloud, 'Nimbus', the Latin word for rain. The vast majority of precipitation occurs from nimbo-form clouds and therefore these clouds have the greatest vertical height.

#### Figure 3. Four main cloud types. Source: National Weather Service.

Kansas State University Department of Agronomy 2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506 www.agronomy.ksu.edu | www.facebook.com/KState.Agron | www.twitter.com/KStateAgron

#### Clouds

Introduction How Clouds Form → The Core Four The Basic Ten Cloud Chart Color of Clouds

#### Very advanced for the weather savvy – COMET MetEd

Perhaps you are well versed in the basic concepts of weather and want to dive into the science with your free time. If so, COMET MetEd from UCAR is for you! You can find a searchable database of modules here: <a href="https://www.meted.ucar.edu/training\_detail.php">https://www.meted.ucar.edu/training\_detail.php</a>. These can get extremely deep into the physics of forecast models, understanding Doppler radar, impacts of volcanic ash, wildfires, and much, much more. These courses are all free and are used by the experts themselves to teach college level courses!

Still need more? Another useful aggregation of home education resources can be found at: https://www.noaa.gov/education/resource-collections/special-topics-educationresources/education-at-home

Be sure to check out another weather-related article in this eUpdate issue – **"Become a volunteer weather reporter in Kansas – Join the CoCoRaHS Network"**. This article discusses a unique, non-profit, community-based network of volunteers that work collaboratively to measure and map precipitation in Kansas and across the U.S.

Thanks for reading and happy learning! Feel free to share with us any other resources you find interesting! If you would like help navigating these websites, or are interested in something that you can't find, let us know and we will see what we can uncover.

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