Issue 731

K-STATE Research and Extension

Extension Agronomy

eUpdate

02/08/2019

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 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. Most years, this can easily be accomplished by topdressing in January or February, since temperatures are cold enough to keep canola from actively growing. If nitrogen 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.

Current conditions for most of Kansas are wet. The greatest limitation to topdressing at this time will be waiting for the ground to freeze up or to dry out. Warmer December temperatures caused the crop to actively grow and add new leaf area, but the recent downturn in temperatures has slowed it back down. Canola can withstand this freezing and thawing process as long as the temperature swings are not too dramatic. Producers should check their fields for surviving plants before applying a topdress application (Figure 1). It may be advisable to wait until canola is actively growing again before topdressing in those fields where stand thinning is greatest. 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 just as plants begin to show increased growth, but before the plants bolt. Nitrogen uptake increases rapidly just 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

Profile N test	**<u>Yield potential (lbs/acre)</u>**

(lbs/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

Source: Great Plains Canola Production Handbook
http://www.ksre.ksu.edu/bookstore/pubs/mf2734.pdf

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 lbs/acre sulfate-S (10 ppm SO_4-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 lbs 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 lbs 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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2. Marestail in soybeans: Strategies for the best control

Controlling marestail in soybeans continues to be a big challenge for Kansas no-till producers. Because soybeans are generally planted later in the season, and marestail generally germinates in the fall or early spring, application timing and weed size are critical factors for successful control.

Figure 1. Glyphosate-resistant marestail in soybeans. Photo by Dallas Peterson, K-State Research and Extension.

Mother Nature is pretty good at controlling some marestail throughout the winter. Research has shown that up to 80% of marestail can die over the winter as a result of cold temperatures and/or lack of adequate moisture. In addition, a well-established cover crop in the fall can further reduce marestail establishment and survival and often is quite effective for marestail control. However, the marestail that do survive are often robust and can be difficult to control with herbicides, especially later in the spring. Fortunately, there are still a few herbicide options that can help manage overwintering and new emerging marestail in the spring.

Early spring options

In the early spring, using a growth regulator herbicide such as 2,4-D and/or dicamba is an inexpensive and effective option to control rosette marestail. Dicamba has provided better marestail control than 2,4-D and will also provide some residual control, especially at higher use rates. A combination of the two will give broader spectrum weed control than either one alone. Recent observations in Kansas suggests marestail will bolt in April throughout most of the state, so timing control before the end of March is recommended. Application of dicamba and 2,4-D in March also generally allows adequate time ahead of planting soybeans to meet required pre-plant intervals.

Using herbicides with longer residual helps control weeds that germinate between treatment and soybean planting. Products that include Canopy EX, Autumn Super, Classic, FirstRate, Sharpen, metribuzin, or Valor can help provide residual control against several broadleaf species, including marestail. However, it is very important to consult and follow the herbicide label guidelines for the required pre-plant intervals prior to planting soybeans.

Pre-plant options

As soybean planting nears, existing marestail plants can become difficult to control because plants will have bolted and be considerably larger. Herbicides to apply as a burndown prior to planting include tank mixes of glyphosate with FirstRate, Classic, Sharpen, Optill, or 2,4-D. Be very careful to follow label directions when using 2,4-D prior to soybean planting. The plant-back restriction ahead of soybean can range from 7-30 days depending on rate and formulation. Sharpen generally provides good marestail control and can be applied any time before soybean emergence. However, it is still most effective if applied before marestail starts to bolt, in a tank-mix with other herbicides, when used with methylated seed oil, and at spray volumes of 15 gallons per acre or more. Elevore is a new herbicide that has provided similar marestail control to dicamba, but needs to be applied at least 14 days prior to planting.

Pre-plant restrictions for dicamba products such as Clarity, Banvel, and others range from 14 to 30 days depending on product, application rate, rainfall amounts, and geography. However, with the introduction of Roundup Ready 2 Xtend soybeans, the new dicamba products Xtendimax, FeXapan, and Engenia have no pre-plant interval restrictions applied ahead of Xtend soybeans and should be some of the more effective treatments for marestail control in that scenario. Xtendimax, FeXapan, and Engenia are still most effective on marestail prior to bolting.

One additional herbicide to consider as a rescue burndown application to control bolting marestail prior to soybean planting is glufosinate (Liberty and others). Although, it would be better to control marestail at an earlier stage of growth, glufosinate has been one of the most effective herbicides to control bolting marestail. Glufosinate also has broad spectrum non-selective activity on other broadleaf and grass species if treated at a young growth stage. Glufosinate is primarily a contact herbicide, so a spray volume of 15 gallons per acre or greater generally provides the most consistent weed control. Glufosinate tends to work best under higher humidity and warm, sunny conditions at application.

Post-emergence options

Controlling marestail in the growing soybean crop can be the biggest challenge for producers, especially in non-traited soybeans or Roundup Ready soybeans (if marestail is glyphosate resistant). The most successful treatments for large marestail in Roundup Ready soybeans have been tank-mixes of glyphosate + FirstRate, glyphosate + Classic, or glyphosate +Synchrony. However, some marestail may also be ALS-resistant, and thus not controlled by those herbicides either.

If Roundup Ready 2 Xtend soybeans are planted, Xtendimax, FeXapan, and Engenia should be some of the most effective herbicides for post-emergence control of marestail in soybeans. Remember that Xtendimax, FeXapan, and Engenia can only be applied to Xtend soybeans.

Another post-emergence option to control marestail in soybeans is to plant Liberty Link soybeans and use glufosinate herbicide. It is important to remember that glufosinate can only be applied postemergence on Liberty Link soybeans.

For more detailed information, see the “2019 Chemical Weed Control for Field Crops, Pastures, and Noncropland” guide available online at https://www.bookstore.ksre.ksu.edu/pubs/SRP1148.pdf or check with your local K-State Research and Extension office for paper copy.

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3. Late-winter preplant applications for kochia control

Producers should begin soon in planning their program for controlling kochia. The spread of glyphosate-resistant kochia populations throughout western Kansas, and the difficulty growers have had controlling these populations, suggest that control measures should begin prior to emergence of kochia.

Major flushes of kochia emerge in late February to early March and into April. If allowed to emerge, postemergence herbicide applications often will not provide adequate control. Incomplete control of these dense populations (Figure 1a.) is likely in these situations. When the kochia is glyphosate-resistant and complete herbicide coverage is not possible, results can be very poor when trying to use postemergence products to control dense populations. The dense populations may also be stressed, which reduces the effectiveness of postemergence herbicide applications.

The choice of herbicides for effective preemergence control of kochia in February and early March will vary depending on subsequent cropping intentions. Various cropping scenarios are discussed below.

Note*: All graphs in this article are based on data from irrigated plots at the K-State Southwest Research-Extension Center at Tribune, and with populations of kochia that are susceptible to triazines. The kochia at this site is a mixed population of glyphosate-resistant and susceptible plants.*

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

Figure 1b. Kochia and Russian thistle "tumbleweeds" in a corn stubble field. Tumbling plants have spread kochia and Russian thistle seed into what otherwise may have been a relatively clean field, making a pre-plant treatment advisable. Photo by Curtis Thompson, K-State Research and Extension.

Components of the herbicide program to effectively manage kochia at germination.

Each herbicide program needs to consist of two components. First, a very soluble and effective herbicide that can be incorporated with very little precipitation, i.e. dicamba. Second, an herbicide that has longer residual and requires perhaps 0.75 inches or more precipitation for adequate incorporation. During January or February, precipitation events often are on the light side with heavier precipitation events more common in the spring months. Dicamba may persist for 4 to 6 weeks and the longer residual herbicide will resume controlling kochia once incorporated and perhaps if dicamba residual runs out. Included below are herbicides by crop that have longer residual control.

The best timing for this application is January through the first week of March but prior to kochia emergence which can vary depending on weather conditions. The later into the season, the more likely it is there will be some small, emerged kochia, which increases the risk of control failure. If producers wait until later to apply the burndown and preemergence herbicide in the same application, the kochia will be larger and most likely will not be controlled.

Fields going to sorghum or corn

A combination of glyphosate (using a minimum of 0.75 lb ae per acre) with herbicides that have PRE and POST activity on kochia is most valuable. Tank mixing 8 to 16 oz of dicamba with 1 to 2 pints of atrazine will control existing broadleaf and grass weeds, and will provide extended preemergence control of kochia often into May as shown in Figures 2 and 3. An application of Clarity alone, shown in Figure 2, suggests that a pint provides better control than 8 oz. However, a combination of atrazine and Clarity is better than Clarity alone.

Fields going to corn only

Dicamba plus Corvus or Balance Flexx are good residual herbicides but should be mixed with a little atrazine. December applications have also been effective in managing kochia. Corvus+atrazine, Scoparia+atrazine, and Atrazine+Clarity were among the best treatments in the experiment shown in Figure 3B. Scoparia contains Isoxaflutole as does Corvus and Balance Flexx, however is not labeled ahead of corn planting. The 24c Special local need label for use of Scoparia to control kochia in fallow or ecofallow has a 4-month plant-back restriction to corn and a 6-month plant-back restriction to sorghum. Figure 3B and 3C also show treatments containing Sencor (metribuzin) or Zidua which both have activity on kochia and can be applied in December through February ahead of planting corn.

Fallow fields going to fall-planted wheat

Atrazine should not be used in this situation. Metribuzin (Sencor and multiple generics) is a triazine and can substitute for atrazine and has a 4-month plant-back restriction to wheat. Additional products include Scoparia, Authority MTZ, and other products containing sulfentrazone. Zidua also has good activity but requires significant rainfall thus applying Zidua with dicamba is critical (3b and 3c).

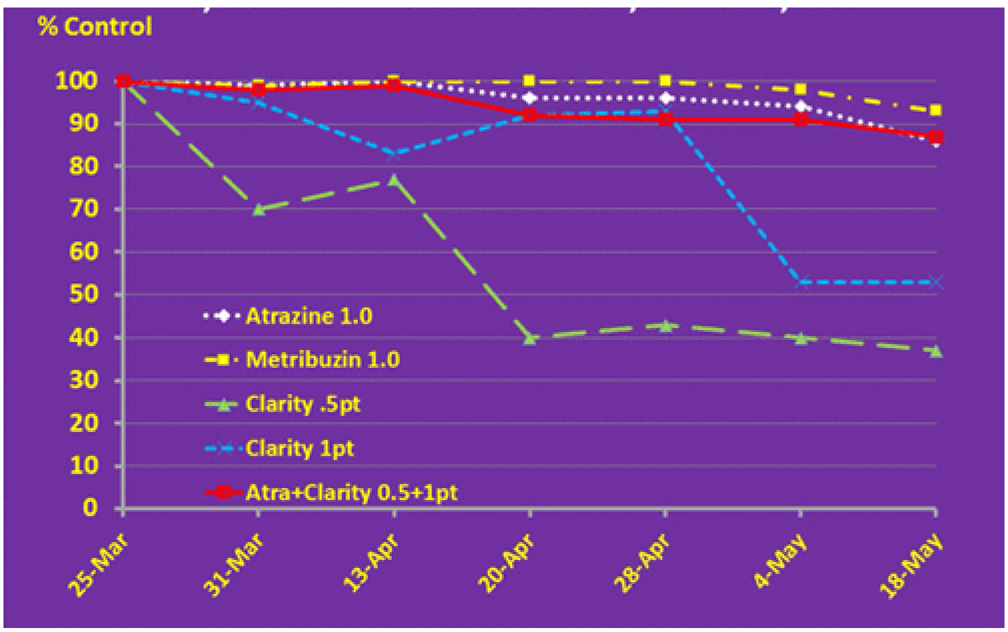

Figure 2. Early preplant herbicides applied March 16, 2012 for kochia control at Tribune, KS.

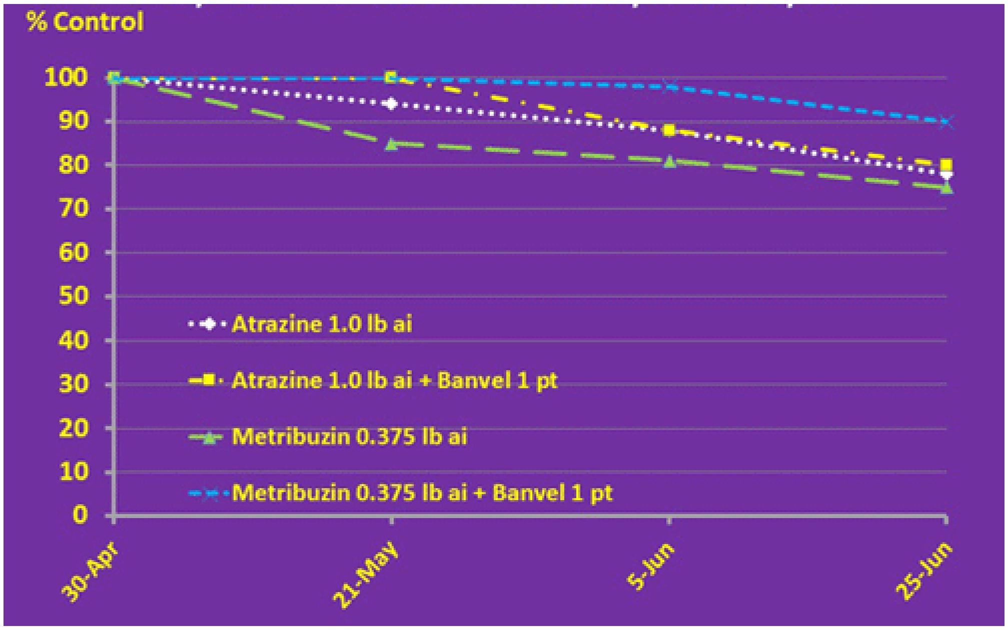

Figure 3. Early preplant herbicides applied March 15, 2013 for kochia control at Tribune, KS.

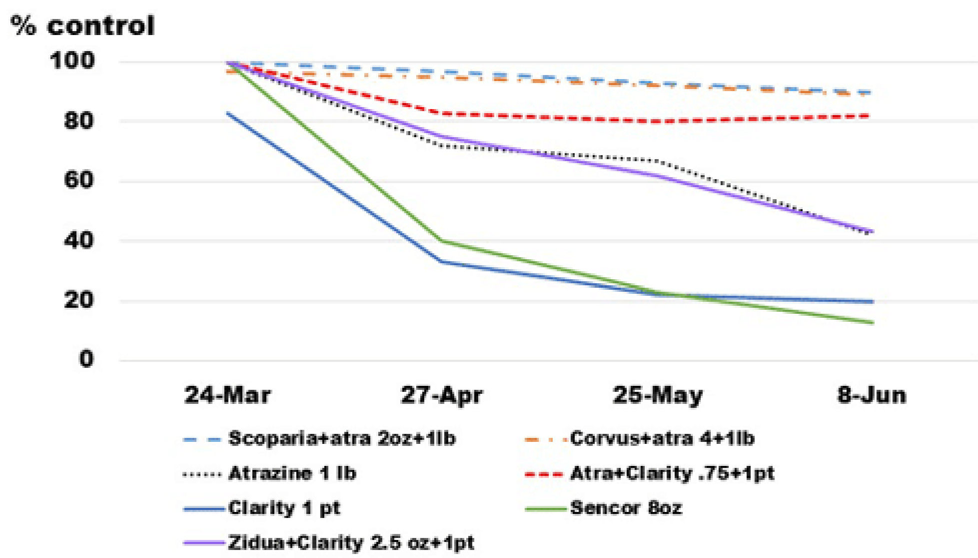

Figure 3b. December 20th applied herbicide treatments for kochia control at Tribune, KS during 2015-16.

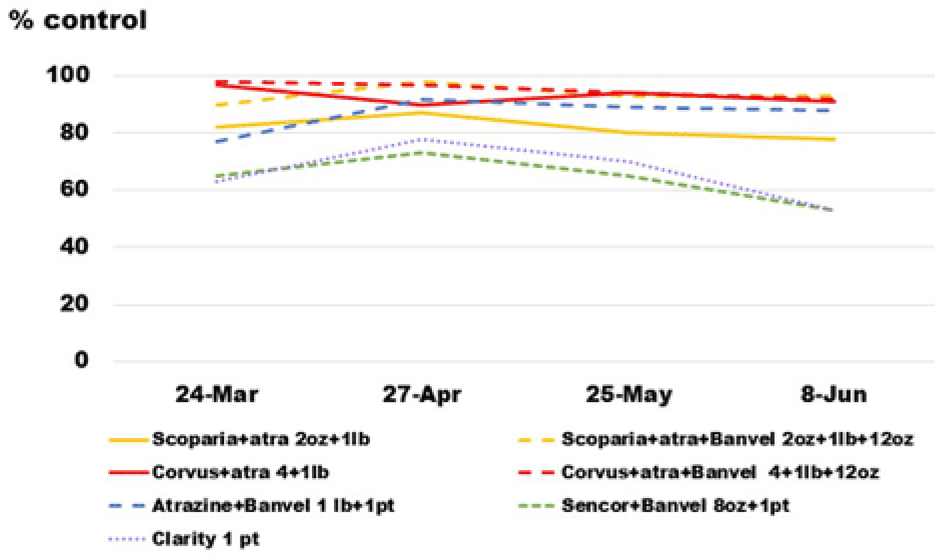

Figure 3c. February 15th applied herbicide treatments for kochia control at Tribune, KS in 2016.

If growers miss this kochia emergence window, note the photos of very small kochia on March 10 and March 20 of 2015 and the corresponding less-than-adequate control of the small emergence kochia shown in the figures (Figures 4, 5, 6, 7, and 8).

Figure 4. An application of herbicides was made to these kochia on March 10, 2015. Photo by

Curtis Thompson, K-State Research and Extension.

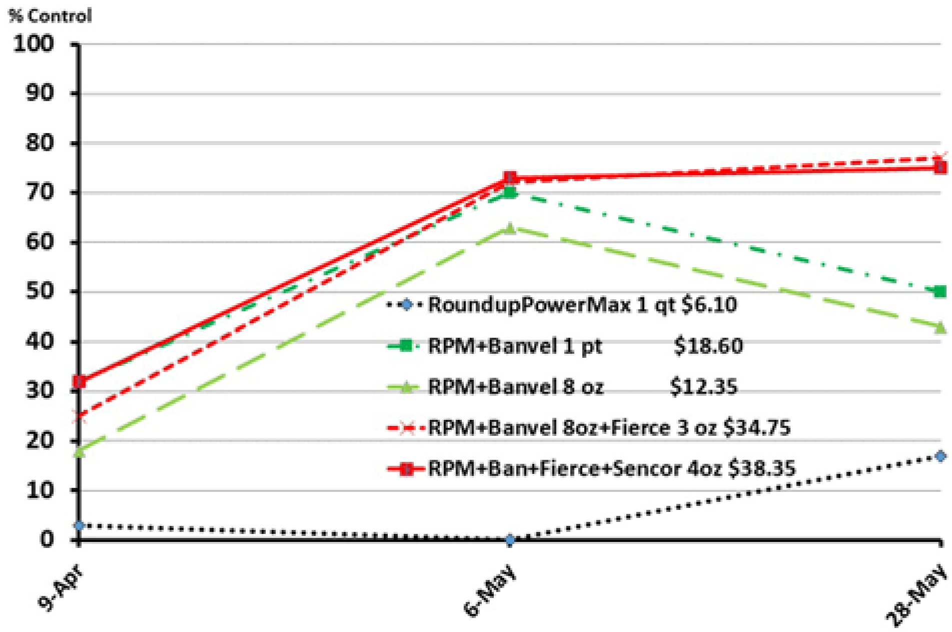

Figure 5. EPP/POST herbicides applied March 10, 2015 for kochia control at Tribune, KS. Kochia at cotyledon stage.

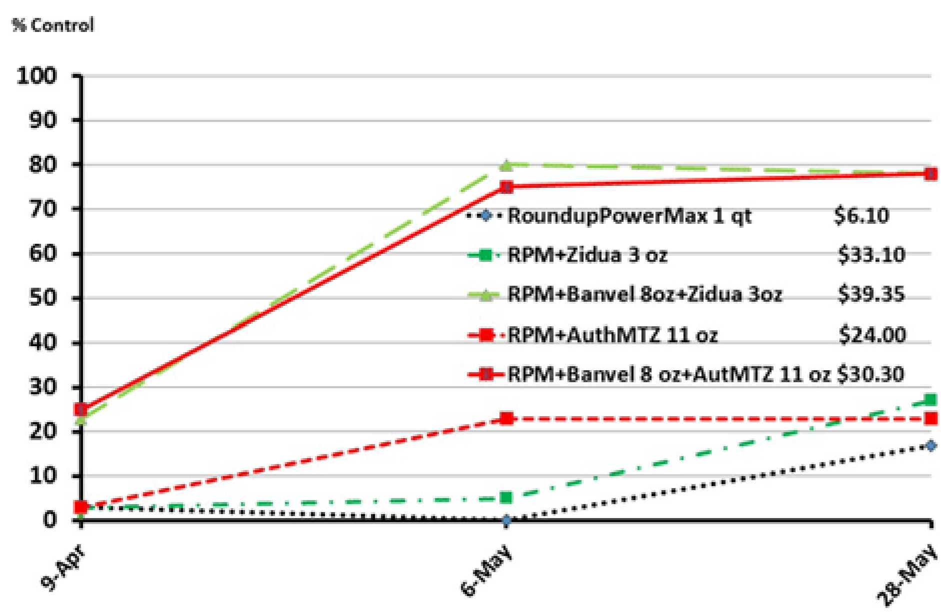

Figure 6. EPP/POST herbicides applied March 10, 2015 for kochia control at Tribune, KS. Kochia at cotyledon stage.

Figure 7. An application of herbicides was made to these kochia on March 20, 2015. Photo by Curtis Thompson, K-State Research and Extension.

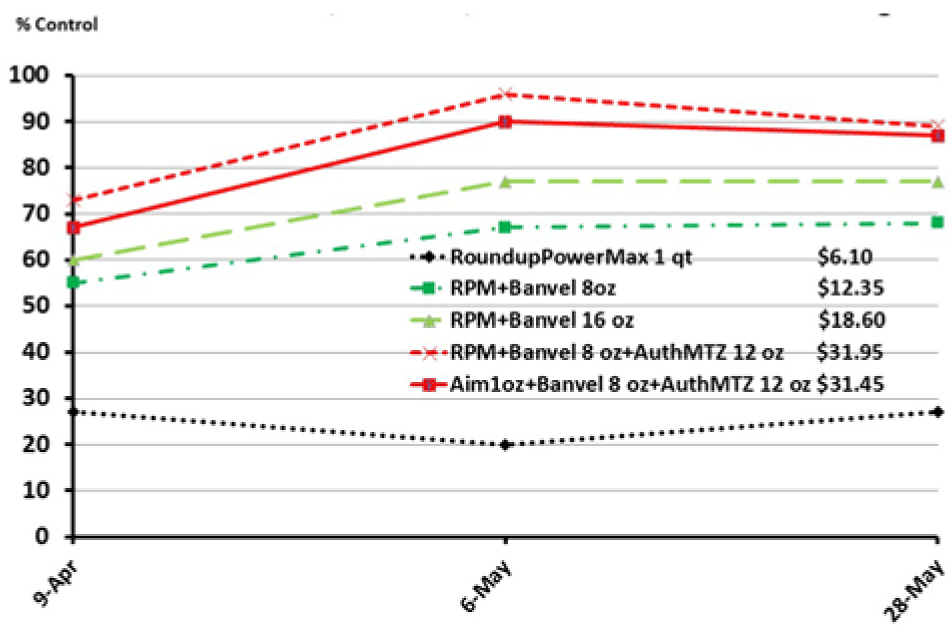

Figure 8. EPP/POST herbicides applied March 20, 2015 for kochia control at Tribune, KS. Kochia at fuzz-ball stage.

Fields going to sunflowers this spring

Planting sunflower into a clean seedbed is a key step to achieving good season-long control of all broadleaf and grassy weeds. But it is especially important for getting good control of any weed populations, such as kochia, that are resistant to glyphosate or ALS-inhibitor herbicides and cannot be controlled with POST applied herbicides in sunflower.

The best approach to kochia control in sunflower is to start in February/early March with a tankmix of glyphosate (using a minimum of 0.75 lb ae/are) and Spartan (sulfentrazone), Spartan Charge (sulfentrazone+Aim), Broadaxe or Authority Elite (sulfentrazone+Dual Magnum), Authority Supreme (sulfentrazone+Zidua) before kochia begin to germinate. The sulfentrazone and Zidua will provide excellent preemergence control of kochia ahead of sunflower planting. Figure 9 indicates that 6 oz of Spartan controlled kochia very effectively in the Tribune experiments up to early June. It is very possible that as little as 4 oz could have done a similar job at the Tribune location because of the 7.8 pH and 1.8% organic matter soil. The label does not allow a March application of dicamba when intending to plant sunflower. Monitor fields closely as additional glyphosate or Gramoxone SL treatments may be required prior to sunflower planting. Select preemergence products that are effective on kochia and apply at planting to extend control of kochia and other weeds.

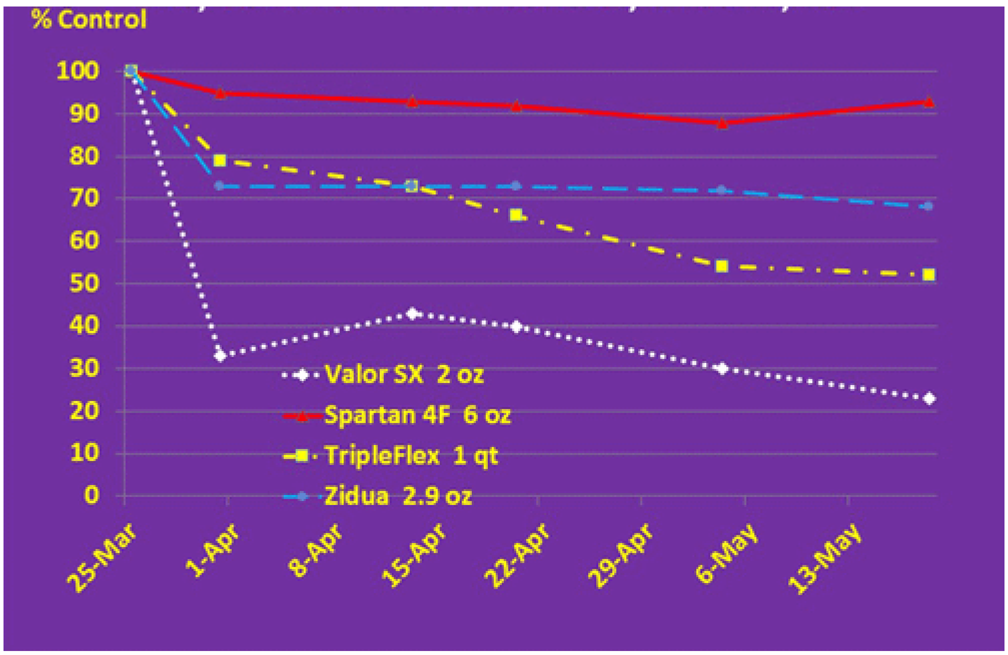

Figure 9. Early preplant herbicides applied March 16, 2012 for kochia control at Tribune, KS.

Fields going to soybeans this spring

The best management strategy for controlling kochia in soybeans is similar to the control strategy for sunflower, but there are more herbicide options for soybeans. Start in February or early March with a tankmix of glyphosate (using a minimum of 0.75 lb ae/acre) and 8 to 16 oz/acre of Clarity prior to kochia emergence. The use of Clarity requires a minimum accumulation of 1 inch of rain and then 28 days prior to planting soybeans. As indicated in the label, Clarity cannot be used as a preplant treatment in soybeans in areas with less than 25 inches of annual rainfall.

Paraquat tank-mixed with metribuzin (Dimetric, Metribuzin, Sencor and others) will provide extended residual control of kochia, as long as the population of kochia is susceptible to triazine herbicides.

Figure 2 shows the effectiveness of a full pound of metribuzin, which is not practical for western Kansas. Figure 3 shows the effectiveness of 3/8 lb of metribuzin alone or with dicamba which provided residual kochia control into May, especially when dicamba was added. Metribuzin can injure soybeans depending on soil texture, organic matter, and soil pH, so be sure to follow label guidelines regarding soil characteristics and guidelines regarding use rate on soybeans.

Authority-based herbicides that contain sulfentrazone could be considered for use prior to kochia emergence to manage an early flush of kochia. However, it's important to note the crop rotation restrictions on these products. The Valor-based products have not provided adequate control of kochia (Figure 9). Authority-based products provided excellent control of kochia well into June (Figure 10). Also, Zidua has activity on kochia. It appears that more rain is required for activation of Zidua; however, once activated, no additional kochia emerged. For adequate kochia control with Zidua, using maximum labels rates for your soil type would be recommended.

Fields going to wheat this fall

If kochia is emerging in row crop stubble intended to be planted to wheat this fall, herbicide options exist that provide residual kochia control. Atrazine cannot be used in this situation, as this treatment is off-label. The following herbicides could provide effective residual control of kochia for fields to be planted to wheat this fall: dicamba, metribuzin (Dimetric label indicates ½ to 2/3 of a pound), Corvus, Balance Flexx, Scoparia (equal to Balance Pro), and Lumax EZ. These products allow wheat to be planted 4 months following application. Effectiveness of some of these herbicide treatments is shown in Figures 2, 3, 10, and 11.

These treatments can be effective when made prior to kochia emergence. A November application of one pound of atrazine was effective through June 12. However, this treatment is labeled only if corn or sorghum will be planted the following year. The November application of Corvus was not adequate. The addition of metribuzin to Corvus would have improved kochia control. HPPD inhibitors should always be applied with a triazine. Only metribuzin, which is a triazine, can be applied in the late fall or early spring when wheat will be planted in the fall. February and March applications of Corvus and metribuzin were very similar and effective. This suggests that if weather cooperates and a window for application is available in February, getting these early treatments applied at that time could be beneficial.

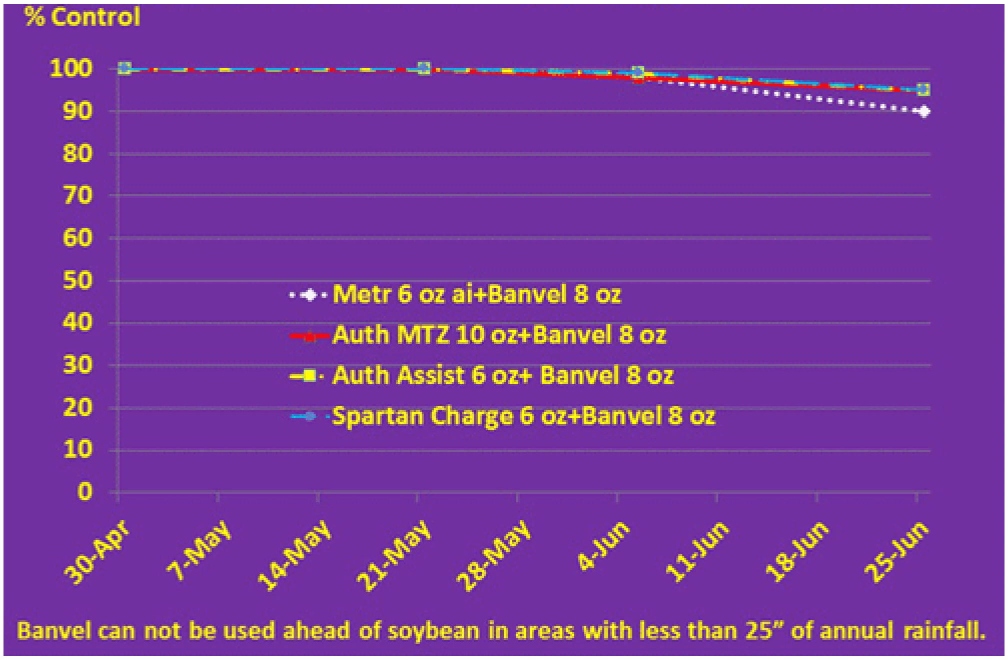

Figure 10. Early preplant herbicides applied March 15, 2013 for kochia control ahead of soybean at Tribune, KS.

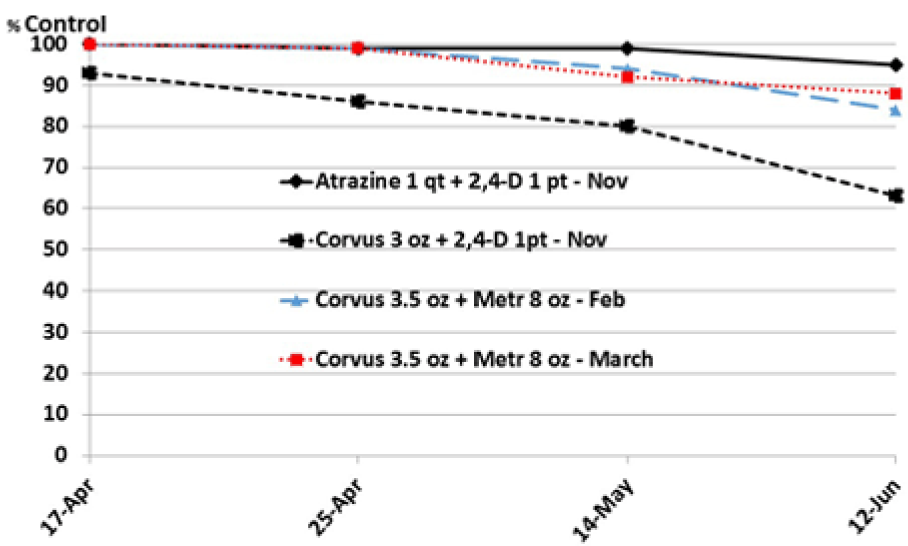

Figure 11. Herbicides applied November 30, 2013, and February 16 and March 15, 2014 for kochia control in fallow at Tribune, KS.

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Ag-Climate Update

Office of the Kansas State Climatologist | January 2019 | climate.k-state.edu

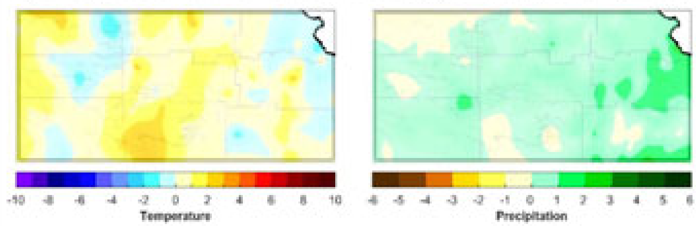
Variable Temperatures Rock January

Summary

Temperatures varied wildly over the month but monthly average was just slightly wamer than normal (Fig. 1). State-wide average temperature for January was 30.3 °F, which is 0.3 degrees warmer than normal. Only the Northeast Division was cooler than normal, with an average of 27.1 °F, or 0.4 degrees cooler than normal. The South Central Division was the warmest with an average of 33.3 °F or 1.1 degrees warmer than normal. Temperatures ranged from a high of 71 °F at Ashland, Clark County, on the 7th to a low of -10 °F at Marysville, Washington County, on the 25th.

State-wide average precipitation for the month was 1.00 inches, 131 percent of normal (Figs. 1 and 2). Root zone soil conditions were wetter across Kansas (Fig. 2b). Monthly snowfall totals ranged from trace amounts in southern Kansas to 18.3 inches in Mitchell County.

Fig.1. Departures from normal temperature (°F) and precipitation (inches)



Poor Wheat Stand (G. Sassenrath)

Snowy Trees (J. Adee)

Impacts

The fluctating temperatures resulted in several freeze/thaw cycles in soil temperatures as well. While the wheat crop can typically withstand negative air temperatures well during the winter, this pattern can result in frost heaving of plants, with increased risk of damage to the roots/crown in the cold. The problem can be more accute in poorly established fields (Sassenrath photo) and fields covered by a layer of ice.

Snow cover (Adee photo) could limit the problem. However, that cover was intermittent.

Fig. 2a

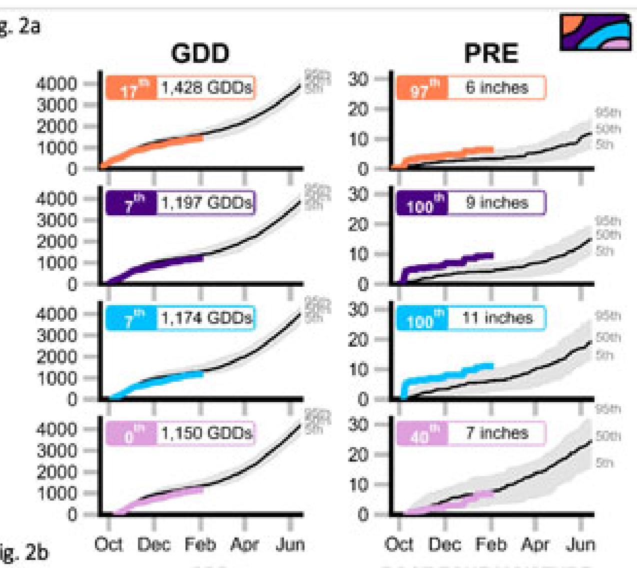


Fig. 2b

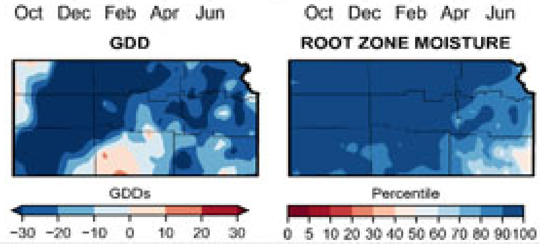
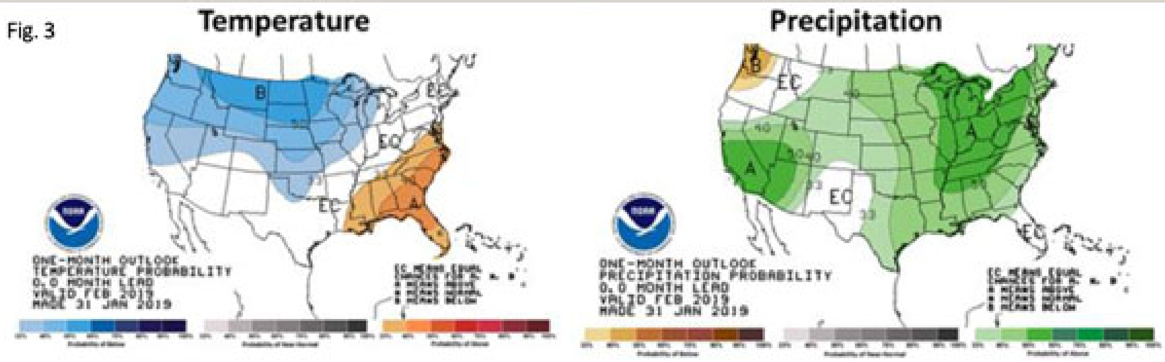


Fig. 2a. Planting zone averaged accumulated Growing Degree Days (GDD) and precipitation (PRE) for winter wheat from planting date until Jan. 31 and their corresponding percentiles (base-period: 1981-2010). GDD is in °F.

Fig. 2b. Spatial distribution of departures from normal GDDs for January and the root zone soil moisture percentile (from the GRACE satellite) as of Jan. 28.

Fig. 3



CPC 1-month Temperature Outlook

The Climate Prediction Center (CPC) outlook for February favors a cooler-than-normal pattern across most of the state (Fig. 3). This cooler pattern stretches northward to the Canadian border. For Kansas, normal average temperatures range from 31.6 °F at Colby in the northwest to 38.4 °F at Columbus in the southeast. It is important to remember that this represents the average for February. The wide variation in temperatures seen in January is likely to continue, with much warmer-than-normal temperatures still possible.

CPC 1-month Precipitation Outlook

Outlook for precipitation is expected to be greater than normal for February (Fig.3). The fact that wetter-than-normal conditions are also expected in the Desert Southwest and in the Southern Plains is encouraging. Atmospheric systems from the southwest tend to bring greater amounts of moisture than those that originate in the north. As we move out of winter, the normal expected precipitation amount increases, with a sharp gradient from northwest to southeast. Normal precipitation in Colby for February is 0.48 inches. For Columbus, the normal is 2.21 inches.

Highlight

The major event in January was the winter storm that extended across much of the state from January 12th to January 13th. Snowfall was a major feature from west central Kansas through east central Kansas. The heavy snow resulted in extended power outages in the Kansas City metropolitan areas. In western and central Kansas, multiple accidents were associated with the storm. The storm was followed by cold temperatures, although the coldest readings did not arrive until the end of the month.

January Extremes

Kansas Mesonet, operated by the Department of Agronomy at Kansas State University, observed the following extremes this January (http://mesonet.k-state.edu/weather/historical/):

Highest air temperature: 74.5°F on Jan. 7 at Ashland 8S

Lowest air temperature: −10.8° F on Jan. 31 at Hiawatha

Highest 4-in soil temperature: 53.1°F on Jan. 8 at Cherokee

Lowest 4-in soil temperature: 20°F on Jan. 3 at Grant

Highest 30-ft wind speed: 53.4 mph on Jan. 1 at Garden City

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5. Learn about the new monthly Kansas Ag-Climate Update

The Office of the Kansas State Climatologist has reported monthly climate summaries over decades. Beginning in 2019, a new monthly Ag-Climate Update for Kansans will be appearing in the Extension Agronomy eUpdate. Each installment will typically appear in the first or second week of each month. The Ag-Climate Update will provide basic climate information, climate impact, growing-degree-day (GDD) information for winter wheat or corn crops, climate outlook, and observed monthly extremes in Kansas. The first Ag-Climate Update is included in this issue of the eUpdate, "Variable Temperatures Rock January".

To help our audience understand all the information presented, the following information serves as a brief description for observational data selections and computation methods used in the Ag-Climate Update.

Data collection

We selected daily and monthly temperature and precipitation observations from the Applied Climate Information System, which is a seamless, integrated, and quality-controlled data system initially sponsored by USDA Natural Resource Conservation Service, the World Agricultural Outlook Board, and Regional Climate Centers in 1998. For the soil moisture data, we used NASA satellite of the Gravity Recovery and Climate Experiment. We also selected observations from the Kansas Mesonet for reporting monthly extremes observed in Kansas.

What is a climate anomaly?

In the Ag-Climate Update, we presented the monthly temperature (^{o}F) and precipitation (inches) anomalies (Figure 1). A climate anomaly is defined as a departure from the base-period 30-year average (from 1981 to 2010). A positive temperature or precipitation anomaly indicates that the observed temperature or precipitation was warmer or wetter than the base-period average value, while a negative anomaly indicates that observed temperature or precipitation was cooler or drier than the base-period average value. The color contour lines in Figure 1 indicate 1 ^{o}F or 1-inch interval for temperature and precipitation, respectively (Figure 1).

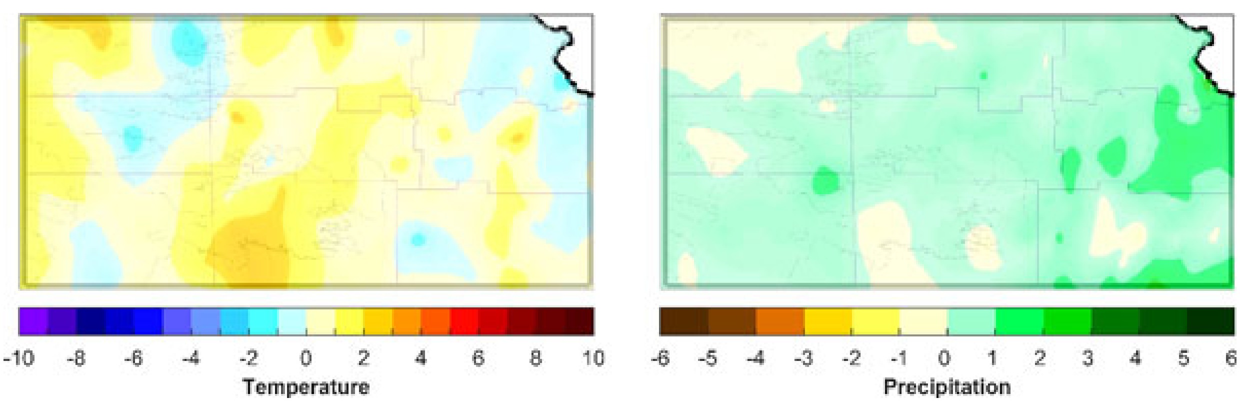

Figure 1. Departures from normal temperature (^{o}F) and precipitation (inches) for January of 2019

What are Growing Degree Days?

The heat unit (or thermal time) concept, commonly called growing degree days (GDD), has been used for over two centuries. This concept is to track plant-temperature relationships and phenological response through the accumulation of daily temperatures during the growing season (McMaster and Smika 1988; McMaster and Wilhelm 1997). More than a dozen of GDD calculation variants have been developed and tested for GDD calculations. The different methods account for changes in variety- and climate-dependent factors, and are thus more inclusive (Aiken 2005; Salazar-Gutierrez et al. 2013; Wang 1960).

Figure 2a displays the integrated information about the growing-degree-days (GDD) (for winter wheat or corn, depending upon the season). Accordingly, four zones for winter wheat planting dates are applied for calculating GDD (an embedded upper-right corner map in Fig. 2a). The colors coded from southeast to northwest Kansas are correspondingly applied to GDD and accumulated precipitation (PRE) calculations shown in Figure 2a. The planting dates assumed are *September 20, October 2, October 7, and October 12* from southeast to northwest Kansas. The GDD and PRE are spatially averaged in each zone and temporally summed from planting dates until the last day in the month of the current Ag-Climate Update. Each GDD subfigure in Figure 2a includes a range of historical daily GDD by a shading area to represent from 5^{th} to 95^{th} percentiles, a median GDD line, a rank of GDD and a current GDD value shown in a color-coded box, all of which are calculated by using the daily base-period of 1981 to 2010. Similarly, each PRE subfigure includes the same information as the GDD but for accumulated precipitation. For example, a precipitation percentile of 100^{th} would indicate that it was the highest accumulated precipitation on the last day in the month (wettest).

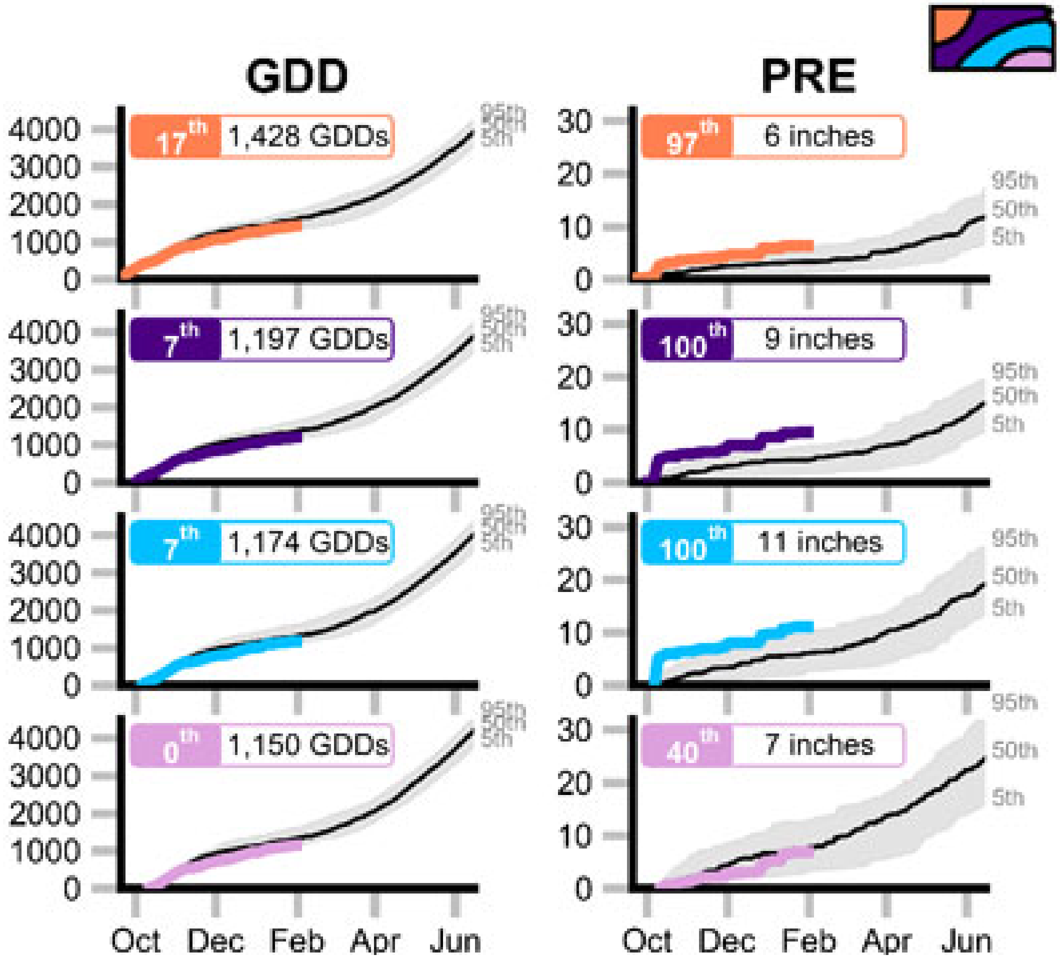

Figure 2a. Planting zone-averaged accumulated GDDs (GDD by °F) and precipitation (inches) for winter wheat from planting dates until January 31 and their corresponding percentiles.

To calculate the GDD, we used,

$$GDD = \sum_{planting}^{nDays} DD \qquad (1)$$

where

$$DD = \frac{T^*_{max} + T^*_{min}}{2} - T_{base}$$

$$T^*_{max} = \begin{cases} T_{max} & \text{if } T_{base} < T_{max} < T_{opt} \\ T_{base} & \text{if } T_{max} \leq T_{base} \\ T_{opt} & \text{if } T_{max} \geq T_{opt} \end{cases}$$

$$T^*_{min} = \begin{cases} T_{min} & \text{if } T_{base} < T_{min} < T_{opt} \\ T_{base} & \text{if } T_{min} \leq T_{base} \\ T_{opt} & \text{if } T_{min} \geq T_{opt} \end{cases}$$

For winter wheat, the base temperature (T_{base}) and optimum temperature (T_{opt}) were 32 °F (0 °C) and 70 °F (21 °C), respectively.

Figure 2b shows the spatial distributions for GDD anomalies and root zone moisture across Kansas. The GDD is displayed as departures from normal GDDs for the month of the current (base-period: 1981-2010). Root zone soil moisture (Figure 2b, right panel) shows how much water is stored in the first one-meter of soil as a probability of occurrence in the period of record from 1948 to the present. For example, a 100th percentile indicates that the root zone soil moisture is the highest observed on record while a value near the 50th percentile indicates near-average conditions. The satellite observations from the Gravity Recovery and Climate Experiment were integrated with ground- and space-based meteorological observations within a land surface model to generate the continuous soil moisture that extends back to 1948 (Houborg et al. 2012; Zaitchik et al. 2008).

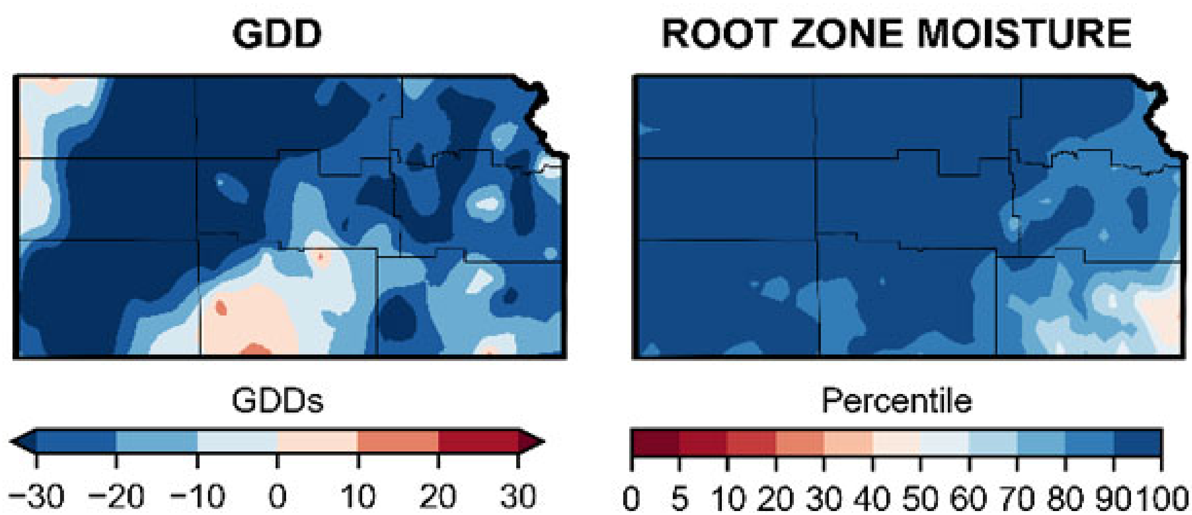

Figure 2. Spatial distribution for GDD anomalies and root zone moisture across Kansas.

What are Extreme Degree Days?

We will calculate the extreme degree day (EDD) during the summer months (Lobell et al. 2013; Schauberger et al. 2017; Schlenker and Roberts 2009). The EDD is defined as the sum from planting to the current day of temperatures that are higher than optimal.

$$EDD = \sum_{planting}^{nDays} DD \quad (2)$$

where

$$DD = \begin{cases} T_{max} - T_{opt} & \text{if } T_{max} > T_{opt} \\ 0 & \text{if } T_{max} \leq T_{opt} \end{cases}$$

For winter wheat, the optimum temperature ($T_{opt} = 70^{o}F$) is consistent with GDD calculation. The EDD is a metric for estimating impacts that may occur under crop heat stress conditions (outside of optimum temperatures) for crop development and growth as well crop yields.

For corn we will use 86 ^{o}F (30 ^{o}C) as the upper temperature threshold and 50^{o}F (10^{o}C) as the lower temperature threshold (Angel et al. 2017). The base temperature (T_{base}) for corn's GDD is 50 ^{o}F (10^{o}C) in the Ag-Climate Update.

Understanding the Precipitation and Temperature Outlook Maps

Taking from the NOAA Climate Prediction Center, **Figure 3** includes two forecast maps of the probability of precipitation and temperature departing from the 30-year average from 1981 to 2010. Both maps indicate a probability that the observed average temperature or total precipitation over the upcoming 30 days will be in the range of one of three possible categories: below (B), normal (N), or above (A) as indicated by three color bars in each of the maps. In other words, these three categories can be defined by separating the 30 years of the climatology period (1981 to 2010) into the coldest or driest 10 years, the middle 10 years, and warmest or wettest 10 years. In a climatology sense, the 33.3% (one in three) probability is also called the climatological probability. The summation of three categories at any point on the map is 100%. The color shading area indicates the degree of confidence the forecaster has in the category indicated (color bars). The darker the colors, the greater is the level of confidence. In addition, the numbers shown in labels for contours provide the probability that indicated category (A, B, or N) will occur (Sutherland, et al. 2018).

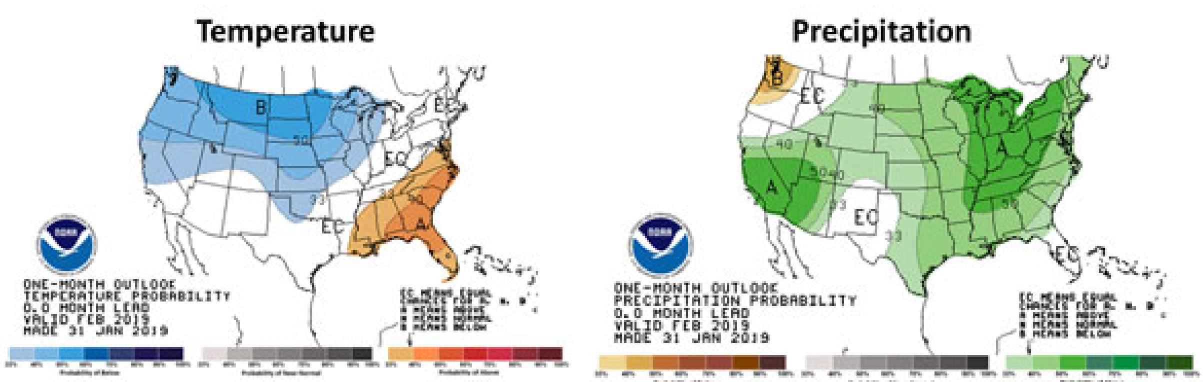

Figure 3. One-month outlook of temperature and precipitation departures in a sense of forecasting probabilities.

We hope this article serves to explain the features in the new Ag-Climate Update. Stay tuned for the February Ag-Climate Update!

References

Aiken, R. J. A. J., 2005: Applying thermal time scales to sunflower development, *Agronomy Journal*, 97**,** 746-754.

Angel, J. R., M. Widhalm, D. Todey, R. Massey, and L. Biehl, 2017: The U2U corn growing degree day tool: Tracking corn growth across the US Corn Belt. *Climate Risk Management*, 15**,** 73-81.

Houborg, R., M. Rodell, B. Li, R. Reichle, and B. F. Zaitchik, 2012: Drought indicators based on model-assimilated Gravity Recovery and Climate Experiment (GRACE) terrestrial water storage observations. *Water Resources Research*, 48.

Lobell, D. B., G. L. Hammer, G. McLean, C. Messina, M. J. Roberts, and W. Schlenker, 2013: The critical role of extreme heat for maize production in the United States. *Nature Climate Change*, 3, 497-501.

McMaster, G. S., and D. E. Smika, 1988: Estimation and evaluation of winter wheat phenology in the central Great Plains. *Agricultural and Forest Meteorology*, 43, 1-18.

McMaster, G. S., and W. Wilhelm, 1997: Growing degree-days: one equation, two interpretations. *Agricultural and forest meteorology*, 87, 291-300.

Salazar-Gutierrez, M., J. Johnson, B. Chaves-Cordoba, and G. Hoogenboom, 2013: Relationship of base temperature to development of winter wheat. *Int. J. Plant Prod*, 7, 741-762.

Schauberger, B., and Coauthors, 2017: Consistent negative response of US crops to high temperatures in observations and crop models. *Nature communications*, 8, 13931.

Schlenker, W., and M. J. Roberts, 2009: Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change. *Proc Natl Acad Sci U S A*, 106, 15594-15598.

Sutherland, A., Knapp, M., McManus, G., Campbell, A. 2018: Climate Outlooks Serving Agriculture: National Weather Service. MF3432.

Wang, J. Y., 1960: A critique of the heat unit approach to plant response studies. *Ecology*, 41, 785-790.

Zaitchik, B. F., M. Rodell, and R. H. Reichle, 2008: Assimilation of GRACE Terrestrial Water Storage Data into a Land Surface Model: Results for the Mississippi River Basin. *Journal of Hydrometeorology*, 9, 535-548.

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6. Updated - Prescribed burning workshops scheduled for 2019

Several prescribed burning workshops have been scheduled for the months of February and March, with more in the planning stages. Partners involved include K-State Research & Extension, Kansas Forest Service, USDA-NRCS, USDA-FSA, Kansas Conservation Districts, Department of Wildlife, Parks & Tourism, the National Weather Service, Local Fire Departments and Emergency Management Personnel, Pheasants Forever, The Wildlife Society – Kansas Chapter, and Great Plains Fire Science Exchange.

Each workshop lasts about 4-5 hours and includes topics on reasons for burning, regulations, weather considerations, liability, burn contractors, equipment and crew, hazards, fuels, firebreaks, fire types and behavior, ignition techniques, and burn plans.

Contact Walt Fick at 785-532-7223 or whfick@ksu.edu if you have any questions regarding a prescribed burning workshop. Be sure to contact the host to register for a workshop.

Date	County/City	Host/ Contact	*Agency*	Phone	e-mail
Feb. 14	Riley/ Manhattan	Aubrey Evans	CD		aubrey.evans@ks.nacdnet.net
Feb. 20	Russell/ Russell	Clint Laflin	KSRE	785-483-3157	cllaflin@ksu.edu
Feb. 21	Wilson/ Fredonia	Pamela Walker	CD	620-378-2866	pamela.walker@ks.nacdnet.net
Feb. 25	Washington/ Barnes	Brett Melton	KSRE	785-243-8185	bmelton@ksu.edu
Feb. 27	Cowley/ Winfield	Elizabeth Espino	KSRE	620-221-5450	eespino@ksu.edu
Feb. 28	Lincoln/ Sylvan Grove	Barrett Simon	KSRE	785-378-3174	barrett8@ksu.edu
Mar. 1	Atchison/ Effingham	Tiffany Hoffman	CD	913-833-5740 ext 333	Tiffany.Hoffman@ks.nacdnet.net
Mar. 6	Franklin/ Ottawa	Keri Harris	CD	785-241-7201	frco.conservation@gmail.com
Mar. 8	Logan/Oakley	Dana Charles	CD	785-672-3841	dana.charles@ks.nacdnet.net
Mar. 18	Johnson/ Olathe	Jessica Barnett	KSRE	913-715-7000	jessica.barnett@jocogov.org

7. K-State Pre-Plant Corn Schools - February 2019

The Department of Agronomy and K-State Research and Extension, in partnership with Kansas Corn, are planning to host three Corn Pre-Plant Schools in 2019. These schools are designed to provide in-depth training for corn producers across Kansas with targeted information for each location.

Each school is free to attend and will have lunch provided thanks to support provided by Pioneer. A range of topics will be covered and vary by location including: corn management, high-yielding corn factors, weed control, soil fertility and nutrient management, soil health considerations, insect management, corn market and policy perspectives, and grower panel discussion.

Pre-Plant Corn Schools

- **February 11 – Parsons**
  Registration begins at 7:45 am, program from 8:30 am – 1:00 pm
  Southeast Research and Extension Center, 25092 Ness Road, Parsons

- **February 13 – Hesston**
  Registration begins at 7:45 am, program from 8:30 am – 1:00 pm
  Dyck Arboretum of the Plains, 177 W Hickory Street, Hesston

- **February 15 – Garden City**
  Registration begins at 7:45 am, program from 8:30 am – 1:00 pm
  Pioneer Garden City Research Station, 1455 East Parallel Road, Garden City

To register for any of the schools, please go online at https://kscorn.com/CornSchool/. Pre-registration is still open! Please try to register one week prior to the event you wish to attend.

CCA and CEU credits have been applied for. Additional local sponsors include Ag Risk Solutions and the Andersons.

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