

Extension Agronomy

eUpdate

09/13/2019

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. Optimum sowing dates and seeding rates for wheat in Kansas

Ensuring optimum sowing date and seeding rate are two steps needed to help achieve the maximum wheat yield potential in a given growing season (Figure 1). Sowing date affects yield potential due to stand establishment, soil and air temperatures to which the crop is exposed, tiller formation, disease pressure, etc. Optimum seeding rate depends on sowing date and its adjustment is crucial to ensure the crop will maximize its yield potential.



Figure 1. Best management practices before and after sowing to ensure maximum yield potential can be attained in a given growing season. Graphic by Romulo Lollato, K-State Research and Extension.

Sowing date

A) K-State recommendations

Optimum sowing date for winter wheat is quickly approaching for a large portion of Kansas (Figure 2). Depending on geographical location, optimum sowing window can start as early as September 10 and last until the end of September (northwest Kansas), or it can start as late as October 5 and last until October 20 (southeast Kansas). This gradient in sowing dates, with earlier dates in the northwest, is a function of temperature. Northern regions with higher elevations will have cooler air and soil temperatures earlier in the year as compared to southern regions.



Figure 2. Optimum planting dates for winter wheat according to geographical location within Kansas. Figure adapted from KSRE publication L-818, Kansas Crop Planting Guide.

B) Actual Kansas wheat sowing dates

According to historical data released by the USDA-NASS crop progress reports, on average, producers in Kansas planted approximately 50% of the crop prior to October 4 and about 90% of the crop prior to October 25 during the 1994-2015 period (Figure 3).





(https://www.nass.usda.gov/Publications/National_Crop_Progress/).

Although 50% of the fields are, on average, planted by October 4, there is large year-to-year variability in percent planted area within the aforementioned date range (see error bars on Figure 3). This year-to-year variability is led by sowing conditions, as extremely moist or dry soils, may keep producers from sowing at the optimum planting date.

The largest variability of area planted in Kansas in the period 1994-2015 occurred between September 20 and October 15. During this period the difference in area planted between the earliest and the latest years on record was above 40% (Figure 4). In other words, while 50% of the wheat area was sown by September 21 in the earliest year on record, only 7% of the area was sown by the same date for the latest year on record. In the latest year, 50% wheat area sown was only achieved October 11. The variability in planted area was lower at earlier planting dates (before September 20), probably because most producers tend to wait until the optimum planting window with a smaller acreage planted early. Year-to-year variability in planted area also decreased towards the late planting window (after October 15), as most of the acreage had been planted by that time in most years.



Figure 4. Percent wheat area planted in Kansas after September 1st for the earliest and latest years on record between 1994 and 2015 as reported by the USDA-NASS Crop Progress Reports (<u>https://www.nass.usda.gov/Publications/National_Crop_Progress/</u>). Range in area sown is shown as light purple area in the main graph. Inset shows the difference in percent area planted between the earliest and the latest sowing years on record.

C) Considerations of wheat growth affected by sowing date

1. Sowing wheat early: Sowing wheat at an earlier-than-optimal date can result in lush vegetative growth, which will require more water to maintain the canopy later in the growing season. For that reason, producers who graze their wheat are encouraged to plant wheat two or three weeks earlier than the optimal sowing date for grain. Early sowing can also lead to an increased incidence of fall pest infestation, such as Hessian fly, and diseases transmitted by certain vectors are more active in warmer temperatures, such as wheat streak mosaic (transmitted by wheat curl mites) and barley yellow dwarf (transmitted by aphids). The consequences of an earlier-than-optimal sowing date are discussed in <u>"Early planting of wheat can lead to several problems"</u> from eUpdate issue 764 on September 6, 2019.

- 2. <u>Sowing wheat at the optimal time</u>: The optimal sowing time differs year-to-year due to environmental conditions, such as temperature and precipitation, but the optimal winter wheat sowing range for different regions in Kansas is shown in Figure 2. Sowing wheat at the optimal time stimulates the right amount of fall tiller formation, as well as root development, to optimize yields while avoiding a lush vegetative growth. Fall-formed tillers contribute more to yield potential than spring-formed tillers, therefore it is crucial that about 3 to 5 tillers are well established before winter. Additionally, this tiller formation, combined with good crown root system development prior to winter dormancy, increases the winter hardiness of the crop, and the chances of winter survival.
- 3. <u>Sowing wheat late</u>: Many reasons may lead producers to plant wheat late. Double-cropping wheat following a late-harvested summer crop, such as soybean or sorghum, is common in many regions of Kansas. Delayed planting date due to environmental conditions, such as low or high soil moisture levels, may also occur. When wheat is sown past the optimal window, it is generally sown into colder soils and the crop is exposed to cooler air temperatures during the fall. Sowing into colder soils will delay wheat emergence, so the importance of a seed fungicide treatment increases as planting date is delayed. Additionally, the crop will experience decreased fall tiller formation because wheat development is dependent on temperatures (Figure 5). An increase in seeding rates in these circumstances is warranted.



Figure 5. Difference in fall growth due to planting date following summer crops. Photos were

taken December 8, 2016 from neighboring fields which were sown in early October in no-till following corn (left photo) or late October no-till following soybeans (right photo). Photos by Romulo Lollato.

Seeding rate

Optimum seeding rate varies with geographical location in Kansas, following the existing east-towest precipitation gradient. If sown at the optimal date, optimum seeding rate should be about 1,125,000 – 1,350,000 seeds per acre in the eastern portion of the state, where annual precipitation is above 30 inches, or under irrigated conditions (Figure 6). Seeding rate should be decreased to 900,000 – 1,250,000 seeds/acre in the central region, where annual precipitation ranges between 20 and 30 inches. A further decrease in seeding rate should occur in the western third of the state where annual precipitation is less than 20 inches, for a final seeding rate between 750,000 and 900,000 seeds per acre in that region (Figure 6).

Seeding rate should always be discussed along with planting date, and in many times with soil fertility status as well. As mentioned above, later planting dates will decrease the potential number of fall tillers formed and grain yield will be more dependent on the main stem and maybe one or two tillers formed during the fall. Thus, seeding rate should be increased as planting date is delayed (for more information see <u>"Management adjustments when planting wheat late" in eUpdate Issue 598</u>).

On the other hand, producers with a history of manure application and very high soil phosphorus and organic matter levels have been observing similarly high yields with reduced plant populations as higher plant populations when sowing towards the early side of the optimum sowing window. The reason behind this response is that high phosphorus levels and increased overall fertility resulting from long-term application of manure, coupled with a slightly early sowing, can increase the wheat tillering potential, decreasing the need for high plant populations.



Figure 6. Optimum planting rates for winter wheat according to geographical location within Kansas. Figure adapted from KSRE publication L-818, Kansas Crop Planting Guide.

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2. Wheat seeding tips for good stand establishment

Regardless of the soil moisture conditions at wheat planting time, there are a few important steps producers can take to improve their chances of getting a good stand of wheat:

Proper tractor speed. It is best to use a tractor speed of between 5 and 6 miles per hour in most cases when drilling wheat, depending on the amount of down pressure on the openers. If higher speeds are used, the openers can tend to "ride up" in the soil every now and then if down pressure is insufficient, which can result in uneven and poor stands.

Proper, uniform seeding depth. In most cases, the ideal planting depth for wheat is about 1.5 inches. When planting early into very warm soils, it is important not to plant too deeply since coleoptile lengths are shorter than normal under warm conditions. On the other extreme, producers should also be careful to not plant too deeply when it is later than the recommended time (very cool soils). Ensuring a uniform seeding depth is also important. Uneven planting depth can be a serious problem when planting into fields with heavy residue, or where there is uneven distribution of chaff from the previous crop. In those situations, poor stand establishment is common in areas of the field where the drill opener rode up over the residue or chaff and was unable to penetrate the soil to the same depth across the field.

Firm seedbed. Planting into loose, fluffy soils can be a problem where soils have been tilled repeatedly during the summer. When seeds are planted into loose soils, rains in the fall will settle the soil and leave the crowns of the seedlings too close to the soil surface. Having a good closing system behind the drill openers, with adequate down pressure, should help.

Plant during the optimum time. In general, wheat should be planted somewhere around the best pest management planting date (BPMP, former Hessian fly-free date). There may be good reasons to plant some wheat before the BPMP date, such as planting for pasture or time pressures from having considerable acreage to plant. However, stand establishment and ultimate grain yields are usually best when wheat is planted after the BPMP date and before deadlines set by crop insurance. Planting more than three weeks after the BPMP can be risky. Late-planted wheat often does not develop an adequate root system before winter, and forms fewer productive fall tillers. When planting late, seeding rates should be increased by 25 to 50 percent (up to a maximum of 120 lbs/acre) to help ensure an adequate stand and compensate for the lack of tillering.

Adequate soil fertility. In general, producers should apply at least part of their nitrogen (N) before or at planting time to get the plants off to a strong start. Nitrogen rates of 20-30 lbs can help with fall establishment and tillering. Soil testing for available phosphorus is good idea. If the soil is low or very low in phosphorus or potassium, these nutrients should be applied at planting time as well so that the plants benefit early in their development. Starter phosphorus with the seed or band-applied close to the seed can also help with early growth and establishment, particularly in low-testing soils. Low soil pH can be a concern, particularly early in the season when root systems are mostly near the surface, which is often an area of lower pH. Soil tests will determine the need for pH adjustment and any potential for aluminum toxicity. Variety selection and phosphorus application with the seed are potential management strategies for low pH and aluminum toxicity issues if it is too late to apply lime before seeding.

Make adjustments for planting into row crop stubble. When planting wheat into grain sorghum

stubble, producers will need an extra 30 lbs N per acre over their normal N rate. Also, it is important to make sure the sorghum is dead before planting wheat. When planting wheat into soybean stubble, producers should not reduce their N rates since the N credit from soybeans does not take effect until the following spring. If the wheat is being planted no-till after row crop harvest, N rates should be increased by 20 lbs N per acre over the normal N rate. Seeding rates should be increased when planting wheat late after row crop harvest. It is best to use a seeding rate of 90 to 120 lbs per acre in central and eastern Kansas, and 75 to 100 lbs per acre in western Kansas. When planting more than three weeks after the BPMP date, producers should use a seeding rate of 120 lbs per acre.

Watch out for potential disease issues when planting into corn residue. The risk of some diseases may be higher when wheat is planted into fields with large amounts of corn residue left on the soil surface. Fusarium head blight (scab) of wheat, for example, is caused by a fungus that is known to cause a stalk rot of corn. Attempt should be made evenly spread crop residue across the full combine header width at harvest to help minimize disease problems and with stand establishment.

Using a seed treatment. Seed treatments can act as an insurance policy, helping avoid seed-borne and early-season fungal diseases. For more information, see the article "<u>Control seed-borne diseases</u> in wheat with fungicide seed treatments" in the August 16, 2019 eUpdate.

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3. Seed drill calibration to improve wheat seed distribution

Decisions taken prior to wheat planting can account for a large proportion of the success or failure of the wheat crop. These decisions include:

- Selecting a variety well adapted to the area and with a good yield stability record
- Soil sampling to determine fertility needs
- Pre-plant fertilization (N, P, K, lime)
- Tillage for weed control and seedbed preparation (or using a contact herbicide in no-till situations)
- Proper drill calibration

Proper drill calibration can increase the chances of success of the wheat crop by ensuring the amount of seed planted per acre is close to the target.

There are several methods to calibrate seed drills. In this article, we discuss the stationary method, which is a simple 4-step method to calibrate a wheat drill prior to planting. In stationary drill calibration, a drill operation is simulated by turning the drive wheel freely above ground, weighing the seeds delivered from the drill spouts, and comparing to a targeted seed weight by length of drill-row. Note: some drills are designed so that using the stationary drill calibration method cannot be easily done and the drill needs to be operated to calibrate.

1. Determine seeding density.

Irrigated

Targeted seeding density varies within the State of Kansas based on annual precipitation. A target range of seeds per acre based on current K-State recommendations is shown in Table 1.

Annual Target seeding density				
precipitation (inches)	(seeds per acre)			
> 20 in	675,000 - 900,000			
20 - 30 in	900,000 - 1,125,000			
>30 in	1.125.000 - 1.350.000			

Table 1. Target seeding density based on annual precipitation

2. Determine the number of seeds in 50 drill-row feet based on row spacing and targeted seeding density.

1,350,000 - 1,800,000

Determine the number of linear row feet per acre based on the drill's row width (Table 2). Next, estimate the number of seeds to be collected in 50 drill-row feet based on row width and the target seeds per acre. This can be done by dividing the number of target seeds per acre by the number of linear row feet per acre based on row width and multiplying the result by 50. Percent emergence can be accounted for by dividing the result by the fraction of emergence (for example, dividing by 0.85 for 85% emergence). Table 2 shows calculations for selected row widths and targeted number of seeds per acre considering 85% emergence.

After determining the number of seeds to be collected from 50 drill-row feet, weigh the equivalent amount of seed of each variety you intend to plant. For instance, if the target is 675,000 seeds per acre and row width is 12 inches, a total of 775 seeds need to be planted in a 50 drill-row feet. Assuming 85% emergence, this number increases to 912 seeds (Table 2). Count and weigh 912 seeds from each variety. If no scale is available, place the 912 seeds in a clear graduated cylinder (i.e. a rain gauge) and mark the level for each variety.

	Feet of linear		Target number of seeds per acre				
	row per acre	675,000	750,000	900,000	1,125,000	1,350,000	1,800,000
Row width			Seeds per 50 drill-row feet				
(inches)							
6	87,120	456	506	608	760	912	1,215
7	74,674	532	591	709	886	1,063	1,418
7.5	69,696	570	633	760	950	1,139	1,519
8	65,340	608	675	810	1,013	1,215	1,620
10	52,272	760	844	1,013	1,266	1,519	2,026
12	43,560	912	1,013	1,215	1,519	1,823	2,431

Table 2. Seeds per 50 drill-row feet as function of row width and target number of seeds per acre. Feet of linear row per acre as a function of row width is also shown.

3. Determine the number of wheel revolutions needed for 50 drill-row ft.

First, attach the seed drill to a tractor and raise the drill off the ground. Measure the drive wheel's circumference using a tape measure, and divide 50 drill-row feet by the length of the circumference to determine how many times the drive wheel needs to be rotated to account for 50 drill-row feet. For example, if the drive wheel's circumference is 7 feet, dividing 50 by 7 indicates that the wheel needs to be rotated 7.15 times to account for 50 drill-row feet. Mark a starting point in the wheel with tape (i.e. duct tape) to facilitate counting how many times the wheel is being turned. If the drill design won't allow turning the drive wheel, then measure and flag a 50' distance and catch the seed out of the seed tube as the drill is operated the measured distance.

4. Calibrate the drill.

Adjust the seed meter using the rate chart provided by the manufacturer for the desired seeding rate, which should result in a first approximation of final calibration. Add enough seed of the variety to ensure seed cups will remain covered throughout the calibration process. Rotate the wheel the number of revolutions needed to cover 50 drill-row feet as calculated in step 3 and collect the seed from each spout in a bucket or similar container. The more spouts and longer distance evaluated, the more accurate the calibration. Weigh the collected seed (or pour it in the marked graduated cylinder from step 2) and compare to the target seed per 50 drill-row feet as determined in step 2. If the collected seed weighs too low or too heavy compared to the target, adjust the metering system to deliver more or less seeds, respectively. Keep a record of the different seeding rates achieved at each

setting for future reference. Repeat this process until the number of seeds delivered from the drill spouts matches the target established in step 2.

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4. Evaluate wheat seed size to improve wheat seeding density and final stand

Wheat seeding rate recommendations in Kansas are in pounds of seed per acre and vary according to precipitation zone. However, seed size can have an impact in the final number of seeds actually planted per acre. A variety with larger kernels, when planted in pounds per acre, will result in less seeds planted per acre and possibly thinner stands. If the weather and soil fertility during the growing season are not favorable for fall tiller formation and survival, the thinner stand might result in reduced grain yields. Examples of varieties with large kernels include WB4458 and Ruby Lee. On the other extreme, a variety with small kernels can result in above-optimal stand establishment, increasing plant-to-plant competition for available resources such as water, nutrients, and incident solar radiation. Additionally, planting in pounds of seeds per acre can reduce seed costs when wheat kernel size is relatively small.

Seed size can be measured in terms of the number of seeds per pound. The "normal" range is about 14-16,000 seeds per pound, but it can range from less than 10,000 seeds per pound to over 18,000 seeds per pound. Although seed size is specific to each individual wheat variety, it can vary within variety depending on seed lot and seed cleaning process. Figure 1 compares three different wheat varieties and the seed size as affected by seed cleaning. For this simple study, the varieties Everest, WB Grainfield, and SY Wolf were evaluated at different times during the seed cleaning process:

- 'Unclean' (harvested seed before cleaning)
- 'Air screened' (seed following air cleaning or the blower)
- 'Mid gravity' (seed from the low end of the gravity table)
- 'Top gravity' (the seed from the top end of the gravity table)

It is clear from Figure 1 that wheat variety plays a major role in determining wheat kernel size as does the quality of seed cleaning. Overall, the number of seeds per pound decreased (or individual seed size increased) as the quality of the seed cleaning process increased.



Figure 1. Effects of wheat variety and seed cleaning on final number of seeds per pound. Seed for this research provided by Ohlde seeds, research by Romulo Lollato.

Figure 2 highlights the two most contrasting treatments from the above study, the 'Unclean' WB-Grainfield (top figure, 17,335 seeds per pound) versus the 'Top-gravity' SY Wolf (bottom figure, 12,427 seeds per pound). To achieve the same number of seeds per acre, 'Top-gravity' SY Wolf would require a 39% increase in pounds per acre planted when compared to 'Unclean' WB-Grainfield. In other words, if both varieties are planted at a seeding rate of 75 pounds/acre, final number of seeds planted per acre will be 1.3 million seeds/acre for 'Unclean' WB-Grainfield and 930,000 seeds/acre for 'Top-gravity SY' Wolf. If the goal was to achieve 1.2 million planted seeds per acre, wheat would be over-seeded at about 8% for the smaller seed and under-seeded in about 22.5% for the larger seed. This assumes the same emergence rate for the cleaned and uncleaned seed, which would not necessarily be expected.



Figure 2. Differences in seed size between treatments 'Unclean' WB-Grainfield (17,335 seeds per pound; top photo) and 'Top-gravity' SY Wolf (12,427 seeds per pound; bottom photo). Photos by Romulo Lollato.

If planting occurs in seeds per acre instead of pounds per acre, we might see the opposite results where seed cleaning will actually increase stand establishment. The seeds above were no-tilled into heavy corn residue in an experiment during the 2015-16 growing season, with final seeding rate established in seeds per acre. The resulting stand counts are shown in Figure 3. These results indicate that the seed cleaning process increased stand establishment. These results were possibly due to better seed quality as the cleaning process removed small and shriveled grains that may have lower vigor than larger, healthier grains. Regardless of planting in seeds per acre or pounds per acre, these results highlight the importance of measuring wheat seed size before planting to avoid the final amount of seeds planted per acre being too far away from the original target.





Certified seed, or seed submitted for germination testing, will have seeds per pound information available. However, an easy on-farm method to estimate the average seed weight of a seed lot is to collect several representative 100-seed samples and weight each 100–seed sample in grams. To calculate seeds per pound, divide the conversion factor 45,360 by the average weight the 100-seed samples. Samples should be collected from the lot as is, including large and small kernels in the same proportion as found in the seed lot. The targeted number of seeds per acre is then divided by the number of seeds per pound to determine the number of pounds to be planted per acre. The following table is a quick reference guide to adjust the planting rate in pounds per acre based on seed size and the targeted number of seeds planted per acre:

		Target planting rate (seeds per acre)				
	600,000	750,000	900,000	1,200,000	1,500,000	
Seeds/lb		Pounds of seed per acre				
10,000	60	75	90	120	150	
12,000	50	63	75	100	125	
14,000	43	54	64	86	107	
16,000	38	47	56	75	94	
18,000	33	42	50	67	83	
20,000	30	38	45	60	75	

Table 1: Reference guide to adjust planting rate in pounds per acre

How to use Table 1:

A dryland wheat producer in western Kansas whose target may be 750,000 seeds per acre has a seed lot with large kernels, averaging 12,000 seeds per pound. Seeding rate in pounds per acre for this seed lot for a final placement of 750,000 seeds per acre should be ~63 lb/ac. The same producer, planting a different lot with smaller seeds averaging of 16,000 seeds per pound, should plant ~47 lb/ac to achieve the same final seed placement of 720,000 seeds per acre.

A wheat producer in eastern Kansas whose target may be 1.2 million seeds per acre has two seed lots, the first averaging 14,000 seeds per pound and the second, with slightly smaller kernels, averaging 16,000 seeds per pound. This producer should use a seeding rate of 86 lb/ac in the first seed lot and 75 lb/ac in the second seed lot to achieve the same final seed placement. In this case, both seed lots were in the "normal" range of about 14,000-16,000 seeds per pound, and a simple $\pm 10\%$ adjustment on the seeding rate should compensate for differences in seed size.

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5. Rate of dry down in corn before harvest

The latest USDA-National Agricultural Statistics Service crop progress and condition report for Kansas classified near 50% of the corn crop as 'good' or 'excellent' condition. Overall, 28% of Kansas' corn is mature with 16% harvested.

The weather conditions experienced from early-August to early-September are critical for corn as related to the grain-filling rate and determining final grain weight. Temperature and precipitation have split across the state, with cooler-than-normal conditions in the north central and northeast, while warmer conditions have dominated in the central and west (Figure 1a). Much of northern and eastern Kansas had excessive moisture; however much of the state had near-normal precipitation for the period (Figure 1b).



Figure 1. a) Departure from normal temperatures; b) Departure from normal precipitation.

In recent years, a common question from producers relates to the dry down rate for corn when approaching the end of the season. Based on previous information, the average dry down rate depends on the weather, primarily temperature and moisture conditions – but it might range from 1% in late August to less than 0.5% per day in October.

The weather outlook for September calls for an increased chance of warmer-than-normal temperatures with chances for above-normal precipitation. Much of this rainfall may have fallen already, which would favor a faster dry down rate than average.

Grain water loss occurs at different rates but with two distinct phases: 1) before "black layer" or maturity (Figure 2), and 2) after black layer. For the first phase, Table 1 contains information on changes in grain moisture from dent until maturity of the corn.



Figure 2. Corn at dent stage and at black layer growth stages. Photo and infographic prepared by Ignacio Ciampitti, K-State Research and Extension.

Table 1. Growth stages, moisture content, and total dry matter progression for corn from late to physiological maturity. Extracted from K-State Research and Extension publication MF3305 (Ciampitti, Elmore, Lauer, 2016).

	Average per Su	bstage		
R Stage	Moisture %	Dry Matter (% of Total Dry Weight)	Growing Degree Days, °F	Days
5.0	60	45	75	3
5.25 (¼ milk line)	52	65	120	6
5.5 (½ milk line)	40	90	175	10
5.75 (¾ milk line)	37	97	205	14
6.0 (Physiological maturity)	35	100		
olo (i hysiological matarity)	33	100		

¹Abendroth, L.J., R.W. Elmore, M.J. Boyer, and S. K. Marlay. 2011. Corn Growth and Development. PMR 1009. Iowa State Univ. Extension. Ames Iowa.

To properly address questions from many producers on the rate of dry down, a study is underway to investigate the grain dry down rate from the moment of "black layer" until commercial harvest grain

moisture was reached. For the conditions experienced in 2017 and 2018 seasons (from late August until mid-September), the overall dry down rate was around 1% per day (from 36-35% to 15-17% grain moisture) – taking an overall period between 18-to-21 days (Figure 3).



day after black layer formation

Figure 3. Grain moisture dry down (purple line) across three hybrids and different N rates near Manhattan, KS during 2017 and 2018. Horizontal dashed lines marked the grain moisture at black layer formation and grain moisture around harvest time for each year*. Graph prepared by Ignacio Ciampitti, K-State Research and Extension.

*Note: It is desired to reach harvest with 15.5% grain moisture to maximize the final grain volume to be sold, thus the importance of timing harvest with the right grain moisture content.

This dry down process can be delayed by:

- Low temperatures
- High humidity
- High grain moisture content at black layer (38-40%)

It is expected that the dry down rate will decrease to <0.5% per day for late-planted corn entering reproductive stages later in the growing season. Expect a similar decrease for corn that was exposed to late-season stress conditions (e.g., drought, heat). Under these conditions, maturity may be reached with high grain water content and the last stages after black layer formation could face lower temperatures and higher humidity. These main factors should be considered when the time comes to schedule corn harvest. You can track temperature and humidity levels on the Kansas Mesonet web site at http://mesonet.k-state.edu/weather/historical/ by selecting the station and time period of interest.

This project is expected to be expanded in the coming years to include additional corn producing regions and to consider other factors such as planting date, hybrid maturity, and diverse weather environments across the state. If you are interested in participating, please contact the researchers listed below.

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K-State agronomists conducted a study from 2014 through 2018 at Garden City, Tribune, and Colby to evaluate wheat yield response to different varieties and seeding rates.

The objectives of this study addressed the following questions:

- 1. Are K-State seeding recommendations appropriate for current varieties?
- 2. Is there a need for variety specific seeding rates (other than adjusting for seeds per lb)?
- 3. How region-specific do seeding rate recommendations need to be?

Popular varieties representing a range of tillering potential were selected and seeding rates were selected to represent the range of rates known to be in use by producers. Four wheat varieties (TAM111 in 2016 and 2017, TAM114 in 2017 and 2018, Byrd, T158, and Winterhawk) were seeded at five seeding rates (30, 45, 60, 75, and 90 lbs/ac) at Garden City, Tribune, and Colby into no-till or reduced-till fallow in a wheat-sorghum-fallow rotation. Data were collected from 960 individual plots across 14 site-years throughout the course of the study. The 2014 study was preliminary, subsequently we chose to evaluate a wider range of seeding rates. For the purposes of evaluating seeding rate response curves, only data from 2015-2018 is reported in this article.

The effect of variety and seeding rate on grain yield is shown in Table 1 for each site-year, along with the interaction of both variables. A value less than 0.05 (shown in bold) represents a significant effect on yield. A significant variety x seeding rate interaction means that the optimal seeding rate depended on the variety. As expected, variety selection is important as it significantly affected grain yield in all 14 site-years. Similarly, yields responded to changes in seeding rate in 13 of 14 site-years (over a wide range of seeding rates we would typically expect a yield response). However, optimal seeding rate depended on the variety used in just two site-years.

These two site-years (Tribune 2015 and Garden City 2015) were during stripe-rust outbreaks and the plots were unable to be sprayed with fungicide. At these two site-years, higher seeding rates of the stripe rust-susceptible varieties were able to partially compensate for the effects of the rust, resulting in different yield responses to seeding rate. In summary, varieties responded similarly to seeding rate in 12 of the 14 site-years.

Table 1. Effect of wheat variety, seeding rate, and their interaction on grain yield at three locations in western Kansas. Data is presented for 14 site-years.

		P > F		
Location	Year	Variety	Seeding Rate	Variety x Seeding
				Rate
Tribune	2014	<0.0001	0.0020	0.1761

Tribune	2015	<0.0001	<0.0001	0.0458
Tribune	2016	<0.0001	<0.0001	0.3607
Tribune	2017	0.0135	<0.0001	0.9101
Tribune	2018	<0.0001	0.0048	0.9073
Garden City	2014	0.0084	0.0095	0.2444
Garden City	2015	<0.0001	<0.0001	0.0006
Garden City	2016	<0.0001	0.2051	0.9986
Garden City	2017	<0.0001	<0.0001	0.3760
Garden City	2018	<0.0001	<0.0001	0.1187
Colby	2015	<0.0001	<0.0001	0.7308
Colby	2016	0.0286	<0.0001	0.1901
Colby	2017	<0.0001	<0.0001	0.2852
Colby	2018	<0.0001	<0.0001	0.0754
No. of Signific Years	ant Site-	14/14	13/14	2/14

Effect of Location

While location affected the overall yield level, with yields increasing in the order of Garden City < Tribune < Colby, location did not affect the overall yield response to seeding rate. As shown in Figure 1, the seeding rate response curve is similarly shaped for all locations when averaged across years and varieties.



Figure 1. Seeding rate response by location. Graph by K-State Research and Extension.

In Figure 1, data points within a location that have the same letter are not statistically different. For example, at Garden City there was no difference between the 60, 75, or 90 lb/ac rates, while all three of those rates were higher yielding than the 45 lb/ac rate, which was higher yielding than the 30 lb/ac rate. At Tribune and Colby, there was no significant difference in grain yield between the 60 and 75 lb/ac rates, however the 90 lb/ac rate was significantly higher than the 60 lb/ac rate. With location and variety selection not playing a significant role in optimal seeding rate, all data were then combined to look at the overall response to seeding rate (Figure 2.)



Figure 2. Effect of seeding rate on grain yield, averaged across varieties and site-years. Graph by K-State Research and Extension.

When the response to seeding rate was evaluated (Figure 2), grain yield significantly increased with increasing seeding rate up through the 75 lb/ac seeding rate. Yield between the 90 and 75 lb/ac rate were not significantly different. When translated into a seeds/ac basis, these seeding rates would have been 452,000, 678,000, 903,000, 1.13 million, and 1.36 million on average.

Important points to keep in mind

- 1. This study was conducted on a lb/acre basis. However, the range in seed size was modest (an average seed size of 15,056 +/- 19%) when compared to the differences between seeding rates. Conducting the study on a seeds/ac basis would not have significantly changed the shape of the overall seeding rate response curve.
- 2. The fields used in this study are managed to be non-fertility limiting, however they are not excessive in their fertility and have no history of manure or compost application. Fields with excessive soil test phosphorus levels will likely result in additional fall tillering and thus satisfactory performance might be obtained from seeding rates lower than what these results suggest are optimal. Differences in soil fertility levels, the use of unreplicated vs. replicated trials, and perhaps planting date are likely factors in lower optimal seeding rates reported by others.
- 3. Due to the dry seeding conditions experienced during the course of this study, seed was often dusted in, or planting was delayed until a rain. Therefore, emergence was often later than what would be obtained from planting on the optimal planting date into good

moisture. Previous work by K-State in Colby has shown the importance of increasing seeding rates as planting is delayed due to reduced opportunity for tillering. This may be why the distinction between the 60 and 75 lb/ac or the 90 lb/ac rate is not clear cut.

Key Results

- 1. The data collected is not supportive of variety-specific seeding rates (other than adjusting for seeds/lb which remains a K-State recommendation).
- 2. The seeding rate response curve was similar across varieties and locations for three sites in western Kansas.
- 3. Across all site-years, 75 lb/ac (an average of 1.13 million seeds/ac) was sufficient to maximize grain yields. When broken down by location, 60 lb/ac (an average of 903,000 seeds/acre) was sufficient to maximize grain yields at Garden City, while at Tribune and Colby the optimal rate appears to lie near 75 lb/ac (approximately 1.13. million seeds/ac).

Producers are often worried about having stands that are too thick, thus an excessive use of soil water in the fall. This is a very valid concern. However, one must also be aware of the two-edged sword. If good growing conditions occur in the spring, there are physical limits to how many kernels per head can be set and maximum kernel weight. If there is a shortage of heads/acre due to an insufficient stand and/or lack of fall tillering, yield will be left on the table in a good year.

Note: Expenses for this study at Colby were funded by the Cover Your Acres Winter Conference.

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7. Estimating grain sorghum yield potential

Estimating crop yields before harvest can be erratic, but producers often like to know about the potential yield of their crops. In previous K-State Agronomy eUpdates we discussed the calculation of the potential yield for soybean and corn. These articles are:

- "Estimating corn yield potential", https://ksu.ag/2SAVSaR (July 19, 2019 eUpdate 758)
- "Estimating soybean yield potential", <u>https://ksu.ag/31YNJOH</u> (August 23, 2019 eUpdate 762)

This article discusses how to get simple but good estimates of sorghum yield potential. As with soybeans, sorghum can compensate for abiotic or biotic stresses. Sorghum compensates through changes in head sizes (grain number and weight) and number of tillers.

Before going into the procedure to estimate sorghum yields, we need to understand the main plant components of sorghum yield. The main yield-driving factors are:

- Number of plants
- Number of tillers per plant
- Total number of seeds per head
- Seeds per pound

The number of plants and the number of tillers per plant are two of the main components and are determined well before the end of the growing season. The initial plant density, planting date, and the environment, among other factors, influence those two yield components.

Understanding sorghum yield components

Increasing the number of plants per acre potentially increases competition for resources, which can diminish the plant's capacity to produce tillers. In addition, the interaction of planting date with plant density can have a similar effect. As planting date is delayed, the capacity of the plant to produce tillers will be reduced; thus, plant population needs to be increased to compensate for the reduction in the number of tillers. Previous research at K-State showed sorghum produces more tillers when planted early (mid-to-late May) at lower plant populations as compared with late planting dates (mid-to-late June).

The environment also plays an important role in the final number of heads per unit area. Heat and drought stress will reduce the plant's ability to produce more tillers, and could severely reduce the tiller survival rate. The total number of seeds per head will be determined within the one- or two-week period before flowering until milk to soft dough stages (approximately two to three weeks after flowering). Seed size will be determined close to the end of the season. In the 15 to 25 days after flowering, during the soft dough stage, sorghum grains have already accumulated about 50% of the final dry mass. Thus, the period around flowering is critical for defining not only the final number of grains per head but also the potential maximum kernel size. Final seed weight will be determined when the grains reach physiological maturity (visualized as a "black-layer" near the seed base). From this time until harvest, the grains will dry down from approximately 35% to 20% moisture content.

The interaction among all four components will determine the actual yield, but a wide range of



Figure 1. Example of the variation expected to be found in the main sorghum yield components. The number of tillers per plant can also be interpreted as the number of heads per plant, considering that all tillers have one fertile head.

When can I start making sorghum yield estimates?

As the sorghum crop gets closer to full maturity, yield estimates will be more accurate because the seed weight will be closer to being set. Nonetheless, we can start taking yield estimations three to four weeks after flowering (from soft to hard dough stages). At these stages, the final seed number can still change. In addition to the seed number, the seed weight will be only partially determined -- approximately 50 to 75% of dry mass accumulation as compared to the final weight.

Variability within the field

Variability between plants needs to be properly accounted for when estimating sorghum yields using the on-farm approach (see next section). Another important factor is the variation between different areas in the field. In general, it is recommended to perform yield estimations in at least 5 to

10 sections of the field to account for field variability.

On-farm approach for estimating sorghum yields

The estimation of sorghum yields should consider the main driving forces:

1. Total number of heads per unit area [number of plants per acre x heads per plant] (1)

- 2. Total number of seeds per head (2)
- 3. Number of seeds per pound (3)
- 4. Pounds per bushel, or test weight, which for sorghum is 56 lbs/bushel (4)

The final equation for estimating sorghum yields:

 $[(1) \times (2) / (3)] / (4) =$ Sorghum yield in bushels/acre

Take the following steps for making sorghum yield estimates:

Step 1. Number of heads per unit area:

For this on-farm approach, start by counting the number of heads from a 17.4-foot length of row when the sorghum is in 30-inch rows. This sample area represents 1/1000th the area of an acre. If the sorghum is in 15-inch rows, then count the number of heads in two rows. For a 7.5-inch spacing, measure four rows. In each of these scenarios, the area counted will be equal to 1/1000th of an acre.

Take head counts in several different areas of the field to properly account for the potential yield variability. If the proportion of smaller heads, less than 3 inches in height, is very low (less than 5%), these heads could be avoided due to the smaller proportion they will represent when determining the final yield.

Step 2. Estimation of the number of seeds per head:

The seed number is, by far, one of the most complicated yield components that needs to be estimated. The total number of seeds per head can vary from 100 to 5,000 seeds per head (Figure 1), but almost ³/₄ of the seed number distribution is around 1,500 to 2,500 seeds per head.





A quick method uses an estimate of seed counts per head based on determinations of general yield environment conditions. From previously published research from K-State Agronomy (Vanderlip and Roozeboom), we can utilize a very simple association between the yield level, conditions around pollination/grain set time, and the number of grains per heads (Figure 3). After harvest, the average number of seeds per head and average seed weights were quantified for different yield environments.

This relationship can give a general idea of the seed count per head based on the general yield environment, using primarily the environmental conditions when pollination and grain set are determined (the week before flowering to 2-3 weeks after flowering). We can then use that estimated seed count per head, and multiply it by the number of heads per acre. The number of seeds per pounds, or seed weight, is also a factor we need to estimate, but the work by Vanderlip and Roozeboom found that to be much less of a factor than seed count per head in estimating yield (Figure 3).

This method of estimating seed counts is summarized in Table 1. If conditions were very poor during pollination and grain set and the general yield environment is low, the total number of seeds per head will average around 500-1,000 seeds per head (900; Table 1). If conditions around flowering were very favorable and the general yield environment is very high, then the number of seeds per head could be around 1,500 to 3,500 (2,500; Table 1). Intermediate yield environment scenarios can

occur if a portion of the three-to-four week period around flowering was favorable and part of it was unfavorable. In that case, the number of seeds per head could range from 1,000-3,500, with an average of 1,745 seeds per head.

This information is provided only for general guidance on estimating sorghum yield potential using the on-farm approach. Different responses between yield and its components might be expected for the complexity of diverse genotypes, crop production practices, and environments.



Figure 3. Relationship between grain yield and yield components, seeds per head (yellow points, left panel) and seed weight (red data points, right panel). The number of seeds per head has the most direct relationship with yield.

Table 1. Tota	I number of	seeds per head	d and seed we	eight components.
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Yield Range (bu/acre)	Crop Condition	Average Seeds per Head	Average Seed Weight (g/1,000)	Number of Observations
<50	Very Poor	900	24.5	154
50-100	Poor	1,500	25.5	391
100-150	Fair	2,000	26.2	495
150-200	Good	2,500	25.6	129
>200	Excellent	3,330	25.5	5

Step 3. Estimation of the Seed Weight:

A similar procedure can be followed to estimate the seed weight (Table 1). For the seed weight component, the variation documented in the dataset showed a very narrow seed weight variation as compared with the variability found in the seed number component. In general, it seems that lower seed weight is expected at low yield ranges, but the difference among yield levels is negligible. Table 2 shows the conversion from average seed weight to seeds per pound, and from seeds per pound to the seed size factor employed in the examples below for sorghum yield estimation.

Yield Range (bu/acre)	Crop Condition	Average Seed Weight (g/1,000)	Seeds Per Pound
<50	Very Poor	24.5	18,520
50-100	Poor	25.5	17,793
100-150	Fair	26.2	17,318
150-200	Good	25.6	17,723
>200	Excellent	25.5	17,793

Table 2. Seed weight, seeds per pound.

Step 4. Final calculation using "On-Farm" Yield Estimation Approach:

[(Heads x Seeds per Head)*1,000 ÷ Seeds per Pound] ÷ Pounds per bushel

Example A. Good Crop Condition:

Irrigated sorghum with adequate plant density (48,000 plants/acre), average number of tillers per plant of 1.3, and good yield environment with adequate flowering and grain filling periods:

(48 plants in 17.4 foot $-1/1000^{\text{th}}$ of an acre- x 1.3 fertile tillers per plant) = 62 heads

Yield Estimation = [(62 * 2,500)*1,000 ÷ 17,723] ÷ 56 = **156 bu/acre**

Example B. Poor to Fair Crop Condition:

Dryland sorghum with adequate plant density (40,000 plants/acre), average number of tillers per plant of 1.3, and poor flowering but fair grain filling period:

Yield Estimation = [(52 * 1,500)*1,000 ÷ 17,723] ÷ 56 = **79 bu/acre**

Example C. Very Poor Crop Condition:

Dryland sorghum with adequate plant density (40,000 plants/acre), average number of tillers per plant of 1.0, and poor yield environment and growing season (poor flowering and grain filling period):

Yield Estimation = [(40 * 900)*1,000 ÷ 18,520] ÷ 56 = **35 bu/acre**

Summary

Seed number is the main driving force of sorghum yield. On-farm estimations can be roughly based on environmental conditions during the week before and the two- to three-week period after flowering, which is the critical period of pollination and grain set. Actual seed counts per head would make the estimates more accurate, but requires considerable time and effort.

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8. Winter canola planting considerations

Winter canola cultivars exist today that make production possible across much of Kansas. When a winter hardy cultivar is planted at the right time into good soil moisture, plant development is optimized and the crop will have the best chance at surviving the extremes of the Kansas climate.



The planting window for winter canola arrives in Kansas by early September. Here are some key points to ensure a successful start to the 2019-2020 growing season.

Variety Selection

- Variety selection should be based on the following traits: winter survival, yield, oil content, herbicide tolerance, disease resistance, maturity, lodging susceptibility, and shatter tolerance.
- Producers also have the option of selecting either open-pollinated varieties or hybrids.
- Winter hardiness should be the number one consideration if the crop is being grown in a new area.
- The majority of the varieties grown in the southern Great Plains are open pollinated. These varieties consistently overwinter and have considerable yield potential. Roundup Ready herbicide tolerance is available in open-pollinated varieties.
- More hybrids are being grown in the region. Hybrids tend to have larger seed size for easier seed metering, vigorous fall and spring growth, and greater yield potential in non-limiting environments. Clearfield herbicide tolerance is available in hybrids.
- Varieties with tolerance to carryover of sulfonylurea (SU) herbicides applied to a previous crop (e.g. Finesse) can be planted in the fall to avoid the long plant-back restrictions these herbicides have for canola.

• Consider selecting two or more varieties with differing relative maturities to spread out harvest operations and reduce risk.

Site Selection

- Although canola grows over a wide range of soil textures, well-drained, medium-textured soils are best. Soils where water stands for several days or those prone to waterlogging are poor choices.
- The soil pH should be between 5.5 and 7.0. Soil pH correction with lime should be considered when growing canola in soil with low pH (less than 5.5).
- Be mindful when planting canola following crops like sunflower, soybean, alfalfa, or cotton. These crops share similar diseases with canola. Planting canola continuously is not recommended and it is not insurable. Plant canola after grass crops such as wheat or corn because these crops do not share diseases with canola.
- Canola will perform best when adequate time is given after the preceding crop to allow for soil moisture recharge and weed control, and where there is adequate time to get the canola planted early enough to help the plants survive over winter.
- Avoid fields with heavy winter broadleaf weed pressure if possible. If planting where heavy broadleaf weed pressure exists, consider planting a Roundup Ready cultivar.
- Grassy winter annual weeds are easily controlled by using herbicides that are labelled for conventional, Roundup Ready, or Clearfield canola.
- Make sure you are aware of the herbicide history of potential sites. Winter canola cultivars are sensitive to SU and triazine herbicide carryover, and these products have long plant back restrictions (often 18 months or greater).

Seedbed Preparation

- Weeds must be controlled chemically, mechanically, or with a combination of both methods prior to planting because canola seedlings are not competitive with weeds.
- Open-pollinated varieties typically range from 100,000 to 125,000 seeds per pound and hybrids range from 70,000 to 100,000 seeds per pound. Because of its small seed size, a properly prepared seedbed is critical for successful canola establishment.
- A level, firm seedbed with adequate moisture within the top inch is preferred. A seedbed with many large clumps results in poor seed placement and seed-to-soil contact. An overworked seedbed may be depleted of moisture and will crust easily, potentially inhibiting emergence. In addition, this could promote deep placement of the seed.
- No-till planting is an option, and some long-term no-till producers have produced canola successfully. With proper settings, no-till planting usually results in very good stands. However, maintaining stands over the winter can be difficult with low disturbance in heavy residue cover. This problem has been overcome by burning surface residue immediately before planting or by using a more aggressive residue manager that removes residue from the seed row. Research in south central Kansas indicates that even with good winter survival, no-till canola yields under heavy residue were lower than where residue was burned or where tillage has been performed.
- No-till producers should ensure that drills and planters are properly set and consider using a setup that creates a more disturbed seed row. Using a high-disturbance opener (such as a coulter, residue manager, or hoe-type opener) in no-till can improve winter survival and result in yields comparable to those obtained in tilled fields.
- If using tillage, perform the most aggressive tillage as early as possible, with each succeeding

tillage operation being shallower than the last. Incorporate fertilizer and herbicide with the last tillage operation. Some producers perform one aggressive tillage operation as early as possible and then control newly emerged weeds chemically. Planting into this "stale" seedbed works quite well.

Seeding Date, Rate, Depth and Row Spacing

- The general rule is to plant canola six weeks before the average date of the first killing frost (28 degrees F) in central and south central Kansas, or six to eight weeks for southwest and northern Kansas. This allows adequate time for plant canopy development and root growth to improve winter survival. Planting too late will result in small plants with inadequate reserves to maximize winter survival. Planting too early may result in excessive growth that can deplete soil moisture. Excessive growth may also elevate the growing point or crown too far above the soil surface, increasing the chance of winterkill. This can be a problem when heavy residue remains in the seed row without correct management.
- In northern Kansas, winter canola should be planted by September 15 and in central Kansas by September 25. In far south central Kansas (Barber, Harper, and Sumner counties), winter canola should be planted by October 1 and in southwest Kansas by September 15 to avoid problems with winterkill.
- The most recent 3-month outlook from NOAA projects an increased chance of warmer-thannormal temperatures during September through November. The precipitation outlook is less clear. There are equal chances of above- or below-normal precipitation across the state.
- Winter canola will compensate for a poor plant stand; however, it is important to obtain as uniform a stand as possible to facilitate optimum plant development, winter survival, weed control, and uniform plant maturity. A seeding rate of 3.5 to 5 pounds per acre (approximately 350,000 to 500,000 seeds per acre at a 100,000 seeds per lb seed size) is recommended for open-pollinated varieties in narrow row spacing. Because of the higher seed costs of hybrids, it is recommended to plant them on a pure live seed basis. The recommended seeding rate is 250,000 to 300,000 pure live seeds per acre in narrow rows.
- More producers are experimenting with canola planted in 30-inch rows. Producers are able to obtain more accurate depth control, precision seed metering, and residue removal from the seed row with row crop planters. Generally, yields may be slightly reduced moving from 15 inches to 30 inches under dryland conditions. However, producers are able to reduce their seeding rate to 1.5 to 3.0 lb per acre (about 135,000 to 270,000 pure live seeds per acre at a 90,000 seed per lb seed weight). Planting an open-pollinated variety or hybrid with prolific branching will also increase the profitability of canola planted in 30-inch rows.
- It is important to check drill calibration. Some drills may require a speed reduction kit to obtain the optimum rate without damaging seed. Some producers planting on 7.5-inch spacing will plug every other row unit and plant on 15-inch spacing so the drill does not have to be slowed as much.
- Seed placement is critical for successful germination, emergence, and stand establishment. Best germination occurs with seed placed ½ to 1 inch deep. Under drier conditions, canola may be planted deeper (not greater than 1.5 inches), but delayed emergence and reduced vigor may occur. Soil crusting following a heavy rain can result in a poor stand. Canola emergence can be greatly reduced when using a deep furrow opener followed by a heavy rain prior to emergence, since soil can fill in the furrow, resulting in a deeper than intended seeding depth.
- To ensure proper seeding depth, producers must plant slower than when planting wheat (preferably 5 mph or slower). Finally, it is important to check seeding depth in each field.

- Rows spaced between 7.5 and 15 inches allow for rapid canopy closure (improved light interception) and weed control. Yields are similar with row spacings in this range.
- Plant-to-plant uniformity at emergence is critical for optimum plant development, overwintering, and weed control.

Plant Nutrition and Soil Fertility

- Soil testing, including a profile sample for nitrogen (N) and sulfur (S), is an important tool in determining fertilizer needs. If you have questions, contact your local Extension office. All nutrient applications should be made based on soil test recommendations. Canola fertility recommendation programs can be found at: http://www.agronomy.ksu.edu/soiltesting/
- Fertility needs are similar to winter wheat; however, canola needs slightly higher N and S levels.
- Applying high rates of fertilizer in-row at planting is not recommended because canola is sensitive to ammonia and salt damage (phytotoxic effects). However, new research by Oklahoma State indicates that a low rate of DAP or MAP (30 to 40 lb/acre of product) is beneficial and not detrimental to yield. The best management practice for banding fertilizer should separate the fertilizer from the seed by two inches to avoid direct contact. Pre-plant broadcast application is also acceptable.
- Lime: Apply lime so that pH is in the range of 5.5-7.0 and early enough so the lime has time to react.
- Phosphorus (P) and Potassium (K): No added P is required if the P soil test is above 30 ppm. Additional K should be applied if soil test levels are less than 125 ppm.
- Sulfur (S): Canola requires more S than wheat because of its high content of sulfur-containing proteins. Sulfur deficiencies are most common on coarse-textured and low-organic-matter soils. Sulfur can be applied at any time from pre-plant until the canola plant breaks dormancy in late winter. Apply S based on the soil test recommendation. Sulfate-sulfur (SO₄-S) soil tests should be above 10 ppm or fertilizer should be applied. If no soil test is available, an application of 20 lb/acre S is recommended.
- Nitrogen (N): Pre-plant N applications must be carefully balanced, as too little or too much fallapplied N may negatively affect winter survival. One-third to one-half of total N (based on expected yield) should be fall-applied. At least 35 lb/acre but no more than 80 lb/acre of actual N is the general rule for fall applications. Winter survival, plant vigor, and yield potential can decrease without applying fall N.

Weed Management

- A clean seedbed is critical to establishing winter canola. Small canola seedlings compete poorly with established weeds. However, once a good stand and canopy are established, canola suppresses and outcompetes most winter annual weeds.
- No matter what herbicide program you use, the most important thing to remember is to control weeds early in the fall.
- Trifluralin and ethalfluralin are effective at controlling many problem winter annual weeds pre-plant, but each requires mechanical incorporation.
- Grass herbicides such as Select Max, Assure II, and Poast are labeled for cool-season grass control in canola.
- Roundup Ready (glyphosate tolerant) canola varieties are available, providing excellent control of many problem weeds. Glyphosate is not labeled for application once the plant has

bolted after dormancy.

- Clearfield canola varieties are available and provide another herbicide resistance option for controlling winter annual grasses.
- Before applying any herbicides, care must be taken to ensure there are no traces of problem herbicides, such as sulfonylurea herbicides, in the sprayer equipment.

Insect Management

- An insecticide seed treatment is highly recommended for control of green peach aphids and turnip aphids through fall and early winter.
- Monitor canola stands for the following fall insect pests: grasshoppers, diamondback moth larvae, flea beetles, aphids, and root maggots. Several products are labeled and provide good to excellent control.

Disease Management

- The best control of canola diseases is achieved through careful rotation. Canola should not be planted on the same field more than once every three years and should never be planted continuously.
- Blackleg (*Leptosphaeria maculans*) is the most serious disease threat to canola. Maintaining proper rotation intervals, planting disease-free seed, and using fungicide seed treatments are important management practices to slow the spread of blackleg.
- Damping-off of young seedlings, which resembles the pinching of the stem at or just below the soil line, is caused by several fungi including *Pythium*, *Fusarium*, and *Rhizoctonia*. A fungicide seed treatment can lessen the effects of these soil-borne diseases.

For further information, see the newly updated *Great Plains Canola Production Handbook*, at your local Extension office, or: <u>https://www.bookstore.ksre.ksu.edu/pubs/mf2734.pdf</u>.

Also see *Canola Growth and Development* poster, available on the web at: <u>https://www.bookstore.ksre.ksu.edu/pubs/MF3236.pdf.</u>

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9. 2019 Agronomy Fall Field Day, September 20 in Manhattan

The 2019 growing season presented many weather-related challenges to producers in Kansas and

neighboring states. In response to these challenges, the focus of the 2019 Agronomy Fall Field Day is "**Building Resiliency in Agronomy**". The field day is scheduled for **Friday, September 20**, from 9:00 a.m. to 1:00 p.m. at the Agronomy North Farm, 2200 Kimball Ave (across from Bill Snyder Stadium) in Manhattan.

Variations in weather and climate are becoming more pronounced and challenging each year. Topics will focus on understanding how different agronomic practices and technologies can aid producers in building a more resilient production system. From integration of cover crops and erosion control to advances in crop genetics and breeding, building resilient cropping systems to withstand these extreme environmental changes is crucial to the overall productivity and profitability of Kansas agriculture.

An overview of the topics includes:

- Resilient soils through conservation practices Dr. Peter Tomlinson and Carlos Boninipires
- Wheat genetics and technology Dr. Alan Fritz
- Sorghum genetics and resiliency: Delivering traits from seed bank to seed bag Dr. Geoff Morris
- Crop physiology and extreme temperatures Dr. Krishna Jagadish
- Managing variability in the field for corn and soybeans Dr. Ignacio Ciampitti
- Using Mesonet and climate data for crop production in Kansas Chip Redmond

The field day will kick-off with registration at 9:00 am. Tours will begin at 9:30 am and a sponsored lunch will be served to conclude the event. There is no cost and all interested individuals are encouraged to attend.

Preregistration is requested by September 16 so that an accurate lunch count can be made. The online registration link is now open at: <u>http://bit.ly/AgronFieldDay2019</u>. You can also preregister by calling Troy Lynn Eckart at 785-532-0400. On-site registration will also be available.

For more information, interested persons can contact Dorivar Ruiz Diaz at 785-532-6183 or ruizdiaz@ksu.edu

2019 Agronomy Field Day



Friday, September 20 | 9:00 AM – 1:00 PM Agronomy North Farm