Issue 760

K-STATE
Research and Extension

Extension Agronomy

eUpdate

08/09/2019

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. Final irrigation of the growing season - Timing is everything

As the growing season wraps up, producers have an opportunity to improve their water productivity by properly timing their final irrigation application. This is an important decision as an early termination of irrigation can result in reductions in grain yield, primarily through reductions in the kernel weight yield component. Conversely, a late termination of irrigation results in unnecessary pumping, energy consumption, and increasing the risk of soil compaction at harvest due to increased soil water and the risk of water loss through drainage.

With the goal of matching available water to crop needs while avoiding excess, it is important to understand crop water use requirements late in the growing season. Anticipated water use from various growth stages until physiological maturity for corn, grain sorghum, and soybeans is shown in Table 1.

Table 1. Anticipated water use for corn, grain sorghum, and soybeans at various growth stages.

Stage of Growth	Approximate number of days to maturity	Water use to maturity (inches)
Corn		
Blister	45	10.5
Dough	34	7.5
Beginning dent	24	5
Full dent	13	2.5
Black layer	0	0
Grain Sorghum		
Mid bloom	34	9
Soft dough	23	5
Hard dough	12	2
Black layer	0	0
Soybeans		
Full pod	37	9
Beginning seed	29	6.5
Full seed	17	3.5
Full maturity	0	0

Adapted from K-State MF2174, Rogers and Sothers.

Research in western Kansas has shown the importance of keeping the management allowable depletion limited to 45% during the post-tassel period. In other words, maintaining available soil water contents above 55%. By knowing anticipated water use from a given growth stage and the remaining soil water in the profile, producers can add just enough irrigation water to meet that demand and maintain profile available soil water content above 55%.

By closely following the growth and development of the crop, one can know when physiological maturity, i.e. black layer in corn, has been reached and at that point water use for the production of grain yield has ceased and additional irrigation is certainly unnecessary.

Termination Based on Calendar Dates

Traditionally many producers have used a fixed calendar date to determine their final irrigation. Long-term studies conducted at the Northwest Research-Extension Center at Colby show the potential problems in this approach. Table 2 shows silking, maturity, and irrigation termination dates for a long term study in corn. Over the course of this study, the irrigation termination date for maximum grain yield varied from August 12 to September 21. This is a significant departure from a general rule of thumb using Labor Day as a termination date. As shown, the use of a fixed date on the calendar without regard to crop progress, soil water status, or ET demand would have resulted in both forfeited yield and wasteful pumping across this timeframe.

Table 2. Silking, maturity, and irrigation termination dates for a long-term study in corn.

Year	Date of Anthesis	Date of Maturity	Irrigation Season Termination Date For		
			80% Max Yield	90% Max Yield	MaxYield
1993	20-Jul	30-Sep	5-Aug	5-Aug	15-Aug
1994	20-Jul	15-Sep	5-Aug	15-Aug	15-Aug
1995	20-Jul	29-Sep	5-Aug	13-Aug	18-Aug
1996	20-Jul	3-Oct	17-Jul	17-Jul	29-Aug
1997	23-Jul	1-Oct	23-Jul	23-Jul	27-Aug
1998	20-Jul	28-Sep	20-Jul	20-Jul	24-Aug
1999	23-Jul	6-Oct	24-Jul	13-Aug	20-Sep
2000	12-Jul	20-Sep	14-Sep	20-Sep	20-Sep
2001	16-Jul	29-Sep	30-Jul	22-Sep	22-Sep
2002	22-Jul	30-Sep	4-Aug	30-Aug	7-Sep
2003	22-Jul	23-Sep	3-Aug	3-Aug	18-Aug
2004	19-Jul	28-Sep	8-Aug	21-Aug	27-Aug
2005	20-Jul	28-Sep	2-Aug	9-Aug	29-Aug
2006	17-Jul	25-Sep	30-Jul	13-Aug	13-Aug
2007	18-Jul	19-Sep	14-Aug	21-Aug	28-Aug
2008	24-Jul	10-Oct	31-Jul	6-Aug	27-Aug
Average	**19-Jul**	**27-Sep**	**2-Aug**	**13-Aug**	**28-Aug**
Standard Dev.	**3 days**	**6 days**	**13 days**	**19 days**	**13 days**
Earliest	**12-Jul**	**14-Sep**	**17-Jul**	**17-Jul**	**12-Aug**
Latest	**24-Jul**	**10-Oct**	**14-Sep**	**21-Sep**	**21-Sep**

* *Estimated dates are based on the individual irrigation treatment dates from each of the different studies when the specified percentage of yield was exceeded.*

Consequences of Excess Late-Season Irrigation

In the silt-loam soil profiles common in western Kansas, water drainage out of the soil profile starts to occur when the profile water content rises above 60% available soil water. The rate of drainage loss increases rapidly with increasing water content. Late-season irrigation in excess of crop water use results in increased accumulation of water in the profile, which is subject to drainage losses. A survey of irrigated corn fields was conducted in 2010 and 2011 (Figure 1). Fields were surveyed after corn harvest across three east-west transects in western Kansas.

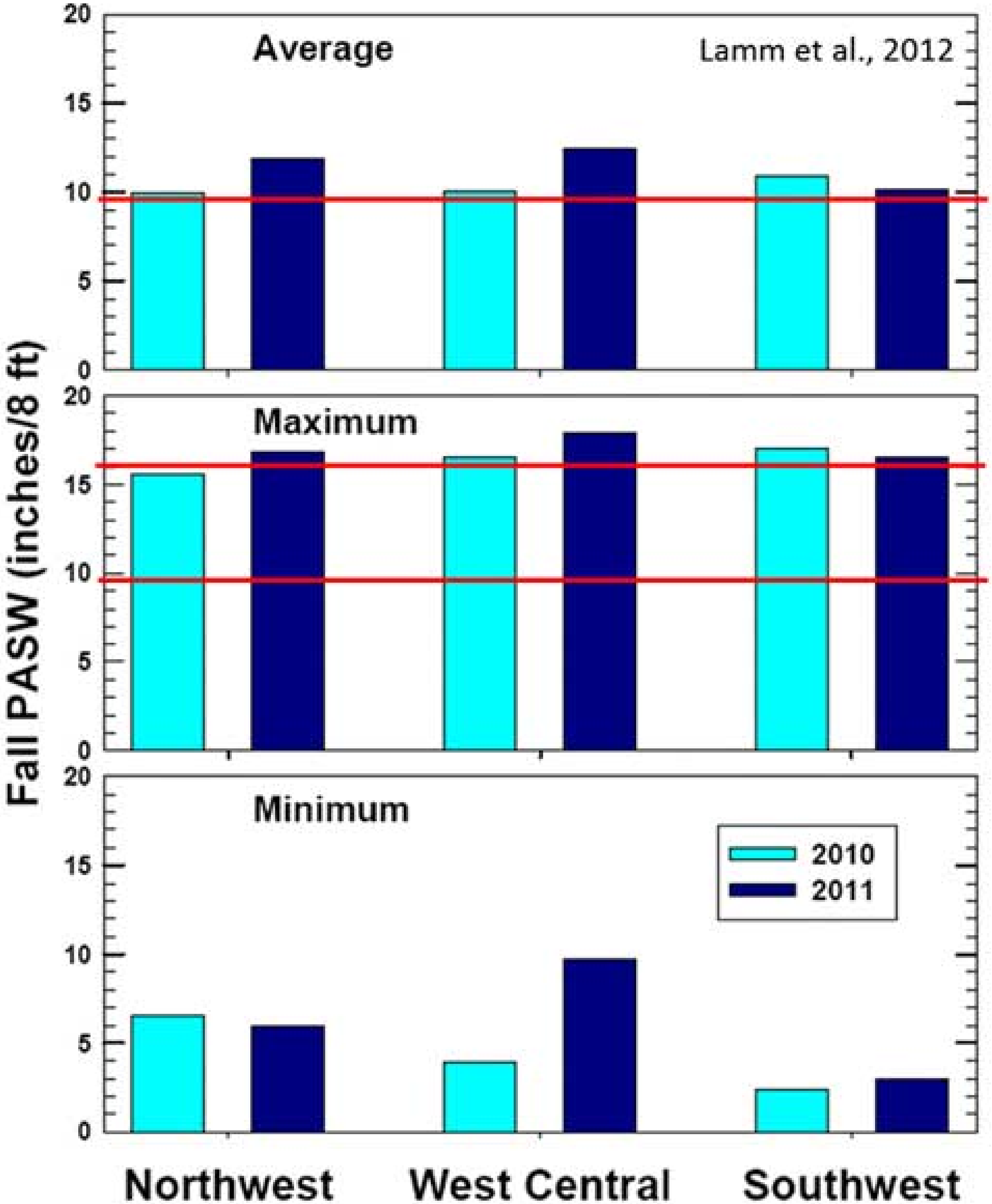

Figure 1. Results from 2-year survey of irrigated corn fields. Fields were surveyed after harvest across three east-west transects in western KS.

The line at 9.6 inches of plant-available soil water (PASW) denotes the approximate water content where drainage losses would start to occur. On average, most producer fields were near this level of soil water storage indicating a good management strategy as drainage losses had been minimized while yet maintaining adequate soil water to complete grain fill.

Producer fields near the minimum observed values likely did not have adequate soil water to ensure maximum grain yields. The most concerning scenario however, are the fields at the upper end of soil water values such as the maximum observation. The red line at 16 inches PASW represents field capacity, the point at which free drainage and significant water losses from the profile would occur. In the wettest producer fields, in all three regions, significant amounts of free drainage and water loss would have been occurring at the time of crop maturation and harvest.

Timing of the final irrigation:

1. Determine crop growth stage and anticipated remaining water use
2. Determine soil water status in the field by probe or calibrated soil sensor technology
3. Determine irrigation strategy necessary to meet remaining crop water use while maintaining soil water content at or above 55% (limit depletion to 45%).
4. Be ready to make adjustments based on changes in ET demand, precipitation, etc.

Additional information, including a step-by-step procedure, can be found in publication MF2174: “Predicting the final irrigation for corn, grain sorghum, and soybeans”; http://www.bookstore.ksre.ksu.edu/pubs/MF2174.pdf

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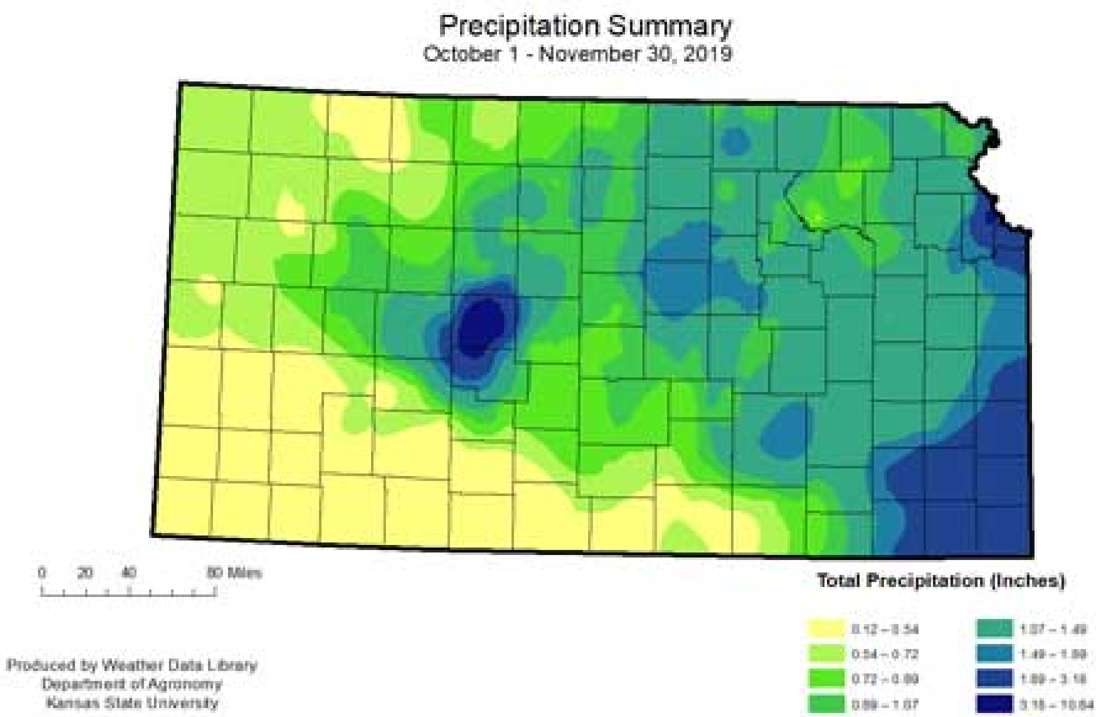
2. Overview of the 2019 Kansas wheat growing season

The 2019 winter wheat growing season in Kansas was a tale of two crops: one extremely challenged (though resilient) crop in the central and eastern portions of the state, and a crop that was exposed to near-optimal conditions in western Kansas.

Central and Eastern Kansas

The challenges faced by the wheat crop started early for central and eastern Kansas, with an excessive amount of rainfall during sowing time. Parts of south central Kansas received as much as 19 inches of precipitation between September 1 and November 30 (up to 11 inches between October and November, Fig. 1 upper panel), which delayed wheat sowing and, in many cases, prevented producers from sowing wheat. This situation was worsened where producers had to harvest a summer crop (soybeans) prior to sowing wheat. Consequently, Kansas set two new records: (1) the latest sowing of the second half of the crop (about 55% of Kansas wheat fields were sown prior to October 5, and the remaining crop was not sown, in many cases, until mid-November, Fig. 1 lower panel); and (2) the lowest area planted to winter wheat in Kansas in ~100 years. The fall of 2018 had an early onset of cold temperatures, which was not conducive for wheat emergence and tillering. Thus, while early-sown fields showed good fall development, many fields sown into November showed very limited fall development and did not start tillering until late February and early March (Fig. 2). With a majority of fields sown late, and coupled with a cool fall, there were very limited reports of aphids and the virus diseases they might transmit, such as barley yellow dwarf.



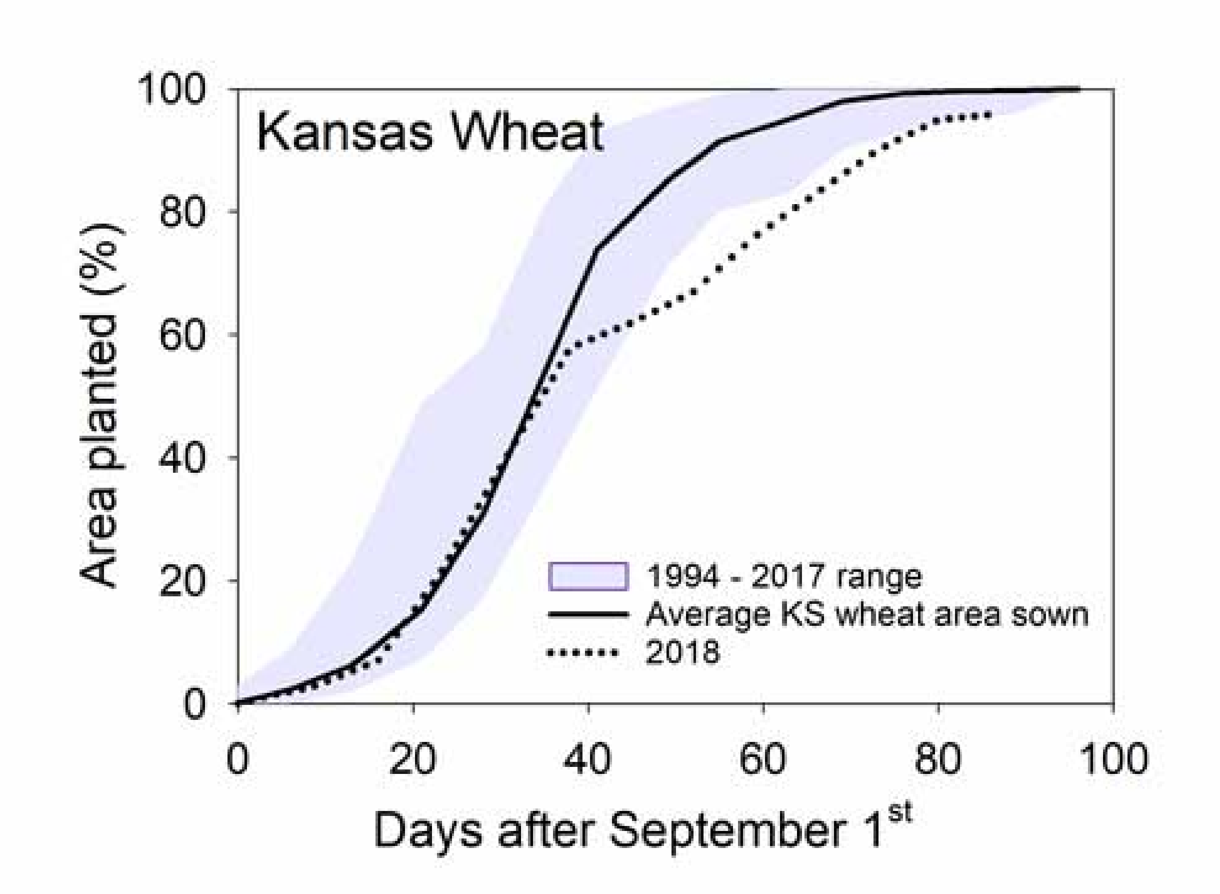


Figure 1. Precipitation summary for the period between October 1 and November 30, 2019 (upper panel). Sowing progress in Kansas during 2018 (dotted line) as compared to the 1994-2017 average (solid line) and range (purple area).

Figure 2. Wheat development in December 2018 as affected by sowing date (September 20, left panel; versus October 25, right panel). Photos by Romulo Lollato, K-State Research and Extension.

The remainder of the growing season was also cooler and wetter than average in central and eastern Kansas. From approximately April 1 until June 10, total precipitation ranged from 10.5 to 30.2 inches in the central corridor, which is excessive (Fig. 3, upper panel). Therefore, water-logging was a common theme during between boot and flowering stages of development (Fig. 3, middle panel). The amount of waterlogging in a given field depended on field slope and drainage capacity, but the majority of the fields in Sumner and Cowley counties had large drowned-out portions (Fig. 3, lower panel). The excessive moisture during the growing season might also have increased nitrogen (N) and sulfur losses via leaching and denitrification (in the case of N), rendering many fields in central Kansas N deficient. Typical symptoms included shortened pale green canopy with limited head size accompanied by contrasting cow pocks of higher fertility. During May, a few hail events brought localized damage and crop termination to some fields in south central Kansas.

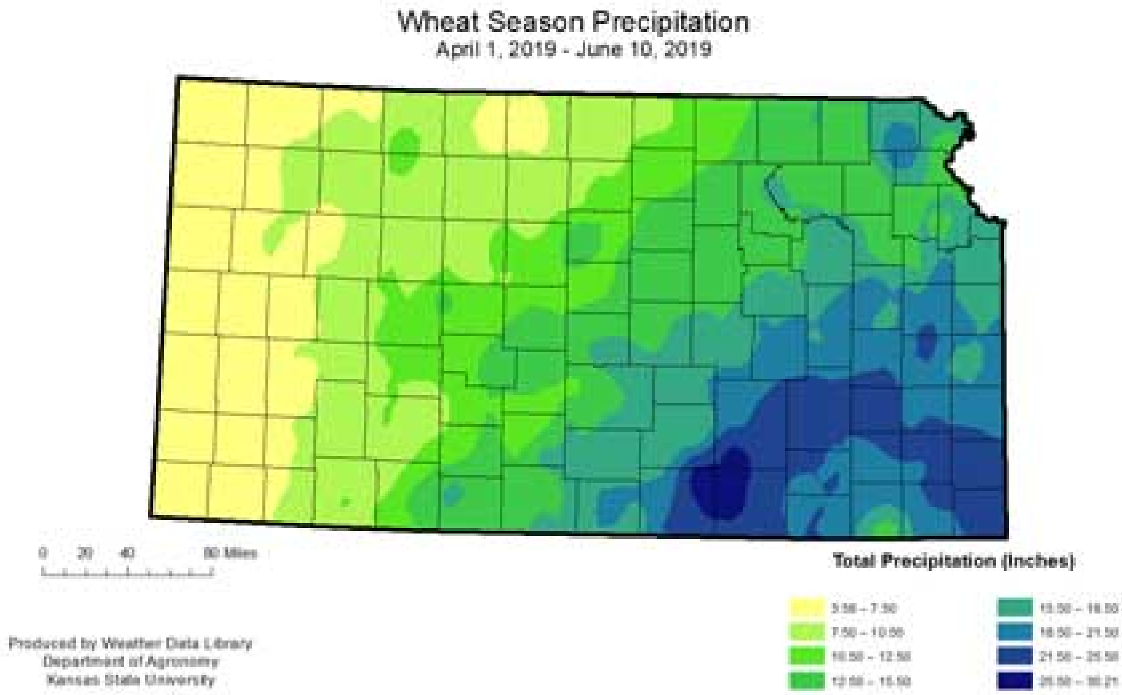

Wheat Season Precipitation
April 1, 2019 - June 10, 2019
0 20 40 80 Miles
Total Precipitation (Inches)
Produced by Weather Data Library
Department of Agronomy
Kansas State University

Figure 3. Precipitation summary for the period between April 1 and June 10, 2019 (upper panel). Water logged conditions near Great Bend (Barton Co, KS) in May due to excessive precipitation (lower panel, photo by Alicia Boor, KSRE District Extension Agent). Wheat fields in south central Kansas showed large portions drowned out due to excessive precipitation during grain filling period (Photo by Romulo Lollato, K-State Research and Extension).

Due to above-average moisture, the incidence of fungal diseases such as stripe rust, leaf rust, and especially Fusarium head blight were also above normal, leading to yield losses across the central portion of the state. Hutchinson, for example, was a hotspot for both leaf and stripe rust, while head scab was scattered across the entire central portion of the state.

The combination of delayed sowing, excessive precipitation (more than 60 inches during the growing season for portions of south central Kansas), and below average temperatures led to a delayed harvest of about 14 days as compared to the long-term average. Likewise, excessive rainfall led to high field-to-field variability in the central portion of the state. It was not uncommon to hear reports of yields of about 60 bushels per acre and test weights of 62 pounds per bushel from one field (typically better drained, sandier soils), while a neighboring field from the same producer yielded 20 bushels per acre with 55 pounds per bushel test weight (flat fields with worse drainage capacity).

Western Kansas

Overall, the western Kansas crop had a very favorable growing season. Sufficient rainfall during sowing time (ranging from 0.5 to ~2 inches between October and November) ensured a good stand establishment. For the most part, the western Kansas wheat crop was sown in a timely manner with the exception of some fields sown after corn, which were delayed due to rainfall during October. However, this represented a minority of the fields, especially when compared to the proportion of fields sown late in central Kansas. An early onset of cold temperatures in the fall avoided excessive fall growth and decreased the incidence of viral diseases that are transmitted by aphids or by the wheat curl mite, restricting wheat streak mosaic occurrence to isolated cases.

Winter precipitation in the form of snowfall was above average, as was spring rainfall in western Kansas, resulting in a full soil moisture profile. This portion of the state received anywhere from four to 13 inches of precipitation between April 1 and June 10, which ensured great grain filling conditions. These above average precipitation amounts also led to some visible symptoms of N deficiency in many fields in western Kansas, likely due to a mismatch between N positioning in the soil profile (leached down below the root zone due to above average precipitation), coupled to a decreased root system due to cooler temperatures. Many symptoms of N deficiency faded after slightly greater temperatures in May allowed for a better root development. Despite above average precipitation, the occurrence of stripe and leaf rusts was sporadic and, while observed at levels to ensure fungicide application in susceptible varieties, caused considerably less yield losses as compared to those observed in central Kansas. During June, a few hail events brought localized damage and crop termination to some fields in western Kansas. It is imperative that producers control their volunteer wheat in fields affected by hail, as the occurrence of volunteer wheat will be greater under these conditions.

Temperatures during the entire growing season were below average, which delayed crop development. Although a late-developing crop is typically more exposed to heat stress, temperatures during the grain fill period continued below average [May average temperatures: 60 degrees F (-3.3 F), and June average temperature: 72 degrees F (-0.9 F)], which led to longer grain filling period and increased overall yield. Many growers reported yields of 60-70 bushels per acre as opposed to their long-term average of 30-35 bushels per acre and, in many cases, yields greater than 100 bushels per acre were reported. This increased grain filling period, in combination with continuous rainfall events, delayed harvest in parts of the state, leading to one of the latest harvests in recent years.

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3. Updated publication examines performance of wheat varieties grown for dual-purpose and grain-only systems

To be successful in dual-purpose systems, wheat varieties often require traits sometimes overlooked in grain-only systems. These include fall forage yield potential, date of first hollow stem, recovery potential from grazing, resistance to viral diseases more commonly transmitted under early sowing, high temperature germination sensitivity, long coleoptile, and tolerance to low soil pH and aluminum toxicity.

A recently revised publication from the Department of Agronomy and K-State Research and Extension examines the fall forage yield, date of first hollow stem, plant height, and grain yield of current varieties in dual-purpose versus grain-only systems.

Fall forage yield potential is an important trait in dual-purpose systems because it sets the potential beef production from wheat grazing in the fall, winter, and early spring. Approximately 100 pounds of beef can be produced for every 1,000 pounds of wheat forage produced in an acre. Forage production is dependent on variety selection, planting date, seeding and nitrogen rates, and fall temperatures and precipitation.

Date of first hollow stem is an important trait in dual-purpose systems (Figure 1). Terminating grazing at the right time is essential to maintaining grain yield potential. Grazing past first hollow stem can decrease wheat grain yield by as much as 1 to 5 percent per day. Varieties with a shorter vernalization requirement might reach first hollow stem up to 30 days earlier than varieties with a longer vernalization requirement, depending on environmental conditions. An early occurrence of first hollow stem reduces the grazing window into early spring. Date of first hollow stem depends on temperature and day length in photoperiod-sensitive varieties.

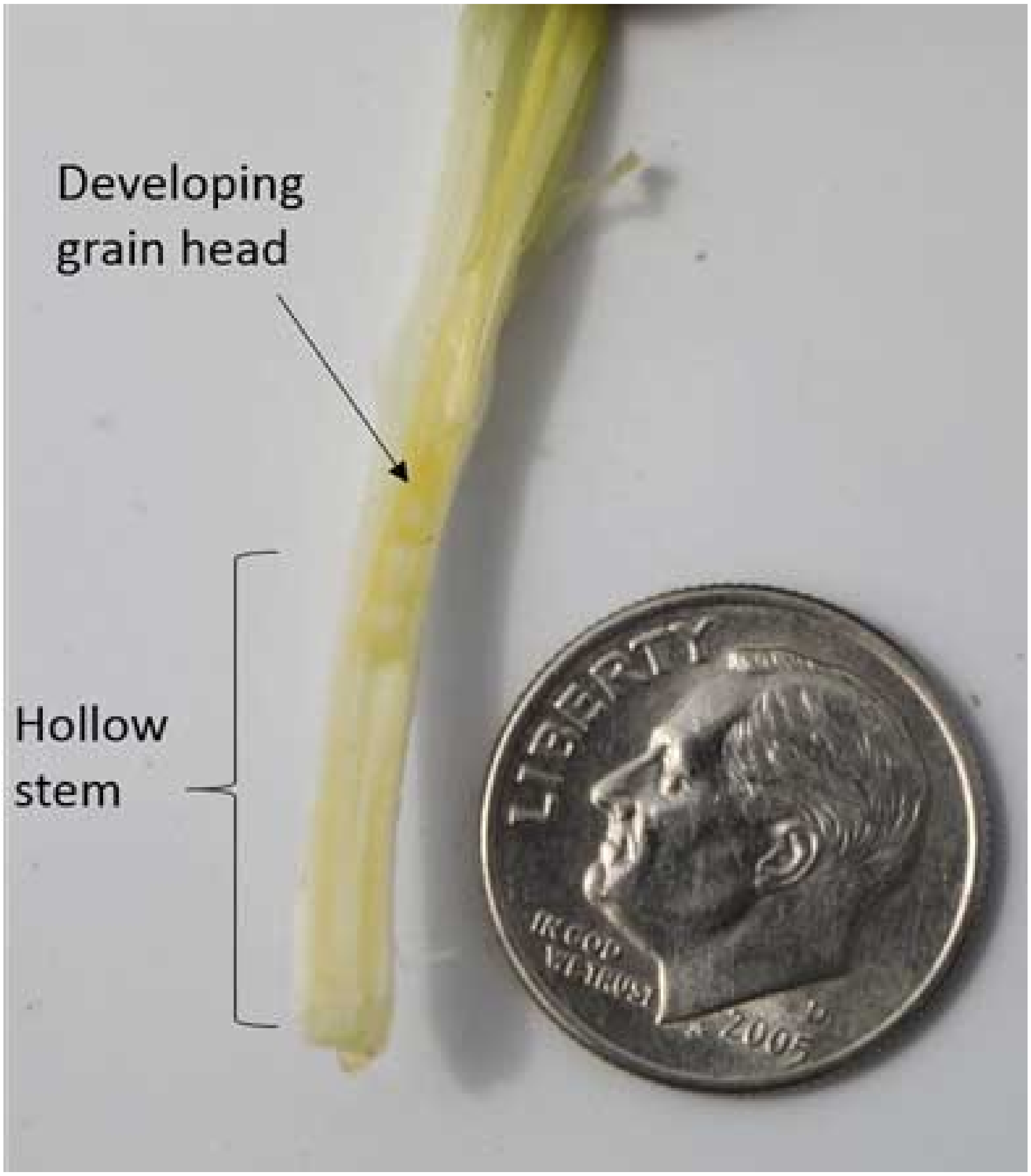

Figure 1. Wheat plant reaching the first hollow stem stage of growth, characterized by approximately 1.5 cm (or roughly the diameter of a dime) of hollow stem underneath the developing grain head. Photo by Romulo Lollato, K-State Research and Extension.

Grain yield following grazing is another important variety-specific trait in dual-purpose systems. Varieties that rely mostly on fall-formed tillers to produce grain yield generally show a greater yield penalty from grazing than varieties with good spring tiller potential.

Variety performance

To evaluate the above traits in grain-only and dual-purpose systems in Kansas, thirty-six commonly grown winter wheat varieties were sown in three neighboring trials in the South Central Experiment Field near Hutchinson, Kansas. Two trials were sown to simulate dual-purpose management, characterized by early sowing date, increased nitrogen rate, and higher seeding rate; while a third trial was sown to the same varieties under grain-only management.

Check out how varieties compared in fall forage production, date of first hollow stem, and grain yield under both dual-purpose or grain only management systems in the full publication, which can be found online at: https://www.bookstore.ksre.ksu.edu/pubs/MF3312.pdf.

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4. North Central Experiment Fall Field Day - August 20

All interested individuals are invited to attend the **2019 North Central Experiment Field Day** on **Tuesday, August 20, at 6:00 p.m**. The event will be held at the South Unit experiment field located approximately 2.5 miles west of Scandia on Hwy 36.

This is a free event and no pre-registration is required. There will be a catered meal at the end of the program. CCA/CEU credits will be available. Topics and speakers will include:

Corn planting date considerations – Stu Duncan, K-State Northeast Area Agronomist

In-furrow fertilizer with soybeans and soybean stand issues – Dorivar Ruiz Diaz, K-State Soil Fertility and Nutrient Management Specialist

Long-term fertility research and trends – Dorivar Ruiz Diaz and Andrew Esser, Agronomist-in-charge, North Central Kansas Experiment Field

For questions about the event, please call Andrew Esser at 785-335-2836

K·STATE
Research and Extension

KSU NCK Experiment Field
Fall Field Day

August 20, 2019
KSU Experiment Field South Unit Location
2.5 miles west of Scandia on Hwy 36
6:00 P.M. Sharp

Tour Topics:

-Corn Planting Date Considerations
Dr. Stu Duncan, KSU Northeast Regional Agronomist

-In-furrow Fertilizer with Soybeans and Soybean Stand Issues
Dr. Dorivar Ruiz-Diaz, Soil Fertility and Nutrient Management Professor K-State

-Long-Term Fertility Research and Trends
Dr. Dorivar Ruiz-Diaz and Andrew Esser, Agronomist-in-Charge NCK-Exp. Fields

Free Event

No registration required
Catered Dinner to Follow Program
Questions Call: 785-335-2836
Andrew Esser, Agronomist-in-Charge

Meeting sponsored by: K·STATE Research and Extension

CCA CEU's available

5. Kansas River Valley Fall Field Day - August 13

All crop producers are invited to attend the **2019 Kansas River Valley Experiment Field Day** on **Tuesday, August 13 at 5:00 p.m**. The field day will be held at the Rossville field located 1 mile east of Rossville on Hwy. 24 on the south side of the road.

This is free event for all and will included a barbeque meal sponsored by Wilbur-Ellis. Presentations will be geared to having a more profitable and efficient crop production operation. Topics and speakers will include:

- **Dr. Stu Duncan and Dr. Dallas Peterson – Weed management in soybeans**
- **Dr. Dorivar Ruiz Diaz – Effect of split late N application in corn on yield and nitrogen use efficiency**
- **Malynda O'Day – Cover crop management for weed suppression**
- **Chip Redmond – Making the most of the Mesonet: A resource to aid herbicide application**

To pre-register for the catered meal sponsored by Wilbur-Ellis, please call Jolene Savage at the Shawnee County Extension office at 785-232-0062, Ext. 100, by **5:00 p.m. on Monday, August 12**. Additional field day sponsorship includes the Kansas Corn Commission. Certified Crop Advisor and Commercial Pesticide Applicator credits have been applied for.

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Kansas State Research & Extension

KSU Agronomy

Kansas River Valley Experiment Field
2019 Fall Field Day

Tuesday, August 13 - **5:00 p.m. Sharp!**

Rossville Field — 1 mile east of Rossville on U.S. Highway 24 on the south side of the road

Dr. Dallas Peterson and Dr. Stewart Duncan- Weed management in soybeans.

Dr. Dorivar Ruiz Diaz – Effect of split late N application in corn on yield and nitrogen use efficiency.

Malynda O'Day- Cover crop management for weed suppression.

Chip Redmond- Making the most of the Mesonet: a resource to aid herbicide application.

To pre-register for the catered BBQ meal sponsored by Wilbur-Ellis, call Jolene Savage at the Shawnee County Extension Office at 785-232-0062 — Ext. 100 by 5:00 p.m. on Monday, August 12. Additional Field Day sponsorship in-part by the Kansas Corn Commission. **Certified Crop Advisor and Commercial Pesticide Applicator Credits have been applied for.**

6. East Central Experiment Field fall field day - August 21

The East Central Experiment Field in Ottawa will host its fall field day on **Wednesday, August 21**. The event will begin at 9:00 a.m. with registration, coffee, and doughnuts. The field day program will begin at 9:30 a.m. A complimentary lunch will be served at noon to conclude the event.

Field day topics and speakers include:

- **Dr. Dallas Peterson – Dicamba injury to non-Xtend soybeans**
- **Dr. Dorivar Ruiz Diaz – Effect of split late N application to corn on yield and nitrogen use efficiency**
- **Malynda O'Day – Cover crop management for weed suppression**
- **Chip Redmond – Making the most of the Mesonet: A resource to aid herbicide application**

The field day is located at the East-Central Experiment field near Ottawa. From I-35 at the Ottawa exit, go south 1.7 miles on Hwy 59, then east 1 mile, and south 0.75 mile.

Certified Crop Advisor and Commercial Pesticide Applicator credits have been applied for. Please contact the East-Central Research Station at 785-242-5616 at least two days prior to the event if accommodations are needed for persons with disabilities or special requirements. The field day is sponsored in part by the Kansas Corn Commission.

Kansas State Research & Extension

KSU Agronomy
Ottawa Field Day

Wednesday, August 21th, 2019

East-Central Experiment Field

Ottawa, KS

From I-35 at Ottawa: South 1.7 miles on 59 Hwy, East 1.0 mile, South 0.75 mile

9:00............... Registration, coffee, and doughnuts

9:30............... Program begins

Dr. Dallas Peterson- "Dicamba injury to non-Xtend soybeans".

Dr. Dorivar Ruiz Diaz – Effect of split late N application in corn on yield and nitrogen use efficiency.

Malynda O'Day- Cover crop management for weed suppression.

Chip Redmond- Making the most of the Mesonet: a resource to aid herbicide application.

12:00............. Lunch

Certified Crop Advisor and Commercial Pesticide Applicator Credits have been applied for. Please contact the East-Central Research Station at 785-242-5616 at least two days prior to this event if accommodations are needed for persons with disabilities or special requirements. Field Day sponsored in-part by the Kansas Corn Commission.

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