Issue 541

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eUpdate

12/18/2015

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update 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 Steve Watson, 785-532-7105 swatson@ksu.edu, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Winter survival of wheat

Conditions were unusually mild throughout Kansas during the first half of December. What implications, if any, does this long, open fall have for the winterhardiness of wheat?

Factors to consider in winter survival of wheat

The following are some of the factors to consider when evaluating the outlook for winter survival of wheat:

Cold acclimation of the crop and maintenance of cold hardiness

During the fall, winter wheat seedlings spend the first month or so of their lives developing their first leaves, the crown, and a secondary root system. All the while, the seedlings are building and storing the energy they will need to go through the cold acclimation process and survive the winter. Normally seedlings will need a minimum of 4-5 leaves and one or two tillers to have built up enough stored energy reserves to survive the winter. Ideally, the wheat plant would have 3 to 5 tillers prior to the onset of the winter. Seedlings will have a better chance of winter survival if their crowns are well developed in firm soil, about one inch below the soil surface.

Winterhardiness or cold tolerance is a physiological process triggered by gradually cooling temperatures in the fall. During the process of cold acclimation, certain genes within winter wheat begin to initiate the production of "anti-freeze" type substances to protect the cell membranes. The process of cold acclimation within a sufficiently developed wheat seedling begins when soil temperatures at crown depth fall below about 50 degrees F (Figure 1). Below this threshold, there is an inverse relationship between crown temperatures and cold acclimation, meaning that plants will acclimate twice as fast when crown temperatures are 32 degrees F as compared to 40 degrees F. Photoperiod also plays a role in the process of cold hardening, with shorter days and longer nights helping initiate the process. Winter survival depends on the crown remaining alive, and the substances that produce cold acclimation are most needed within the crown.

It takes about 4 to 6 weeks of soil temperatures below 50 degrees at the depth of the crown for winter wheat to fully cold harden. The colder the soil at the depth of the crown, the more quickly the plants will develop winterhardiness.

Cold hardiness is not a static state, however. After the cold hardening process begins in the fall, wheat plants can rapidly unharden when soil temperatures at the depth of the crown get above 50 degrees. But the plants will re-harden as crown temperatures cool below 50 degrees again. By the time winter begins, winter wheat will normally have reached its maximum level of cold hardiness. Wheat in Kansas normally has its maximum level of winterhardiness from mid-December to mid-January, unless there are high temperatures during that period.

Figure 1. Gradually cooling soil temperatures at the crown level during the fall triggers winterhardiness in winter wheat. Photo by Romulo Lollato, K-State Research and Extension.

Even during the depths of winter, winter wheat is still respiring and roots may be growing – as long as the ground is not frozen. It is not unusual to find a much more developed crown root system in early February than existed in early December. It is not unusual to see some green leaves intermingled with straw-colored or pale leaves in the winter (Figure 2). The fact that some of the leaves have some green color does not mean the wheat is not cold tolerant.

Once winter wheat has reached the level of full cold hardiness, it will remain cold hardy as long as crown temperatures remain below about 32 degrees– assuming the plants had a good supply of energy going into the winter.

If soil temperatures at the crown depth rise to 50 degrees or more for a prolonged period, there will be a gradual loss of cold hardiness, even in the middle of winter. The warmer the crown temperature during the winter, the more quickly the plants will start losing their maximum level of cold hardiness. Winter wheat can re-harden during the winter if it loses its full level of winter hardiness, but will not regain its maximum level of winterhardiness.

Even at its maximum level of winterhardiness, winter wheat can still be injured or even killed by cold temperatures if temperatures at the crown level reach single digits or if plants are subjected to long periods when soil temperatures approach the minimum survival temperatures. Thus, winter survival is affected not only how by cold it gets, but also for how long it is cold. As soil temperatures at the crown level rise to 50 degrees or more, usually in late winter or spring, winter wheat will gradually lose its winterhardiness entirely. Photoperiod also plays a role in this process, and there are varietal differences in winterhardiness. When the leaves switch from being prostrate to upright, the plants will have completely dehardened.

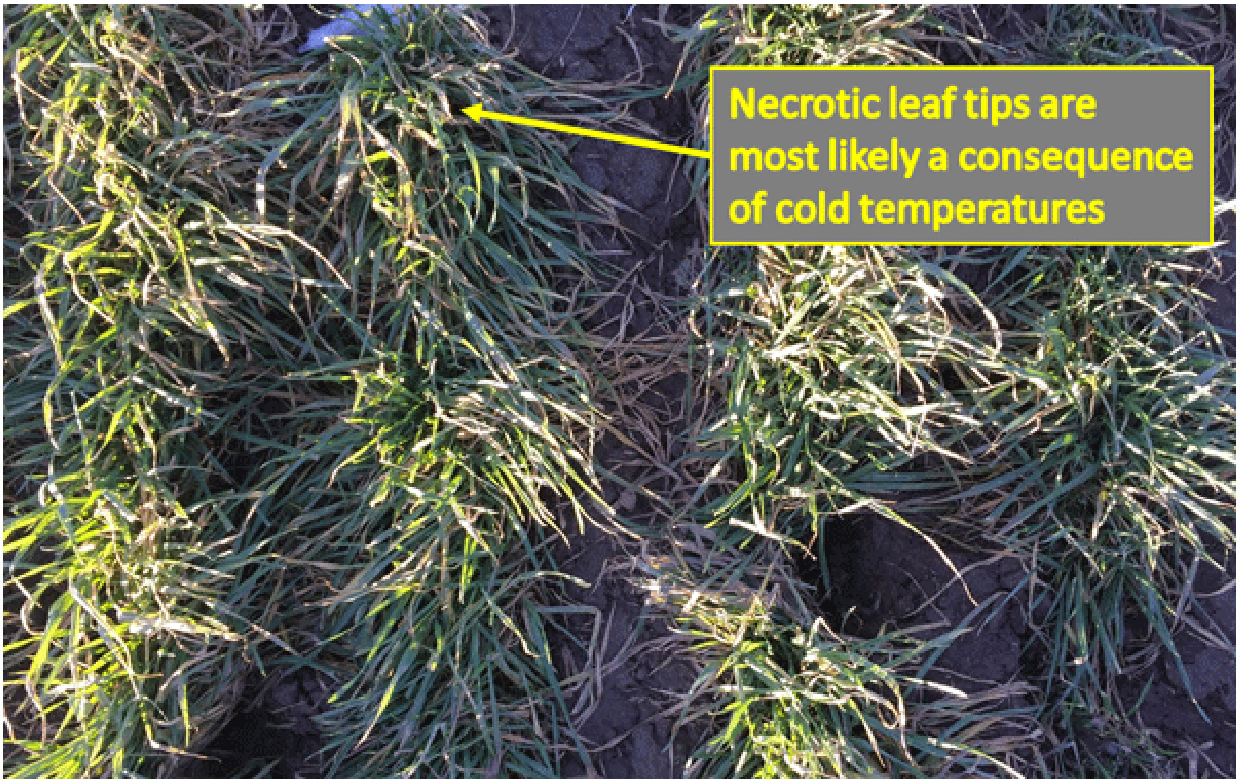


Figure 2. Wheat plants starting to show straw-colored or pale leaf tips as consequence of cold temperatures near Healy. Brown, dried leaves do not necessarily indicate winter injury. The only way to assess the plant's condition following winter is to examine the crown for winterkill. Photo by Romulo Lollato, K-State Research and Extension.

Fall root system development

Good top growth of wheat doesn't necessarily indicate good root development. Poor root development is a concern where conditions have been dry. Where wheat plants have a good crown root system and two or more tillers, they will tolerate the cold better. If plants are poorly developed going into winter, with very few secondary roots and no tillers, they will be more susceptible to winterkill or desiccation, especially when soils remain dry. Poor development of secondary roots may not be readily apparent unless the plants are pulled up and examined (Figure 3). If secondary roots are poorly developed, it may be due to dry soils, poor seed-to-soil contact, very low pH, insect damage, or other causes.

Figure 3. Differences in wheat development prior to winter dormancy. Both examples above should be able to make it through the winter, although the more developed root system in the photo to the right will be able to provide water and nutrients with less limitations to the plant during the winter. Photos by Romulo Lollato, K-State Research and Extension.

Soil temperatures at the crown level

This depends on snow cover, moisture levels in the soil, and seedbed conditions. Winterkill is possible if soil temperatures at the crown level (about one inch deep if the wheat was planted at the correct depth) fall into the single digits. If there is at least an inch of snow on the ground, the wheat will be insulated and protected, and soil temperatures will usually remain above the critical level. Also, if the soil has good moisture, it's possible that soil temperatures at the crown level may not reach the critical level even in the absence of snow cover. However, if the soil is dry and there is no snow cover, there may be the potential for winterkill, especially on exposed slopes or terrace tops, depending on the condition of the plants. Dry soils and loose seedbeds warm up and cool down much faster than moist or firm soils, contributing to winter injury. For more details on current conditions of soil temperatures across Kansas, please see the article in this issue of the Agronomy eUpdate (No. 541, December 18 2015 titled "Soil temperatures getting colder after December 13." The eUpdates can be accessed at: https://webapp.agron.ksu.edu/agr_social/eu.throck

Is the crown well protected by soil?

If wheat is planted at the correct depth, about 1.5 to 2 inches deep, and in good contact with the soil, the crown should be about one inch below the soil surface and well protected by the soil from the effects of cold temperatures. If the wheat seed was planted too shallowly, then the crown will have developed too close to the soil surface and will be more susceptible to winterkill. Also, if the seed was planted into loose soil or into heavy surface residue, the crown could be more exposed and could be susceptible to cold temperatures and desiccation.

Is there any insect or disease damage to the plants?

Plants may die during the winter not from winterkill, but from the direct effects of a fall infestation of Hessian fly. Many people are familiar with the lodging that Hessian fly can cause to wheat in the spring, but fewer recognize the damage that can be caused by fall infestations of Hessian fly. Wheat infested in the fall often remains green until the winter when the infested tillers gradually die. Depending on the stage of wheat when the larvae begin their feeding, individual tillers or whole plants can die. If the infestation occurs before multiple tillers are well established then whole plants can die. If the plants have multiple tillers before the plants are infested then often only individual tillers that are infested by the fly larvae will die.

The key to being able to confirm that the Hessian fly is the cause of the dead tillers is to carefully inspect the dead plants or tillers for Hessian fly larvae or pupae. This can be done by carefully removing the plant from the soil and pulling back the leaf material to expose the base of the plant. By late winter all of the larvae should have pupated and thus the pupae should be easily detected as elongated brown structures pressed against the base of the plant. The pupae are fairly resilient and will remain at the base of the plant well into the spring.

Damage from winter grain mites, brown wheat mites, aphids, and crown and root rot diseases can also weaken wheat plants and make them somewhat more susceptible to injury from cold weather stress or desiccation.

Fall armyworms and army cutworms may have fed on emerging wheat in the previous month, leaving bare patches. If the worms were fall armyworms they have died by now. If the worms were army cutworms they will overwinter where they are in the soil and continue to feed on wheat plants anytime the temperature is 45 degrees or more from now through about April.

So if you have bare patches now, it is a good idea to keep an eye on them and if they slowly expand over the winter, get out and check in the soil around the base of the plants to see if there are small worms curled up about an inch or two below the surface, especially in loose soils. A spot application of a registered insecticide on a warm (above 55 degrees) winter afternoon will do a pretty good job of controlling the worms and allow the plants to come back in the spring as these worms only feed on the above ground leaf tissue, and not on the roots or crown.

Symptoms of winter survival problems

Symptoms of winterkill will be more apparent when the weather warms up and plants start to green up early spring. If plants are killed outright by cold temperatures, they won't green up next spring. But if they are only damaged, it might take them a while to die. In some cases, damaged plants will green up and then slowly go "backwards" and eventually die. This happens because although there may be enough nutrients in the crown to allow the plants to green up, the winter injury causes vascular damage so that remaining nutrients cannot move, or root rot diseases move in and kill the plants. This slow death is probably the most common result of winter injury on wheat.

Direct cold injury is not the only source of winter injury. Under dry soil conditions, wheat plants may suffer from desiccation. This can kill or weaken plants, and is actually a more common problem than direct cold injury.

Summary

Ideally, wheat plants will have at least 1-2 tillers and 3-5 leaves, as well as a good crown root system development, when going into the winter. A fall with open field conditions, gradually falling soil temperatures, and little snow cover until freeze-up, will contribute to winterhardiness development by the wheat crop. During the winter, moist and firm soil as well as at least an inch snow cover will help buffer and insulate crown temperatures and increase the chances of winter survival.

Romulo Lollato, Wheat and Forages Specialist
lollato@ksu.edu

2. Topdressing canola: How to maximize the benefits

To maximize the yield potential of winter canola, producers should topdress with nitrogen, sulfur, 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.

Nutrients

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

Nitrogen. About two-thirds of the total nitrogen 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. Topdress applications should be based on an updated assessment of yield potential, less profile residual nitrogen, and the amount of nitrogen applied in the fall. Suggested nitrogen rates for five yield levels and a soil with 2 percent organic matter and varying residual nitrate-nitrogen levels is shown in the table below. For soils with 1 percent organic matter, add 15 pounds nitrogen for each yield and nitrate level above and for soils with 3 percent organic matter subtract 15 pounds nitrogen for each yield and nitrate level.

Total nitrogen fertilizer needs for canola as affected by yield potential and soil test nitrogen levels in the southern Great Plains

Profile N test	Yield potential (lbs/acre)				
(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 nitrogen 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.

Some of the new 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 sulfur, the consequences can be very serious because the crop needs sulfur to produce oil and protein in the seed. For this reason, soils having less than 20 lbs/acre sulfate-sulfur (10 ppm SO_4-S) in the upper 24 inches should receive supplemental sulfur. A good rule to follow is to keep sulfur to nitrogen availability at a ratio of about 1 to 7. Another simple guideline is to apply 20 pounds sulfur 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 nitrogen in the winter topdressing. Canola growers may consider using elemental sulfur, ammonium sulfate, or a thiosulfate form of sulfur. Since elemental sulfur 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.

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. Do not use high flotation tires. 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.

Mike Stamm, Canola Breeder
mjstamm@ksu.edu

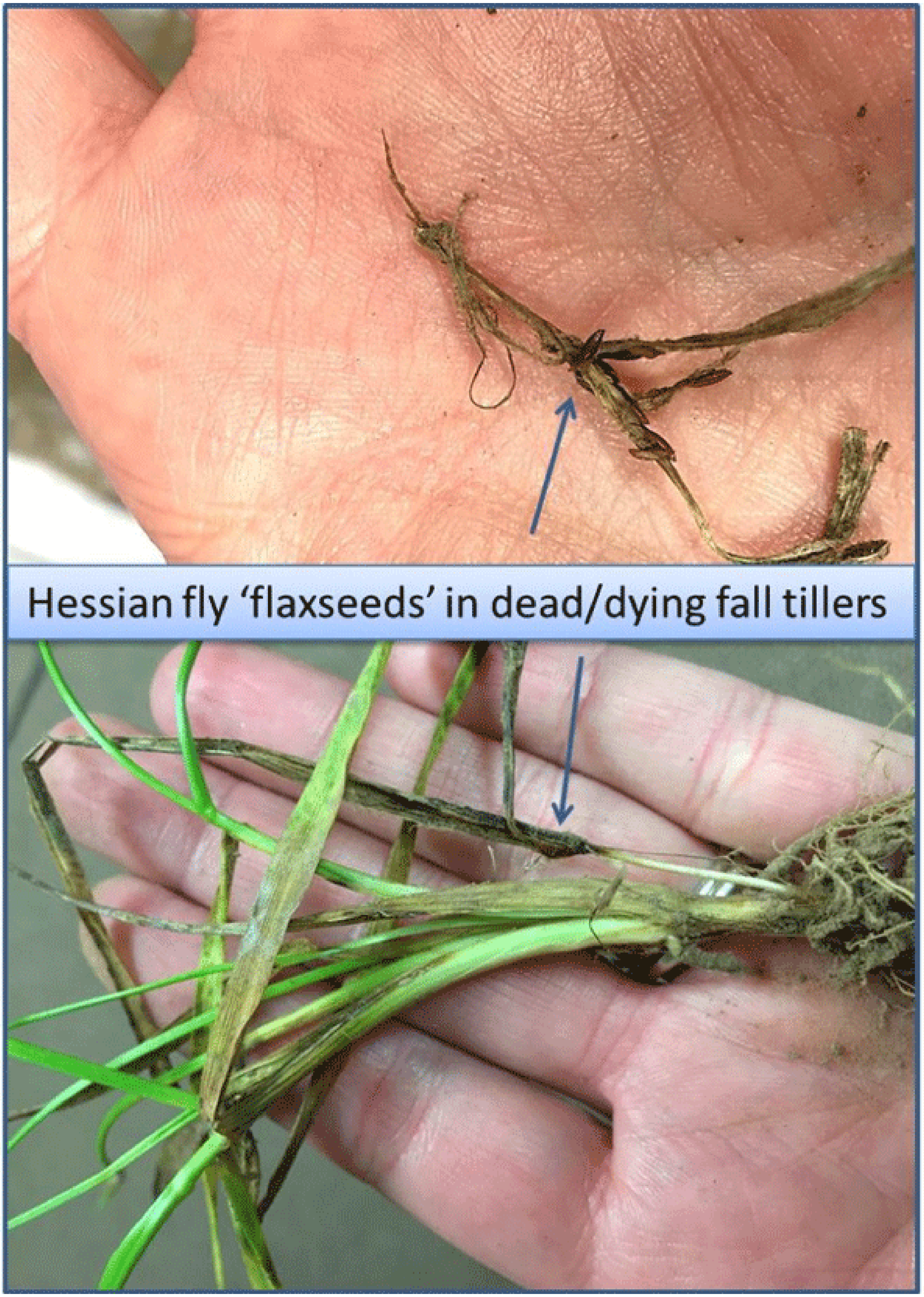
Dorivar Ruiz Diaz, Nutrient Management Specialist
ruizdiaz@ksu.edu

3. Hessian fly on wheat in southwest Kansas

Recent visits to Edwards County wheat fields have revealed spotty but heavy infestations of Hessian fly. As an example, one field visited was planted on Sept. 25, just a few days shy of the "fly-free" date of October 1 in Edwards County. The variety planted on this field is susceptible to Hessian fly. In this case of fall infestation, Hessian fly adults likely emerged from the adjacent wheat stubble, then infested the nearby wheat seedlings in mid- to late-October. Even if the farmer would have planted after Oct. 1, some egg laying would still have occurred in this field because many of the adult Hessian flies emerged later than the fly-free date this fall.

Although the "Hessian fly-free date" is still a good general rule, that term is not completely correct anymore since Hessian fly adults have been caught flying up until December in some places in Kansas now.

Hessian fly infestations this fall are likely not limited to Edwards County since large populations of Hessian flies were detected in many areas in south central Kansas last spring. The adults were detected by sweeping wheat fields located near wheat stubble or in continuous wheat. Farmers should check now for the puparia or "flaxseed" stage (see below). Where infestations are found, farmers will need to evaluate the extent of the infestation and weigh the potential value of any further input costs on infested fields.



Hessian fly ‘flaxseeds’ in dead/dying fall tillers

Hessian fly maggot feeding on seedlings in the fall can cause severe injury to plants. Infested wheat is stunted, and its leaves are dark green and broader than normal. Such injured plants will never grow past the four-leaf stage and will generally die during the winter.

If tillering has begun, then only infested tillers may die. To scout for the Hessian fly in the winter months, peel back the leaf sheaths to uncover the puparia. Flies in the flaxseed stage will usually emerge as adults in March or April and will fly to nearby areas to deposit their eggs onto wheat leaves.

There are no chemical management options for Hessian fly maggots or those in the flaxseed stage. Managing adult Hessian flies is not recommended either because emergence can be staggered over a period of several weeks -- yet adults live for only a few days. The best way farmers can prevent future infestations is to plant varieties of wheat that have greater resistance to Hessian flies and plant after the fly-free dates for their county.

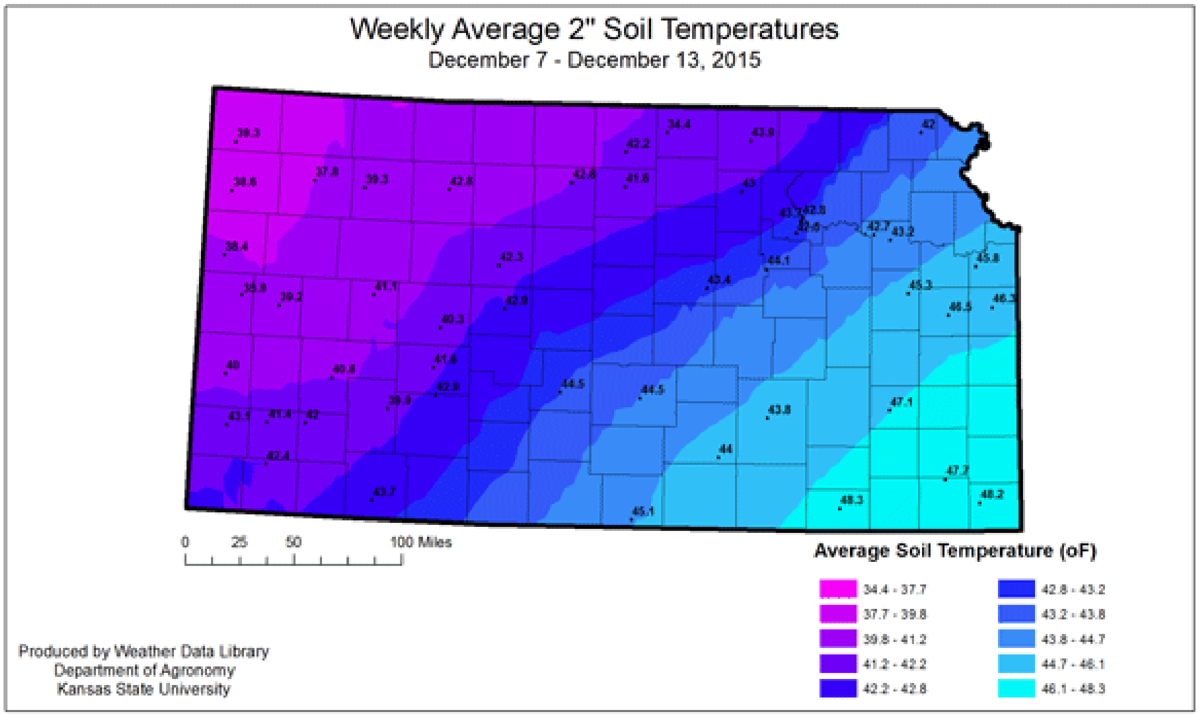
For more detailed information on the Hessian fly in Kansas see the *Hessian fly factsheet*: https://www.bookstore.ksre.ksu.edu/pubs/MF2866.pdf,

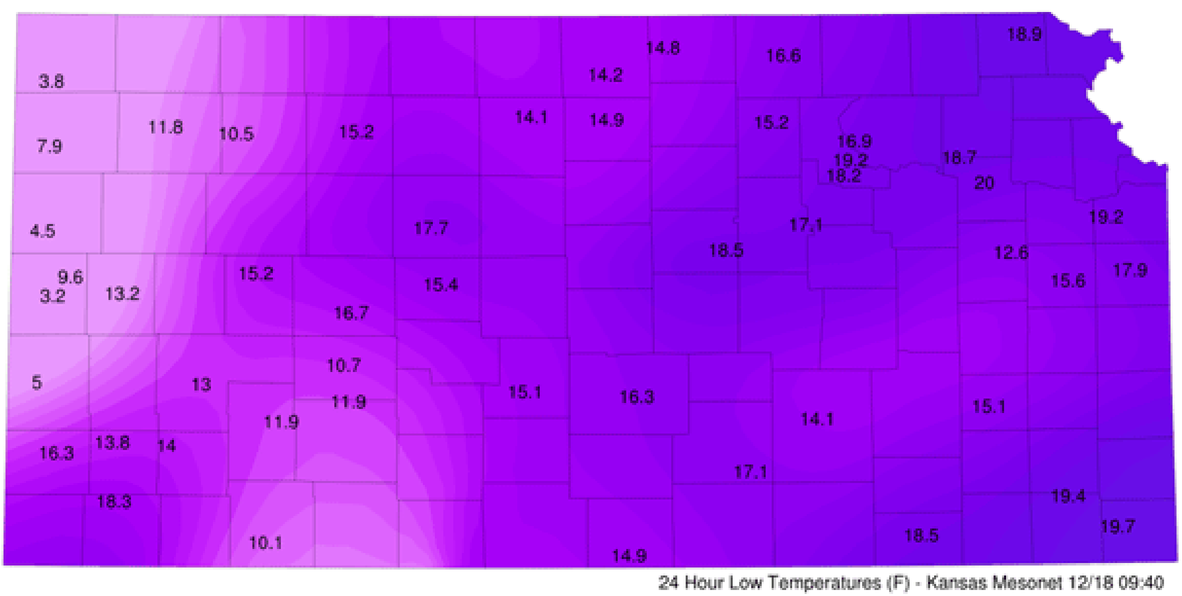
Recommended management options are discussed here: https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=691

Sarah Zukoff, Southwest Area Extension Entomologist
snzukoff@ksu.edu

4. Soil temperatures getting colder after December 13

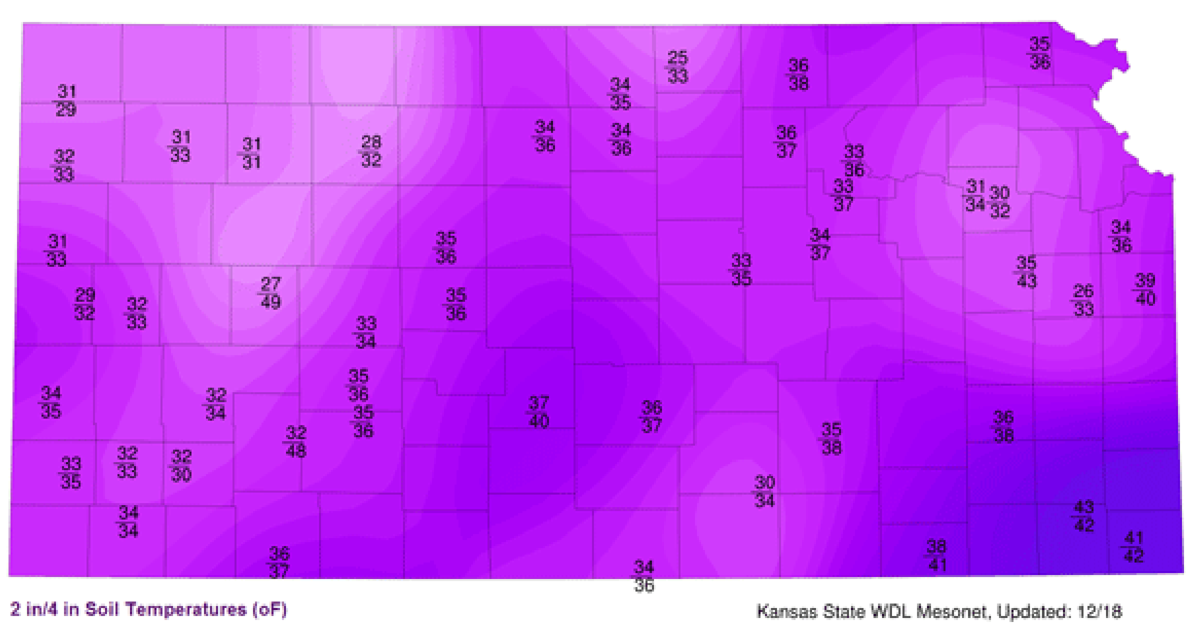
Surface soil temperatures can serve as a proxy for the temperature at which the crown of winter wheat is located. The mild conditions in November and the beginning of December kept soil temperatures above freezing across the state. Although air temperatures in the teens were experienced in the western parts of Kansas during this period, there was snow cover to insulate the ground in most cases. The map below shows the average 2-inch soil temperature for the week ending December 13:





Colder conditions have developed since Dec. 13 and snow cover has been mostly eliminated. Low temperatures on the morning of Dec. 18, as reported by the Kansas Mesonet, showed readings in the low teens to single digits in the west and in the upper teens in the east:

The result has been a sharp drop in soil temperatures in areas where the snow is no longer present, as depicted in the map below:



You can follow the low temperatures and the number of hours below freezing on the Kansas Mesonet site at http://mesonet.ksu.edu/freeze

Mary Knapp, Weather Data Library
mknapp@ksu.edu

Christopher Redmond, Weather Data Library
christopherredmond@ksu.edu

5. K-State Soybean Schools scheduled for late January

2016 SOYBEAN SCHOOLS

KANSAS STATE UNIVERSITY

Department of Agronomy

A series of four K-State Soybean Production Schools will be offered in late-January 2016 to provide in-depth training for soybean producers.

The one-day schools will cover issues facing soybean producers: weed control strategies, crop production practices, soil fertility and nutrient management, insect and disease control, and risk management.

All the Schools will offer CEU (Certified Crop Advisor) and Commercial Pesticide Applicators credits.

The schools will begin at 9 a.m. and adjourn at 2.30 p.m., including a farmer panel at the end of the School. The dates and locations are:

Jan. 25 - Great Bend: Great Bend Recreation Commission, 1214 Stone Street

- Alicia Boor, Ag Ext. Agent, Barton Co., aboor@ksu.edu, 620-793-1910

Jan. 26 - Overbrook: Grace Community Church, 310 E 8th Street

- Darren Hibdon, Crop Production Ext. Agent, Frontier District, dhibdon@ksu.edu, 785-229-3520

Jan. 28 - Beloit: NC Kansas Technical College Auditorium, Highway 24

- Sandra Wick, Crop Production Ext. Agent, Post Rock District, swick@ksu.edu, 785-282-6823

Jan. 29 - Marysville: American Legion, 310 N 19th St

- Anastasia Johnson, Ag Ext. Agent, Marshall Co., anastasia@ksu.edu, 785-562-3531

Lunch will be provided, courtesy of the sponsors. There is no cost to attend, but participants are asked to pre-register before Jan. 22.

Online registration at K-State Soybean Schools: **http://bit.ly/KSBEANSchools**

An alternative to the online registration is by emailing or calling the nearest local Research and Extension office for the location participants plan to attend.

For more information, contact:

Doug Shoup, Southeast Area Crops and Soils Specialist
dshoup@ksu.edu

Stu Duncan, Northeast Area Crops and Soils Specialist
sduncan@ksu.edu

Ignacio Ciampitti, Crop Production and Cropping Systems Specialist
ciampitti@ksu.edu

6. K-State Sorghum Schools scheduled for early February

A series of four K-State Sorghum Production Schools will be offered in early February 2016 to provide in-depth training for sorghum producers. The schools will be sponsored by Kansas Grain Sorghum Commission.

The one-day schools will cover issues facing sorghum producers: weed control strategies, crop production practices, soil fertility and nutrient management, insect control, irrigation, limited irrigation and iron chlorosis (western Kansas), sugarcane aphid, and risk management.

All the Schools will offer CEU (Crop Certified Advisor) and Commercial Pesticide Applicators credits.

The schools will begin at 9 a.m. and adjourn at 3 p.m., including a farmer panel at the end of the School. The dates and locations are:

Feb. 2 - Scott City: Wm. Carpenter 4-H Building, 608 N Fairground Rd

- John Beckman, Scott County, jbeckman@ksu.edu, 620-872-2930

Feb. 3 - Phillipsburg: Phillips County Fair Building, 1481 US-183

- Cody Miller, Phillips-Rooks District, codym@ksu.edu, 785-543-6845

Feb. 4 - Ellsworth: American Legion Post 174, 645 W 15th St

- Michelle Buchanan, Midway District, mbuchanan@ksu.edu, 785-472-4442

Feb. 5 - Emporia: Bowyer Community Building, 2650 W US Hwy 50

- Brian Rees, Lyon County, brees@ksu.edu, 620-341-3220

Lunch will be provided, courtesy of the sponsors. There is no cost to attend, but participants are asked to pre-register before Jan. 29.

Online registration at K-State Sorghum Schools: **http://bit.ly/KSSORGHUMSchools**

An alternative to the online registration is by emailing or calling the nearest local Research and Extension office for the location participants plan to attend.

For more information, contact:

Jill Barnhardt, Kansas Grain Sorghum Commission, jill@ksgrainsorghum.org

Ignacio Ciampitti, Crop Production and Cropping Systems Specialist, ciampitti@ksu.edu

Curtis Thompson, Weed Management Specialist, cthompso@ksu.edu

K-State Area Extension Agronomists:

Lucas Haag, Northwest Area Crops and Soils Specialist, lhaag@ksu.edu

AJ Foster, Southwest Area Crops and Soils Specialist, anserdj@ksu.edu

Stu Duncan, Northeast Area Crops and Soils Specialist, sduncan@ksu.edu

Doug Shoup, Southeast Area Crops and Soils Specialist, dshoup@ksu.edu