

# KANSAS COOPERATIVE PLANT DISEASE SURVEY REPORT

## PRELIMINARY 2018 KANSAS WHEAT DISEASE LOSS ESTIMATES

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### **HIGHLIGHTS**

The NATIONAL AGRICULTURAL STATISTICS SERVICE July forecast of 277.0 million bushels represented an expected harvest of 7.3 million acres of wheat with an average of 37.9 bushels per acre yield. This is a decrease of 9 bushels per acre compared to 2017's harvest, and overall 14.6% decrease in harvested bushels statewide. However, acres harvested were up 5.8%.

The estimated yield loss due to lesion nematodes was 2.0% or 5.7 million bushels. The cumulative disease loss estimate excluding nematodes for the 2018 wheat crop was 0.4% or 1.1 million bushels. The potential yield of the crop without diseases was calculated at 283.8 million bushels, or 38.9 bushels per acre.

In 2018, Kansas wheat producers' yields and test weights were decreased largely because of weather conditions rather than disease pressure. An intense drought plagued much of the state for most of the summer, which is not conducive to most disease development. In addition, rain in fall 2017 delayed planting in many areas of western Kansas. This later planting date means that wheat was emerging at a time when weather conditions were less favorable for disease. Of the diseases of concern this year, the most important disease statewide was lesion nematodes, followed by leaf rust and wheat streak mosaic virus complex. No crop reporting districts suffered significant losses due to disease, and due to the low overall yield losses, severity of loss due to any specific disease did not vary significantly between districts from East to West.

Peaks and valleys which are correlated with weather patterns and disease epidemics mark loss estimates and are based on data collected yearly since 1976 (Figure 1). 2018 was a much below average year for wheat disease, very similar to disease levels in 2014 which was also a drought year.

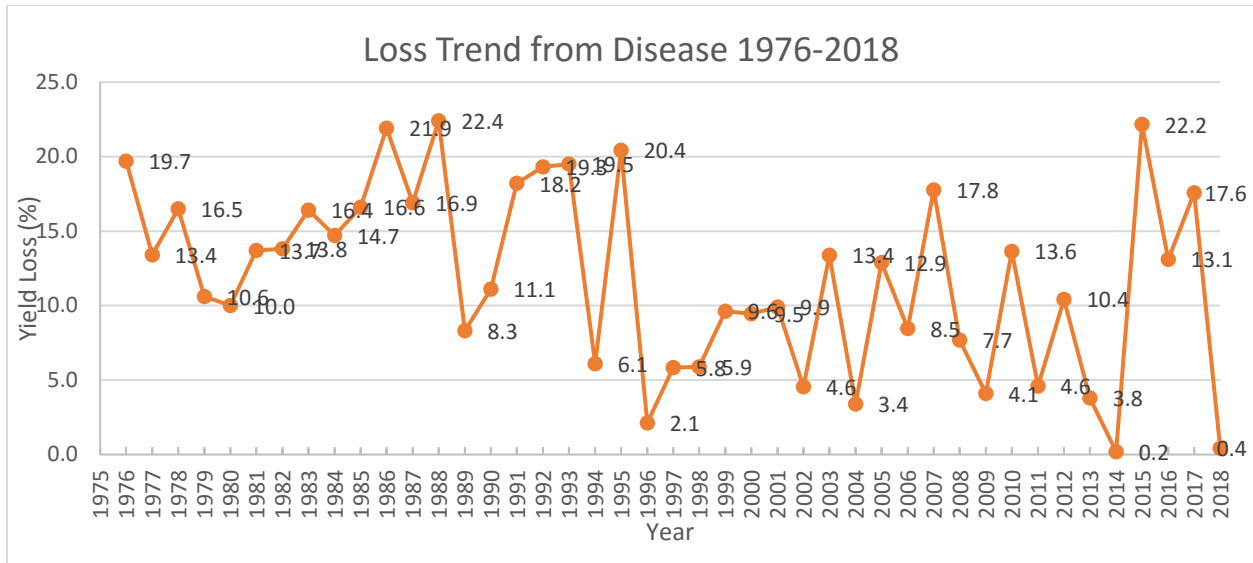


Figure 1. Trend graph of estimated wheat yield loss due to disease from 1976 to 2018, excluding yield loss due to root lesion nematodes. Lesion nematode estimation data were only collected from 2010 to 2015 and in 2017 and 2018 so it was left out for presentation purposes.

**DISEASES**

The most important disease of 2018 was **root lesion nematodes**. Data collection continued as in 2010-2015 and 2017, with a one-year absence in 2016. Thirty-nine fields were sampled across 20 counties in Central and Western Kansas for nematode populations (Figure 2). Estimated yield loss due to root lesion nematode was 2.0% or 5.7 million bushels, which is similar to estimated losses in most years of nematode survey. This contrasts with 2017, which was by far the lowest estimated yield loss since root lesion nematode data collection commenced in 2010, with a 0.6% yield loss. The average level of losses estimated due to nematodes is likely because the nematodes were already established in the safety of the soil and were therefore less affected by the adverse weather conditions, and generally their populations do not fluctuate to the degree that foliar diseases do. The estimate compares to a 5-year average of 1.55% loss and 10-year average of 1.81%.

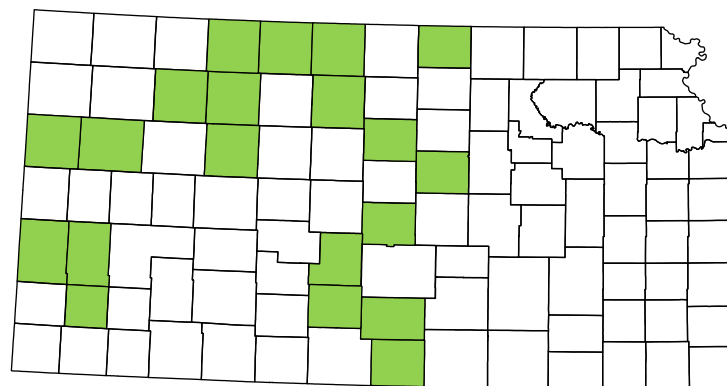


Figure 2. The 20 counties targeted in the 2018 wheat root lesion nematode survey.

**Leaf rust** was the second most important disease of 2018, with a 0.22% estimated loss, or 611,000 bushels. No observed field experienced severe levels of leaf rust. This is likely because of 1) a combination of drought conditions being uncondusive to disease development; and 2) by the time any fungal spores reached Kansas (they cannot overwinter in Kansas and therefore must blow in from more southerly states each year) the wheat was already too dried down for many spores to infect the plants. This late development of leaf rust likely increased the reduction of the damaged caused this year. The 2018 loss to leaf rust was lower than the estimated loss in 2017, which was 0.8%. It was a below-average estimated loss for the tenth year in a row, in comparison to the slightly higher 5-, 10-, and 20-year averages (0.56%, 0.62%, and 1.87% losses, respectively). Leaf rust was of most concern in Central Kansas, while causing no measurable losses in the East. Losses in Central and Northwest Kansas were estimated highest at 0.5% and 0.6% loss respectively, while all Eastern districts showed no loss (Figure 3). This may be due to a continued high percentage of the wheat variety ‘Everest,’ which is highly resistant to leaf rust, being planted in the Eastern third of the state, as much as 43.8% of the combined acreage of the three Eastern crop reporting districts.

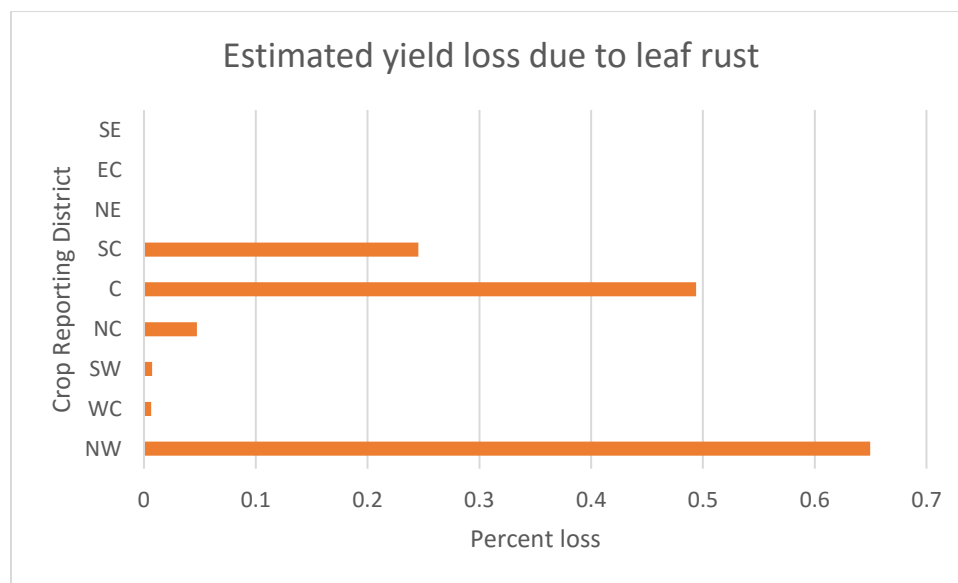


Figure 3. Estimated yield loss due to leaf rust in susceptible varieties ranged from 0% to 0.65% in crop reporting districts but was most severe in Central and Northwestern districts.

**Wheat streak mosaic virus complex (WSM)** was the third most important disease of 2018, at 0.07% estimated loss statewide, or 194 thousand bushels. This is an unusually low yield loss due to this disease, much lower than the 5-, 10-, and 20-year averages (1.69%, 1.28%, and 1.32%, respectively). This is in stark contrast to the yield loss in 2017 (5.6%), a year of unusually severe WSM due to decreased control of volunteer wheat in late summer 2016 and weather conditions conducive to disease development. After such a high loss in 2017, with some observed wheat fields suffering as much as 100% yield loss, farmers may have better controlled the volunteer wheat in post-harvest 2017. This would have decreased the ability of the wheat curl mite to

survive between 2017 harvest and planting, which would have better controlled the disease spread. In addition, there was a much more rapid transition to cool temperatures in the fall of 2017. These cold temperatures in October and November likely reduced the activity and movement of the wheat curl mites.

Wheat streak mosaic virus complex is comprised of wheat streak mosaic virus, high plains virus, and *Triticum* mosaic virus, and is transmitted by wheat curl mites.

WSM only caused detectable yield loss in two crop reporting districts, the Northwest and the West Central districts, causing 0.2% and 0.4% loss respectively.

**Stripe rust**, unlike recent years, was present but not of much importance in 2018. Percent yield loss this year was 0.03%, which is the lowest since the drought year of 2014 and much lower than the 5-, 10-, and 20-year averages (6.63%, 4.92%, and 3.77%, respectively). This dramatic decrease in yield loss due to stripe rust is most likely due to the dry weather conditions rather than foliar fungicide practices.

Stripe rust is favored by cool temperatures and moderately frequent rainfall throughout the spring and summer, which Kansas did not have in 2018. Many of the most commonly-planted wheat varieties in Kansas are susceptible to stripe rust, but the conditions were so unfavorable that there was very little disease despite this. Stripe rust caused a loss of 79 thousand bushels of wheat statewide.

Stripe rust caused detectable yield loss only in Northwest, East Central, and Southeast crop reporting districts, causing an estimated 0.1% loss in each district.

Other diseases of interest in 2018 were **root and crown rot** (0.06% estimated loss), **bacterial leaf complex** (0.03% estimated loss), **powdery mildew** (0.02% estimated loss), **barley yellow dwarf virus** (0.001% estimated loss), **tan spot** (0.001% estimated loss), and **Septoria complex** (0.001% estimated loss). This year, **flag smut** was detected in 2 counties during the annual survey. One of these counties, Saline county, was a new county confirmed this year. It was also found in Rush county, confirmed positive in 2015. Flag smut reappeared in Kansas in 2015 after a 70-year absence and has now been confirmed positive in 27 counties in Kansas over the past 4 years. A **Karnal bunt** survey was also conducted post-harvest in 2018. Karnal bunt was not detected in Kansas. This survey has been conducted yearly since 1993 with no positive finds.

The yield loss table from the past 20 years shows how each year is unique (Figure 4). Factors such as weather, crop rotation, variety selection, and cultural practices can all have a significant impact on which diseases may thrive and which may be suppressed in any given year. In an unprecedented occurrence, root lesion nematodes were the most important disease of wheat in 2018, with all other diseases far behind in severity.

										5- YR	10- YR	20- YR	
2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVE	AVE	AVE	DISEASE
0.01	10.3	0.05	5.7	0.03	0	15.4	9.1	8.6	0.03	6.63	4.92	3.77	STRIPE RUST
1.37	1	0.01	1	0.01	0.001	0.5	1.3	0.8	0.22	0.56	0.62	1.87	LEAF RUST
0.001	0.2	1.7	1.2	1.2	0.05	2.7	0.05	5.6	0.07	1.69	1.28	1.32	WHEAT STREAK MOSAIC COMPLEX
0.44	0.3	2.74	2.3	0.25	0.001	0.001	1.3	0.9	0.001	0.44	0.82	0.91	BARLEY YELLOW DWARF
0.26	0.2	0.01	0.01	0.5	0.1	0.01	0.9	0.9	0.001	0.38	0.29	0.53	TAN SPOT
1	1.1	0.01	0.01	1.7	0	0.1	0.3	0.4	0.001	0.16	0.46	0.40	SEPTORIA COMPLEX
0.9	0.3	0.01	0.001	0.05	0.02	3.4	0.1	0.3	0	0.76	0.51	0.37	SCAB
0.001	0.1	0.01	0.01	0.01	0.001	0.01	0	0	0	0.00	0.01	0.04	SOILBORNE & SPINDLE STREAK
0.02	0.1	0.01	0.001	0.01	0.001	0.001	0.05	0.05	0.02	0.02	0.03	0.08	POWDERY MILDEW
0.001	0.01	0.01	0.1	0.01	0.01	0.001	0	0	0.06	0.01	0.02	0.03	ROOT & CROWN ROT
0.04	0.03	0.01	0.05	0.01	0.001	0.001	0.01	0.01	0.001	0.00	0.02	0.02	BUNT, LOOSE SMUT, FLAG SMUT
0.01	0.001	0	0	0	0.001	0	0	0	0	0.00	0.00	0.01	TAKE-ALL
0	0	0	0	0	0	0	0	0.01	0	0.00	0.00	0.02	STRAWBREAKER
0.04	0	0.01	0.03	0.03	0.01	0.03	0	0	0.03	0.01	0.02	0.01	BACTERIAL LEAF COMPLEX
0.001	0.001	0.01	0.01	0	0.001	0.001	0	0	0.001	0.00	0.00	0.00	STEM RUST
0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	SNOW MOLD*
0.001	0.001	0.001	0	0	0.001	0	0	0	0	0.00	0.00	0.00	CEPHALOSPORIUM STRIPE
0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	AMERICAN WHEAT STRIATE*
	2.0	1.6	2.3	2.4	1.0	2.6	-	0.6	2.0	1.55	1.81	-	LESION NEMATODES*
<b>4.1</b>	<b>13.6</b>	<b>4.6</b>	<b>10.4</b>	<b>3.8</b>	<b>0.2</b>	<b>22.2</b>	<b>13.1</b>	<b>17.6</b>	<b>0.4</b>	<b>10.7</b>	<b>9.0</b>	<b>9.4</b>	<b>TOTAL</b>

Figure 4. Yield loss estimates from Kansas production 2009-2018 with 5-, 10-, and 20-year averages.

- Estimates were prepared by Kansas State University, Kansas Department of Agriculture, and USDA-ARS personnel. Estimates are based on expert opinions, not statistically designed.
- Estimates use a disease survey, variety resistance, variety acreages, crop district yield estimates, and loss functions for each disease. NASS/Kansas Agricultural Statistics provided information for variety acreages and crop district yield estimates.
- Special thanks to the staff at the Great Plains Diagnostic Laboratory, Kansas State University, and the Plant Protection & Weed Control program, Kansas Department of Agriculture, for their aid in surveying and disease diagnosis. Without their contributions, this paper would not be possible.
- \*Lesion nematode estimates were begun in 2008-2010. The 2010 estimate is an average based upon 3 years of sampling. In total, over 2100 fields at a rate of 1 location/sample (2-3 acres) per 4800 acres of planted production acreages per county (NASS) were taken over the three-year period. After 2010, a preservation survey based upon a small number of samples (25-30/state annually) has been used for loss estimates to extend the 2008-2010 foundation survey. No data were collected in 2016.