

KANSAS COOPERATIVE PLANT DISEASE SURVEY REPORT

PRELIMINARY 2019 KANSAS WHEAT DISEASE LOSS ESTIMATES

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Gaelle F. Hollandbeck, Erick DeWolf, and Timothy Todd

Plant Pathologist, Plant Protection Program, Kansas Department of Agriculture, Manhattan, 66502; Extension Wheat Pathologist, Plant Pathology, Kansas State University, Manhattan, 66506; Instructor/Nematologist, Plant Pathology, Kansas State University, Manhattan, 66506.

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HIGHLIGHTS

The NATIONAL AGRICULTURAL STATISTICS SERVICE August forecast of 350.0 million bushels represented an expected harvest of 6.6 million acres of wheat with an average of 53.0 bushels per acre yield. This is an increase of 15.1 bushels per acre compared to 2018's harvest, and overall 26.3% increase in harvested bushels statewide. However, acres harvested were down 10.6%.

The estimated yield loss due to lesion nematodes was 1.4% or 5.0 million bushels. The cumulative disease loss estimate excluding nematodes for the 2019 wheat crop was 13.2% or 46.2 million bushels. The potential yield of the crop without diseases was calculated at 401.2 million bushels, or 60.8 bushels per acre.

In 2019, Kansas wheat producers' yields and test weights were decreased as a result of disease pressure. The most important diseases statewide in 2019 were stripe rust (4.6% loss), leaf rust (3.0% loss), and Fusarium head blight (2.1% loss). All crop reporting districts suffered significant losses but severity of loss due to any specific disease varied between districts due to the variety in crop environment 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). 2019 was an average year for wheat disease.

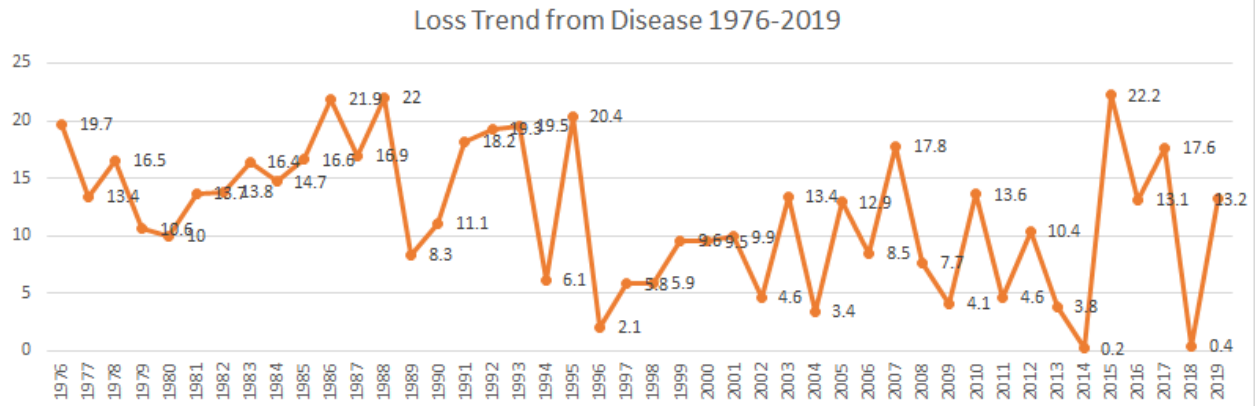


Figure 1. Trend graph of estimated wheat yield loss due to disease from 1976 to 2019, excluding yield loss due to root lesion nematodes. Lesion nematode estimation data were only collected from 2010 to 2015 and in 2017 to 2019, so it was left out for presentation purposes.

DISEASES

The most important disease in wheat in 2019 was **stripe rust**, following a trend of recent years. Percent yield loss this year was 4.6%, which is higher than 2018 (0.03%) but lower than 2017, 2016, and 2015 (8.6%, 9.1%, and 15.4% respectively), as well as lower than the 5- and 10- year average (7.55% and 5.38% respectively) but slightly higher than the 20-year average (4.0%). The large increase compared to 2018 is due to the drought last year, which, unsurprisingly, near-halted disease of all types. However, aside from 2018, this is a general continued slight decrease in yield loss over the past years. This may be due to a continuation of the foliar fungicide practices that have occurred in recent years, which may have managed to keep the fungus at bay and minimize losses.

Stripe rust was favored by cool temperatures and very frequent rainfall throughout the spring and summer in 2019. Many of the most commonly-planted wheat varieties in Kansas are susceptible to stripe rust. Stripe rust caused a loss of 16.9 million bushels of wheat statewide.

Stripe rust caused yield loss in six of nine crop reporting districts in 2019. It caused no measurable yield loss in any of the three Eastern crop reporting districts. In susceptible varieties, the minimum estimated yield loss was 6.4%, in South Central district and the maximum was 14.5%, in North Central district (Figure 2). Both the Central and the Western districts were approximately equally affected.

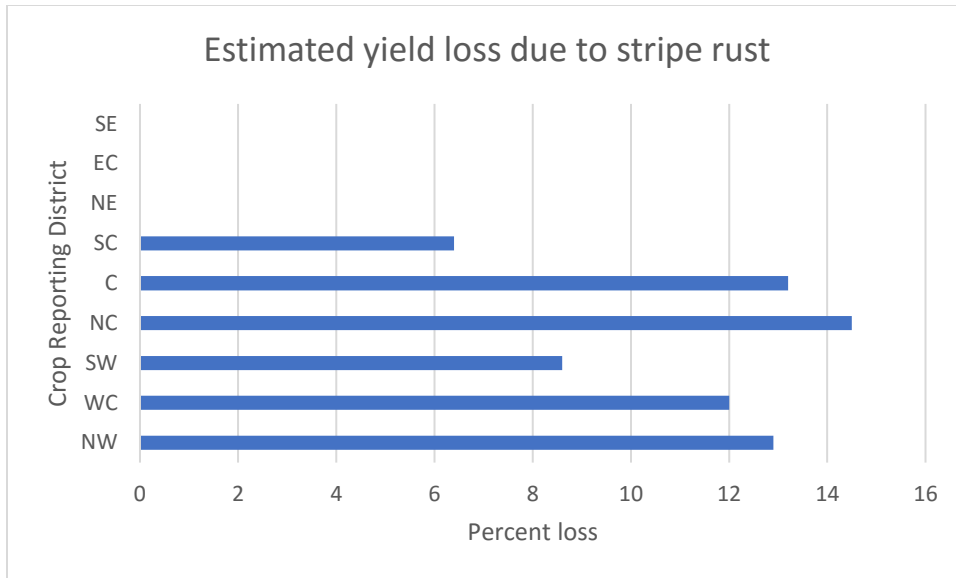


Figure 2. Estimated yield loss due to stripe rust in susceptible varieties ranged from 0% to 14.5% in crop reporting districts but was most severe in Central and Western districts.

Leaf rust was the second most important disease this year, causing an estimated loss of 3.0%, or 10.9 million bushels. This was an above-average year for leaf rust compared to the 5-, 10- and 20-year averages of 1.16%, 0.78 %, and 1.85% respectively. This broke the 10-year trend of below-average losses from leaf rust. Leaf rust was of most concern in Western and Central Kansas, while causing only moderate losses in the East. Losses in West Central Kansas were estimated highest at 9.7% loss, with Northeast Kansas had the lowest estimated loss with 1.8%. The spike in yield loss due to leaf rust is likely due to the persistent rains Kansas received throughout late spring and early summer. It still remains below stripe rust in importance 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.

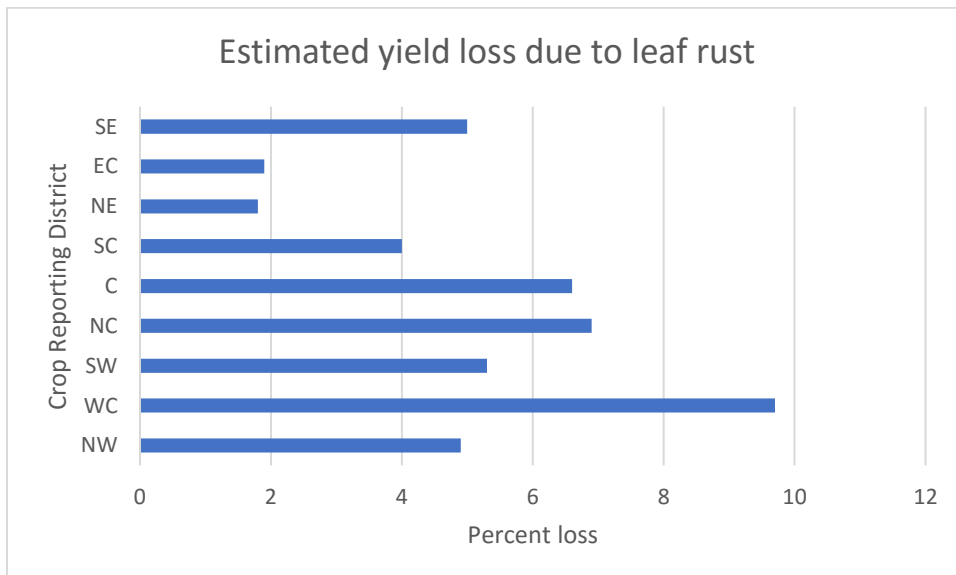


Figure 3. Estimated yield loss due to leaf rust in susceptible varieties ranged from 1.8% to 9.7% in crop reporting districts but was most severe in Central and Western districts.

Fusarium head blight was the third most important disease of wheat in 2019, with a statewide yield loss of 2.1% or 7.6 million bushels. This was an above-average year for Fusarium head blight, well above the 5-, 10-, and 20-year averages (1.18%, 0.63%, and 0.47% respectively). FHB was most damaging in eastern Kansas this year, and least damaging in western Kansas, ranging from 0% loss in the Southwest crop reporting district to 17% loss in the Northeast district (Figure 4). It affected the Western crop reporting districts almost none but was most heavy in Northeast and North Central Kansas. The heavy, frequent rainfall and cooler temperatures throughout spring and into beginning summer are to blame for the spike in losses due to FHB. It was likely heavier in the Northeast, North Central, and South Central crop reporting districts because although it rained everywhere, these areas received some of the heaviest rainfall. In addition to yield lost in bushels, this disease, a grain mold, also would have caused losses in the form of dockage at the elevators due to the vomitoxin the fungus produces.

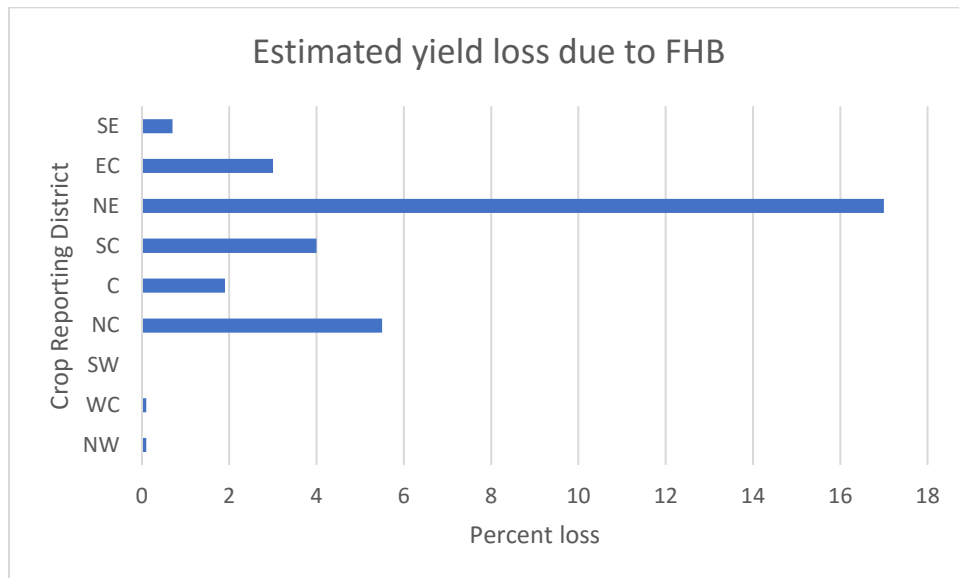


Figure 4. Estimated yield loss due to Fusarium head blight in susceptible varieties ranged from 0% to 17% in crop reporting districts but was most severe in Northeast and North Central districts.

Tan spot had a 1.6% estimated loss in 2019, or about 5.7 million bushels. This yield loss was above the 5-, 10-, and 20-year averages for tan spot (0.68%, 0.42%, and 0.54% respectively). Tan spot was most prevalent in Central Kansas, while moderately present in the west and east.

Other diseases of interest in 2019 were **Septoria complex** (1.4% estimated loss), **wheat streak mosaic** (0.3% estimated loss), **soilborne mosaic and spindle streak viruses** (0.1% estimated loss), **bacterial leaf complex** (0.05% estimated loss), and **powdery mildew** (0.01% estimated loss). A **Karnal bunt** survey was also conducted post-harvest in 2019. Karnal bunt was not detected in Kansas. This survey has been conducted yearly since 1993 with no positive finds.

Root lesion nematode data collection continued in 2019. Twenty-seven fields were sampled across 17 counties in Central and Western Kansas for nematode populations (Figure 5). Estimated yield loss due to root lesion nematode was 1.4% or 5.0 million bushels, slightly below estimated losses in an average year of nematode survey. This near-average level of losses is likely because the nematodes are 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. It could be slightly below average as a result of the randomness of sampling, but also the quantity of rain in the fall and spring may have washed the nematodes away before they could infest the roots. The estimate compares to a 5-year average of 1.65% and an 8-year average of 1.77%.

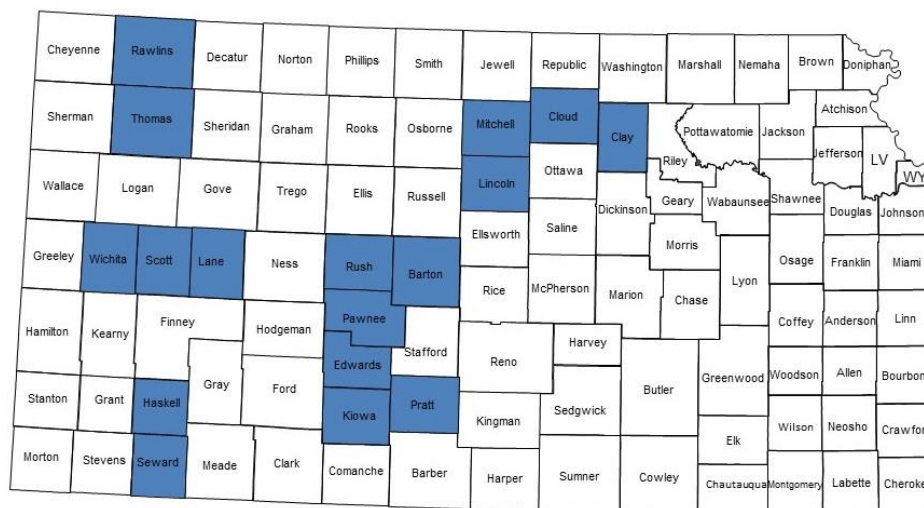


Figure 5. The 17 counties targeted in the 2019 wheat root lesion nematode survey.

The yield loss table from the past 20 years shows how each year is unique (Figure 6). 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. Stripe rust continues to be the most important wheat disease in Kansas, having surpassed leaf rust in recent years due to introduction of a new race of the pathogen capable of tolerating the hotter temperatures of the Great Plains. However, this year saw a tremendous increase in wheat streak mosaic complex, likely due to above normal populations of volunteer wheat.

									5-YR	10-YR	20-YR		
2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE	AVE	AVE	DISEASE	
0.05	5.7	0.03	0	15.4	9.1	8.6	0.03	4.6	7.55	5.38	4.00	STRIPE RUST	
0.01	1	0.01	0.001	0.5	1.3	0.8	0.22	3	1.16	0.78	1.85	LEAF RUST	
1.7	1.2	1.2	0.05	2.7	0.05	5.6	0.07	0.3	1.74	1.31	1.26	WHEAT STREAK MOSAIC COMPLEX	
2.74	2.3	0.25	0.001	0.001	1.3	0.9	0.001	0.001	0.44	0.78	0.79	BARLEY YELLOW DWARF	
0.01	0.01	0.5	0.1	0.01	0.9	0.9	0.001	1.6	0.68	0.42	0.54	TAN SPOT	

0.01	0.01	1.7	0	0.1	0.3	0.4	0.001	1.4	0.44	0.50	0.45	SEPTORIA COMPLEX
0.01	0.001	0.05	0.02	3.4	0.1	0.3	0	2.1	1.18	0.63	0.47	SCAB
0.01	0.01	0.01	0.001	0.01	0	0	0	0.1	0.02	0.02	0.02	SOILBORNE & SPINDLE STREAK
0.01	0.001	0.01	0.001	0.001	0.05	0.05	0.02	0.01	0.03	0.03	0.08	POWDERY MILDEW
0.01	0.1	0.01	0.01	0.001	0	0	0.06	0.01	0.01	0.02	0.03	ROOT & CROWN ROT
0.01	0.05	0.01	0.001	0.001	0.01	0.01	0.001	0.001	0.00	0.01	0.02	BUNT, LOOSE SMUT, FLAG SMUT
0	0	0	0.001	0	0	0	0	0	0.00	0.00	0.01	TAKE-ALL
0	0	0	0	0	0	0.01	0	0	0.00	0.00	0.02	STRAWBREAKER
0.01	0.03	0.03	0.01	0.03	0	0	0.03	0.05	0.02	0.02	0.01	BACTERIAL LEAF COMPLEX
0.01	0.01	0	0.001	0.001	0	0	0.001	0.01	0.00	0.00	0.00	STEM RUST
0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	SNOW MOLD*
0.001	0	0	0.001	0	0	0	0	0	0.00	0.00	0.00	CEPHALOSPORIUM STRIPE
0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	AMERICAN WHEAT STRIATE*
1.6	2.3	2.4	1.0	2.6	-	0.6	2.0	1.4	1.65	1.77	-	LESION NEMATODES*
4.6	10.4	3.8	0.2	22.2	13.1	17.6	0.4	13.2	13.3	9.9	9.5	TOTAL

Figure 6. Yield loss estimates from Kansas production 2011-2019 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.