KANSAS COOPERATIVE PLANT DISEASE SURVEY REPORT

PRELIMINARY 2020 KANSAS WHEAT DISEASE LOSS ESTIMATES

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NOTE FROM THE AUTHORS

Due to circumstances surrounding the COVID-19 pandemic, surveyors were not able to collect as much data on disease severity in the field as is commonly collected in other years. These numbers were put together and represent the loss due to disease to the best of our knowledge but are based on fewer data points than usual.

HIGHLIGHTS

The NATIONAL AGRICULTURAL STATISTICS SERVICE August forecast of 294.0 million bushels represented an expected harvest of 6.4 million acres of wheat with an average of 46.0 bushels per acre yield. This is a decrease of 6 bushels per acre compared to 2019's harvest, and overall 13.0% decrease in harvested bushels statewide. Acres harvested were down 2.0%.

The cumulative disease loss estimate for the 2020 wheat crop was 10.8% or 31.8 million bushels. The potential yield of the crop without diseases was calculated at 325.8 million bushels, or 50.9 bushels per acre.

Due to constraints posed by the COVID-19 pandemic, no lesion nematode data were collected in 2020.

In 2020, Kansas wheat producers' yields and test weights were decreased as a result of disease pressure. The most important diseases statewide in 2020 were stripe rust (2.9% loss), leaf rust (2.8% loss), and Fusarium head blight (1.9% 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). 2020 was an average year for wheat disease.

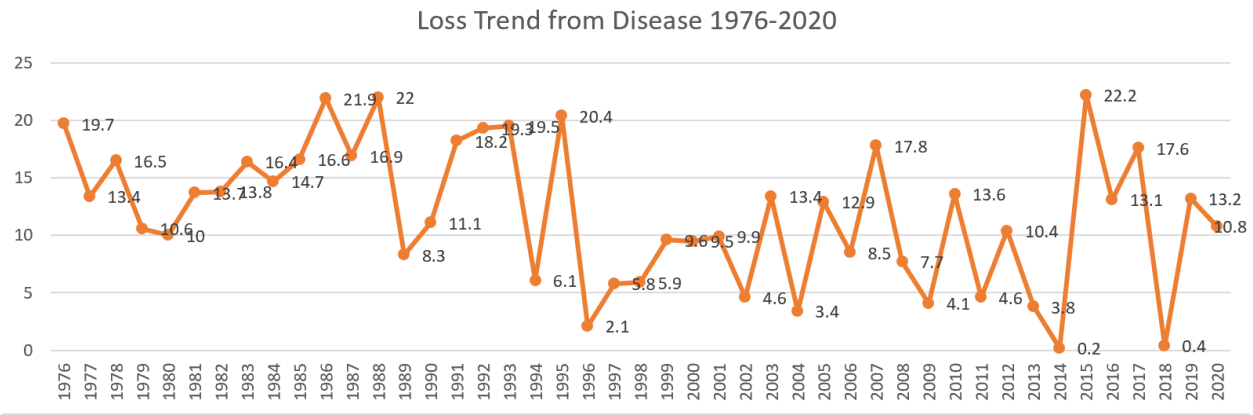

Figure 1. Trend graph of estimated wheat yield loss due to disease from 1976 to 2020, excluding yield loss due to root lesion nematodes. Lesion nematode estimation data were only collected from 2010 to 2015 and in 2017 to 2019, so it was left out for presentation purposes.

DISEASES

The most important disease in wheat in 2020 was **stripe rust,** following a trend of recent years. Percent yield loss this year was 2.9%, which is higher than 2018 (0.03%) but lower than 2019, 2017, and 2016 (4.6%, 8.6%, and 9.1% respectively), as well as lower than the 5-, 10-, and 20-year average (5.04%, 4.64%, and 4.14% respectively). The large increase compared to 2018 is due to the drought that 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 2020. Many of the most commonly-planted wheat varieties in Kansas are susceptible to stripe rust. Stripe rust caused a loss of 8.7 million bushels of wheat statewide.

Stripe rust caused yield loss in seven of nine crop reporting districts in 2020. It caused no measurable yield loss in the East Central and Southwest crop reporting districts. In susceptible varieties, the minimum estimated yield loss was 1.3%, in Northeast district and the maximum was 13.1%, in South Central district (Figure 2). The Central districts were the most heavily affected, while the Eastern districts suffered very little loss.

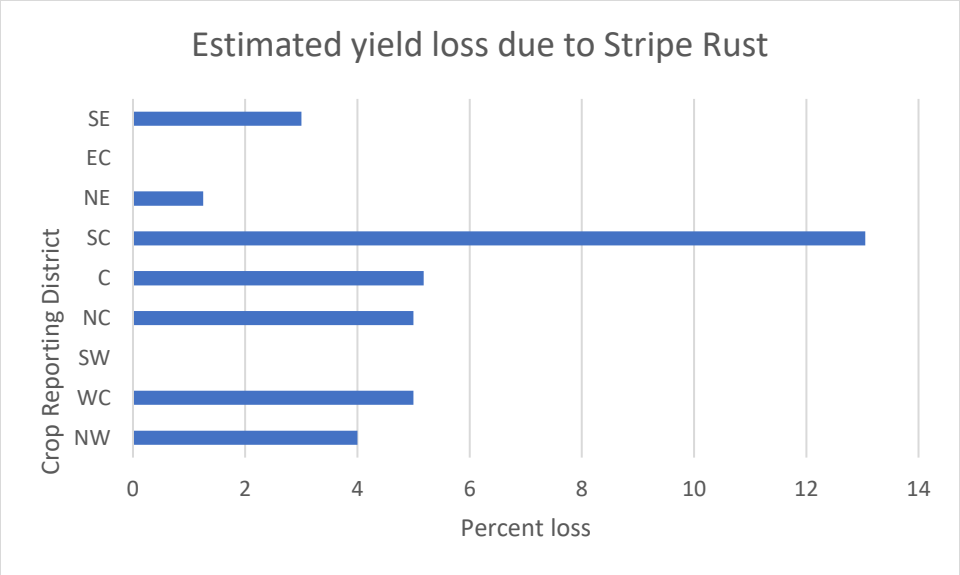

Figure 2. Estimated yield loss due to stripe rust in susceptible varieties ranged from 0% to 13.1% in crop reporting districts but was most severe in Central and Western districts.

Leaf rust was the second most important disease this year, causing an estimated loss of 2.8%, or 8.5 million bushels in six of the nine crop reporting districts. This was an above-average year for leaf rust compared to the 5-, 10- and 20-year averages of 1.63%, 0.97 %, and 1.84% respectively. Leaf rust was by far of most concern in Central Kansas, while causing only moderate losses in the West and negligible losses in the East. Losses in South Central Kansas were estimated highest at 13.0% loss, while Northeast Kansas had the lowest estimated measurable loss with 1.3%. 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, although just barely in 2020, 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.

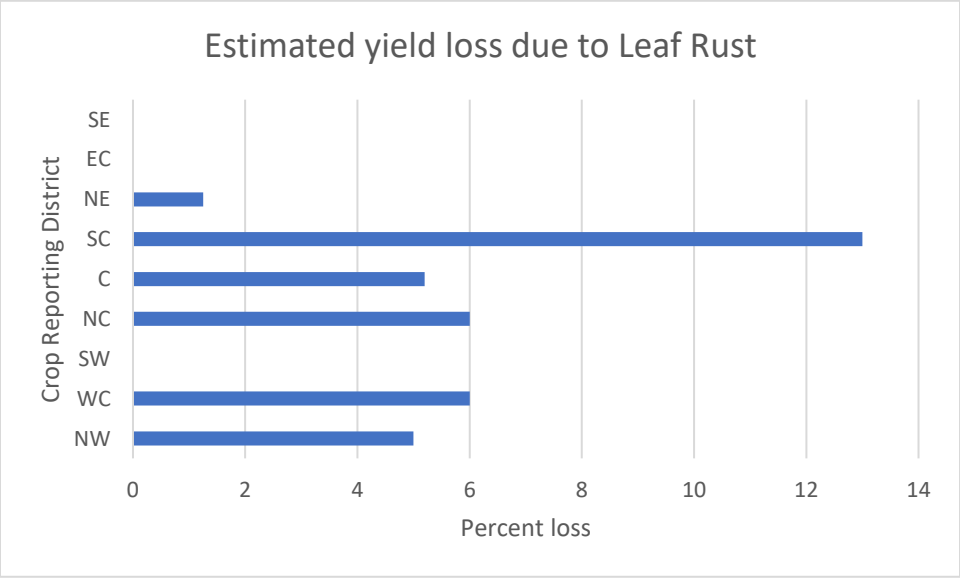

Figure 3. Estimated yield loss due to leaf rust in susceptible varieties ranged from 0% to 13.0% in crop reporting districts but was most severe in Central and Western districts.

Fusarium head blight was the third most important disease of wheat in 2020, with a statewide yield loss of 1.9% or 5.6 million bushels. This was an above-average year for Fusarium head blight, well above the 5-, 10-, and 20-year averages (0.88%, 0.79%, and 0.56% respectively). However, it was lower than the estimated losses in 2019 (2.1% estimated loss). FHB was most damaging in Eastern Kansas this year, although the Central region was close behind, and least damaging in Western Kansas. The losses ranged from 0% loss in the Southwest and West Central crop reporting districts to 8.6% loss in the Southeast district (Figure 4). It affected the Western crop reporting districts almost none but was heaviest in Southeast and South 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. 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.

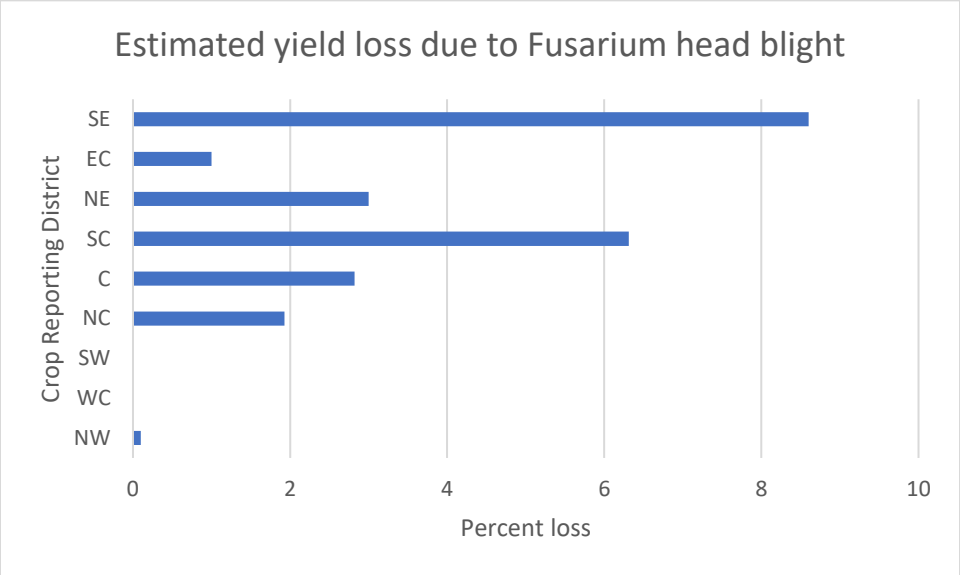

Figure 4. Estimated yield loss due to Fusarium head blight in susceptible varieties ranged from 0% to 8.6% in crop reporting districts but was most severe in Southeast and South Central districts.

Tan spot had a 1.6% estimated loss in 2020, or about 4.9 million bushels. This yield loss was above the 5-, 10-, and 20-year averages for tan spot (1.01%, 0.57%, and 0.61% respectively). Tan spot was most prevalent in Eastern and Central Kansas, while nearly absent in the West.

Other diseases of interest in 2020 were ***Septoria* complex** (0.64% estimated loss), **wheat streak mosaic** (0.5% estimated loss), **barley yellow dwarf virus** (0.1% estimated loss), **bunt and loose smut** (0.3% estimated loss), and **bacterial leaf complex** (0.03% estimated loss). A **Karnal bunt** survey was also conducted post-harvest in 2020. 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 5). 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.

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	5-YR AVE	10-YR AVE	20-YR AVE	DISEASE
0.05	5.7	0.03	0	15.4	9.1	8.6	0.03	4.6	2.87	5.04	4.64	4.14	STRIPE RUST
0.01	1	0.01	0.001	0.5	1.3	0.8	0.22	3	2.82	1.63	0.97	1.84	LEAF RUST
1.7	1.2	1.2	0.05	2.7	0.05	5.6	0.07	0.3	0.5	1.30	1.34	1.24	WHEAT STREAK MOSAIC COMPLEX
2.74	2.3	0.25	0.001	0.001	1.3	0.9	0.001	0.001	0.1	0.46	0.76	0.55	BARLEY YELLOW DWARF
0.01	0.01	0.5	0.1	0.01	0.9	0.9	0.001	1.6	1.63	1.01	0.57	0.61	TAN SPOT
0.01	0.01	1.7	0	0.1	0.3	0.4	0.001	1.4	0.64	0.55	0.46	0.48	SEPTORIA COMPLEX
0.01	0.001	0.05	0.02	3.4	0.1	0.3	0	2.1	1.88	0.88	0.79	0.56	SCAB
0.01	0.01	0.01	0.001	0.01	0	0	0	0.1	0.001	0.02	0.01	0.02	SOILBORNE & SPINDLE STREAK
0.01	0.001	0.01	0.001	0.001	0.05	0.05	0.02	0.01	0.01	0.03	0.02	0.08	POWDERY MILDEW
0.01	0.1	0.01	0.01	0.001	0	0	0.06	0.01	0.05	0.02	0.03	0.03	ROOT & CROWN ROT
0.01	0.05	0.01	0.001	0.001	0.01	0.01	0.001	0.001	0.3	0.06	0.04	0.03	BUNT, LOOSE SMUT, FLAG SMUT
0	0	0	0.001	0	0	0	0	0	0.01	0.00	0.00	0.01	TAKE-ALL
0	0	0	0	0	0	0.01	0	0	0	0.00	0.00	0.00	STRAWBREAKER
0.01	0.03	0.03	0.01	0.03	0	0	0.03	0.05	0.03	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	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	0	0.001	0	0	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
1.6	2.3	2.4	1.0	2.6	-	0.6	2.0	1.4	-	1.33	1.74	-	LESION NEMATODES*
4.6	**10.4**	**3.8**	**0.2**	**22.2**	**13.1**	**17.6**	**0.4**	**13.2**	**10.8**	**11.0**	**9.6**	**9.6**	**TOTAL**

Figure 5. Yield loss estimates from Kansas production 2011-2020 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 or 2020.