KANSAS COOPERATIVE PLANT DISEASE SURVEY REPORT

PRELIMINARY 2016 KANSAS WHEAT DISEASE LOSS ESTIMATES

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HIGHLIGHTS

The KANSAS AGRICULTURAL STATISTICS SERVICE July forecast of 453.6 million bushels represented an expected harvest of 8.1 million acres of wheat with an average of 56 bushels per acre yield, an increase of 19 bushels per acre over the previous year. If this yield was achieved, it would be a record yield for Kansas.

The cumulative disease loss estimate for the 2016 wheat crop was 13.1 percent or 68.4 million bushels. The potential yield of the crop without diseases was calculated at 522.0 million bushels, or 8.4 bushels per acre.

In 2016, Kansas wheat producers' yields and test weights were decreased as a result of disease pressure. The most important diseases in 2016 were stripe rust (9.1% loss), leaf rust (1.3% loss), and barley yellow dwarf virus (1.3% loss). All crop reporting districts had significant losses but severity of loss varied slightly between districts.

Peaks and valleys correlated with weather patterns and disease epidemics mark loss estimates and are based on data collected yearly since 1976 (Figure 1). 2016 was an average year for wheat disease.

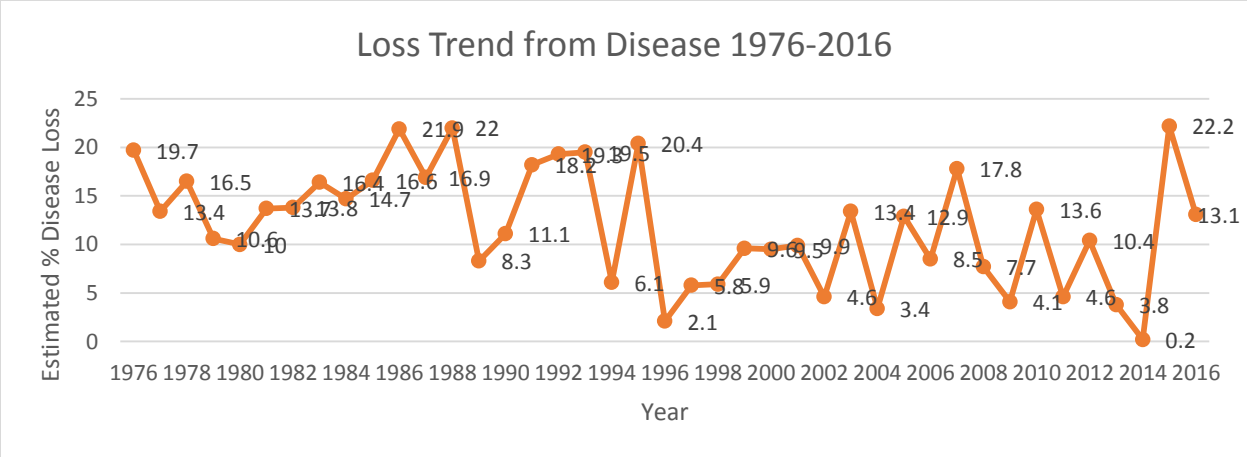

Figure 1. Trend graph of estimated wheat yield loss due to disease from 1976 to 2016, excluding yield loss due to lesion nematodes. Lesion nematode estimation data was only collected from 2010 to 2015 so it was left out for presentation purposes.

DISEASES

The most important disease of 2016 was **stripe rust**. This year saw a drastic decrease in estimated yield loss due to stripe rust compared to 2015 (15.4%) at 9.1%, but was still well above the 5-, 10-, and 20-year averages (6.05%, 4.08%, and 3.34% respectively). The decrease compared to 2015 may be due to increased fungicide use over 2015, when very little fungicide was applied, but favorable weather and a possible continued under-use of fungicides in 2016 may be the cause of above average loss. The loss was 45.6 million bushels of wheat statewide.

The crop reporting districts all suffered from high estimated yield loss due to stripe rust in susceptible varieties. In drier areas less suited to stripe rust (western crop reporting districts), yield loss was lower than in areas that receive a lot of rain during the summer (central and eastern crop reporting districts). In susceptible varieties the minimum estimated yield loss was 6% and the maximum was 20% (Figure 2).

Favorable conditions for stripe rust include cool and wet weather. It grows most favorably when temperatures are 50-60 degrees Fahrenheit and rain is frequent. Its growth slows when temperatures reach above 75 degrees.

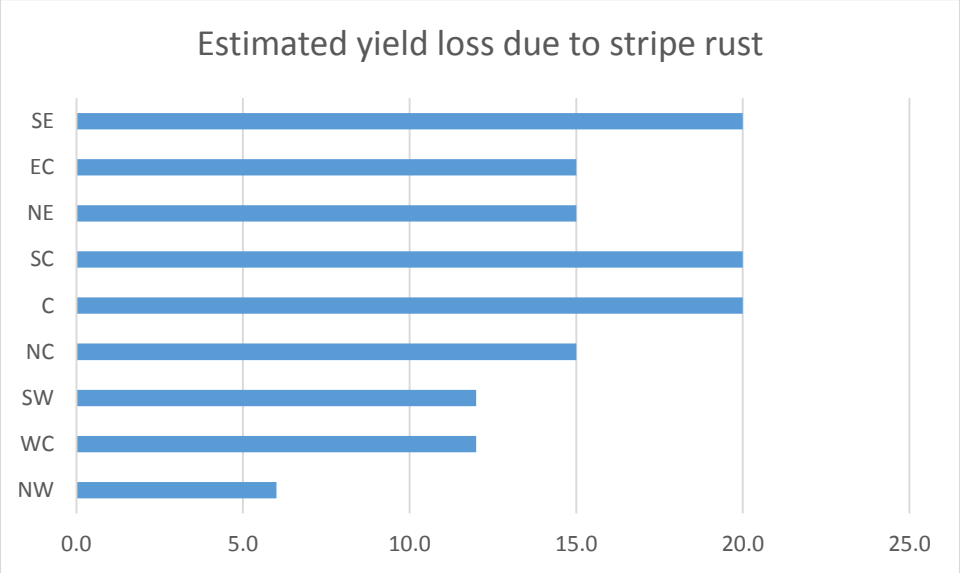

Figure 2. Estimated yield loss due to stripe rust in susceptible wheat varieties ranged from 6% to 20% in crop reporting districts but was most severe in eastern and central districts.

Leaf rust was the second most important disease this year, despite causing a much lower estimated loss than stripe rust (1.3%). This was a below-average year for leaf rust for the eighth year in a row compared to the 10- and 20-year averages of 2.38% and 2.13% respectively. The five-year average was 0.56%. Disease severity ranged around 10% and incidence varied but ranged around 20% statewide. Leaf rust was of most concern in western and central districts, reaching as much as 4% estimated loss. It was not commonly found in the eastern districts,

possibly in part due to 55.2% of the acreage planted in eastern Kansas being planted to Everest, a variety resistant to leaf rust. An estimated total of 6.2 million bushels were lost.

Barley yellow dwarf was an additional disease of concern in 2016, due to an increase in aphid population. A 1.3% loss was estimated as a result of barley yellow dwarf, or 5.9 million bushels. This was an above average year for barley yellow dwarf, as the 5-, 10-, and 20-year averages all fall below 1%. Similarly to leaf rust but contrary to stripe rust, this disease was most common in western and central Kansas and barely present in eastern districts.

Other diseases of interest in 2016 were **tan spot** (0.9% estimated loss) and ***Septoria* complex** (0.3% estimated loss). In addition, **flag smut**, which resurfaced in 2015 after not having been seen for over 70 years, was surveyed for again this year and found to be present in 12 counties in western and central Kansas, including four new county records: Ellsworth, Clay, Decatur, and Pawnee counties. A **Karnal bunt** survey was also conducted post-harvest and it was not found in Kansas. This survey has been conducted yearly since 1993 with no positive finds.

Lesion nematode data were not collected in 2016 but data collection will resume in 2017.

The yield loss table from the last 20 years (Figure 3) shows that each year is unique. Weather, crop rotation, variety selection, and cultural practices all can affect disease severity and loss due to a disease changes from one year to the next. Stripe rust is currently the most important disease of wheat in Kansas, with a 9.1% estimated loss in 2016 and the highest 5-, 10-, and 20-year averages of any disease. It has surpassed leaf rust as the most important disease of Kansas.

Figure 3. Yield loss estimates from Kansas production 2008-2016 with 5-, 10-, and 20-year averages.

2008	2009	2010	2011	2012	2013	2014	2015	2016	5-YR AVE	10-YR AVE	20-YR AVE	DISEASE
0.01	0.01	10.3	0.05	5.7	0.03	0	15.4	9.1	6.05	4.08	3.34	STRIPE RUST
4.72	1.37	1	0.01	1	0.01	0.001	0.5	1.3	0.56	2.38	2.13	LEAF RUST
0.02	0.001	0.2	1.7	1.2	1.2	0.05	2.7	0.05	1.04	0.71	1.08	WHEAT STREAK MOSAIC COMPLEX
0.01	0.44	0.3	2.74	2.3	0.25	0.001	0.001	1.3	0.77	0.75	0.88	BARLEY YELLOW DWARF
0.45	0.26	0.2	0.01	0.01	0.5	0.1	0.01	0.9	0.30	0.37	0.60	TAN SPOT
0.5	1	1.1	0.01	0.01	1.7	0	0.1	0.3	0.42	0.65	0.41	SEPTORIA COMPLEX
1.9	0.9	0.3	0.01	0.001	0.05	0.02	3.4	0.1	0.71	0.68	0.36	SCAB
0.001	0.001	0.1	0.01	0.01	0.01	0.001	0.01	0	0.01	0.02	0.09	SOILBORNE & SPINDLE STREAK
0.03	0.02	0.1	0.01	0.001	0.01	0.001	0.001	0.05	0.01	0.04	0.08	POWDERY MILDEW
0.001	0.001	0.01	0.01	0.1	0.01	0.01	0.001	0	0.02	0.02	0.03	ROOT & CROWN ROT
0.01	0.04	0.03	0.01	0.05	0.01	0.001	0.001	0.01	0.01	0.02	0.02	BUNT, LOOSE SMUT, FLAG SMUT
0.001	0.01	0.001	0	0	0	0.001	0	0	0.00	0.00	0.02	TAKE-ALL
0	0	0	0	0	0	0	0	0	0.00	0.00	0.02	STRAWBREAKER
0.03	0.04	0	0.01	0.03	0.03	0.01	0.03	0	0.02	0.02	0.01	BACTERIAL LEAF COMPLEX
0.001	0.001	0.001	0.01	0.01	0	0.001	0.001	0	0.00	0.00	0.00	STEM RUST
0.001	0	0	0	0	0	0	0	0	0.00	0.00	0.00	SNOW MOLD

0	0.001	0.001	0.001	0	0	0.001	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
		2.0	1.6	2.3	2.4	1.0	2.6	-	2.08	--	--	LESION NEMATODES*
7.7	**4.1**	**13.6**	**4.6**	**10.4**	**3.8**	**0.2**	**22.2**	**13.1**	**9.9**	**9.7**	**9.0**	**TOTAL**

- 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 but collection will resume in 2017.