KANSAS COOPERATIVE PLANT DISEASE SURVEY REPORT

PRELIMINARY 2015 KANSAS WHEAT DISEASE LOSS ESTIMATES

August 10, 2015

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This article was posted to the following website:
http://agriculture.ks.gov/docs/default-source/pp-disease-reports-2015/2015-ks-wheat-disease-loss-estimates.pdf

HIGHLIGHTS

The KANSAS AGRICULTURAL STATISTICS SERVICE July forecast of 334 million bushels represented an expected harvest of 8.8 million acres of wheat with an average yield of 38 bushels per acre. The primary factor for the increase of 10 bushels per acre average from the dismal 2014 crop was the weather. Temperatures were favorable during grain fill and moisture was abundant in much of the state.

The cumulative disease loss estimate for the 2015 wheat crop was 22.2 per cent or 95.3 million bushels (10.8 bushels per acre). The potential yield of the crop without diseases was calculated at 429.3 million bushels.

For Kansas producers in 2015, wheat disease pressure negatively affected both test weight and yield. All crop reporting districts had significant disease pressure although issues sometimes varied from district to district. The top three diseases were stripe rust (15.4%), head scab (3.4%), and wheat streak mosaic (2.7%). Stripe rust was statewide in prevalence while head scab affected production in eastern districts and the north central. Wheat streak was an issue primarily in extreme western counties and occasionally in pockets of the central districts.

Peaks and valleys associated with epidemics and weather influences have marked the loss estimates that began in 1976 (Figure 1). The trend is generally greater disease pressure and losses in wet springs as opposed in drier growing conditions of April through June.

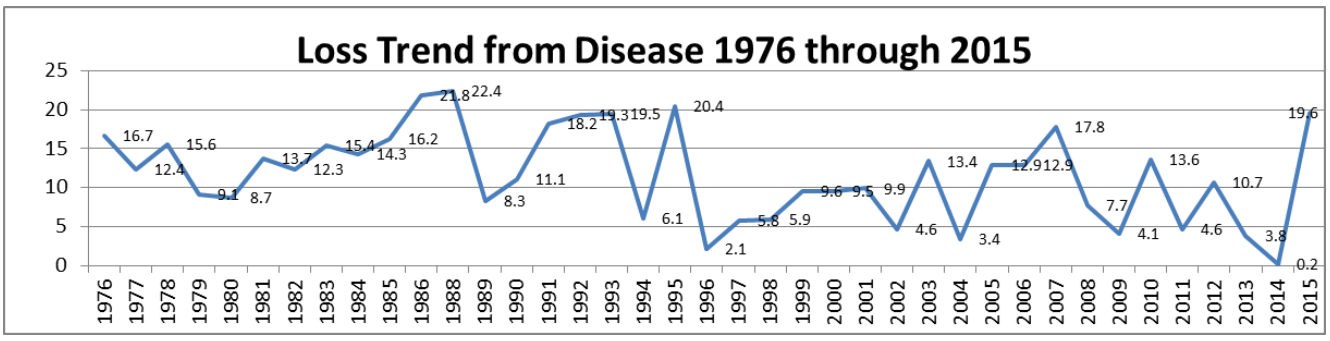

Figure 1. Loss trend graph with trend line of wheat disease loss estimates from 1976 to 2015 without lesion nematodes estimates: lesion nematode estimates were only made since 2010 and left out for presentation purposes.

DISEASES

Stripe rust sometimes referred to as yellow rust was favored by a wet and cool spring. Mid- April disease alerts began to circulate after the first reports of the disease from southeast and south central districts where

the crop was heading or nearing heading. Producers in the southern half of the state had a difficult time in late April assessing the economics, potential for the disease, and a small window of time to decide on fungicide applications. Many producers because of the potential grain price and lower than normal harvest expectations did not proceed with fungicide applications or decided later as a rescue treatment to apply a fungicide. If a crystal ball had been available, many growers would have gladly treated their crop as frequent rains with milder temperatures dominated weather patterns in May and early June. The stripe rust snowballed into epidemic proportions as a result of ideal weather. Leaves of susceptible and tolerant cultivars were lost in early grain fill to the disease in much of southern Kansas.

In more northern counties, producers had better information on disease pressure and a greater window of time to decide on application but many still did not treat because of poor prices for the crop.
Stripe rust did not dither as weather systems that brought needed moisture pushed through northern counties sometimes in what seemed to be a carousel of storms.

Regrets were made by many producers across the state as they visited fields in late grain fill and found little in the presence of leaves because of stripe rust infections. Susceptible cultivars experienced 20 per cent or more loss in all nine crop reporting districts and northwest Kansas was hit hardest with an estimated 28 per cent loss. Overall, northwest Kansas lost an estimated 18 per cent of the yield to stripe rust for all cultivars and was followed by southwest, north central and south central districts. Losses for crop reporting districts ranged from 13 to 18 per cent for a total state average based on cultivar acreages of 15.4 per cent or 66 million bushels. With the 2015 statewide epidemic, stripe rust replaced leaf rust in the 20 year loss estimates as the disease of greatest importance to production at an average of 2.9 per cent.

Head Scab in some districts of Kansas was a disease that the weather pattern of May and June was near ideal. Crop losses for the state were primarily limited to eastern crop reporting districts and north central Kansas where corn has been commonly grown in the rotation system. Losses were extensive in individual fields and dockages at grain elevators were sometimes near the grain market value because of the concern with vomitoxin to animal health. Incidences within fields of 60 per cent were reported in many areas and loss of grain was complete in much of the heads that were diseased. Susceptible cultivars were estimated to have lost 27 per cent of the yield in the three eastern districts followed by 13.6 per cent in the north central district. Over 14 million bushels (3.4 per cent) was attributed to direct loss of the grain from head scab. It was the worst year on record in Kansas for head scab in terms of yield loss.

The third most important disease to Kansas producers in 2015 was found in the extreme opposite end of the state from head scab in eastern Kansas. **Wheat streak mosaic** (complex of wheat curl mite transmitted viruses) was a principal issue to many fields in the two columns of counties near the Colorado border from Oklahoma to Nebraska. Incidence in many of the fields exceeded 60 per cent and sometimes over 90 per cent. Plants were stooled, displayed trapped stems and leaves, and were barren of much of the normal grain found in a head. Ten to fifteen per cent of the susceptible acreage production of northwest, west central and southwest districts was lost to the virus complex. Test weights were also reduced in addition to lost bushels. Nearly twelve million bushels were estimated to have been lost to wheat streak statewide with the majority from extreme western Kansas. South central and central had localized areas with WSM concerns. The 2015 loss of 2.7 per cent compares to a five year average of 1.4 per cent.

Closely following wheat streak mosaic in loss estimates was **lesion nematodes**, a disease of the root system. These endo-parasitic roundworms burrow and multiply inside the cortical tissue of feeder roots primarily beginning in early spring. As a continuing annual survey, 25 samples were taken across the state to see if pest levels were similar to past documented assessments. These samples taken at early head stage found nematode counts a little higher than average. Based on the numbers from root assays, a loss prediction model indicated about a 2.6 per cent loss was likely from the chronic often hard to observe root system affliction.

Leaf rust also contributed to the loss complex of 2015. Leaf rust came on late because mid spring temperatures were too cool for leaf rust development. It wasn't until June that leaf rust started to build up. In the later maturing regions of northern and western (higher altitudes) leaf rust had significant levels during

mid grain fill. Survey teams observed the leaf rust in fields where stripe rust was not of concern. Disease pressure reached 15 to 20 per cent leaf severities at times. The loss estimate was made primarily from observations in the western crop reporting districts and calculated at a 0.5 per cent loss statewide. The five year average is 0.3 per cent. The greatest production loss to leaf rust was in 2007 when 13.9 per cent of the crop was lost to the disease.

Other diseases of noteworthiness were ***Xanthomonas*** **bacterial leaf streak** with a 0.03 loss estimate and **flag smut** (*Urocystis tritici*). Flag smut reemerged in Kansas in 2015 and had not been observed in the field for over 70 years. It was noted in central and western Kansas fields (see KDA Plant Disease Report 4 July 10, 2015) both in grain and seed production systems. Most reports were less than 0.5% but one field in Rooks (NC) had an incidence of nearly 20 per cent. There was indication from 2003-2005 grain and seed laboratory analysis that *Urocystis* spores were in some grain samples but subsequent field surveys did not discover any disease. Some countries list flag smut as a disease of importance in determining the eligibility of a shipment of grain or seed to meet plant health concerns.

The yield loss table of the last 20 years (Figure 2.), displays that every year is unique and that a loss for a disease often varies from one year to the next. Weather, cultivar selection, and cropping practices can influence the disease loss. Stripe rust (15.4% loss in 2015) is now officially the most important disease to Kansas producers replacing leaf rust which falls to number 2 in the 10 year and 20 year averages. It is important to note that lesion nematode is the second most important disease in the past 5 years.

Figure 2. Yield loss estimates from Kansas production 2006-2015 with 5, 10, and 20 years averages.

										5-YR	10-YR	20-YR	
2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	AVE	AVE	AVE	DISEASE
0.001	0.15	0.01	0.01	10.3	0.05	5.7	0.03	0	15.4	4.24	3.17	2.88	STRIPE RUST
0.1	13.9	4.72	1.37	1	0.01	1	0.01	0.001	0.5	0.30	2.26	2.07	LEAF RUST
7	0.01	0.02	0.001	0.2	1.7	1.2	1.2	0.05	2.7	1.37	1.41	1.07	WHEAT STREAK MOSAIC COMPLEX
0.8	0.19	0.01	0.44	0.3	2.74	2.3	0.25	0.001	0.001	1.06	0.70	0.82	BARLEY YELLOW DWARF VIRUS
0.2	1.3	0.45	0.26	0.2	0.01	0.01	0.5	0.1	0.01	0.13	0.30	0.55	TAN SPOT
0.001	1.8	0.5	1	1.1	0.01	0.01	1.7	0	0.1	0.36	0.62	0.47	SEPTORIA COMPLEX
0.001	0.16	1.9	0.9	0.3	0.01	0.001	0.05	0.02	3.4	0.70	0.67	0.36	SCAB
0.05	0.01	0.001	0.001	0.1	0.01	0.01	0.01	0.001	0.01	0.01	0.02	0.09	SOILBORNE & SPINDLE STREAK
0.1	0.21	0.03	0.02	0.1	0.01	0.001	0.01	0.001	0.001	0.00	0.05	0.08	POWDERY MILDEW
0.1	0.01	0.001	0.001	0.01	0.01	0.1	0.01	0.01	0.001	0.03	0.03	0.04	ROOT & CROWN ROT
0.05	0.02	0.01	0.04	0.03	0.01	0.05	0.01	0.001	0.001	0.01	0.02	0.02	COMMON BUNT, LOOSE SMUT & FLAG SMUT
0.05	0.001	0.001	0.01	0.001	0	0	0	0.001	0	0.00	0.01	0.02	TAKE-ALL
0.001	0	0	0	0	0	0	0	0	0	0.00	0.00	0.02	STRAWBREAKER
0.001	0.001	0.03	0.04	0	0.01	0.03	0.03	0.01	0.03	0.02	0.02	0.01	BACTERIAL LEAF COMPLEX
0	0	0.001	0.001	0.001	0.01	0.01	0	0.001	0.001	0.00	0.00	0.01	STEM RUST
0	0.01	0.001	0	0	0	0	0	0	0	0.00	0.00	0.00	SNOW MOLD
0.001	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	AMERICAN WHEAT STRIATE
0	0	0	0.001	0.001	0.001	0	0	0.001	0	0.00	0.00	0.00	CEPHALOSPORIUM STRIPE
				2.0	1.6	2.3	2.4	1.0	2.6	1.98	--	--	LESION NEMATODES *
8.5	**17.8**	**7.7**	**4.1**	**13.6**	**4.6**	**10.4**	**3.8**	**0.2**	**22.2**	**8.2**	**9.3**	**8.49**	**TOTAL**

- Estimates prepared by Kansas State University, Kansas Department of Agriculture and USDA-ARS personnel. Estimates are based on expert opinions, but are not statistically designed.
- Estimates utilize a disease survey, variety resistance, variety acreages, crop district yield estimates, and loss functions or estimates 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 help in survey and diagnosis of wheat diseases. Without their contribution, 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 4,800 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 per state annually has been used for loss estimates to extend the 2008-2010 foundation survey.

Authors Note: This is my final disease loss report as senior author for the Kansas Wheat Disease Loss Estimates as I am retiring in September from employment with the Kansas Department of Agriculture. I have been fortunate to work within one of the greatest industries in the state. I have had the special privilege to work with the following pathologists: Dr. Bill Willis KSU Plant Pathology Extension (deceased), Tom Sim III KDA, Merle Eversmeyer USDA-ARS, Dr. Robert Bowden USDA-ARS, Dr. James Stack KSU Plant Pathology and National Plant Disease Network, Judy O'Mara KSU diagnostics, various pathologists with USDA ARS and APHIS, and particularly my fellow authors of this article Erick, Bill, and Tim. I want to express my sincerest appreciation and gratitude to the many people and organizations that make up the industry. Thank you.