

Soybean Disease Loss Estimates From the United States and Ontario, Canada — 2015

Each year, soybean diseases reduce yield in the United States and Ontario, Canada. Diseases of importance vary on an annual basis, and diseases that affect yield are based on many factors, including environment, crop production practices, as well as variety selection and susceptibility to disease.

This publication provides the annual estimates for soybean losses due to plant diseases and pathogens for the major soybean-producing states in the United States and Ontario, Canada. Extension, university, USDA plant pathologists, and soybean specialists from each state and Ontario provided the estimates used in this report. These reports accounted for 3.9 billion bushels (99.6 percent) of the total soybean produced in the United States and Ontario in 2015. This publication includes seedling blights, foliar diseases, stem diseases, nematodes, and seed diseases in the estimated losses.

It is important to note that the methods for estimating disease loss vary by state and province. The estimates may be based on disease surveys; feedback from university, extension, industry, and farmer representatives; and personal experience with disease losses.

For this publication, the authors determined disease loss values based on yield before estimated losses for each state or province:

bushels harvested

$$(100 - \text{percent estimated disease loss}) \div 100$$

The authors then formulated total bushels lost per disease (percent loss \times yield before estimated losses) for each state.

2015 Conditions and Production

The United States produced more than 3.93 billion bushels of soybean in 2015, and many areas reported record yield. Overall, temperatures were mild, and 2015 marked the 19th consecutive year that the average temperature was greater than the 20th century average. Much of the central and southeastern United States had



Figure 1. Septoria brown spot is a common foliar disease of soybean. Brown spot is caused by a fungal pathogen that survives the winter on soybean residue.

above-average precipitation.

In Ontario, the 2015 growing season overall was moderate and near normal in terms of temperature and rainfall. The total soybean production in Ontario for 2015 was 132,489,900 bushels.

2015 Disease Losses

In all, 11.7 percent of the total estimated soybean bushels in 2015 were lost due to disease in the top 28 soybean-producing states, and 10.4 percent of the total estimated soybean bushels in 2015 were lost due to disease in Ontario, Canada. Table 1 provides yield loss estimates for all diseases.

Table 1. Estimated soybean yield losses from diseases in the top 28 U.S. soybean-producing states and Ontario, Canada, in 2015.

Disease/Pathogen	2015 Estimated Yield Losses for U.S. (thousands of bushels)	2015 Estimated Yield Losses for Ontario (thousands of bushels)
Root Rots and Seedling Blights		
Soybean cyst nematode	109,288	3,696
Seedling diseases (caused by species of <i>Fusarium</i> , <i>Pythium</i> , or <i>Rhizoctonia</i>)	62,948	2,957
Root-knot nematode	12,366	0
Reniform nematode	4,438	0
Other nematodes (lesion, Columbia lance, sting, stubby root)	1,465	148
Leaf and Aboveground Diseases		
Septoria brown spot	26,868	37
Frogeye leaf spot	17,662	15
Cercospora leaf blight	12,840	0
Downy mildew	4,383	7
Bacterial diseases (bacterial blight and bacterial pustule)	2,774	4
Virus Diseases (AMV, BPMV, SbDV, SMV, SVNV, TRSV, TSV)*	2,602	74
Other leaf and aboveground diseases (Phyllosticta leaf spot, target spot)	2,427	0
Purple seed stain	1,594	15
Rhizoctonia aerial blight	652	0
Soybean rust	157	0



Figure 2. Soybean cyst nematode was estimated to have reduced yield by more than 109 million bushels in 2015 — more than any other disease during the 2015 season.

Disease/Pathogen	2015 Estimated Yield Losses for U.S. (thousands of bushels)	2015 Estimated Yield Losses for Ontario (thousands of bushels)
Stem Diseases		
Sudden death syndrome	43,776	2,218
Sclerotinia stem rot (also known as white mold, caused by <i>Sclerotinia sclerotiorum</i>)	40,083	2,957
Phytophthora root and stem rot	28,275	1,479
Charcoal rot	20,808	15
Brown stem rot	17,389	74
Stem canker	12,349	222
Pod and stem blight	10,718	296
Anthracnose	5,188	0
Diaporthe/Phomopsis complex (seed rot)	3,612	44
Fusarium wilt and root rot	3,169	1,109
Other stem diseases (Phymatotrichopsis root rot, red crown rot, taproot decline)	2,253	0
Southern blight	523	0

*AMV = alfalfa mosaic virus, BPMV = bean pod mottle virus, SbDV = soybean dwarf virus, SMV = soybean mosaic virus, TRSV = tobacco ringspot virus, TSV = tobacco streak virus.

Diseases in the Northern United States

A total of 81.6 percent of the estimated yield losses for 2015 occurred in northern U.S. states. Disease losses in the northern states greatly influence the overall importance of various diseases across the United States, because the majority (78 percent) of soybean production occurs in these states.

Soybean cyst nematode caused the greatest estimated yield losses in the northern states, with more than 95 million bushels lost (Table 2), which is almost 25 percent of the total amount of disease-related losses. Wet conditions at planting across most of the Midwest contributed to increased loss from soilborne diseases such as seedling diseases and sudden death syndrome.

Table 2. Estimated soybean yield losses due to diseases in the 12 northernmost U.S. states* in 2015.

Disease/Pathogen	Estimated Yield Losses (thousands of bushels)
Soybean cyst nematode	95,883
Seedling diseases	53,812
Sudden death syndrome	40,160
Sclerotinia stem rot (also known as white mold, caused by <i>Sclerotinia sclerotiorum</i>)	40,083
Septoria brown spot	24,089
Phytophthora root and stem rot	23,775

*Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, Pennsylvania, South Dakota, and Wisconsin.

Diseases in Southern States

In southern states, soybean cyst nematode and root-knot nematode were particularly damaging (Table 3). High relative humidity and warm temperatures contributed to the prevalence of frogeye leaf spot.

Table 3. Estimated soybean yield losses due to diseases in the 16 southernmost states* in 2015.

Disease/Pathogen	Estimated Yield Losses (thousands of bushels)
Soybean cyst nematode	13,405
Frogeye leaf spot	11,886
Root-knot nematode	11,711
Seedling diseases	9,136
Charcoal rot	9,042
Cercospora leaf blight	4,695

*Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Summary

Environmental conditions varied across the United States and Ontario in 2015, which affected the presence and impact of many diseases. Wet conditions during planting across the Midwest likely influenced the prevalence of seedling and stem diseases observed.

See Find Out More (page 4) for disease loss estimates for previous years.

Disclaimer

The yield losses estimated in this publication were provided by members of the North Central Research and Extension Activity (NCERA) 137 Soybean Disease Committee and the Southern Soybean Disease Workers. This information is only a guide. The values in this publication are estimates and are not intended to be used as exact measurements of soybean yield losses due to diseases. The most appropriate means available were used to estimate disease losses and no liability resulting from the use of these estimates is assumed.

Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Individuals using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Authors

Carl Bradley University of Kentucky
 Tom Allen Mississippi State University
 Martin Chilvers Michigan State University
 Loren Giesler University of Nebraska
 Kelsey Mehl University of Kentucky
 Daren Mueller Iowa State University
 Albert Tenuta Ontario Ministry of Agriculture,
 Food and Rural Affairs
 Adam Sisson Iowa State University
 Kiersten Wise Purdue University

Contributors

The following individuals contributed to this publication:

Alabama Ed Sikora
 Arkansas Terry Spurlock, Travis Faske
 Delaware Nathan Kleczewski
 Florida Nick Dufault
 Georgia Bob Kemerait
 Illinois Glen Hartman, Jason Bond, and Carl Bradley
 Indiana Kiersten Wise
 Iowa Daren Mueller
 Kansas Doug Jardine

Kentucky	Carl Bradley
Louisiana	Charlie Overstreet, Trey Price, and Clayton Hollier
Maryland	Nathan Kleczewski
Michigan	Marty Chilvers and Fred Warner
Minnesota	Dean Malvick and James Kurle
Mississippi	Tom Allen
Missouri	Bill Weibold
Nebraska	Loren Giesler
North Carolina	Steve Koennig
North Dakota	Sam Markell and Berlin Nelson
Ohio	Anne Dorrance
Oklahoma	John Damicone
Ontario, Canada	Albert Tenuta
Pennsylvania	Alyssa Collins
South Carolina	John Mueller
South Dakota	Emmanuel Byamukama and Connie Tande
Tennessee	Heather Kelly
Texas	Tom Isakeit
Virginia	Hillary Mehl
Wisconsin	Damon Smith

Figure 1 provided by Daren Mueller, Iowa State University. Figure 2 provided by Craig Grau, University of Wisconsin-Madison.

Find out More

This publication was developed by the Crop Protection Network (CPN), a multi-state and international collaboration of university and provincial extension specialists and public and private professionals who provide unbiased, research-based information to farmers and agricultural personnel. Our goal is to communicate relevant information that will help professionals identify and manage field crop diseases.

Find more crop disease resources at CropProtectionNetwork.org.

Dr. J. Allen Wrather (University of Missouri) and Dr. Stephen Koenning (North Carolina State University) began this project in 1996 with the support of the United Soybean Board. Their previous reports are listed below. In addition, you can access estimates from previous years at extension.cropsciences.illinois.edu/fieldcrops/diseases/yield_reductions.php.

Koenning, S. R., and Wrather, J. A. 2010. Suppression of soybean yield potential in the continental United States by plant diseases from 2006 to 2009. Online. Plant Health Progress doi:10.1094/PHP-2010-122-01-RS.

Wrather, J. A., and Koenning, S. R. 2006. Estimates of disease effects on soybean yields in the United States 2003 to 2005. *Journal of Nematology* 38:173-180.

Wrather, J. A., Koenning, S. R., and Anderson, T. R. 2003. Effect of diseases on soybean yields in the United States and Ontario (1999 to 2002). Online. Plant Health Progress doi:10.1094/PHP-2003-0325-01-RV.

Wrather, J. A., Stienstra, W. C., and Koenning, S. R. 2001. Soybean disease loss estimates for the United States from 1996 to 1998. *Canadian Journal of Plant Pathology* 23:122-131.

Acknowledgements

In addition to support from the United Soybean Board, this project was funded in part through Growing Forward 2 (GF2), a federal-provincial territorial initiative. The Agricultural Adaptation Council assists in the delivery of GF2 in Ontario. The authors thank the United Soybean Board and Grain Farmers of Ontario for their support. Design and production by Purdue Agricultural Communication.



United States Department of Agriculture
National Institute of Food and Agriculture



Mar 2017

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

©2017 by the Crop Protection Network. All rights reserved.