

Soybean Disease Loss Estimates from the United States and Ontario, Canada – 2016

Each year, soybean diseases reduce yield in the United States and Ontario, Canada. The importance of these diseases vary annually, and many factors influence which diseases significantly affect yield. These factors can include environment, production practices, and a variety's susceptibility to disease.

This publication provides the estimated annual soybean yield losses due to plant diseases and pathogens in 2016 for the major soybean-producing areas in the United States and Ontario, Canada. Extension, university, USDA plant pathologists and soybean specialists from each state and province provided the estimates used in this publication. These reports accounted for 99.6 percent of the total soybean production in the United States and Ontario in 2016. The estimated losses include those caused by foliar diseases, stem diseases, nematodes, seedling blights, and seed diseases.

Disease loss estimates are gathered through various means including disease surveys; interactions with extension, university, government, industry, and farmer representatives; and personal experience with diseases losses. Estimation methods vary by state or province.

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

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

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

2016 Conditions and Production

The United States produced nearly 4.3 billion bushels of soybean in 2016, and many areas reported record production. Ontario, Canada, produced 124 million bushels.



Figure 1. Septoria brown spot was the top yield-reducing foliar disease in the United States in 2016.

2016 Disease Losses

In all, 8.9 percent of the total estimated soybean production (bushels) lost in 2016 were due to diseases in the top 28 soybean-producing states, and 7.8 percent of the total estimated soybean bushels were lost to disease in Ontario, Canada. Table 1 provides yield loss estimates for the specific diseases included in the survey of plant pathologists throughout the soybean production system in the United States and Ontario, Canada.

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Table 1. Estimated soybean yield losses from diseases in the top 28 soybean-producing states in the United States and Ontario, Canada, in 2016.

Disease/Pathogen	2016 Estimated Yield Losses for U.S. (thousands of bushels)	2016 Estimated Yield Losses for Ontario (thousands of bushels)
Root Rots and Seedling Blights		
Soybean cyst nematode	103,140	3,699
Seedling diseases due to <i>Fusarium</i> , <i>Pythium</i> , <i>Phomopsis</i> , and <i>Rhizoctonia</i>	50,107	1,480
Root-knot nematode	11,442	0
Reniform nematode	3,373	0
Other nematodes ^a	1,243	0
Leaf and Aboveground Diseases		
Septoria brown spot	18,267	1
Frogeye leaf spot	17,994	7
Cercospora leaf blight	12,109	1
Bacterial diseases	6,135	1
Virus diseases ^b	3,514	67
Purple seed stain	3,136	67
Downy mildew	2,393	0
Rhizoctonia aerial blight	2,088	0
Soybean rust	217	0
Stem Diseases		
Sudden death syndrome	47,181	1,749
Sclerotinia stem rot (White mold)	37,934	1,749
Phytophthora root and stem rot	27,873	1,480
Brown stem rot	14,526	40
Pod and stem blight	10,875	13
Charcoal rot	10,663	13
Stem Canker	9,763	67
Anthracnose	7,065	0
Diaporthe/Phomopsis seed decay	6,466	13
Fusarium wilt and root rot	3,985	67
Southern blight	418	0
Other Diseases^c	6,929	0

^a Lesion, Columbia lance, sting, and stubby root.

^b Alfalfa mosaic, bean pod mottle, cowpea mild mottle, soybean dwarf, soybean mosaic, soybean vein necrosis, tobacco ringspot, and tobacco streak. Only soybean mosaic virus was reported in Ontario, Canada.

^c Phyllosticta leaf spot, Phymatotrichopsis root rot, red crown rot, and target spot.

Diseases in the Northern United States

The northern U.S. states accounted for 78.7 percent of the total estimated yield losses in 2016. Since more than three-quarters of U.S. soybean production happens in the northern states, disease losses in these areas greatly affect the overall importance of different diseases across the country (see Table 2).

Table 2. Estimated soybean yield losses due to the six most significant diseases in the northernmost U.S. states^a in 2016.

Rank		Disease/Pathogen	Estimated Yield Losses (thousands of bushels)
Northern Region	Nation		
1	1	Soybean cyst nematode	84,454
2	2	Seedling diseases due to <i>Fusarium</i> , <i>Pythium</i> , <i>Phomopsis</i> and <i>Rhizoctonia</i>	46,070
3	3	Sudden death syndrome	43,961
4	4	Sclerotinia stem rot (white mold)	37,934
5	5	Phytophthora root and stem rot	25,513
6	8	Brown stem rot	14,520

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

Diseases in the Southern United States

More than 33 percent of the disease loss in the southern U.S. states came from soybean cyst nematode and root-knot nematode in 2016 — soybean cyst nematode caused the greatest yield loss (Table 3). Frogeye leaf spot followed closely behind.

Table 3. Estimated soybean yield losses due to the six most significant diseases in the southernmost states^a in 2016.

Rank		Disease/Pathogen	Estimated Yield Losses (thousands of bushels)
Southern Region	Nation		
1	1	Soybean cyst nematode	18,686
2	10	Root-knot nematode	11,407
3	7	Frogeye leaf spot	9,603
4	12	Charcoal rot	7,619
5	9	Cercospora leaf blight	7,404
6	15	Other diseases ^b	6,929

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

^b Phymatotrichopsis root rot, red crown rot, and target spot.



Figure 2. Nematodes, including root-knot nematode, caused the most yield loss in the southern United States in 2016.

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. However, these data provide valuable insight into the significance of a given disease within a production region (north or south) as well as across the entire production system. The authors used the most

appropriate means available 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.

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. We here list several of their publications that focus on these estimates. In addition, we also list a recently published article that focuses on loss estimates from 2010 to 2014.

Allen, T.W., et al. 2017. Soybean yield loss estimates due to diseases in the United States and Ontario, Canada, from 2010 to 2014. *Plant Health Progress* 18:19-27.

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. *Plant Health Progress* doi: 10.1094/PHP-2010-1122-01-RS.

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

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