



SOYBEAN YIELD LOSS TO DISEASES IN THE MIDSOUTHERN U.S.

Members of the Southern Soybean Disease Workers Group conduct an annual survey to estimate yield losses to soybean diseases in the southern US. These estimates are solicited from pathologists throughout the region, and are based on field surveys, plant disease diagnostic samples, variety trials, questionnaires to Extension Specialists, research plots,

grower demonstrations, private crop consultant reports, foliar fungicide trials, and sentinel plot data. Production losses are based on estimates of yield in the absence of diseases. Below are summary results from this survey for the 2015-2023 period in the midsouthern U.S. [Click [here](#) to access annual data sources from Dr. Tom Allen et al.].

Table 1. Soybean yield loss to diseases and nematodes in the midsouthern U.S. states of Ark., La., Miss., Mo., and Tenn., 2015-2023. [Selected diseases are charcoal rot (CR), soybean cyst nematode (SCN), root knot nematode (RKN), reniform nematode (RN), frogeye leaf spot (FLS), Cercospora leaf blight (CLB), Phomopsis seed decay (PSD), sudden death syndrome (SDS), seedling diseases, Rhizoctonia aerial blight (RAB), anthracnose, pod and stem blight (PSB), Phytophthora root rot (PRR), stem canker (SC), Septoria brown spot (SBS), and taproot decline (TRD)].

2015: CR—none in Mo.; SCN—none in La.; RKN—negligible in Mo., Tenn.; RN—significant in La., Miss.; FLS—significant in all states; CLB—significant in La., Miss.; SDS—significant in Mo., Tenn.; seedling diseases—significant in Mo., Tenn.; PRR—significant in Mo.

2016: CR—none in Mo., negligible in La.; SCN—negligible in La., 2/3 of yield loss in Mo.; RKN—significant in Ark., La., Miss.; RN—significant in La., Miss.; FLS—significant in all states; CLB—significant in Ark., La., Miss.; SDS—significant in Mo., Tenn.; seedling diseases—significant in Tenn.; RAB—significant in La., Miss.; PRR—significant in Mo.

2017: CR—none in La., Mo., negligible in Ark.; SCN—none or negligible in La., Miss., ~half of yield loss in Mo.; RKN—none or negligible in Mo., Tenn., half of yield loss in Ark.; RN—none in Ark., Mo., Tenn.; FLS—significant in all states; CLB—negligible in Mo., Tenn., significant in La., Miss.; SDS—significant in Mo.; Seedling diseases—significant in Mo., Tenn.; RAB—significant in La.; PRR—significant in Mo.

2018: CR—significant in La., Miss., Tenn.; SCN—significant in Ark., Mo., Tenn.; RKN—significant in Ark., La., Miss.; FLS—significant in Ark., La., Tenn.; CLB—significant in all states except Tenn.; PSD—significant in all states except Mo.; SDS—significant in Mo.; seedling diseases—significant in Mo., Tenn.; SBS—significant in Miss., Tenn.; TRD—significant in La.

2019: CR—significant in La., Tenn.; SCN—significant in Ark., Mo., Tenn.; RKN—significant in Ark., La., Miss.; FLS—significant in Ark., La., Tenn.; CLB—significant in all states except Tenn.; SDS—significant in Mo.; seedling diseases—significant in Miss., Mo., Tenn.; SBS—significant in Miss., Tenn.; TRD—significant in La.

2020: CR—minor significance in Tenn.; SCN—significant in Mo., Tenn.; RKN—significant in Ark., La., Miss.; RN—significant in Ark., La.; FLS—significant in Tenn.; CLB—significant in all states except Tenn.; SDS—significant in Mo.; seedling diseases—significant in Miss., Mo., Tenn.; TRD—significant in Ark., La., Miss.; PRR—significant in Mo.

2021: CR—significant in Tenn.; SCN—significant in Ark., Mo., Tenn.; RKN—significant in Ark., La., Miss.; RN—significant in La.; FLS—significant in Tenn.; CLB—significant in Ark., La., Miss., Mo.; seedling diseases—significant in Miss., Mo., Tenn.; PRR—significant in Mo.; TRD—significant in Ark., La., Miss.

2022: CR—significant in Tenn.; SCN—significant in Mo., Tenn.; RKN & RN—significant in Ark., La.; FLS—significant in Tenn.; CLB—significant in Ark., La.; seedling diseases—significant in Tenn.; PRR—significant in Miss., Mo.; PSD—significant in La., Tenn.

2023. CR—significant in Mo., Tenn.; SCN—significant in Mo., Tenn.; RKN—significant in Ark., La., Miss.; RN—significant in La.; FLS—significant in Tenn.; CLB—significant in La., Miss.; seedling diseases—significant in Tenn.; PRR—significant in Mo.; SDS—significant in Mo.; TRD—significant in La.; SBS—significant in Tenn.

Table 2. Estimated yield lost to diseases [%, millions of bushels, and value (x \$1000)] in indicated Midsouth states in the 2015-2023 period. Data in last row are total value of lost yield for each year in dollars x 1000 [lost yield x \$10/bu] for the five shown Midsouth states [using production data from NASS].

	-----Year-----																	
	2015		2016		2017		2018		2019		2020		2021		2022		2023	
	-----Yield lost to diseases--% and bushels x 1 million-----																	
	State	%	Bu.	%	Bu.	%	Bu.	%	Bu.	%	Bu.	%	Bu.	%	Bu.	%	Bu.	%
Arkansas	9.10	15.55	9.09	14.59	7.85	15.21	13.71	26.25	8.48	11.85	8.05	12.17	7.84	13.06	6.22	10.83	5.47	9.22
Louisiana	12.95	8.51	16.00	10.99	12.80	9.91	20.90	16.48	10.10	4.64	9.96	5.98	10.00	6.12	12.61	8.21	5.33	2.21
Miss.	15.04	18.48	14.28	16.15	8.96	11.32	11.24	15.11	5.94	5.15	7.08	8.48	5.66	7.06	5.12	6.67	4.09	5.09
Missouri	8.90	17.72	7.60	22.33	8.50	26.90	8.19	23.28	5.02	12.18	7.20	22.54	7.67	23.00	3.55	8.27	4.18	11.56
Tenn.	11.17	9.95	14.21	12.15	9.10	8.31	10.30	8.82	6.30	4.33	6.35	5.49	6.16	4.99	6.39	5.31	6.46	5.53
Total	70.21		76.21		71.65		89.94		38.15		54.66		54.23		39.29			33.61
Value	\$702,183		\$761,915		\$716,442		\$899,594		\$381,443		\$546,560		\$542,334		\$392,900		\$336,100	

A summary of the estimates of soybean yield lost to diseases and nematodes in the above five midsouthern states follows.

- In 2015-2018, soybean yield losses to disease pathogens and nematodes in the Midsouth approached or exceeded 10% in all five states. This was the case only in Louisiana in 2019-2022. In 2023, none of the five states had estimated yield losses to diseases that were greater than 6.5%.
- In the 2014-2017 growing seasons, the most damaging diseases/pathogens across the Midsouth states were charcoal rot [CR], soybean cyst nematode [SCN], root knot nematode [RKN], and frogeye leaf spot [FLS]. Starting in 2019, CR and FLS declined in significance, while *Cercospora* leaf blight [CLB] was important in the 2016-2021 period. In 2023, yield losses to RKN were heavy in Ark., La., and Miss.
- From 2014 to 2016, CR was a significant damaging disease across all years in all states except Missouri. In 2017-2019, it was significant only in Mississippi and Tennessee. In 2020-2023, it was significant only in Tennessee.
- FLS was a significant damaging disease in all states starting in 2013, and this may be associated with the increasing resistance of the FLS pathogen to fungicide control. Its effect was reduced in Louisiana and Mississippi in 2018. In the 2019-2023 period, it was a major disease only in Tenn.
- Sudden death syndrome [SDS] was a significant disease in 2014, but declined in significance thereafter. Its major yield-reducing effect in 2015 and 2016 was in Missouri and Tennessee, whereas in 2017-2020, it was significant only in Missouri. It did not cause major yield losses in any of the five states in 2021-2023.
- CLB became a significant disease in Louisiana and Mississippi in 2014, and continued as significant in those

states through 2023. It was also a significant yield limiter in Arkansas and Missouri in 2019 and 2020, and in Arkansas in 2022.

- The high losses to RKN that occurred in Ark., La., and Miss. emphasize the need to develop resistant varieties to combat this pest. Click [here](#) for an article on this website that summarizes research that addresses this need.
- Bacterial diseases and viruses resulted in no significant yield losses in any state during the 2015-2023 period.
- The relatively low yield loss to stem canker [SC] in all years underlines the effectiveness of varietal resistance as a control measure to avoid yield loss to a fungal pathogen. The virility of the SC pathogen is documented by the devastating effect this disease had on the Midsouth soybean crop in the late 1980's when planted varieties had little or no resistance to the SC pathogen. Since there is no efficacious fungicide for its control, this is even stronger testimony that genetic resistance to a fungal pathogen can be a most effective long-term tool to minimize losses to disease.
- Taproot decline [TRD] was a major disease in Louisiana in 2018 and 2019, and became obvious in Arkansas and Mississippi in those years. Its significance in Louisiana soybeans has been apparent through 2023.
- *Phomopsis* seed decay [PSD] was a major yield limiting disease in 2018, but its effect on yield in the 2019-2021 period and in 2023 was negligible. It was a significant yield reducer in Louisiana and Tennessee in 2022. The importance of PSD as a yield limiter of soybean is strongly correlated to late-season weather conditions that occur at and/or soon after maturity.

The above estimates and summary points result in the following important tenets for disease management in the



Midsouth soybean crop.

- Diseases and nematodes pose a constant threat to soybean production in the midsouthern U.S. Economic losses using a commodity price of \$10/bu were estimated to be near or above 3/4 billion dollars in 2014-2017, and were near 900 million dollars in 2018. Losses to diseases in 2019 were the least in the 2014-2019 period, whereas losses in the 2020-2022 period approached or exceeded ½ billion dollars. Estimated yield losses to diseases in the 2023 soybean crop were relatively small. Of course, the economic losses would be greater when a commodity price greater than the \$10/bu price used for these calculations is obtained by producers.
- Fungicide resistance management must be constantly practiced in order to protect the efficacy of current fungicides that are used against major foliar diseases such as FLS, which has developed widespread resistance to the strobilurin class of fungicides. The reduced losses to this disease in the 2019-2023 period indicate that producers are either selecting varieties with resistance or are using more efficacious fungicides, or both.
- A constant effort must be exerted to provide genetic resistance to major soybean disease pathogens and nematodes in order to provide the most effective long-term defense against these pests. The effectiveness of this strategy is evidenced by the continued low effect of SC on soybean yield in the region. This is a major point to consider for protection against pathogens that cause maladies such as PSD that was associated with devastating mature soybean seed decay and subsequent financial losses due to dockage in 2018.
- The major effect of SCN on soybean yield reduction in Missouri and Tennessee across the survey period underlines the continued importance of using resistant varieties and crop rotation to manage this pest. Seed-applied nematicides will not replace these proven management practices. It is also important to rotate varieties that have different resistance sources since SCN will adapt to varieties that have the same source of genetic resistance. In fields known to be infested with SCN, it is imperative to have an HG Type test conducted on nematode samples. Click [here](#) for details about use of this test.
- It is apparent from these survey data that many of the diseases that affect soybeans are geographically specific—e.g. diseases such as SDS are more devastating to soybean yield in the northern portions of the Midsouth, whereas the RKN pest is more devastating to soybean yield in the southern portions of the Midsouth. Thus, producers are encouraged to select varieties that have tolerance or resistance to disease pathogens that are likely to occur in their region of production.

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