

## Soybean Production and Disease Loss Estimates for North Central United States From 1989 to 1991

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Growers in the north central region of the United States produced approximately 80% of the total soybean production in the United States from 1989 to 1991 on 75% of the harvested acreage; six of the most productive states and 10 of the top 12 are located in this region.

In 1989, the North Central Regional Committee on Soybean Diseases (NCR-137) initiated a three-year project to estimate soybean disease losses for the north central United States. This project represents the first organized effort to estimate soybean disease losses for this region.

The NCR-137 is composed of 12 members, one from each of the states in the north central region. The members are: Illinois, J. B. Sinclair, 217-333-6588; Indiana, D. H. Scott, 317-494-4627; Iowa, G. Tylka, 515-294-3021; Kansas, F. W. Schwenk, 913-532-6176; Michigan, G. Safir, 517-355-4697; Minnesota, W. C. Stienstra, 612-625-6290; Missouri, A. Wrather, 314-379-5431; Nebraska, B. Douppnik, Jr. 402-762-4437; North Dakota, J. R. Venette, 701-237-8362; Ohio, A. F. Schmitthenner, 216-263-3838; South Dakota, T. Chase, 605-688-5550; and Wisconsin, C. R. Grau, 608-262-6289.

Various methods were used to estimate disease losses; most states used more than one (Table 1). "Field surveys and observations" and "plant disease diagnostic clinic and seed lab samples" were the more frequently used methods.

Table 2 shows the estimated percent disease losses, production losses, and dollar losses for the north central region from 1989 to 1991. These estimates are based on reports from nine states for 1989, 11 for 1990, and 10 for 1991. Disease loss estimates are based on the percent loss from what production would have been in the absence of disease. Actual production figures were obtained from the Annual Crop Summary reports

published by the USDA National Agricultural Statistical Service (1,2). Dollar losses were calculated by multiplying the estimated production losses by an average price per metric ton (Mg) of \$202.13 which is equivalent to \$5.50/bu.

During 1989, disease losses were estimated at 12.78%, resulting in a production loss of  $6.076 \times 10^6$  Mg ( $223.280 \times 10^6$  bu) and an economic loss of \$1,228.04

$\times 10^6$  for the north central region. Individually, percent disease loss ranged from a low of 2.6% for Minnesota to a high of 19.4% for Illinois. During 1990, disease losses were estimated at 16.5%, resulting in a production loss of  $8.331 \times 10^6$  Mg ( $306.180 \times 10^6$  bu) and an economic loss of \$1,683.990  $\times 10^6$ . Individually, percent disease loss ranged from a low of 3.7% for North Dakota

**Table 1.** Methods used to estimate soybean disease losses by state for the north central United States (1989-1991)

Method	State (s)
1. Field surveys and observations	IL, IN, KS, MN, MO, ND, NE, OH, SD, WI
2. Plant disease diagnostic clinic and seed lab samples	IL, IN, KS, MN, MO, ND, NE, SD, WI
3. Variety trial and observation plots	IL, KS, MN, MO, NE, SD, WI
4. Guess estimates	IA, KS, MI, MN, ND, NE, SD
5. Questionnaires to extension agents and/or growers	IL, MN, MO, ND, SD
6. Seed treatment tests	KS, MN, NE
7. Private crop consultant reports	IN, MO, ND
8. Telephone and personal contacts with growers and with extension agents, other university staff, and regulatory personnel working on soybeans	IN, ND, NE
9. State Department of Agriculture Survey Reports	KS, WI
10. State Crop Improvement Associations	IL, IN
11. Foliar fungicide tests	NE
12. Yield comparisons of Phytophthora-resistant and -susceptible cultivars	OH

**Table 2.** Soybean Production and Disease Loss Estimates for north central United States (1989-1991)

Year	Harvested areas <sup>a,b</sup> (ha) (acre)	Production <sup>a,b</sup> (Mg) (bu)	Disease loss <sup>c,d</sup> (%)	Production loss <sup>b,e</sup> (Mg) (bu)	\$ Loss <sup>b</sup> (\$202.13/Mg) (\$5.50/bu)
1989	17.585	41.465	12.78	6.076	1,228.040
	43.420	1,523.825		223.280	
1990	16.891	42.165	16.50	8.331	1,683.990
	41.705	1,549.550		306.180	
1991	18.132	43.783	10.10	4.918	994.015
	44.770	1,609.040		180.730	
Total <sup>e</sup>	52.608	127.413	NA	19.325	3,906.045
	129.895	4,682.415		710.190	
Avg/yr <sup>e</sup>	17.536	42.471	13.17	6.442	1,302.015
	43.298	1,560.805	13.17	236.730	

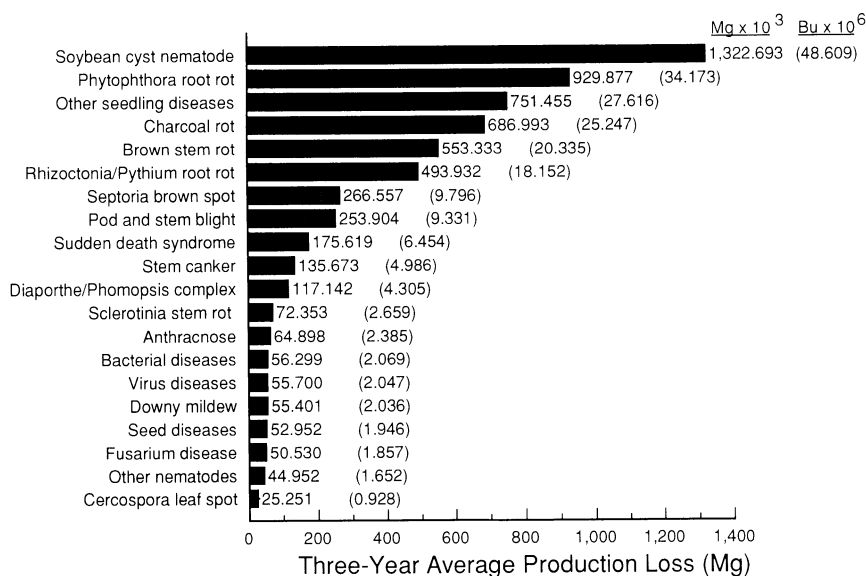
<sup>a</sup>Source: Annual Crop Summary - Agricultural Statistical Board, National Agricultural Statistical Service, USDA; January 1992 and January 1993.

<sup>b</sup>All values in millions except disease loss (%). Mg = metric ton.

<sup>c</sup>Estimation based on responses from nine states in 1989, 11 in 1990, and 10 in 1991. Twelve states are included in the north central region.

<sup>d</sup>Rounding errors present.

<sup>e</sup>Loss = production  $\times$  % loss / 100% - % loss = production without loss  $\times$  % loss.



**Fig. 1.** Summary of north central region soybean disease loss estimates by disease (1989–1991). Values are the three-year average production loss for each disease for the north central region in thousands of metric tons (Mg). Equivalent bushels (in millions) are shown in parentheses.

to a high of 28.5% for Illinois. During 1991, disease losses were estimated at 10.1%, resulting in a production loss of  $4.918 \times 10^6$  Mg ( $180.730 \times 10^6$  bu) and an economic loss of  $\$994.015 \times 10^6$ . Individually, percent disease loss ranged from a low of 2.0% for South Dakota to a high of 17.5% for Minnesota.

The three-year averages (1989–1991) for percent disease loss and production loss were 13.17% and  $6.442 \times 10^6$  Mg ( $236.730 \times 10^6$  bu), respectively (Table

2). Dollar losses from soybean diseases over the region thus averaged over \$1.3 billion/year.

A summary of the three-year average production loss estimates caused by each disease in the north central region from 1989 to 1991 is shown in Figure 1. The values were obtained by estimating the production loss for each disease by each state over the three-year period. Data for the nonreporting states were extrapolated by using the average percent disease loss

of the reporting states for each disease each year. The percent disease loss was then weighted by acreage for each non-reporting state.

Soybean cyst nematode was the most yield-suppressing disease followed by Phytophthora root rot, other seedling diseases, charcoal rot, brown stem rot, Rhizoctonia/Pythium root rot, Septoria brown spot, and pod and stem blight. The most serious diseases are caused by root, stem, and/or seedling pathogens. The above diseases were in the top eight each year but not in the same rank.

The diseases ranked in Figure 1 are listed by common name. Additional information on the causal agents and symptom descriptions can be found in the Compendium of Soybean Diseases, 3rd ed. (APS Press, St. Paul, MN 1989).

It is obvious from these production loss estimates that diseases play a major role in limiting soybean production in the north central United States. Production losses averaged over 6 million metric ton/year (nearly 237 million bu) at an annual cost of over \$1.3 billion to soybean producers. Expanded research and extension efforts are needed to provide more effective disease management systems of production.

#### LITERATURE CITED

- Anonymous. 1992. Crop Production-1991 Summary. Agricultural Statistics Board, National Agricultural Statistics Service, USDA, Washington, DC. Pages A44-45.
- Anonymous. 1993. Crop Production-1992 Summary. Agricultural Statistics Board, National Agricultural Statistics Service, USDA, Washington, DC. Pages A44-45.

## Salute to APS Sustaining Associates

This section is designed to help APS members understand more about APS Sustaining Associates. Information is supplied by company representatives. Each month features different companies. A complete listing appears in each issue of *Phytopathology*.

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**Pest Pros, Inc. Contact: Randy M. Van Haren, P.O. Box 188, Plainfield, WI 54966; 715/335-4046, Fax: 715/335-4746.** Pest Pros is an independent crop consulting firm specializing in integrated crop management of vegetables. It offers fertility, IPM, and cultural management expertise on potatoes, onions, carrots, cole crops, and mint. Pest Pros runs its own nematode diagnostic laboratory to complement its IPM program. This laboratory is one of the few private labs to run soil screening for *Verticillium dahliae*. A potato early dying analysis service assesses the nematode/*Verticillium* complex in each field during the rotation crop prior to potatoes. Management strategies are developed for the efficient control of potato early dying on this basis.

**Pioneer Hi-Bred International, Inc. Contact: Dan Wilkinson, Plant Pathologist, 7301 NW 62nd Ave., P.O. Box 85, Johnston, IA 50131; 515/270-3300.** Pioneer Hi-Bred International, Inc., was founded in 1926 by Henry A. Wallace and a few friends. Pioneer has grown to be the world's largest independent agricultural genetics supply company, doing business in approximately 100 countries. Pioneer has 99 research stations around the world dedicated to increasing the efficiency and profitability of farmers. Pioneer breeds, produces, and sells hybrid corn, sorghum and sunflower seed, and pure-line varieties of soybean, soft red winter wheat, alfalfa, and

canola seed. Pioneer pathologists conduct both classical and molecular research on these crops.

**Rhone-Poulenc Ag Company. Contact: Elymar V. Vea, Product Development Manager of Fungicides and Plant Growth Regulators, P.O. Box 12014, 2 T.W. Alexander Dr., Research Triangle Park, NC 27709; 919/549-2243, Fax: 919/549-9024.** Rhone-Poulenc is a rapidly growing company engaged in the discovery, manufacturing, and marketing of crop protection chemicals. It is the U.S. affiliate of Rhone-Poulenc S.A., the largest chemical manufacturer in France and among the 10 largest chemical groups in the world. Current products include the fungicides Aliette, Rovral, and Chipco 26019; herbicides Ronstar, Asulox, Bucril, Weedar, and Weedar 2,4-D; plant growth regulators Cerone, Ethrel, Prep, and Florel; insecticides-nematicides Larvin, Mocap, Sevin, Temik, and Zolone; and the defoliant Folex. Aliette is a systemic material capable of providing bidirectional translocation in the plant. It is active primarily against Phycomycetes (downy mildew, *Phytophthora*, and *Pythium* species). Rovral (Chipco 26019) is a broad-spectrum fungicide that provides control of *Alternaria*, *Botrytis*, *Helminthosporium*, *Monilinia*, *Rhizoctonia*, *Sclerotinia*, *Aspergillus*, *Penicillium*, *Rhizopus*, and *Mucor*.

**Ricerca, Inc. Contact: Suzan H. Woodhead, 7528 Auburn Rd., Painesville, OH 44077; 216/357-3752, Fax: 216/354-4662.** Ricerca, Inc., is a broad-based technology company that provides R & D services on a contract basis to clients in the agricultural and chemical industries. More than 300 scientists and support personnel help clients to develop new products, improve existing products, and support the registration of products in compliance with Good Laboratory Practices. The Plant Disease Control Group has the expertise and facilities for large volume primary screening and advanced testing of chemicals against more than 30 diseases and several nematode species. Specialty studies such as rain tenacity evaluations and wood preservative assays are available. The Biocontrol Group conducts discovery, development, toxicology, and formulations research leading to the registration of biocontrol agents of plant diseases, weeds, and insects. The Biological Evaluations Group offers herbicide and insecticide screening and Subdivision J studies.