Survey of Fungal diseases in Commercial Soybean fields in South Dakota

Febina Mathew, Paul Okello, Ahmed Gebreil, and *Darrell Deneke

Department of Plant Sciences, South Dakota State University, Brookings, SD 57007

Introduction

Soybean (*Glycine max* L.) acreage in South Dakota has increased in the recent years with the total acreage planted averaging 4.8 million acres during 2012 to 2014. The value of the crop was estimated at over $200 million in 2013 (USDA-NASS 2014). As the acreage of soybeans continues to increase in South Dakota, the time between soybean crops in a field may decrease (i.e. shorter rotation) and growers can expect greater diseases problems. For example, in 2003-2005, soybean yields were suppressed by several plant diseases including soybean cyst nematode (*Heterodera glycines*), Phytophthora root and stem rot (*Phytophthora sojae*), Stem canker (*Diaporthe* species), and seedling diseases (*Fusarium* species, *Rhizoctonia* species and *Pythium* species) (Wrather and Koenning 2006).

In 2014, a disease survey was conducted in commercial soybean fields in South Dakota. Evaluations were made on foliar and root diseases infecting soybean plants. We anticipate the results from this survey will benefit the soybean industry in South Dakota by increasing awareness of soybean diseases among growers and guiding them on future research efforts geared at improving disease management in soybeans.

Materials & Method

- In 2014, a total of 200 commercial soybean fields covering 22 counties were surveyed in late August or early September.

- The fields were arbitrarily selected and evaluations were made on foliar diseases infecting soybean plants between R1 (beginning flowering) and R5 (beginning seed) growth stages. A one acre section of each field was used for disease evaluations. A field was considered positive for the disease if it was present on at least 10 soybean plants.

- Additionally, a total of 2000 soybean root samples were collected. The root pieces were surface disinfected in 10% NaOCl for 2 min, rinsed 2 times in sterile distilled water, and blotted dry. The pieces were placed on antibiotic-amended (0.02% streptomycin sulfate) potato dextrose agar (PDA) media at 25°C for 7-d under 12-h fluorescent light/dark conditions.

- Isolates of different fungal pathogens including *Fusarium, Rhizoctonia, Pythium, Phoma* and *Diaporthe* species were hyphal-tipped, cultured, and identified microscopically based on colony growth and spores produced on PDA (Leslie and Summerell 2006, Barnett and Hunter 1972).

Summary

- Among the soybean fungal foliar diseases,
  - Sudden death syndrome was the most prevalent of the fungal diseases observed (20%).
  - Phytophthora stem rot was the second most common foliar disease and observed in 12% of the fields.
  - Other diseases in low prevalence (<10%) were Stem canker, Downy mildew, White mold, Septoria brown spot and Charcoal rot.
- Among the fungal pathogens causing root rot on soybeans,
  - *Fusarium* species were most recovered (88%) from the soybean roots.
  - Other root-infecting fungal pathogens were *Rhizoctonia* species (25%), *Diaporthe* species (29%) and *Macrophomina phaseolina* (29%).
- One of the driving factors for development of diseases such as sudden death syndrome, Phytophthora stem rot and Fusarium root rot in 2014 was significant rainfall during the growing season. For example, the precipitation total in Lincoln County for June and August were 13.7 and 22.73 inches respectively (The 30-yr mean was 4.01 and 16.64 inches for June and August respectively; South Dakota State Climate Office, 2014).

County	No. of fields	Growth stage[a]	Crop(s) previous to soybean in rotation	Disease prevalence (%)[b,c]						Fungal pathogens isolated from soybean roots[d]					
				Sudden death syndrome	Phytophthora Stem rot	Stem canker	Downy mildew	White mold	Septoria Brown Spot	*Fusarium* sp.	*Diaporthe* sp.	*Phoma* sp.	*Macrophomina phaseolina*	*Pythium* sp.	*Rhizoctonia solani*
Brookings	13	R3-R5	Corn	7.6	15.4	0	7.6	0	0	76	2	0	3	1	3
Brown	6	R3-R4	Corn	16.7	0	0	0	0	0	31	1	0	0	0	1
Clark	10	R3-R4	Corn	0	0	0	0	0	0	31	0	0	0	0	0
Clay	10	R3-R4	Corn, Soybean	10	0	0	10	0	10	59	6	0	0	0	4
Codington	10	R3-R5	Corn	10	10	0	0	0	10	14	0	0	0	0	1
Davison	6	R3-R5	Corn	16.6	16.6	0	0	0	0	62	1	0	3	0	0
Deuel	11	R3-R4	Corn	9.1	0	0	0	0	0	46	0	0	0	0	3
Grant	6	R3-R4	Corn	50	33.3	16.6	0	0	0	14	0	0	0	0	0
Hamlin	9	R3-R4	Corn	11.1	0	0	0	0	0	45	0	0	0	0	3
Hanson	7	R4-R5	Corn	0	42.8	14.3	0	0	0	87	0	0	0	0	0
Kingsbury	6	R3-R6	Corn	16.7	0	0	0	50	0	57	0	0	2	0	0
Lake	10	R2-R5	Corn	20	0	0	10	0	0	93	0	0	1	0	1
Marshall	6	R3-R4	Corn	0	0	0	0	0	0	17	1	2	0	0	0
McCook	8	R4-R5	Corn	50	25	0	0	0	0	70	1	0	2	0	3
Miner	18	R3-R6	Corn	27.7	27.7	11.1	0	0	0	145	6	0	6	2	9
Minnehaha	10	R2-R5	Corn	20	10	0	10	0	0	92	1	0	0	0	2
Moody	9	R2-R4	Corn	33.3	22.2	0	0	0	0	57	0	0	0	0	2
Roberts	14	R3-R4	Wheat, Corn	0	21.4	0	0	0	7.1	36	0	0	0	11	0
Sanborn	7	R4-R6	Corn	0	14.3	0	0	0	0	66	0	0	0	0	0
Spink	4	R3-R4	Corn	25	25	0	0	0	0	10	2	0	3	0	0
Union	10	R1-R5	Corn, Soybean, Sunflower	10	10	0	30	0	0	59	11	0	0	1	0
Yankton	10	R3-R4	Corn	30	10	0	0	0	0	52	2	0	9	2	0

[a] R1 = Beginning flowering - plants have at least one flower on any node; R2 = Full flowering - there is an open flower at one of the two uppermost nodes; R3 = Beginning pod - pods are 3/16 inch (5 mm) at one of the four uppermost nodes; R4 = Full pod - pods are 3/4 inch (2 cm) at one of the four uppermost nodes; R5 = Beginning seed - seed is 1/8 inch long (3 mm) long in the pod at one of the four uppermost nodes on the main stem.
[b] Disease prevalence was based on if the disease was present on at least 10 soybean plants in a field
[c] Other diseases in very low prevalence (< 5%) were Bacterial blight and Cercospora leaf spot.
[d] Number of isolates recovered from a total of 200 soybean roots that were randomly sampled from the 200 fields and these were identified based on cultural characteristics on potato dextrose agar

SOUTH DAKOTA SOYBEAN RESEARCH & PROMOTION COUNCIL