Influence of Row Spacing, Plant Population, and Variety Selection on Sudden Death Syndrome of Soybean in Kansas and Iowa

Madison Kessler[1], Nabin Dangal[2], Daren Mueller[2], Rodrigo B. Onofre[1]
[1] Department of Plant Pathology, Kansas State University, Manhattan, Kansas.
[2]Department of Plant Pathology, Entomology and Microbiology, Iowa State University, Ames, Iowa.
E-mail: mkessler@ksu.edu

INTRODUCTION

- *Fusarium virguliforme*, a soilborne pathogen that infects and colonizes the roots of soybeans, is the primary causal agent of soybean sudden death syndrome (SDS) in US.
- Symptoms appear at or shortly after flowering and include root necrosis, interveinal leaf chlorosis and necrosis, flower abortion, reduced number of pods and seed size, and premature defoliation.
- Yield losses typically range from 5-15%, with highly infested fields reporting losses up to 100%.

Fig. 1: Progression of SDS leaf chlorosis and necrosis.

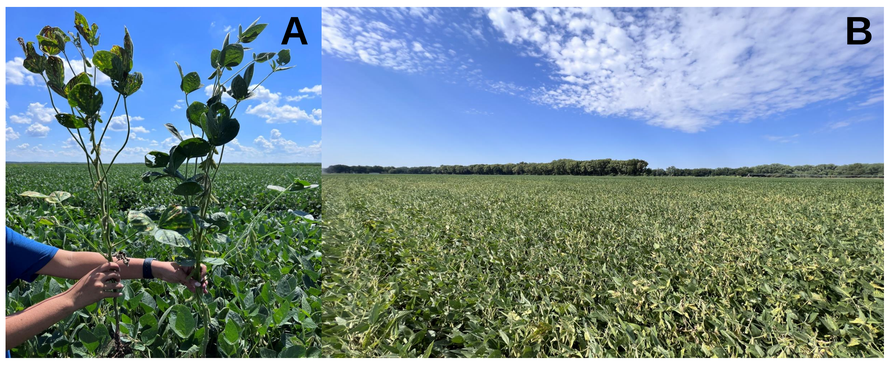

Fig. 2a: Symptomatic SDS soybean plant (left) compared to healthy soybean plant (right). **Fig. 2b:** Visual SDS symptoms from Shawnee County, KS from 2022.

OBJECTIVE

- Evaluate the influence of agronomic practices on soybean sudden death syndrome through on-farm trials evaluating row spacing, plant population, and variety selection.

MATERIALS AND METHODS

- **Plot Size:** 30 ft with 15-inch and 30-inch row spacing with 4 repetition with RCBD.
- **Plant population:** 80k, 120k, 160k, and 200k seeds/acre.
- **Varieties:** Resistant (R) and susceptible (S)
- **Inoculum:** *F. virguliforme*-infested sorghum grain was applied in-furrow at planting.
- **Data collection – Rossville, KS and Topeka, KS during the 2023 season.**
  - Pre-planting: Soybean cyst nematode (SCN) eggs counted
  - V2: Live plants counted.
  - R4: Root rot severity was estimated on a 0-100% scale.
  - R6: Foliar SDS symptoms (FDX) assed using SIU's rating scale.
  - R8: Yield adjusted to 13% moisture.
  - Post-harvest: SCN J2+egg count

RESULTS

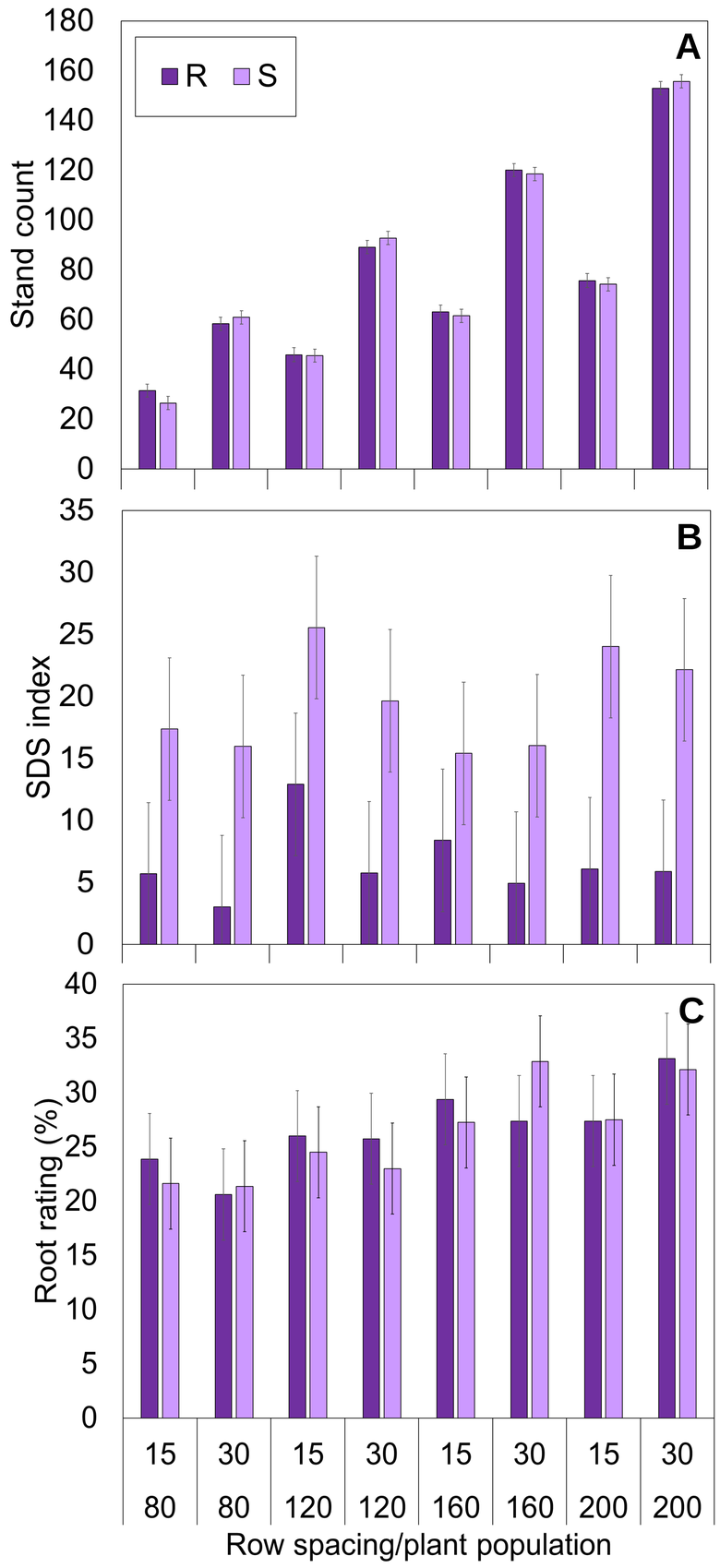

Fig. 3. Effect of row spacing and plant population on (**A**) stand count, (**B**) SDS Index, and (**C**) SDS root rot.

Table 1: Type 3 tests of fixed effects for stand count. Cult = cultivar; Pop = Plant Population; Row = Row spacing.

Effect	Num DF	Den DF	F Value	Pr > F
CULT	1	95	0.01	0.915
POP	**3**	**95**	**639.19**	**<.0001**
CULT*POP	3	95	0.4	0.7557
ROW	**1**	**7**	**1959.03**	**<.0001**
CULT*ROW	1	95	2.7	0.1034
POP*ROW	**3**	**95**	**74.36**	**<.0001**
CULT*POP*ROW	3	95	0.42	0.7357

Table 2: Type 3 tests of fixed effects for SDS Index. Cult = cultivar; Pop = Plant Population; Row = Row spacing.

Effect	Num DF	Den DF	F Value	Pr > F
CULT	**1**	**98**	**75.06**	**<.0001**
POP	**3**	**98**	**3.08**	**0.0309**
CULT*POP	3	98	1.23	0.304
ROW	1	7	2.46	0.1609
CULT*ROW	1	98	0.17	0.6817
POP*ROW	3	98	0.73	0.5361
CULT*POP*ROW	3	98	0.15	0.9264

Table 3: Type 3 tests of fixed effects for SDS root rot. Cult = cultivar; Pop = Plant Population; Row = Row spacing.

Effect	Num DF	Den DF	F Value	Pr > F
CULT	1	98	0.2	0.656
POP	**3**	**98**	**17.8**	**<.0001**
CULT*POP	3	98	0.75	0.524
ROW	1	7	1.06	0.3377
CULT*ROW	1	98	1.29	0.2595
POP*ROW	**3**	**98**	**2.95**	**0.0363**
CULT*POP*ROW	3	98	1.33	0.2676

Stand count and plant population are great predictors for SDS root rot

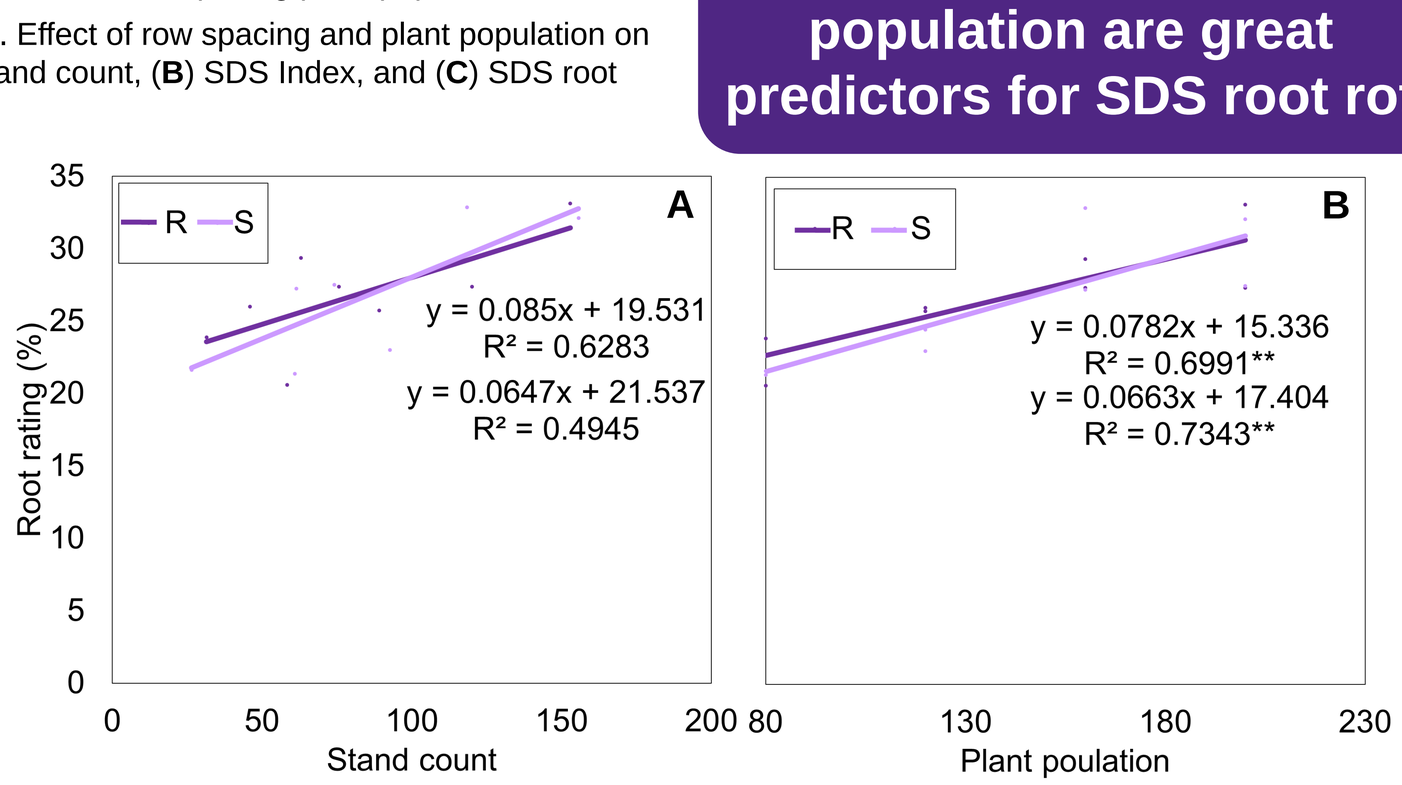

Fig. 4. Effect of (**A**) stand count and (B) plant population on SDS root rot.

CONCLUSIONS

- Resistant cultivars reduced SDS index and increase yield (data not shown).
- There was an increase in root rot ratings with higher plant populations.
- The cultivar, plant population, and row spacing interaction was not significant.