Effect of nozzle types and pressure on fungicide efficacy against Phomopsis stem canker in sunflower

Nabin K. Dangal, Nathan Braun and Febina M. Mathew

Department of Agronomy, Horticulture and Plant Science, South Dakota State University, Brookings, SD 57007

Introduction

- Different nozzle types, pressures and orientations have bee studied in the past on various crops (Wunsch et al. 2018, Wunsch et al. 2017; Egel and Harmon 2001; McMullen et al.1999).
- Application at high pressures may result in unavoidable spray drift on nontarget crops (Egel and Harmon 2001).
- Selection of optimum nozzle type and spray pressure varies with individual pathosystem (Egel and Harmon 2001).
- There have been no studies on the most effective nozzle type and spray pressure for fungicide efficacy against Phomopsis stem canker in sunflower.

Objective

- To study the effect of nozzle types and pressure on fungicide efficacy against Phomopsis stem canker in sunflower

References

Egel, D. S., and Harmon, P. 2001. Plant Dis. 85:1081-1084.

Mathew et.al. 2015. Phytopathology 105: 990-7.

McMullen et al. 1999. https://library.ndsu.edu/ir/bitstream/handle/10365/16339/er56.pdf?sequence=1&isAllowed=y

Ryley et al. 2003. Aust. Plant. Pathol. 32: 329-338

Wunsch et al. 2017. https://www.sunflowernsa.com/uploads/63/wunsch_drop.nozzles.head.rot_2017.pdf

Wunsch et al. 2018. https://www.sunflowernsa.com/uploads/71/wunsch_management.sclerotinia_2018.pdf

Materials and methods

Location : Felt Farm Brookings, SD

Year: 2020

Design: RCBD

Replication: 4

Sunflower Hybrid: Non-oil, oils

Fungicide: Headline @ 6 oz/A

Spraying at R1 stage (July 23rd 2020)

Boom Height:	55"
Speed	2 MPH
Nozzle size:	Hollow-cone: 06 Flat-fan: 02 Twinjet: 03
Number of nozzles	3
Spacing between nozzles	15”

Temperature:84°F

RH: 60%

Wind speed: 15-24 MPH

BP: 28.5

Disease rating: 0-5 scale (Mathew et al. 2015) at R8-R9 growth stage (Sep 16th 2020)

Table 1. Treatment details

Treatments	Nozzle type	Spraying pressure (psi)*	Spray volume (GPA)
Hollow-cone-40		40	47
Hollow-cone-65		65	78
Hollow-cone-90		90	94
Flatfan-20		20	27.8
Flatfan-55		55	48
Flatfan-90		90	62
Twinjet-15		15	38.7
Twinjet-35		35	54
Twinjet-60		60	72
Control	-	-	-

*Nozzle pressure selected based on the manufacturer recommendation

Results

Table 2. Disease severity index (DSI) and yield for non-oil in Brookings, SD in 2020

Nozzle type/pressure	DSI-R8 (%)	Yield (lb/A)
Hollow-cone-40	26 bcd	2190
Hollow-cone-65	23 cd	2413
Hollow-cone-90	18 d	2448
Control	53 a	2021
Flatfan-20	38 b	2088
Flatfan-55	24 bcd	2179
Flatfan-90	20 cd	2300
Twinjet-15	32 bc	2249
Twinjet-35	26 bcd	2403
Twinjet-60	27 bcd	2458
p-value	0.001	0.500
LSD	14	NS

Table 3. Disease severity index (DSI) and yield for oil in Brookings, SD in 2020

Nozzle type/pressure	DSI-R8 (%)	Yield (lb/A)
Hollow-cone-40	44.58 bcd	1865.1 e
Hollow-cone-65	40.21 bcd	2048.8 de
Hollow-cone-90	21.25 e	2214.5 bcd
Control	63.50 a	2121.8 cde
Flatfan-20	51.83 ab	2058.6 de
Flatfan-55	39.50 cd	2401.3 ab
Flatfan-90	37.04 d	2506.7 a
Twinjet-15	49.79 bc	2378.6 abc
Twinjet-35	39.79 bcd	2551.8 a
Twinjet-60	48.33 bcd	2459.6 ab
p-value	0.00045	0.0001
LSD	12.32	271.80

Conclusions

- Foliar fungicides applied using all nozzle types/pressures significantly reduced severity of Phomopsis stem canker at R8 growth stage of sunflower in comparison to non-treated control (Tables 2 and 3)
- Yield was significantly greater in Flatfan-55, Flatfan-90, Twinjet 35 and Twinjet-60 than the non treated control in oils. However, significant differences in yield were not observed for non-oil.
- Our study suggests the use of flat fan, twin-jet or hollow-cone nozzles at higher nozzle pressure for greater disease severity reduction and yield benefit. Similar observations were made by Ryley et al. (2003) for flat fan nozzle to minimize severity of sorghum ergot and maximize yield.