

# DRAINAGE WATER MANAGEMENT AND HEADLINE FUNGICIDE EFFECTS ON SOYBEAN YIELD

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Production challenges associated with cool, wet soils in the spring, drought during the summer, and wet conditions in the fall have caused farmers to consider new production systems that maximize yield and maintain environmental sustainability. Subsurface tile drainage on 20 ft spacings increased soybean yields 4 bu/acre compared to a non-drained control on a claypan soil in southern Illinois (Walker et al., 1982). However, no research has evaluated how drainage water management (DWM) affects the severity of foliage diseases in soybean. Drainage plus subirrigation (DSI), as a DWM practice, could reduce leaf wetness associated with overhead irrigation and provide a climate that is less favorable to foliage diseases. In a high-yield soybean production system, DSI with tile lines 20 ft apart increased soybean yields 24 bu/acre compared to a nonirrigated control on soils with a fragipan 14 to 30 inches deep in Ohio (Cooper et al., 1992). In narrow rows (7 inches), long-term soybean yields using DSI reached 80 bu/acre in the 1980s (Cooper et al., 1991), with the use of benomyl every 2 wk and permethrin as needed. Control of foliage diseases was recommended as a part of high-yield (>75 bu/acre) management system that used overhead irrigation or had high rainfall (Cooper, 1989). Frogeye leaf spot (FLS) (*Cercospora sojina*) was managed with benomyl (Dashiell and Akem, 1991; Akem, 1995), and a split application (R1+R3) was more effective in managing the disease than early vegetative applications (Akem, 1995). More recently, research evaluating strobilurin fungicides applied from R3 to R5 increased yield up to 6 bu/acre in the presence of Septoria brown spot (SBS) (*Septoria glycines*) and/or FLS (Cruz et al., 2010; Dorrance et al., 2010; Nelson et al., 2010). However, there was no soybean yield increase with pyraclostrobin applied during the vegetative stage of development (Nelson et al., 2010; Bradley and Sweets 2008). High-yield production systems have started combining preventive fungicide and insecticide treatments to manage soybean aphids (*Aphis glycines* Matsumura) along with SBS or FLS (Dorrance et al., 2010; Nelson et al., 2010). Such treatments increased yield 9 bu/acre averaged over eight of the nine locations depending on insect threshold levels and severity of disease (Dorrance et al., 2010).

Headline fungicide has been used to protect soybean [*Glycine max* (L.) Merr] from foliar diseases, while its interaction with drainage water management (DWM) systems was unknown. Field research was conducted during two wet years (2009 and 2010) with 3.8 inches of rainfall greater than the past decade average. The objective of this research was to evaluate the effects of Headline (6 oz/acre) application timing (R3, R5, R3+R5, and R3+R5+Warrior insecticide at 2.6 oz/acre) and DWM system (nondrained and drainage only [DO] or drainage plus subirrigation [DSI] at 20 and 40 ft drain tile spacings) on soybean yield, grain quality, and severity of SBS and FLS. Grain yields increased 18 to 22% with DO or DSI at 6.1 and 12.2 m spacings compared to a nonfungicide treated, nondrained control (Table 1). In the absence of drainage, pyraclostrobin with or without lambda-cyhalothrin increased yields 20 to 27% compared to the nondrained, nonfungicide treated control. The combination of DWM and pyraclostrobin increased grain yields up to 36%. Pyraclostrobin plus lambda-cyhalothrin at R3+R5 increased yield 8 to 12% except with DO at 40 ft compared to similar nonfungicide-treated DWM systems. A DWM and pyraclostrobin interaction was detected for grain oil and protein concentration, but differences were minimal (data not mentioned). Pyraclostrobin with or without lambda-cyhalothrin reduced severity of SBS and FLS 2 to 8% depending on the year (data not presented), but DWM did not

affect severity of these diseases. The greatest synergistic yield increase on a claypan soil occurred when foliar disease management and DWM systems were used together in years with higher than normal rainfall.

**Table 1.** Soybean yield response from Headline (6 oz/acre) application timings and drainage water management systems at 20 and 40 ft spacings. Data were combined over 2009 and 2010.

Headline application timing†	Non-drained	DO		DSI	
		20 ft	40 ft	20 ft	40 ft
----- bu/acre -----					
Non-treated	45	53	55	53	55
R3‡	54	59	59	57	58
R5	54	56	59	56	55
R3+R5	56	57	59	55	56
R3+R5+Warrior insecticide§	57	60	60	58	61
LSD ( $P = 0.05$ )		----- 5 -----			

†Abbreviations: DO, drainage only; DSI, drainage plus subirrigation.

‡Growth stages at which pyraclostrobin were applied (Fehr and Caviness, 1971).

§Lambda-cyhalothrin at 2.6 oz/acre.

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