Sulphur Fertilizer Response Trials 2018 & 2019

Purpose

To determine the frequency and extent of sulphur deficiency and yield response to sulphur fertilization across a wide variety of soil and climatic conditions in Ontario for corn, winter wheat, and soybean following their typical rotation over three years. The project also aims to develop a sulphur soil test for the province.

Methods

Table 1: Summary of locations, experimental layouts, sulphur sources and rates for 2018 and 2019 sulphur fertility trials.

Year	Location	Trial Layout*	S Source	S Rates (lbs S/ac)
Winter Wheat				
2018	Elora	SP	SOP (0-0-60-18S)	0-9-18-27-36
	Sombra	OF	ATS (12-0-0-26S)	0-14
	Stayner	OF	K-Mag (0-0-22-22S)	0-22
2019	Bornholm	SP	AMS (21-0-0-24S)	0-10-20
	Douglas	OF	AMS	0-10-20-30
	Elora	SP	SOP	0-9-18-27-36
	Mildmay	OF	ATS	0-20
	Winchester	SP	SOP	0-9-18-27-36
Corn				
2018	Bornholm	SP	SOP	0-10-20-30
	Elora	SP	SOP	0-9-18-27-36
2019	Elora	SP	SOP	0-9-18-27-36
	Mildmay	OF	MESZ (12-40-0-10S)	0-19
	Winchester	SP	SOP	0-9-18-27-36
Soybean				
2018	Arkona	OF	ATS	0-14
	Bornholm S12P3X	SP	AMS	0-24
	Bornholm Titus	SP	AMS	0-24
	Elora (B)	SP	AMS	0-24
	Elora (S)	SP	SOP	0-9-18-27-36
	Merlin	OF	AMS	0-24
	Thorndale	SP	ATS	0-10-20-30
	Winchester	SP	AMS	0-24
2019	Bornholm	SP	AMS	0-24
	Elora	SP	AMS	0-24
	Mildmay	OF	ATS	0-20
	Ridgetown	SP	AMS	0-24
	St. Thomas	SP	AMS	0-24
	Winchester (B)	SP	AMS	0-24
	Winchester (Station)	SP	SOP	0-9-18-27-36
Legend: SP – small plot trial; OF – on-farm trial				

Sulphur fertility yield response trials were conducted at various locations in 2018 and 2019 (Table 1) by a team of university researchers, OMAFRA staff, and grower cooperators. Field-length strip trials were performed on-farm and many small plot research sites were used as well.

Sulphur was spring-applied as an available sulphate or thiosulphate fertilizer source. The only exception to this was the 2019 Mildmay corn trial where MESZ was utilized, meaning that half the sulphur applied was in an elemental form. For simplicity, results presented here only compare the control yield to that for the sulphur rate closest to 20 lbs S/ac. Response results for this statistical analysis were identical to those from the full analysis of all sulphur rates.

Results

Winter Wheat:

Table 2: 2018 and 2019 winter wheat yield response to sulphur at various locations across Ontario.

	Yield (bu/acre @ 14% moisture)			Significance (p < 0.1)
	-S	+S	ΔYield	
2018				
Elora	119	119	0	No
Sombra	87	83	-4	Yes
Stayner	106	107	+1	Yes
2019				
Bornholm	73	81	+8	Yes
Douglas (HRW)	103	110	+7	No
Elora	111	115	+4	No
Mildmay	84	100	+16	No
Winchester	93	84	-9	No
Average	**97**	**100**	**+3**	
Sites with significant positive response: 2/8				

Figure 1: Winter wheat yield response to sulphur application at the bottom vs top of the hill at the Mildmay 2019 on-farm location.

Corn:

Table 3: Corn yield response to sulphur application at various locations across Ontario in 2018 and 2019.

	Yield (bu/acre @ 15.5% moisture)			Significance (p < 0.1)
	-S	+S	ΔYield	
2018				
Bornholm	153	166	+13	No
Elora	235	222	-13	No
2019				
Elora	173	174	+1	No
Mildmay	195	198	+3	No
Winchester	175	172	-3	No
Average	**186**	**186**	**0**	
Responsive sites: 0/5				

Soybean:

Table 4: 2018 and 2019 soybean yield response to sulphur at various locations across Ontario

	Yield (bu/acre @ 13% moisture)			Significance (p < 0.1)
	-S	+S	ΔYield	
2018				
Arkona	58	60	+2	No
Bornholm S12	70	78	+8	Yes* (N not balanced)
Bornholm Titus	73	74	+1	No
Elora (B)	45	46	+1	No
Elora (S)	62	61	-1	No
Merlin	56	56	0	No
Thorndale	90	88	-2	No
Winchester	57	56	-1	No
Average	**64**	**65**	**+1**	
2019				
Bornholm	58	55	-3	No
Elora	48	49	+1	No
Mildmay	47	46	-1	No
Ridgetown	62	60	-2	No
St. Thomas	63	65	+2	No
Winchester (B)	68	72	+4	No
Winchester	63	64	+1	No
Average	**58**	**59**	**+1**	
Responsive sites: 1/15				

Figure 3: Sulphate of potash (SOP) applied PPI at 18 lbs S/ac vs no sulphur applied at the Elora (S) 2018 site.

Summary

Response to sulphur applications generally followed what we would expect in terms of crop species: more response in winter wheat than in corn and soybean. This study found a response in winter wheat for two out of eight locations while there was no significant response at any of the five corn locations. There was significant response at one in fifteen soybean trials, but the nitrogen supplied by the AMS in the responsive site was not balanced out in the control treatment. This leaves to question whether the yield increase was due to sulphur, nitrogen, or a combination of the two. Overall, the results match fairly well with previous work conducted in Ontario. However, this study is lacking sites with course-textured soils (which are expected to more frequently show response) and will be conducted over a third and final year in 2020 with the hope of addressing this gap. Work continues on a sulphur soil test. Greenhouse experiments are currently underway to compare a handful of potential extractants, with the optimum one to be tested and calibrated under field conditions.

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