

Sulfur and Nitrogen Effects on Yield and Protein of Barley

Jasper M. Teboh, Szilvia Yuja, Mike Ostlie, and Ezra Aberle

Objective

- Assessment of sulfur fertilization influences yield and grain protein of malting barley

Materials and methods

Two trials were conducted at Carrington and New Rockford (and on a farmer's field) to assess the effects of four sulfur (S) rates across three levels of N on performance of two malting varieties, ND Genesis (two-row) and Tradition (six-row). The four S rates were 0, 10, 20, and 30 lbs S/ac, applied as ammonium sulfate. The S treatments were applied in all combinations with N at 0, 30, and 60 lbs at CREC, and 30, 60, and 90 lbs/ac at New Rockford to each variety. Treatments were replicated four times.

Results

Yields were relatively lower than in some years. High grasshopper infestation in 2019, especially at New Rockford, probably had serious impacts on yields. The main highlights of these results are that no significant interaction effects were observed between any of the treatment combinations at Carrington (Table 1) or at New Rockford (Table 2). Sulfur did not have an effect on yields or any variable measured. Nitrogen enhanced yield significantly at Carrington, but not at New Rockford. Grain protein differed between varieties. Tradition produced significantly greater grain protein than ND Genesis at either location. The fact that N had no significant effect on grain protein suggests that soil residual N contributed N in amounts that were adequate to produce similar yields as the fertilized plots.

Table 1. Performance of two barley varieties in response to S and N at Carrington,

Treatments	Yield	Protein	TWT	Plump
	bu/ac	lb/bu	----- % -----	
Variety				
ND Genesis	56.1	10.99b	44.1	93.90
Tradition	60.4	13.52a	44.6	993.9
N Rates (lb/ac)				
0	52.1b	12.10	43.8b	94.0
30	58.6ab	12.18	44.4ab	93.9
60	64.1a	12.50	44.8a	93.8
S Rates (lb/ac)				
0	57.20	12.19	44.3	0.938
10	58.20	12.31	44.4	0.940
20	58.40	12.30	44.3	0.940
30	59.20	12.26	44.3	0.938
Effect	-----Pr > F-----			
Variety (Var)	0.427	0.0075	0.4096	0.9307
N rates (N)	0.007	0.2399	0.0342	0.4958
Var x N	0.2148	0.0931	0.0515	0.7500
S Rates (S)	0.7443	0.9149	0.9746	0.6835
Var x S	0.2188	0.8114	0.219	0.7928
N x S	0.9881	0.9391	0.9868	0.1532
Var x N x S	0.7784	0.3216	0.5779	0.0069

^{ab} Means followed by the same letter within a column are not significantly different.



Trial site at the CREC, established to assess the effects of sulfur and nitrogen on two varieties of malting barley.

Table 2. Performance of two barley varieties in response to S and N at New Rockford, 2019.

Treatments	Yield bu/ac	Protein %	TWT lb/bu	Plump -----%	Thin -----%	Grain N -----%	Grain S -----%	N:S Grain	N_Rmval -----lb/ac-----	S_Rmval
Variety										
ND Genesis	53.2	10.96b	42.41	93.9	2.23	1.61b	0.105b	15.44b	51.6b	8.6
Tradition	53.0	12.82a	41.79	90.9	3.59	1.81a	0.112a	16.26a	57.7a	9.0
N Rates (lb/ac)										
60	52.5	11.93	42.23	92.2	2.85	1.71	0.109	15.76	54.0	8.9
90	52.7	11.66	42.19	92.8	2.74	1.68	0.106	15.88	53.5	8.6
120	54.2	12.63	41.88	92.1	3.15	1.74	0.109	15.91	56.4	9.0
S Rates (lb/ac)										
0	54.8	11.80	42.00	93.3	2.58	1.71	1.060	16.1042	56.4	8.60
10	52.9	11.89	42.24	91.8	3.18	1.71	1.090	15.6542	54.2	8.90
20	52.9	11.93	42.17	92.2	3.02	1.72	1.080	15.9958	54.7	8.80
30	51.9	11.93	41.99	92.3	2.87	1.70	1.090	15.6535	53.3	8.90
Effect	-----Pr > F-----									
Variety (Var)	0.9144	0.0031	0.1943	0.2816	0.2870	<.0001	0.0488	0.0114	0.0095	0.3651
N rates (N)	0.6530	0.1068	0.5555	0.8223	0.7745	0.3381	0.1309	0.9051	0.4727	0.4330
Var x N	0.3517	0.3944	0.2914	0.8718	0.8467	0.7947	0.1568	0.7068	0.5696	0.3320
S Rates (S)	0.2171	0.8560	0.3777	0.2271	0.2912	0.8449	0.3263	0.188	0.3003	0.5070
Var x S	0.9852	0.4150	0.4170	0.1767	0.3212	0.8131	0.6115	0.2607	0.9798	0.6956
N x S	0.5334	0.1490	0.1966	0.7178	0.8071	0.0845	0.4046	0.1458	0.7850	0.5403
Var x N x S	0.4897	0.1767	0.3605	0.2334	0.5359	0.4140	0.1225	0.1259	0.8619	0.8147

^{ab} Means followed by the same letter within a column are not significantly different.

Conclusion

Sulfur did not have a significant impact on grain yields and protein. Consistent with previous reports, Tradition was a higher yielding variety than ND Genesis.