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Soil Research

Supplementary Material

Variation in wheat yield and soil properties at different landscape positions, nutrient sources, and rates in the tropical cereal-based cropping systems of Ethiopia

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Supplementary Table 1. Significance of the fixed effect of NP, K and S rates, and landscape positions.

Effect	Num DF	F Value				P > F			
		GY	BY	RWP	HI	GY	BY	RWP	HI
		2.78						0.000	0.059
			1.97	3.92	1.94	0.007	0.055	3	3
		203.1	194.8					<.000	0.196
LP	2		2	163.54	1.63	<.0001	<.0001	1	6
		528.2	111.1					<.000	<.000
NP	3	1	7	279.59	127.89	<.0001	<.0001	1	1
		0.56							<.000
K	2		11.8	0.39	10.52	0.5718	<.0001	0.679	1
		0.19						0.904	0.732
S	2		0.56	0.1	0.31	0.8252	0.5694	5	9
		4.61						0.007	0.014
LP*NP	6		1.29	2.91	2.64	0.0001	0.2575	9	9
		0.34						0.926	0.003
LP*K	4		2.05	0.22	3.9	0.8537	0.0853	2	6
		0.11						0.998	0.613
LP*S	4		0.29	0.03	0.67	0.9803	0.8843	1	7
		0.33						0.989	<.000
NP*K	6		10.5	0.15	17.65	0.9194	<.0001	2	1
		0.3						0.990	0.021
NP*S	6		3.26	0.14	2.49	0.9367	0.0034	2	1
K*S	4	0.15	6.03	0.08	3.9	0.963	<.0001	0.989	0.003

							3	7	
		0.28						0.027	
LP*NP*K*S	68		0.99	0.11	1.36	1	0.4998	1	5

Den DF for GY = 2483, BY = 2483, HI = 2364, and RWP = 2481; LP: landscape position; NP: nitrogen and phosphorus rate; K: potassium rate; S: sulfur rate.

Supplementary Table 2. Significance of the fixed effect of NP and Zn rates, soil type, and landscape position.

Effect	Num DF	Den DF	F value			P > F		
			BY	GY	HI	BY	GY	HI
Rep	7	485	1.81	6.82	4.56	0.0826	<.0001	<.0001
ST	2	485	209.76	100.66	48.35	<.0001	<.0001	<.0001
LP	2	485	81.81	54.2	4.29	<.0001	<.0001	0.0142
NP rate (NP)	3	485	90.61	213.86	20.86	<.0001	<.0001	<.0001
Zn rate (Zn)	2	485	3.53	0.68	1.1	0.03	0.5078	0.3343
ST*NP	6	485	15.97	13.38	47.51	<.0001	<.0001	<.0001
ST*Zn	4	485	3.36	0.09	1.84	0.0099	0.9858	0.1199
LP*NP	6	485	7.19	0.65	6.47	<.0001	0.6921	<.0001
LP*Zn	4	485	1.51	0.27	2.71	0.198	0.8965	0.0297
NP*Zn	6	485	2.31	0.26	2.42	0.0329	0.9555	0.0256
ST*NP*Zn	12	485	5.97	0.22	4.88	<.0001	0.9974	<.0001
LP*NP*Zn	12	485	1.53	0.41	2.02	0.11	0.9597	0.0211

LP: landscape position; ST: soil type; NP: nitrogen and phosphorus rate; Zn: zinc rate

Supplementary Table 3. Model comparison for selecting random effect for the model using AIC and BIC

Model	AICc	BIC
$Y = \mu + \text{Rep} + \text{Landscape} + \text{NP} + \text{K} + \text{S} + \text{Landscape} * \text{NP} + \text{Landscape} * \text{K} + \text{Landscape} * \text{S} + \text{NP} * \text{K} + \text{NP} * \text{S} + \text{K} * \text{S} + \text{Landscape} * \text{NP} * \text{K} * \text{S} + \text{soil type} + \varepsilon$	42693.1	42691.9
$Y = \mu + \text{Rep} + \text{Landscape} + \text{NP} + \text{K} + \text{S} + \text{Landscape} * \text{NP} + \text{Landscape} * \text{K} + \text{Landscape} * \text{S} + \text{NP} * \text{K} + \text{NP} * \text{S} + \text{K} * \text{S} + \text{Landscape} * \text{NP} * \text{K} * \text{S} + \text{Location} + \varepsilon$	43454.9	43454.1