

Supplementary Table S1a: Comparison of Standard Statistics, for All Nutrients, Across Years										
Trait		Boron (B)	Calcium (Ca)	Copper (Cu)	Iron (Fe)	Potassium (K)	Magnesium (Mg)	Manganese (Mn)	Phosphorus (P)	Zinc (Zn)
Minimum	2006-07	0.00	249.14	1.52	34.76	3728.00	1279.30	8.09	2731.60	27.22
	2015-16	0.00	327.93	1.93	32.45	4210.60	1641.50	9.43	3380.10	32.87
Maximum	2006-07	3.10	766.97	8.42	91.72	10967.00	2547.80	25.09	6271.50	69.46
	2015-16	7.55	1275.00	7.45	93.72	10754.00	3013.50	48.04	9479.00	76.96
Mean	2006-07	0.38	486.60	4.91	60.15	6491.43	1695.65	15.35	4192.85	42.96
	2015-16	1.64	582.87	4.29	57.11	6647.68	2145.32	17.75	5347.83	49.96
Median	2006-07	0.25	477.15	4.86	59.23	6335.65	1655.65	14.92	4131.55	42.69
	2015-16	1.36	554.49	4.24	55.64	6581.25	2110.20	17.18	5241.50	48.92
Range	2006-07	3.10	517.83	6.90	56.97	7239.00	1268.50	17.00	3539.90	42.24
	2015-16	7.55	947.07	5.52	61.27	6543.40	1372.00	38.61	6098.90	44.09
Standard Deviation	2006-07	0.45	95.35	1.26	12.00	1134.91	217.04	3.33	693.93	7.43
	2015-16	1.17	144.51	1.02	11.89	1106.64	264.36	4.19	927.89	8.01
Standard Error	2006-07	0.03	6.26	0.08	0.79	74.51	14.25	0.22	45.56	0.49
	2015-16	0.08	9.49	0.07	0.78	72.65	17.36	0.28	60.92	0.53
Skew	2006-07	1.95	0.29	0.09	0.40	0.51	0.80	0.63	0.35	0.27
	2015-16	1.76	1.55	0.58	0.53	0.63	0.58	1.99	0.79	0.58

Supplementary Table S1b: Comparison of Standard Statistics, Across Years. Data Cube Root Transformed.

Trait		Boron (B)	Calcium (Ca)	Copper (Cu)	Iron (Fe)	Potassium (K)	Magnesium (Mg)	Manganese (Mn)	Phosphorus (P)	Zinc (Zn)
Minimum	2006-07	0.000	6.292	1.149	3.263	15.506	10.856	2.007	13.979	3.008
	2015-16	0.000	6.896	1.245	3.190	16.148	11.796	2.113	15.008	3.203
Maximum	2006-07	1.457	9.154	2.034	4.510	22.218	13.658	2.928	18.441	4.111
	2015-16	1.962	10.844	1.953	4.542	22.073	14.444	3.635	21.164	4.254
Mean	2006-07	0.590	7.832	1.686	3.901	18.592	11.904	2.473	16.077	3.491
	2015-16	1.116	8.303	1.615	3.833	18.747	12.876	2.594	17.431	3.673
Median	2006-07	0.630	7.814	1.694	3.898	18.504	11.830	2.462	16.046	3.495
	2015-16	1.107	8.215	1.619	3.818	18.740	12.826	2.580	17.371	3.657
Range	2006-07	1.457	2.861	0.885	1.246	6.712	2.802	0.920	4.462	1.103
	2015-16	1.962	3.948	0.708	1.353	5.925	2.648	1.523	6.156	1.050
Sample Variance	2006-07	0.100	0.266	0.023	0.067	1.165	0.248	0.031	0.785	0.041
	2015-16	0.082	0.411	0.016	0.070	1.059	0.272	0.037	0.978	0.038
Standard Deviation	2006-07	0.316	0.516	0.152	0.259	1.079	0.498	0.177	0.886	0.202
	2015-16	0.285	0.641	0.128	0.264	1.029	0.522	0.192	0.989	0.194
Standard Error	2006-07	0.021	0.034	0.010	0.017	0.071	0.033	0.012	0.058	0.013
	2015-16	0.019	0.042	0.008	0.017	0.068	0.034	0.013	0.065	0.013
Skew	2006-07	0.101	-0.041	-0.586	0.082	0.119	0.537	0.252	0.102	0.002
	2015-16	-0.072	0.973	0.118	0.199	0.239	0.400	0.795	0.391	0.286
Shapiro Wilk	2006-07	W = 0.899, p = 2.106x10 ⁻¹¹	W = 0.997, p = 0.946	W = 0.976, p = 4.879x10 ⁻⁰⁴	W = 0.993, p = 0.3037	W = 0.994, p = 0.5171	W = 0.980, p = 0.002605	W = 0.990, p = 0.1134	W = 0.992, p = 0.2866	W = 0.992, p = 0.2564
	2015-16	W = 0.952, p = 6.147x10 ⁻⁰⁷	W = 0.949, p = 2.944x10 ⁻⁰⁷	W = 0.995, p = 0.6205	W = 0.992, p = 0.2289	W = 0.993, p = 0.3591	W = 0.981, p = 0.003394	W = 0.967, p = 2.831 x10 ⁻⁰⁵	W = 0.989, p = 0.06434	W = 0.991, p = 0.1611

Supplementary Table S2: Analysis of Variance (ANOVA) Accession ~ Year							
Trait	Source	df	Sum Squared	Mean Squared	F value	Pr (>F)	Significance
Boron (B)							
	Accessions	231	22.142	0.096	1.257	0.1844	
	Trials	1	31.9	31.9	374.6438	<2.0x10 ⁻¹⁶	***
	Residuals	231	19.669	0.085			
Calcium (Ca)							
	Accessions	231	112.628	0.4876	2.58	7.88E-13	***
	Trials	1	25.7642	25.7642	136.502	<2.2x10 ⁻¹⁶	***
	Residuals	231	43.649	0.189			
Copper (Cu)							
	Accessions	231	6.9917	0.03027	3.2861	<2.2x10 ⁻¹⁶	***
	Trials	1	0.5914	0.59145	64.2136	5.51x10 ⁻¹⁴	***
	Residuals	231	2.1277	0.00921			
Iron (Fe)							
	Accessions	231	20.8379	0.09021	1.9251	4.14E-07	***
	Trials	1	0.53564	0.53564	11.4312	0.0008479	
	Residuals	231	10.8241	0.04686			
Potassium (K)							
	Accessions	231	354.54	1.5348	2.2273	9.84E-10	***
	Trials	1	2.7673	2.7673	4.0157	0.04625	
	Residuals	231	159.18	0.6891			
Magnesium (Mg)							
	Accessions	231	80.715	0.349	2.0496	3.50E-08	***
	Trials	1	109.662	109.662	643.2576	<2.2x10 ⁻¹⁶	***
	Residuals	231	39.381	0.17			
Manganese (Mn)							
	Accessions	231	11.5031	0.0498	2.7489	2.70E-14	***
	Trials	1	1.71242	1.71242	95.5312	<2.2x10 ⁻¹⁶	***
	Residuals	231	4.1845	0.01811			
Phosphorus (P)							
	Accessions	231	246.74	1.068	1.538	0.000566	***
	Trials	1	212.911	212.911	306.564	<2.2x10 ⁻¹⁶	***
	Residuals	231	160.43	0.695			
Zinc (Zn)							
	Accessions	231	12.2156	0.0529	2.0635	2.27E-08	***
	Trials	1	3.8464	3.8464	150.0933	<2.2x10 ⁻¹⁶	***
	Residuals	231	5.9198	0.0256			
Significance Codes			*** 0.001	** 0.01	* 0.05	! 0.1	

Supplementary Table S3: SNPs Associated with Seed Micronutrients and Genes of Interest in that Genomic Region, Identified by GWASpoly

Trait	Year	SNP	Chr	Position	Allele	p-value	R ²	maf	Stable Gene ID	IPK Descriptions
B	15-16	S3H_116597238	3H	116597238	G/T	5.98x10 ⁻⁰⁶	0.026	0.030	HORVU.MOREX.r3.3HG0246670	DUF4228 domain protein
B	15-16	S7H_177304153	7H	177304153	A/G	7.37x10 ⁻⁰⁷	0.135	0.045	HORVU.MOREX.r3.7HG0680110	Potassium transporter
									HORVU.MOREX.r3.7HG0680120	3-oxoacyl-reductase
									HORVU.MOREX.r3.7HG0680130	NAC (No Apical Meristem) domain transcriptional regulator superfamily protein
B	15-16	S7H_180179844	7H	180179844	C/T	7.68x10 ⁻⁰⁶	--	0.039	None	N/A
Ca	15-16	S3H_440581824	3H	440581824	A/C	5.90x10 ⁻⁰⁶	0.040	0.228	None	N/A
Ca	15-16	S3H_610176767	3H	610176767	G/T	4.67x10 ⁻⁰⁶	0.023	0.069	HORVU.MOREX.r3.3HG0326120	Glutathione S-transferase T3
									HORVU.MOREX.r3.3HG0326130	FBD-associated F-box protein
									HORVU.MOREX.r3.3HG0326140	FBD-associated F-box protein
									HORVU.MOREX.r3.3HG0326160	F-box protein-like protein
									HORVU.MOREX.r3.3HG0326170	Nuclear transport factor 2 (NTF2) family protein
									HORVU.MOREX.r3.3HG0326190	ABC transporter ATP-binding protein
									HORVU.MOREX.r3.3HG0326200	Cofactor assembly
									HORVU.MOREX.r3.3HG0326210	Mitochondrial-processing peptidase subunit alpha
									HORVU.MOREX.r3.3HG0326220	Leucine-rich repeat-containing protein 1
									HORVU.MOREX.r3.3HG0326230	Vacuolar protein sorting 55 containing protein
Ca	15-16	S5H_439603234	5H	439603234	A/G	1.52x10 ⁻⁰⁵	0.011	0.101	HORVU.MOREX.r3.5HG0481890	Early light-induced protein
									HORVU.MOREX.r3.5HG0481900	Early light-induced protein
									HORVU.MOREX.r3.5HG0481920	Early light-induced protein
									HORVU.MOREX.r3.5HG0481930	cyclin-dependent kinase inhibitor SMR2-like protein
									HORVU.MOREX.r3.5HG0481940	S-adenosylmethionine-dependent methyltransferase, putative
Cu	06-07	S3H_11066728	3H	11066728	C/T	1.12x10 ⁻⁰⁸	0.053	0.127	HORVU.MOREX.r3.3HG0224020	BED zinc finger,hAT family dimerization domain
Cu	06-07	S3H_11068225	3H	11068225	A/C	3.25x10 ⁻⁰⁷	--	0.125	HORVU.MOREX.r3.3HG0224040	Pentatricopeptide repeat-containing protein
Cu	06-07	S3H_585247556	3H	585247556	C/G	1.36x10 ⁻⁰⁶	0.000	0.056	HORVU.MOREX.r3.3HG0314200	Early nodulin-like protein 1
									HORVU.MOREX.r3.3HG0314210	2-oxoglutarate (2OG) and Fe(II)-dependent oxygenase superfamily protein

									HORVU.MOREX.r3.3HG0314220	Histone-lysine N-methyltransferase
Fe	06-07	S5H_74074539	5H	74074539	A/G	1.61×10^{-05}	--	0.494	HORVU.MOREX.r3.5HG0439690	F-box protein
Fe	06-07	S5H_76074047	5H	76074047	C/T	1.48×10^{-06}	0.059	0.500	HORVU.MOREX.r3.5HG0439860	Disease resistance protein RPM1
									HORVU.MOREX.r3.5HG0439870	Dicer-like 3
Fe	06-07	S7H_630244607	7H	630244607	A/G	7.67×10^{-06}	0.013	0.332	HORVU.MOREX.r3.7HG0752330	2-oxoglutarate (2OG) and Fe(II)-dependent oxygenase superfamily protein
									HORVU.MOREX.r3.7HG0752340	2-oxoglutarate (2OG) and Fe(II)-dependent oxygenase superfamily protein
									HORVU.MOREX.r3.7HG0752350	AT hook motif DNA-binding family protein
K	15-16	S2H_20020739	2H	20020739	A/G	5.47×10^{-06}	0.040	0.347	HORVU.MOREX.r3.2HG0105270	UPF0307 protein
									HORVU.MOREX.r3.2HG0105290	Telomere repeat-binding factor like-protein
Mg	15-16	S2H_647484280	2H	647484280	A/T	1.15×10^{-05}	0.162	0.200	HORVU.MOREX.r3.2HG0210270	Dihydroorotate dehydrogenase (Quinone)
									HORVU.MOREX.r3.2HG0210280	Pentatricopeptide repeat-containing protein
									HORVU.MOREX.r3.2HG0210290	Thioredoxin
									HORVU.MOREX.r3.2HG0210300	disease resistance family protein / LRR family protein
Mg	15-16	S6H_59682630	6H	59682630	C/T	8.58×10^{-06}	0.241	0.026	HORVU.MOREX.r3.6HG0558640	26S proteasome non-ATPase regulatory subunit-like protein
Mg	15-16	S6H_59682682	6H	59682682	A/G	8.58×10^{-06}	--	0.026	HORVU.MOREX.r3.6HG0558690	Polynucleotide 5'-hydroxyl-kinase NOL9
Mn	06-07	S1H_437852428	1H	437852428	C/G	1.23×10^{-05}	0.006	0.037	HORVU.MOREX.r3.1HG0067260	NB-ARC domain-containing disease resistance protein
									HORVU.MOREX.r3.1HG0067270	H/ACA ribonucleoprotein complex non-core subunit NAF1
Mn	15-16	S5H_569184852	5H	569184852	A/T	3.87×10^{-06}	0.147	0.108	HORVU.MOREX.r3.5HG0529130	Elongation factor
									HORVU.MOREX.r3.5HG0529140	Elongation factor
									HORVU.MOREX.r3.5HG0529160	LINE-1 reverse transcriptase
									HORVU.MOREX.r3.5HG0529170	F-box domain containing protein
									HORVU.MOREX.r3.5HG0529180	Huntingtin interacting protein K
Mn	15-16	S7H_24895773	7H	24895773	A/G	1.11×10^{-05}	0.131	0.108	HORVU.MOREX.r3.7HG0647710	Pentatricopeptide repeat-containing protein
									HORVU.MOREX.r3.7HG0647750	Werner Syndrome-like exonuclease
									HORVU.MOREX.r3.7HG0647760	F-box family protein
Cu	06-07 15-16	S7H_123030780	7H	123030780	C/T	$\leq 3.1 \times 10^{-04}$	--	0.500	HORVU.MOREX.r3.7HG0671730	Kanadaplin
									HORVU.MOREX.r3.7HG0671750	RNA-directed DNA polymerase (reverse transcriptase)-related family protein