

Dwarf allele differentially affects barley root traits influencing nitrogen acquisition under low nutrient supply.

¹Karley A. J., Valentine T. A., Squire G.

Electronic appendix for supplementary material

Table S1 Mean values and ANOVA results for plant dry mass

Source of variation	¹ Total dry mass (g)	¹ Leaf dry mass (g)	¹ Stem dry mass (g)	¹ Root dry mass (g)	¹ Ear/Grain dry mass (g)
Stem extension					
(a) Standard nutrient					
Kenia	0.761	0.201	0.216	0.346	
Golden Promise	0.479	0.146	0.096	0.237	
B83	0.575	0.176	0.121	0.294	
Westminster	0.748	0.196	0.154	0.397	
Derkado	0.675	0.184	0.130	0.361	
(b) ²Reduced nutrient					
Kenia	0.390	0.079	0.117	0.193	
Golden Promise	0.226	0.053	0.054	0.118	
B83	0.285	0.064	0.050	0.172	
Westminster	0.298	0.064	0.078	0.155	
Derkado	0.273	0.057	0.063	0.153	
Anthesis					
(a) Standard nutrient					
Kenia	1.694	0.272	0.708	0.483	0.232

	Golden Promise	1.677	0.354	0.541	0.587	0.210
	B83	2.294	0.508	0.948	0.570	0.268
	Westminster	1.478	0.261	0.513	0.446	0.257
	Derkado	2.012	0.344	0.742	0.621	0.305
(b) Reduced nutrient						
	Kenia	0.691	0.086	0.258	0.259	0.088
	Golden Promise	0.522	0.092	0.150	0.186	0.094
	B83	0.674	0.109	0.227	0.205	0.133
	Westminster	0.541	0.074	0.198	0.181	0.089
	Derkado	0.493	0.073	0.192	0.144	0.084
Maturity						
(a) Standard nutrient						
	Kenia	9.149	0.777	2.842	0.764	4.767
	Golden Promise	7.826	0.823	1.894	0.659	4.449
	B83	9.074	0.935	2.174	0.833	5.131
	Westminster	9.139	0.708	2.418	0.824	5.190
	Derkado	8.820	0.975	2.443	0.865	4.538
(b) Reduced nutrient						
	Kenia	2.719	0.248	0.940	0.337	1.194
	Golden Promise	3.684	0.215	0.666	0.397	1.837
	B83	2.384	0.185	0.488	0.306	1.405
	Westminster	2.360	0.158	0.717	0.193	1.293
	Derkado	2.090	0.229	0.637	0.199	1.025
Block		F ₄ =0.23	F ₄ =0.02	F ₄ =0.09	F ₄ =0.53	F ₄ =0.67
Block.Plot						
Growth stage		F ₂ =112.32 P<0.001	F ₂ =52.33 P<0.001	F ₂ =113.66 P<0.001	F ₂ =7.34 P<0.05	F ₁ =225.97 P<0.001
Residual		F ₈ =3.27	F ₈ =2.53	F ₈ =2.91	F ₈ =2.69	F ₄ =2.37
Block.Plot.Plant						

Nutrient	F ₁ =239.87 P<0.001	F ₁ =420.53 P<0.001	F ₁ =186.66 P<0.001	F ₁ =145.88 P<0.001	F ₁ =114.01 P<0.001
Genotype	F ₄ =1.10 P>0.1	F ₄ =1.29 P>0.1	F ₄ =5.44 P<0.001	F ₄ =0.50 P>0.1	F ₄ =0.52 P>0.1
Growthstage.Nutrient	F ₂ =3.93 P<0.05	F ₂ =4.42 P<0.05	F ₂ =6.28 P<0.01	F ₂ =1.52 P>0.1	F ₁ =4.14 P<0.05
Growthstage.Genotype	F ₈ =1.56 P>0.1	F ₈ =1.65 P>0.1	F ₈ =1.41 P>0.1	F ₈ =0.96 P>0.1	F ₄ =0.57 P>0.1
Nutrition.Genotype	F ₄ =1.48 P>0.1	F ₄ =0.81 P>0.1	F ₄ =0.81 P>0.1	F ₄ =2.58 P<0.05	F ₄ =0.77 P>0.1
Growthstage.Nutrient.Genotype	F ₈ =0.74 P>0.1	F ₈ =0.22 P>0.1	F ₈ =0.22 P>0.1	F ₈ =0.96 P>0.1	F ₄ =0.19 P>0.1
Residual	102 df	106 df	106 df	102 df	72 df
Total	143 df	147 df	147 df	143 df	99 df

¹Analysis performed on ln-transformed data

²Reduced nutrient supply was 50% of the standard nutrient supply

Table S2 Mean values and ANOVA results for plant N content

Source of variation	¹ Total plant N (g)	¹ Leaf N (g)	¹ Stem N (g)	¹ Root N (g)	¹ Ear/grain N (g)
Stem extension					
(a) Standard nutrient					
Kenia	0.0099	0.0050	0.0027	0.0021	
Golden Promise	0.0090	0.0048	0.0018	0.0024	
B83	0.0096	0.0051	0.0021	0.0024	
Westminster	0.0102	0.0058	0.0019	0.0026	
Derkado	0.0090	0.0050	0.0015	0.0024	
(b) ²Reduced nutrient					
Kenia	0.0030	0.0012	0.0008	0.0009	
Golden Promise	0.0022	0.0010	0.0005	0.0007	
B83	0.0029	0.0013	0.0005	0.0011	
Westminster	0.0027	0.0012	0.0007	0.0008	
Derkado	0.0024	0.0012	0.0006	0.0007	
Anthesis					
(a) Standard nutrient					
Kenia	0.0371	0.0111	0.0148	0.0060	0.0052
Golden Promise	0.0394	0.0147	0.0130	0.0066	0.0048
B83	0.0499	0.0174	0.0178	0.0076	0.0071
Westminster	0.0295	0.0102	0.0090	0.0051	0.0053
Derkado	0.0366	0.0128	0.0116	0.0060	0.0062
(b) Reduced nutrient					
Kenia	0.0081	0.0020	0.0029	0.0015	0.0017
Golden Promise	0.0080	0.0025	0.0021	0.0016	0.0019
B83	0.0109	0.0027	0.0031	0.0020	0.0031

	Westminster	0.0059	0.0016	0.0017	0.0011	0.0015
	Derkado	0.0066	0.0019	0.0018	0.0013	0.0016
Maturity						
(a) Standard nutrient						
	Kenia	0.1502	0.0069	0.0204	0.0074	0.1156
	Golden Promise	0.1198	0.0079	0.0098	0.0057	0.0964
	B83	0.1441	0.0105	0.0123	0.0109	0.1104
	Westminster	0.1234	0.0065	0.0096	0.0077	0.0996
	Derkado	0.1268	0.0124	0.0148	0.0104	0.0892
(b) Reduced nutrient						
	Kenia	0.0347	0.0027	0.0046	0.0034	0.0239
	Golden Promise	0.0502	0.0015	0.0022	0.0027	0.0361
	B83	0.0347	0.0015	0.0015	0.0019	0.0297
	Westminster	0.0268	0.0013	0.0022	0.0015	0.0218
	Derkado	0.0310	0.0038	0.0039	0.0020	0.0214
Block		F ₄ =0.15	F ₄ =0.2	F ₄ =0.83	F ₄ =0.73	F ₄ =0.68
Block.Plot						
Growth stage		F ₂ =190.12 P<0.01	F ₂ =10.24 P<0.01	F ₂ =232.88 P<0.01	F ₂ =38.12 P<0.001	F ₁ =343.20 P<0.001
Residual		F ₈ =2.75	F ₈ =3.93	F ₈ =0.93	F ₈ =1.93	F ₄ =1.69
Block.Plot.Plant						
Nutrient		F ₁ =514.16 P<0.001	F ₁ =629.39 P<0.001	F ₁ =424.21 P<0.001	F ₁ =351.61 P<0.001	F ₁ =144.86 P<0.001
Genotype		F ₄ =2.70 P<0.05	F ₄ =2.77 P<0.05	F ₄ =6.13 P<0.001	F ₄ =2.34 P<0.1	F ₄ =1.54 P>0.1
Growthstage.Nutrient		F ₂ =1.75 P>0.1	F ₂ =2.79 P<0.1	F ₂ =6.04 P<0.01	F ₂ =2.60 P<0.1	F ₁ =3.81 P<0.1
Growthstage.Genotype		F ₈ =1.55 P>0.1	F ₈ =2.94 P<0.01	F ₈ =2.84 P<0.01	F ₈ =0.59 P>0.1	F ₄ =0.91 P>0.1
Nutrient.Genotype		F ₄ =0.70 P>0.1	F ₄ =1.21 P>0.1	F ₄ =0.79 P>0.1	F ₄ =2.23 P<0.1	F ₄ =0.65 P>0.1
Growthstage.Nutrient.Genotype		F ₈ =0.95 P>0.1	F ₈ =0.74 P>0.1	F ₈ =0.27 P>0.1	F ₈ =1.50 P>0.1	F ₄ =0.23 P>0.1
Residual		102 df	106 df	106 df	102 df	72 df
Total		143 df	147 df	147 df	143 df	99 df

¹Analysis performed on ln-transformed data

²Reduced nutrient supply was 50% of the standard nutrient supply

Table S3 Mean values and ANOVA results for root investment parameters

Source of variation	¹ Fraction of dry mass in the roots	² Plant N content per unit root dry mass(g N g ⁻¹ root)	Root dry mass with depth fit	
			² Coefficient a	² Coefficient b
Stem extension				
(a) Standard nutrient				
Kenia	0.453	0.030	0.0118	-0.0349
Golden Promise	0.493	0.040	0.0065	-0.0287
B83	0.510	0.037	0.0095	-0.0256
Westminster	0.529	0.026	0.0113	-0.0333
Derkado	0.527	0.027	0.0111	-0.0303
(b) ³Reduced nutrient				
Kenia	0.489	0.016	0.0078	-0.0428
Golden Promise	0.523	0.019	0.0040	-0.0355
B83	0.603	0.017	0.0050	-0.0280
Westminster	0.506	0.020	0.0053	-0.0361
Derkado	0.550	0.019	0.0064	-0.0381
Anthesis				
(a) Standard nutrient				
Kenia	0.283	0.079	0.0152	-0.0319
Golden Promise	0.349	0.068	0.0177	-0.0314
B83	0.241	0.099	0.0155	-0.0237
Westminster	0.296	0.066	0.0127	-0.0305
Derkado	0.319	0.060	0.0206	-0.0326
(b) Reduced nutrient				
Kenia	0.366	0.034	0.0112	-0.0459

	Golden Promise	0.352	0.045	0.0059	-0.0368
	B83	0.292	0.065	0.0072	-0.0333
	Westminster	0.313	0.039	0.0083	-0.0401
	Derkado	0.289	0.048	0.0054	-0.0381
Maturity					
(a) Standard nutrient					
	Kenia	0.084	0.239	0.0344	-0.0370
	Golden Promise	0.076	0.236	0.0238	-0.0461
	B83	0.086	0.222	0.0233	-0.0351
	Westminster	0.094	0.150	0.0306	-0.0454
	Derkado	0.122	0.158	0.0317	-0.0313
(b) Reduced nutrient					
	Kenia	0.111	0.147	0.0152	-0.0470
	Golden Promise	0.109	0.132	0.0131	-0.0351
	B83	0.146	0.125	0.0112	-0.0344
	Westminster	0.106	0.130	0.0068	-0.0385
	Derkado	0.102	0.158	0.0082	-0.0345
Block		F ₄ =4.40	F ₄ =2.81	F ₄ =1.49	F ₄ =12.00
Block.Plot					
Growth stage		F ₂ =901.05 P<0.001	F ₂ =497.90 P<0.001	F ₂ =10.36 P<0.01	F ₂ =15.26 P<0.005
Residual		F ₈ =0.73	F ₈ =0.72	F ₈ =2.41	F ₈ =0.26
Block.Plot.Plant					
Nutrient		F ₁ =7.65 P<0.01	F ₁ =65.25 P<0.001	F ₁ =110.77 P<0.001	F ₁ =11.27 P<0.005
Genotype		F ₄ =0.46 P>0.1	F ₄ =1.78 P>0.1	F ₄ =1.96 P>0.1	F ₄ =5.15 P<0.001
Growthstage.Nutrient		F ₂ =0.12 P>0.1	F ₂ =0.79 P>0.1	F ₂ =3.74 P<0.05	F ₂ =4.35 P<0.05
Growthstage.Genotype		F ₈ =2.41 P<0.05	F ₈ =1.19 P>0.1	F ₈ =0.83 P>0.1	F ₈ =0.75 P>0.1
Nutrient.Genotype		F ₄ =2.09 P<0.1	F ₄ =2.21 P<0.1	F ₄ =2.23 P<0.1	F ₄ =0.79 P>0.1
Growthstage.Nutrient.Genotype		F ₈ =0.43 P>0.1	F ₈ =0.49 P>0.1	F ₈ =1.77 P<0.1	F ₈ =0.44 P>0.1

Residual	102 df	102 df	82 df	82 df
Total	143 df	143 df	123 df	123 df

Analysis performed on ¹arcsin-squareroot-transformed data or ²ln-transformed data

³Reduced nutrient supply was 50% of the standard nutrient supply