Supplemental materials

Rice root architectural plasticity traits and genetic regions for adaptation to variable cultivation and stress conditions

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Supp Table 1. Mean values of all genotypes and significance level of genotypes for each treatment for root, shoot, and water uptake traits in the greenhouse lysimeter study. Mean values for all genotypes for each trait in respective treatments are shown. Significant differences among genotypes are indicated by *: p<0.05, **: p<0.01, ***p<0.001, and significant differences among treatments are indicated by letter groups.

Aus 276/3*MTU1010	**LDS**		**LRW**		**UDS**		**URW**	
	stress	**control**	**stress**	**control**	**stress**	**control**	**stress**	**control**
TWU (kg)	7.21**e	11.4a*	6.52*f	10.7**b	5.48*g	10.1**c	4.56h	9.32d
RGR (g g^{-1} day^{-1})	0.187***c	0.222ab	0.205bc	0.204*bc	0.216*ab	0.216ab	0.200***bc	0.237**a
RDW 0-20 cm (g)	1.3f	2.45a	1.32f	1.71b	1.63*d	1.48e	1.33f	1.66c
RDW 20-40 cm (g)	0.887*a	0.783b	0.547d	0.809b	0.698c	0.495e	0.372f	0.519de
RDW 40-60 cm (g)	0.57a	0.283f	0.41c	0.53b	0.421*c	0.332e	0.369d	0.383d
RDW > 60 cm (g)	0.054cd	0.143e	0.033*cde	0.149e	0.133a	0.104b	0.060*c	0.031de
TRDW (g)	2.81d	3.51a	2.28g	3.05b	2.88c	2.4f	2.13*h	2.59e
SDW (g)	28.72***g	38.15***c	37.10***d	47.88***a	23.65*h	36.57***e	32.58f	39.38*b
WUE (g L^{-1})	27.32d	24.45f	39.63**b	21.81*g	30.25*c	26.32**e	51.18a	21.49*h
R/S	0.096a	0.096a	0.066b	0.065b	0.068a	0.065b	0.066***b	0.064b
TRL >60 cm (cm)	1325.69f	477.2h	1376.92**e	768.74g	2971.29b	2858.72a	2504.66c	1811.94d
Ave root diam > 60 cm (mm)	2.034b	1.025a	0.152c	0.139c	0.13d	0.142*d	0.132*d	0.134d
% LR >60 cm	76.86b	78.17a	63.78g	54.92h	82.0c	75.32e	83.87d	72.44f
# Forks > 60 cm	10750f	3910h	11988*e	5606g	25300b	22694a	23980c	15218d

Kali Aus/2*MTU1010	**LDS**		**LRW**		**UDS**		**URW**	
	stress	**control**	**stress**	**control**	**stress**	**control**	**stress**	**control**
TWU (kg)	7.28c	11.8a	6.23***d	11.6a	5.23e	9.23*b	4.58f	9.36b
RGR (g g^{-1} day^{-1})	0.216**a	0.213a	0.181*b	0.216***a	0.213*a	0.21a	0.216*a	0.220**a
RDW 0-20 cm (g)	1.41c	2.08*a	1.42*c	2.07*a	1.37d	1.43c	1.43*c	1.82b
RDW 20-40 cm (g)	0.852c	1.001b	0.47g	0.709d	0.567*e	0.5f	0.401h	0.339a
RDW 40-60 cm (g)	0.518b	0.35e	0.474c	0.601a	0.411d	0.324e	0.323e	0.462c
RDW > 60 cm (g)	0.048bc	0.031bc	0.034*bc	0.023c	0.112a	0.098a	0.058b	0.033bc
TRDW (g)	2.82d	3.45b	2.39**f	3.39*c	2.46e	2.34g	2.22*h	2.14a
SDW (g)	28.70*g	39.76b	38.99***d	51.81a	21.68*h	30.89*f	32.89***e	39.12c
WUE (g L^{-1})	27.16**d	24.59e	40.48**b	22.37g	28.91c	23.98f	50.95a	20.74h
R/S	0.096bc	0.087bcd	0.064d	0.066*d	0.113b	0.082cd	0.068d	0.049a
TRL >60 cm (cm)	1385.59*f	589.57h	1957.42e	1016.23g	2810.28b	2530.23*a	2749.82c	2262.56d
Ave root diam > 60 cm (mm)	0.961b	0.482a	0.155e	0.175d	0.135f	0.142ef	0.435c	0.14f
% LR >60 cm	75.79c	71.35a	68.35f	60.37h	82.1d	66.06g	86.64b	77.76e

# Forks > 60 cm	11785f	4585h	17539e	7556g	23347c	22106**b	26307a	20249d

TWU: Total water uptake (kg), RGR: relative growth rate from 24 to 31 days after sowing, RDW: root dry weight, TRDW: total root dry weight (all depths) (g), SDW: shoot dry weight (g), WUE: water use efficiency (g shoot mass L^{-1} water uptake), R/S: root:shoot ratio, TRL: total root length (cm), Ave root diam: average root diameter (mm), % LR: % lateral roots, LDS: lowland drought stress, LRW: lowland re-watered, UDS: upland drought stress, URW: upland re-watered.

Supp. Table 2. Field trial means for grain yield (GY), days to flowering (DTF), and plant height (PHT), as well as the stress classification based on trial GY means.

Env. code	Study	Expt	GY (kg ha^{-1})	DTF	PHT (cm)	Stress classification
Aus 276/3*MTU1010						
1	Agronomic	2012LNS	4432	77	126	control
2	Agronomic	2012LS	1578	77	104	moderate stress
3	Agronomic	2012UNS	1766	81	103	moderate stress
4	Agronomic	2012US	528	99	81	severe stress
5	Agronomic	2013UNS	3923	76	115	control
6	Agronomic	2013US	37	101	66	over-stressed (excluded from AMMI)
7	Physiology	2013UNS phys	3032	80	101	control
8	Physiology	2013US phys	1223	88	95	moderate stress
Kali Aus/2*MTU1010						
1	Agronomic	2012LNS	4582	78	129	control
2	Agronomic	2012LS	3224	77	106	control
3	Agronomic	2012UNS	1701	77	95	moderate stress
4	Agronomic	2012US	440	86	89	over-stressed (excluded from AMMI)
5	Agronomic	2013LS	899	79	103	severe stress
6	Agronomic	2013UNS	1946	82	91	moderate stress
7	Agronomic	2013US	23	103	61	over-stressed (excluded from AMMI)
8	Physiology	2013UNS phys	2541	84	94	moderate stress
9	Physiology	2013US phys	967	101	65	severe stress

Supp. Table 3. Root, shoot, and water uptake traits measured in the field physiology experiment. Mean values for all genotypes for each trait are shown. *: p<0.05, **: p<0.01, ***: p<0.001.

Depth	Trait	Aus 276/3*MTU1010		Kali Aus/2*MTU1010		
		Control	Stress	Control	Stress	Treatment effect
0-15 cm	RLD (cm cm^{-3})	5.919*	3.022	6.453*	3.146	***
	% LR	79.92	78.65*	79.8	80.01	ns
	# Forks	8691.02*	4002.14	9594.65*	4033.78	***
	Ave root diam (mm)	0.1655*	0.1669	0.1658*	0.162	ns
	RDW (g)	0.0193*	0.00737	0.0234	0.0076	***
15-30 cm	RLD (cm cm^{-3})	0.9439	0.8875	1.0187	0.7535	**
	% LR	63.14	66.04*	62.91	64.82*	***
	# Forks	2238.21	1346.74	2481.37	1100.25	***
	Ave root diam (mm)	0.2723	0.2311*	0.2537	0.2438	***
	RDW (g)	0.00326*	0.0066	0.0034	0.0065	***
30-45 cm	RLD (cm cm^{-3})	0.8607	1.224	0.8526	1.0507*	**
	% LR	65.76*	75.05	65.417	76.338*	***
	# Forks	2193.9	3784.5	2452.96	3258.11	***
	Ave root diam (mm)	0.2698	0.1922	0.2717	0.1863	***
	RDW (g)	0.00156	0.0048	0.00146	0.00507	***
45-60 cm	RLD (cm cm^{-3})	0.4966*	0.3845	0.5435	0.3388	***
	% LR	59.263*	65.58*	59.52	63.09	*
	# Forks	1885.66	453.04	2113.08	452.55	***
	Ave root diam (mm)	0.301	0.235	0.3594	0.2607	***
	RDW (g)	0.00069	0.00329	0.00055	0.00263	***
0-60 cm	TRDW (g)	0.0244*	0.0195	0.0285*	0.0194	***

RLD: root length density (cm cm^{-3}), % LR: % lateral roots, Ave root diam: average root diameter (mm), RDW: root dry weight (g), TDRW: Total root dry weight (g)

Supp. Table 4. Mean values of all genotypes and significance level of the treatment effect on different root and shoot traits in the Rhizoscope experiment. *: p<0.05, **: p<0.01, ***: p<0.001.

Trait	Control (P)	Low P (P/8)	Treatment effect
Tiller number	4.5	5.3	***
Shoot length	64	63	ns
SDW (g)	0.710	0.775	ns
RDW 0-15 cm (g)	0.127	0.150	***
RDW 15-30 cm (g)	0.019	0.024	*
RDW > 30 cm (g)	0.001	0.001	ns
TRDW (g)	0.146	0.175	***
R/S	0.211	0.232	**
Root number >20 cm	10	11	ns
Root number >30 cm	1.5	2.2	*
Root diameter (cm)	0.0572	0.0641	***
Root length in rhizobox (cm)	29.57	31.19	**
Root length (cm)	30.98	32.15	*
Root cone angle (º)	77.30	77.52	ns

RDW: Root dry weight (g), SDW: shoot dry weight (g), R/S: root:shoot ratio, TDRW: Total root dry weight (g), P: Phosphorus

Supp. Table 5. Correlation matrix of root architectural plasticity traits measured in the Aus 276 population in the field physiology study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

	Yield stability coeff.	plas RLD 0-15 cm	plas RLD 15-30 cm	plas RLD 30-45 cm	plas RLD 45-60 cm	plas %LR 0-15 cm	plas %LR 15-30 cm	plas %LR 30-45 cm	plas %LR 45-60 cm	plas RDW 0-15 cm	plas RDW 15-30 cm	plas RDW 30-45 cm
plas RLD 0-15 cm	-0.23											
plas RLD 15-30 cm	0.53	-0.32										
plas RLD 30-45 cm	0.72*	-0.22	0.44									
plas RLD 45-60 cm	0.67*	0.3	0.23	0.45								
plas %LR 0-15 cm	-0.17	0.82**	-0.31	-0.41	0.29							
plas %LR 15-30 cm	0.09	-0.66*	0.1	0.12	0.05	-0.71*						
plas %LR 30-45 cm	0.43	-0.05	0.15	0.78**	0.13	-0.32	-0.01					
plas %LR 45-60 cm	0.18	-0.42	0.7*	0.18	0.12	-0.2	0.18	-0.17				
plas RDW 0-15 cm	0.21	-0.58	-0.09	0.06	-0.35	-0.42	0.13	0.08	0.07			
plas RDW 15-30 cm	-0.59	-0.39	-0.06	-0.62	-0.74**	-0.28	0.17	-0.46	0.05	0.05		
plas RDW 30-45 cm	-0.62	0.03	-0.05	-0.54	-0.63	0.15	-0.13	-0.09	0.09	-0.1	0.55	
plas RDW 45-60 cm	-0.2	-0.51	-0.01	-0.2	-0.55	-0.22	-0.06	-0.01	0.25	0.4	0.64*	0.49

RDW: root dry weight (g), RLD: root length density (cm cm^{-3}), % LR: % lateral roots, plas: plasticity

Supp. Table 6. Correlation matrix of root architectural plasticity traits measured in the Aus 276 population in the lysimeter study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

Lowland lysimeter

	Yield stability coeff.	Plas TRL > 60 cm LDS	Plas TRL > 60 cm LRW	Plas % LR > 60 cm LDS	Plas % LR > 60 cm LRW	Plas RDW 0-20 cm LDS	Plas RDW 0-20 cm LRW	Plas RDW 20-40 cm LDS	Plas RDW 20-40 cm LRW	Plas RDW 40-60 cm LDS	Plas RDW 40-60 cm LRW	Plas RDW > 60 cm LDS
Plas TRL > 60 cm LDS	-0.23											
Plas TRL > 60 cm LRW	-0.29	-0.27										
Plas % LR > 60 cm LDS	-0.39	0.57**	-0.29									
Plas % LR > 60 cm LRW	-0.02	-0.18	0.47*	-0.01								
Plas RDW 0-20 cm LDS	-0.26	0.06	0.37	0.06	-0.07							
Plas RDW 0-20 cm LRW	-0.01	0.38	0.15	-0.03	-0.2	0.41						
Plas RDW 20-40 cm LDS	-0.33	0.08	0.11	0.34	0.09	0.49*	0.16					
Plas RDW 20-40 cm LRW	-0.26	0.79***	-0.26	0.53*	-0.01	0.14	0.23	0.34				
Plas RDW 40-60 cm LDS	0.15	0.32	-0.22	0.06	-0.07	0.01	0.24	0.28	0.54**			
Plas RDW 40-60 cm LRW	-0.29	-0.08	0.2	0.02	0.08	0.46*	0.09	0.43*	0.31	0.49		
Plas RDW > 60 cm LDS	-0.35	0.04	0.17	0.36	0.29	0.4	0.01	0.75***	0.3	0.15	0.33	
Plas RDW > 60 cm LRW	-0.04	0.07	-0.17	0.25	-0.02	0.13	-0.1	0.59**	0.27	0.48*	0.4	0.36

Upland lysimeter

	Yield stability coeff.	Plas TRL > 60 cm UDS	Plas TRL > 60 cm URW	Plas % LR > 60 cm UDS	Plas % LR > 60 cm URW	Plas RDW 0-20 cm UDS	Plas RDW 0-20 cm URW	Plas RDW 20-40 cm UDS	Plas RDW 20-40 cm URW	Plas RDW 40-60 cm UDS	Plas RDW 40-60 cm URW	Plas RDW > 60 cm UDS
Plas TRL > 60 cm UDS	0.19											
Plas TRL > 60 cm URW	-0.04	0.06										
Plas % LR > 60 cm UDS	0.22	0.27	-0.07									
Plas % LR > 60 cm URW	-0.14	-0.01	0.27	-0.1								
Plas RDW 0-20 cm UDS	-0.57**	-0.11	-0.01	-0.37	0.16							
Plas RDW 0-20 cm URW	-0.13	-0.16	-0.03	0.09	-0.36	0.53						

Plas RDW 20-40 cm UDS	-0.46*	0.19	0.13	0.08	0.39	0.3	0.18					
Plas RDW 20-40 cm URW	-0.05	0.04	0.14	-0.23	0.18	0.29	0.28	0.25				
Plas RDW 40-60 cm UDS	0.01	-0.15	0.04	-0.2	-0.02	0.19	0.09	0.07	0.26			
Plas RDW 40-60 cm URW	0.14	-0.05	0.23	-0.18	-0.1	0.09	0.43	0.2	0.57**	0.44*		
Plas RDW > 60 cm UDS	0.04	0.18	-0.01	0.11	0.13	0.36	0.23	-0.02	0.13	0.25	0.13	
Plas RDW > 60 cm URW	0.09	0.5	-0.2	0.14	-0.08	0.12	0.28	0.43	0.26	0.19	0.49*	0.2

TRL: total root length (cm), RDW: root dry weight (g), % LR: % lateral roots, LDS: lowland drought stress, LRW: lowland re-watered, UDS: upland drought stress, URW: upland re-watered.

Supp. Table 7. Correlation matrix of root architectural plasticity traits measured in the Aus 276 population in the Rhizoscope study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

	Yield stability coeff.	Plas root length in box	Plas root length	Plas RDW 0-15 cm	Plas RDW 15-30 cm	Plas RDW > 30 cm	Plas TRDW	Plas R/S	Plas Root number > 20 cm	Plas Root number > 30 cm	Root diameter
Plas root length in box	-0.11										
Plas root length	0.11	0.87***									
Plas RDW 0-15 cm	0.09	0.64**	0.59**								
Plas RDW 15-30 cm	-0.1	0.83***	0.82***	0.82***							
Plas RDW > 30 cm	0.25	0.45	0.63**	0.42	0.48*						
Plas TRDW	0.08	0.66***	0.63**	1	0.85***	0.45					
Plas R/S	0.18	0.05	0.1	0.41	0.05***	0.19	0.41				
Plas Root number > 20 cm	0.06	0.62**	0.61**	0.78***	0.69**	0.3	0.8***	0.38			
Plas Root number > 30 cm	0.46	0.69**	0.65**	0.57*	0.62	0.68**	0.57*	0.09	0.34		
Root diameter	0.32	0.22	0.15	0.29	0.27	0.25	0.3	0.17	0.24	0.47	
Root cone angle	0	0.06	0.18	-0.09	-0.04	0.36	-0.08	0.01	0.03	0.09	0.03

RDW: root dry weight (g), TRDW: total root dry weight (g), R/S: root shoot ratio, plas: plasticity

Supp. Table 8. Correlation matrix of root architectural plasticity traits measured in the Kali Aus population in the field physiology study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

	Yield stability coeff.	plas RLD 0-15 cm	plas RLD 15-30 cm	plas RLD 30-45 cm	plas RLD 45-60 cm	plas %LR 0-15 cm	plas %LR 15-30 cm	plas %LR 30-45 cm	plas %LR 45-60 cm	plas RDW 0-15 cm	plas RDW 15-30 cm	plas RDW 30-45 cm
plas RLD 0-15 cm	0.14											
plas RLD 15-30 cm	-0.14	0.61										
plas RLD 30-45 cm	0.13	0.44	0.23									
plas RLD 45-60 cm	-0.04	-0.11	-0.08	0.76**								
plas %LR 0-15 cm	-0.18	0.62	0.37	0.41	0.17							
plas %LR 15-30 cm	0.09	0.09	0.15	-0.14	-0.18	-0.04						
plas %LR 30-45 cm	-0.18	0.31	0.37	0.83**	0.57	0.26	0.04					
plas %LR 45-60 cm	0.03	-0.22	0.13	0.16	0.43	0.31	-0.3	0				
plas RDW 0-15 cm	-0.07	-0.78**	-0.51	-0.41	-0.13	-0.71*	0.35	-0.09	-0.17			
plas RDW 15-30 cm	0.41	-0.52	-0.34	-0.24	0.09	-0.38	-0.03	-0.47	0.31	0.23		
plas RDW 30-45 cm	-0.35	0.1	0.09	-0.44	-0.34	0.42	0.47	-0.4	-0.14	-0.13	0.02	
plas RDW 45-60 cm	0.37	-0.35	-0.44	-0.47	-0.35	-0.03	-0.25	-0.66*	0.37	0.11	0.62	0.11

RDW: root dry weight (g), RLD: root length density (cm cm^{-3}), % LR: % lateral roots, plas: plasticity

Supp. Table 9. Correlation matrix of root architectural plasticity traits measured in the Kali Aus population in the lysimeter study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

Lowland lysimeter

	Yield stability coeff.	Plas TRL > 60 cm LDS	Plas TRL > 60 cm LRW	Plas % LR > 60 cm LDS	Plas % LR > 60 cm LRW	Plas RDW 0-20 cm LDS	Plas RDW 0-20 cm LRW	Plas RDW 20-40 cm LDS	Plas RDW 20-40 cm LRW	Plas RDW 40-60 cm LDS	Plas RDW 40-60 cm LRW	Plas RDW > 60 cm LDS
Plas TRL > 60 cm LDS	0.17											
Plas TRL > 60 cm LRW	-0.21	0.12										
Plas % LR > 60 cm LDS	0.34	0.46*	-0.05									
Plas % LR > 60 cm LRW	-0.19	-0.02	0.66***	-0.09								
Plas RDW 0-20 cm LDS	0.17	-0.22	-0.46*	-0.11	-0.26							
Plas RDW 0-20 cm LRW	0.03	-0.57*	-0.31	0	-0.41	0.39						
Plas RDW 20-40 cm LDS	0.09	-0.06	-0.18	-0.23	-0.43*	0.01	-0.03					
Plas RDW 20-40 cm LRW	-0.29	0	0.03	-0.3	0.04	-0.27	-0.37	0.23				
Plas RDW 40-60 cm LDS	0.24	-0.18	-0.01	-0.21	-0.13	0.12	0.03	0.64**	-0.14			
Plas RDW 40-60 cm LRW	-0.07	0.2	0.26	-0.05	0.17	-0.39	-0.1	0.06	0.06	-0.02		
Plas RDW > 60 cm LDS	0.03	0.64**	0.21	0.55*	0	-0.3	-0.22	-0.27	-0.19	-0.16	0.06	
Plas RDW > 60 cm LRW	-0.08	0.4	0.02	0.42	-0.11	-0.38	-0.2	-0.04	0.31	-0.12	0.03	0.19

Upland Lysimeter

	Yield stability coeff.	Plas TRL > 60 cm UDS	Plas TRL > 60 cm URW	Plas % LR > 60 cm UDS	Plas % LR > 60 cm URW	Plas RDW 0-20 cm UDS	Plas RDW 0-20 cm URW	Plas RDW 20-40 cm UDS	Plas RDW 20-40 cm URW	Plas RDW 40-60 cm UDS	Plas RDW 40-60 cm URW	Plas RDW > 60 cm UDS
Plas TRL > 60 cm UDS	-0.3											
Plas TRL > 60 cm URW	-0.12	0.16										
Plas % LR > 60 cm UDS	-0.07	0.47*	0.22									
Plas % LR > 60 cm URW	-0.19	0.07	0.26	-0.06								
Plas RDW 0-20 cm UDS	0.09	0.41	0.37	-0.13	0.21							

Plas	RDW 0-20 cm URW	-0.02	0.57**	-0.02	0.21	-0.04	0.39						
Plas	RDW 20-40 cm UDS	-0.29	0.48*	0.06	0.14	0.2	0.28	0.4					
Plas	RDW 20-40 cm URW	-0.25	0.39	0.13	-0.1	0.17	0.36	0.16	0.77***				
Plas	RDW 40-60 cm UDS	-0.1	0.41	-0.01	0.1	0.29	0.36	0.63**	0.16	0.17*			
Plas	RDW 40-60 cm URW	-0.28	0.25	-0.05	0.13	-0.12	-0.03	0.46*	0.39	0.16*	0.49*		
Plas	RDW > 60 cm UDS	0	-0.05	-0.16	-0.19	0	0.1	-0.06	0.55**	0.59**	-0.06	0.04	
Plas	RDW > 60 cm URW	-0.12	0.14	0.07	0.4	-0.09	0.18	0.36	0.26	-0.1	0.27	0.35	-0.06

RLD: root length density (cm cm^{-3}), % LR: % lateral roots, RDW: root dry weight (g), plas: plasticity, TRL: total root length (cm), % LR: % lateral roots, LDS: lowland drought stress, LRW: lowland re-watered, UDS: upland drought stress, URW: upland re-watered.

Supp. Table 10. Correlation matrix of root architectural plasticity traits measured in the Kali Aus population in the Rhizoscope study. Values shown are the Pearson two-sided correlation coefficient and significance levels are indicated by *: p<0.05, **: p<0.01, ***: p<0.001. Correlations with the yield stability coefficient are also shown.

	Yield stability coeff.	Plas root length in box	Plas root length	Plas RDW 0-15 cm	Plas RDW 15-30 cm	Plas RDW > 30 cm	Plas TRDW	Plas R/S	Plas Root number > 20 cm	Plas Root number > 30 cm	Root diameter
Plas root length in box	0.3										
Plas root length	0.24	0.98***									
Plas RDW 0-15 cm	0.17	0.88***	0.85***								
Plas RDW 15-30 cm	0.16	0.84***	0.85***	0.72***							
Plas RDW > 30 cm	0.43	0.81***	0.75***	0.71***	0.75***						
Plas TRDW	0.15	0.88***	0.87***	0.98***	0.8***	0.72***					
Plas R/S	-0.25	`-0.34*	`-0.32*	`-0.34*	-0.11	`-0.22*	`-0.25*				
Plas Root number > 20 cm	0.21	0.87***	0.87***	0.73***	0.86***	0.7***	0.76***	-0.33			
Plas Root number > 30 cm	-0.05	0.77***	0.75***	0.84***	0.64**	0.69**	0.82***	-0.16	0.66**		
Root diameter	0.09	0.77***	0.79***	0.81***	0.61**	0.75***	0.79***	-0.25	0.53*	0.73***	
Root cone angle	0.3	0.23*	0.26*	0.25*	0.1	0.14	0.24*	-0.02	0.17*	0.05	0.39

RDW: root dry weight (g), TRDW: total root dry weight (g), R/S: root shoot ratio, plas: plasticity

Supp. Table 11. Correlations of plasticity in RDW among the field, lysimeter, and Rhizoscope studies. Values shown are the Pearson two-sided correlation coefficients, and significant correlations are indicated by *: p<0.05, **: p<0.01, ***: p<0.001.

Population	Greenhouse lysimeter experiment	Field physiology trial		Rhizoscope experiment	
Aus 276		Plas RDW 30-45 cm	Plas RDW 45-60 cm	Plas RDW 15-30 cm	Plas RDW >30 cm
	Plas RDW 40-60 cm LDS	-0.55	0.03	0.01	0.32
	Plas RDW >60 cm LDS	0.80**	0.75*	-0.11	-0.03
	Plas RDW 40-60 cm LRW	-0.17	0.25	0.07	-0.02
	Plas RDW >60 cm LRW	-0.15	0.23	-0.05	0.00
	Plas RDW 40-60 cm UDS	-0.04	0.09	-0.16	-0.14
	Plas RDW >60 cm UDS	-0.16	0.36	-0.25	-0.02
	Plas RDW 40-60 cm URW	0.03	-0.25	-0.19	-0.11
	Plas RDW >60 cm URW	0.38	0.43	0.08	-0.11
Kali Aus					
	Plas RDW 40-60 cm LDS	-0.14	0.24	0.30	0.08
	Plas RDW >60 cm LDS	-0.15	-0.31	0.06	0.34
	Plas RDW 40-60 cm LRW	0.58	-0.10	-0.40	-0.45*
	Plas RDW >60 cm LRW	0.27	-0.23	-0.2	0.09
	Plas RDW 40-60 cm UDS	0.13	-0.27	-0.30	-0.23
	Plas RDW >60 cm UDS	0.34	0.18	-0.1	0.01
	Plas RDW 40-60 cm URW	-0.15	-0.31	-0.19	-0.16
	Plas RDW >60 cm URW	-0.10	-0.43	0.30	0.30

Population	Field physiology trial	Rhizoscope experiment		
		Plas RDW 0-15 cm	Plas RDW 15-30 cm	Plas RDW >30 cm
Aus 276	Plas RDW 0-15 cm	0.47	0.75*	0.30
	Plas RDW 15-30 cm	-0.30	0.21	-0.65
	Plas RDW 30-45 cm	-0.12	-0.16	-0.88**
	Plas RDW 45-60 cm	0.34	0.46	-0.32
Kali Aus	Plas RDW 0-15 cm	-0.14	-0.28	-0.11
	Plas RDW 15-30 cm	-0.31	-0.11	-0.72*
	Plas RDW 30-45 cm	-0.07	0.25	-0.29
	Plas RDW 45-60 cm	-0.13	0.15	-0.08

RDW: root dry weight (g), LDS: Lowland drought stress, LRW: Lowland re-watered, UDS: Upland drought stress, URW: Upland re-watered, Plas: plasticity

Supp Table 12. Grain yield stability in the Aus 276 and Kali Aus populations across experiments, according to the analyses showing the the best fitting variance–covariance structure according to the Akaike Information Criterion (AIC). For the AMMI-1 analysis, a relatively small coefficient indicates lower sensitivity (above average stability) to changing environmental conditions. For the Eberhart-Russell model and the Finlay-Wilkinson test, a regression coefficient close to 1.0 (indicating average stability) associated with a high mean yield indicates general adaptability. The AMMI-1 model showed the best fit for both the Aus 276 and Kali Aus populations across the seven field environments tested.

Aus 276 population

Genotype	Eberhart-Russell		AMMI -1	
	λ_i	$\sigma^2_{\delta(i)}$	λ_i	$\sigma^2_{\delta(i)}$
Aus 276	1.0479	1.3072	0.9224	0.2786
IR 94226-B-109	0.3574	1.0423	-0.2494	0.2786
IR 94226-B-145	0.3745	1.2556	-0.2256	0.2786
IR 94226-B-150	0.3506	1.4934	-0.1974	0.2786
IR 94226-B-167	0.5463	1.1224	0.6972	0.2786
IR 94226-B-184	0.0783	1.5905	0.5431	0.2786
IR 94226-B-239	0.1649	1.6014	0.2586	0.2786
IR 94226-B-254	0.2869	0.8927	0.4356	0.2786
IR 94226-B-258	0.09316	1.5641	0.3261	0.2786
IR 94226-B-265	0.03479	1.433	**0.264**	0.2786
IR 94226-B-353	0.1707	1.1149	0.1553	0.2786
IR 94226-B-362	0.3334	1.851	0.1426	0.2786
IR 94226-B-364	0.02737	1.5646	0.3104	0.2786
IR 94226-B-372	0.08255	1.793	0.4498	0.2786
IR 94226-B-376	0.2602	0.8739	-0.0711	0.2786
IR 94226-B-419	0.07527	1.3577	**0.1497**	0.2786
IR 94226-B-474	1.0779	1.0798	-0.2636	0.2786
IR 94226-B-56	0.4239	1.6494	0.8175	0.2786
IR 94226-B-57	0.7843	1.9238	-0.3206	0.2786
IR 94226-B-63	0.02772	1.4478	0.44	0.2786
IR 94226-B-97	0.4055	2.1271	0.9881	0.2786
MTU1010	0.7516	1.5355	1.1452	0.2786

Kali Aus population

Genotype	Finlay Wilkinson		AMMI -1	
	λ_i	σ^2_{δ}	λ_i	$\sigma^2_{\delta(i)}$
IR 92801-110-B	1.1483	0.2424	1.0412	0.2231
IR 92801-134-B	1.2603	0.2424	1.2136	0.2231
IR 92801-194-B	1.2032	0.2424	1.197	0.2231
IR 92801-25-B	1.091	0.2424	0.9982	0.2231
IR 92801-256-B	1.5941	0.2424	1.6029	0.2231
IR 92801-268-B	0.8888	0.2424	0.8047	0.2231
IR 92801-36-B	1.3158	0.2424	1.2624	0.2231
IR 92801-360-B	1.543	0.2424	1.3845	0.2231
IR 92801-365-B	1.429	0.2424	1.3419	0.2231
IR 92801-368-B	1.6715	0.2424	1.6562	0.2231
IR 92801-371-B	1.9969	0.2424	2.0025	0.2231
IR 92801-43-B	0.8497	0.2424	0.7619	0.2231
IR 92801-434-B	2.2243	0.2424	2.1784	0.2231
IR 92801-504-B	0.8246	0.2424	**0.6875**	0.2231
IR 92801-527-B	0.7261	0.2424	**0.6185**	0.2231
IR 92801-560-B	1.1144	0.2424	1.0089	0.2231
IR 92801-562-B	1.3666	0.2424	1.319	0.2231
IR 92801-634-B	1.2324	0.2424	1.0694	0.2231
IR 92801-94-B	1.8071	0.2424	1.7022	0.2231
IR 92801-95-B	1.9544	0.2424	1.8525	0.2231
MTU1010	0.5848	0.2424	0.4825	0.2231
Kali Aus	1.1328	0.2424	1.0855	0.2231

λ_i is the coefficient of regression in the case of Eberhart–Russell and Finlay–Wilkinson models and is the sensitivity of the i^{th} genotype to environmental (trial) changes in the case of AMMI model. σ^2_d is the deviation from regression. $\sigma^2_{\square(i)}$ is the specific variance associated with genotype i.

Supp. Table 13. Days to 50% flowering (DTF) in the yield-stable, root plastic genotypes and the parents in field agronomic trials.

	2012LNS	2012LS	2012UNS	2012US	2013UNS	2013US
IR 94226-B-265	80	76	80	93	78	101
IR 94226-B-419	75	80	80	76	77	97
IR 92801-504-B	76	75	76	84	86	103
IR 92801-527-B	77	73	74	87	80	104
Aus276	80	80	76	75	72	93
Kali Aus	75	72	74	84	79	85
MTU1010	81	78	77	85	75	91

Supp Table 14. Significant loci identified for different traits under different lysimeter treatments in the Aus 276 population.

SN.	Trait	Chr	Marker	Position (Mbp)	Mean of lines with A allele	Mean of lines with M allele	Aus 276	MTU 1010	P value (Q)	R^2
1	SDW LRW control	1	id1000556	0.66	53.397	40.878	43.283	41.23	0.0003	0.068
2	SDW UDS stress	1	id1010526	17.22	32.075	38.807	24.617	22.677	0.0015	0.124
3	RDW LRW control	1	id1023158	36.44	3.66	2.344	2.114	2.301	0.0255	0.481
4	SDW URW stress	1	id1023892	37.79	33.829	28.324	23.738	27.118	0.0173	0.342
5	TWU LRW stress	1	id1023892	37.79	0.964	0.788	0.736	0.837	0.0001	0.489
6	TWU LDS control	1	id1023892	37.79	1.662	1.216	1.495	1.222	0	0.397
7	WUE LDS stress	1	id1023892	37.79	28.24	24.809	25.022	25.629	0.0016	0.548
8	WUE LRW control	1	id1023892	37.79	22.948	18.798	21.746	15.906	0.0011	0.368
9	Plas RDW >60 cm UDS	1	id1023892	37.79	-0.028	0.04	0.15	0.089	0.007	0.303
10	RDW 20-40 cm LDS stress	1	id1023892	37.79	1.077	0.434	0.857	0.33	0.0043	0.268
11	SDW LDS stress	1	id1023892	37.79	31.095	23.13	21.92	24.68	0	0.591
12	SDW LRW stress	1	id1023892	37.79	39.341	26.386	27.203	29.19	0	0.511
13	SDW LDS stress	1	id1023892	37.79	40.71	28.841	35.55	34.107	0	0.375
14	SDW UDS stress	1	id1024972	39.37	38.568	30.063	24.617	22.677	0.0002	0.400
15	TWU URW stress	2	id2015767	34.87	0.778	0.627	0.525	0.5	0.0036	0.455
16	Forks >60 cm UDS control	4	id4010621	31.37	30252.17	24503.61	11576	20419	0.033	0.619
17	TRL >60 cm LDS stress	4	id4010621	31.37	1836.04	189.87	1348.4	49.72	0	0.845
18	WUE LRW stress	5	id5010992	24.09	43.36	38.373	38.35	35.198	0.038	0.183
19	Forks >60 cm LRW stress	6	id6004481	7.00	21087.74	9048.63	839	8711.1	0.0019	0.541
20	Plas RDW 40-60 cm LDS	6	id6008973	15.36	17.541	8.132	12.121	14.153	0.0382	0.250
21	RDW 20-40 cm LDS control	6	id6012064	23.29	1.172	0.629	0.661	0.2735	0.0454	0.399
22	Plas RDW >60 cm LRW	6	id6012064	23.29	1.902	0.178	-0.149	0.605	0.0063	0.388
23	RDW 0-20 cm URW control	6	id6013529	25.15	2.315	1.352	1.631	0.986	0.049	0.495
24	TWU LDS control	9	id9000389	1.33	1.329	1.542	1.495	1.222	0	0.195
25	TWU URW control	9	id9000389	1.33	1.536	1.828	1.614	1.814	0.0033	0.197
26	SDW LDS control	9	id9000389	1.33	31.983	37.797	35.55	34.11	0.0002	0.240
27	RGR LDS control	9	id9000661	2.36	0.257	0.182	0.223	0.155	0.0076	0.345
28	% LR >60 cm LRW stress	11	id11000133	0.68	77.11	61.46	51.51	56.02	0.037	0.209
29	RDW 20-40 cm UDS control	11	id11008862	23.02	0.647	0.412	0.3584	0.2958	0.0335	0.530

30	RDW 20-40 cm UDS stress	11	id11010335	26.30	0.954	0.607	0.5436	0.6493	0.0105	0.458
31	RDW >60 cm LRW control	12	id12000605	1.32	0.031	0.008	0.0031	0.0258	0.0182	0.636
32	SDW LRW control	12	id12000605	1.32	56.99	46.44	43.28	41.23	0.0079	0.225
33	TWU UDS stress	12	id12000605	1.32	0.871	0.769	0.867	0.737	0.0029	0.190
34	RDW 40-60 cm LDS control	12	id12001321	3.21	0.443	0.197	0.306	0.06	0.0156	0.452
35	% LR >60 cm URW stress	12	id12001321	3.21	71.42	86.49	72.52	74.80	0.0045	0.438
36	TRL >60 cm UDS stress	12	id12004047	10.47	3494.44	2744.33	3238.7	3222.7	0.0147	0.365
37	RDW 0-20 cm LRW control	12	id12007988	23.29	1.127	2.066	1.315	1.705	0.0117	0.407

TWU: Total water uptake (kg), RGR: relative growth rate from 24 to 31 days after sowing (g g^{-1} d^{-1}), RDW: root dry weight (g), SDW: shoot dry weight (g), WUE: water use efficiency (g shoot mass L^{-1} water uptake), TRL: total root length (cm), % LR: % lateral roots, LDS: lowland drought stress, LRW: lowland re-watered, UDS: upland drought stress, URW: upland re-watered, plas: plasticity, chr: chromosome, A: Aus 276, M: MTU1010, R^2: phenotypic variance.

Supp Table 15. Significant loci identified for different traits under field condition in the Aus 276 population.

SN	Trait	Chr	Marker	Position (Mbp)	Mean of lines with A allele	Mean of lines with M allele	Aus 276	MTU1010	P value (Q)	R^2
1	Plas Forks 0-15 cm	1	id1011535	19.27	-7.28	-25.51	-7.17	-1.15	0.0246	0.672
2	Plas RLD 30-45 cm	1	id1011535	19.27	5.66	16.581	6.623	2.161	0.0142	0.655
3	Plas RLD 0-15 cm	1	id1012481	22.04	-12.45	-28.03	-12.01	-5.78	0.0085	0.644
4	Plas Ave root diam 15-30 cm	1	id1024972	39.37	-3.859	4.572	5.866	3.481	0.0162	0.806
5	Plas % LR 15-30 cm	1	id1024972	39.37	1.242	-3.92	2.41	-1.29	0.02	0.401
6	Plas % LR 45-60 cm	1	id1024972	39.37	12.06	-30.95	11.01	-20.32	0.007	0.618
7	% LR 30-45 cm	3	id3200001	16.73	59.74	67.54	66.28	66.87	0.0231	0.314
8	GY 2013UNS	5	id5000759	1.13	2962	4004.61	6711.8	5048	0.0001	0.644
9	GY 2013US	5	id5009997	22.71	19.88	87.94	98.75	56.78	0.0313	0.806
10	RDW 0-15 cm	5	id5010992	24.09	0.0263	0.0162	0.0168	0.02	0.0038	0.030
11	RLD 0-15 cm	5	id5010992	24.09	9.68	4.854	6.068	5.412	0.0006	0.014
12	GY 2013US	5	id5010992	24.09	100	22.595	62	54.9	0.0489	0.071
13	Plas RLD 15-30 cm	6	id6012064	23.29	-2.29	6.472	6.33	4.526	0.0171	0.695
14	RLD 15-30 cm	8	id8001477	4.56	1.135	0.837	1.08	1.067	0.0087	0.060
15	RDW 45-60 cm	9	id9000389	1.33	0.0018	0.0031	0.0005	0.0008	0.0457	0.576
16	Plas % LR 45-60 cm	9	id9000661	2.36	0.52	10.738	1.39	-3.168	0.0099	0.770
17	% LR 45-60 cm	9	id9001352	5.31	13.52	25.56	34.45	44.24	0.0009	0.879
18	Plas % LR 15-30 cm	9	id9001352	5.31	1.841	-3.188	0.491	1.696	0.0378	0.532
19	Plas % LR 45-60 cm	9	id9001352	5.31	2.52	5.992	1.39	-3.168	0.0333	0.768
20	GY 2012LNS	10	id10003056	11.79	3894.56	4896.69	3621.9	3300.6	0.0023	0.298
21	GY 2013US	10	id10003056	11.79	176.96	192.26	231.68	128.58	0.014	0.477
22	Ave root diam 30-45 cm	11	id11000133	0.68	0.323	0.259	0.255	0.242	0.0397	0.031
23	RLD 45-60 cm	11	id11010335	26.30	0.11	0.269	0.256	0.204	0.017	0.575

RDW: root dry weight (g), RLD: root length density (cm cm^{-3}), Ave root diam: average root diameter (mm), % LR: % lateral roots, GY: grain yield (kg ha^{-1}), US: upland stress, LNS: lowland non-stress, UNS: upland non-stress, chr: chromosome, A: Aus 276, M: MTU1010, R^2: phenotypic variance

144 **Supp Table 16.** Significant loci identified for different traits under different lysimeter treatments in the Kali Aus population.
145

	Trait	Chr	Marker	Position (Mbp)	Mean of lines with K allele	Mean of lines with M allele	Kali Aus	MTU1010	P value (Q)	R^2
1	Plas RDW 40-60 cm UDS stress	1	id1012481	22.04	-1.072	11.97	0.072	-1.254	0.0103	0.274
2	Plas RDW 20-40 cm LRW stress	1	id1015541	26.70	-0.483	-0.116	-0.535	-0.177	0.0009	0.296
3	RDW 20-40 cm LRW control	1	id1019332	31.83	1.014	0.626	1.073	0.463	0.0196	0.396
4	SDW LDS stress	1	id1023892	37.79	30.31	25.94	34.83	24.68	0.0007	0.357
5	WUE UDS control	1	id1024972	39.37	26.459	21.124	24.03	19.99	0.0019	0.410
6	TWU LDS control	1	id1025983	40.78	1759.7	1503.11	1.99	1.22	0.0448	0.239
7	Plas RDW >60 cm URW	3	id3000111	0.41	4.364	0.893	1.357	1.756	0.0289	0.163
8	RGR UDS stress	3	id3000111	0.41	0.2699	0.1771	0.249	0.229	0.0499	0.018
9	RGR URW control	3	id3002377	4.27	0.1356	0.2576	0.156	0.248	0.0002	0.454
10	SDW UDS stress	3	id3002377	4.27	37.88	26.31	31.08	37.59	0.0008	0.277
11	TWU UDS stress	3	id3002377	4.27	1.5	1.124	1.58	1.098	0.0001	0.402
12	RGR UDS stress	3	id3011048	25.52	0.1318	0.2357	0.177	0.183	0.0179	0.491
13	RDW 0-20 cm UDS stress	3	dd3000535	27.67	1.76	1.242	1.894	1.402	0.0295	0.319
14	RDW 0-20 cm LRW control	3	id3015399	32.01	3.316	1.611	1.458	1.705	0.0002	0.594
15	Plas RDW 40-60 cm URW	3	id3015399	32.01	-20.67	1.02	-1.349	-15.88	0.0008	0.378
16	R/S LRW control	3	id3015399	32.01	0.0962	0.0568	0.0636	0.054	0.0004	0.484
17	Plas RDW 0-20 cm LDS stress	3	id3016429	33.63	0.447	-0.964	0.275	-0.293	0.00048	0.203
18	Plas RDW 20-40 cm LRW stress	3	id3016429	33.63	-0.592	-0.175	-0.535	-0.177	0.0021	0.210
19	Forks >60 cm LRW control	3	id3016429	33.63	13169.19	4823.63	15185.17	5802	0.0062	0.394
20	TRL >60 cm LRW control	3	id3017266	34.94	1789.61	562.06	2132.72	827.633	0.0038	0.394
21	Plas RDW 0-20 cm LDS	3	id3017266	34.94	0.3	-1.066	0.275	-0.293	0.00017	0.310
22	Plas RDW 20-40 cm UDS	3	id3017266	34.94	0.485	-0.103	-0.309	0.153	2.20E-06	0.233
23	Plas RDW >60 cm UDS	4	id4001113	2.48	-0.0755	0.0898	-0.108	0.054	6.20E-07	0.301
24	Plas RDW UDS >60 cm	4	id4002562	6.48	-1.02	4.82	-1.84	2.888	0.0343	0.303
25	Ave root diam >60 cm UDS stress	4	id4005867	19.93	0.1477	0.1285	0.120	0.128	0.0271	0.317
26	TWU URW stress	5	id5004668	9.21	0.926	1.011	0.802	0.911	0.0001	0.285
27	Plas RDW 20-40 cm UDS stress	5	id5012152	25.68	0.465	-0.226	-0.309	0.153	3.40E-09	0.432
28	R/S UDS stress	5	id5012480	26.26	0.1371	0.1031	0.14	0.113	0.0031	0.539

29	Plas RDW 0-20 cm UDS	5	id5012480	26.26	0.522	-0.285	-0.339	0.131	0.00022	0.226
30	Plas RDW 20-40 cm UDS	5	id5012480	26.26	0.374	-0.118	-0.309	0.153	3.80E-08	0.251
31	% LR >60 cm URW stress	6	id6004481	7.00	118.55	83.86	89.19	88.65	0.0031	0.485
32	Ave root diam >60 cm URW stress	6	id6004481	7.00	3.4942	0.1242	0.117	0.139	0.0099	0.620
33	RDW >60 cm URW control	7	id7001912	10.81	0.079	0.018	0.069	0.022	0.0039	0.393
34	Plas RDW 40-60 cm LDS	8	id8002662	8.68	17.38	4.73	2.706	14.15	0.014	0.301
35	RDW 40-60 cm LRW control	8	wd8003200	17.18	1.056	0.481	1.151	0.108	0.0252	0.307
36	RGR LDS stress	8	id8005359	19.83	0.2405	0.167	0.219	0.198	0.0043	0.413
37	RDW 0-20cm LDS control	9	id9000661	2.36	3.13	1.595	1.41	1.359	0.0021	0.469
38	TWU LDS stress	9	id9002563	8.71	1.28	0.921	1.012	0.766	0.0006	0.232
39	TRL >60 cm LRW stress	9	id9005086	16.48	3171.95	1602.59	2710.21	1107.38	0.0269	0.381
40	RDW 0-20 cm LDS stress	9	id9006988	19.49	2.176	1.149	1.685	1.067	0.0014	0.431
41	Plas RDW >60 cm URW	10	id10000644	2.35	3.403	0.344	1.357	1.756	0.0519	0.281
42	Forks >60 cm UDS control	10	ud10000620	9.99	45155.05	15837.32	71614.89	20419.7	0	0.319
43	TRL >60 cm UDS control	10	ud10000620	9.99	4370.63	1982.2	5903.9	2332.81	0.0002	0.342
44	RGR UDS stress	10	id10003555	13.55	0.179	0.2069	0.24927	0.22893	0.0405	0.538
45	Forks >60 cm URW stress	10	id10006161	19.52	37441.34	19569.21	55052.13	19574.5	0.0022	0.513
46	RDW 20-40 cm URW stress	11	id11003556	9.13	0.504	0.355	0.3175	0.321	0.0192	0.614
47	Forks >60 cm LRW stress	11	id11003556	9.13	34011.96	14905.69	27962.42	8711.13	0.0161	0.373
48	Forks >60 cm UDS stress	11	id11005065	15.45	21654.51	25491.5	34182.13	25804.0	0.0511	0.403
49	TRL >60 cm UDS stress	11	id11005065	15.45	2633.43	3043.77	3719.59	3222.79	0.0134	0.443
50	RDW 20-40 cm LDS control	12	id12003803	9.54	1.645	0.687	1.562	0.274	0.0043	0.518

TWU: Total water uptake (kg), RGR: relative growth rate from 24 to 31 days after sowing (g g^{-1} d^{-1}), RDW: root dry weight (g), SDW: shoot dry weight (g), WUE: water use efficiency (g shoot mass L^{-1} water uptake), R/S: root/shoot ratio, TRL: total root length (cm), % LR: % lateral roots, LDS: lowland drought stress, LRW: lowland re-watered, UDS: upland drought stress, URW: upland re-watered, chr: chromosome, K: Kali Aus, M: MTU1010, R^2: phenotypic variance.

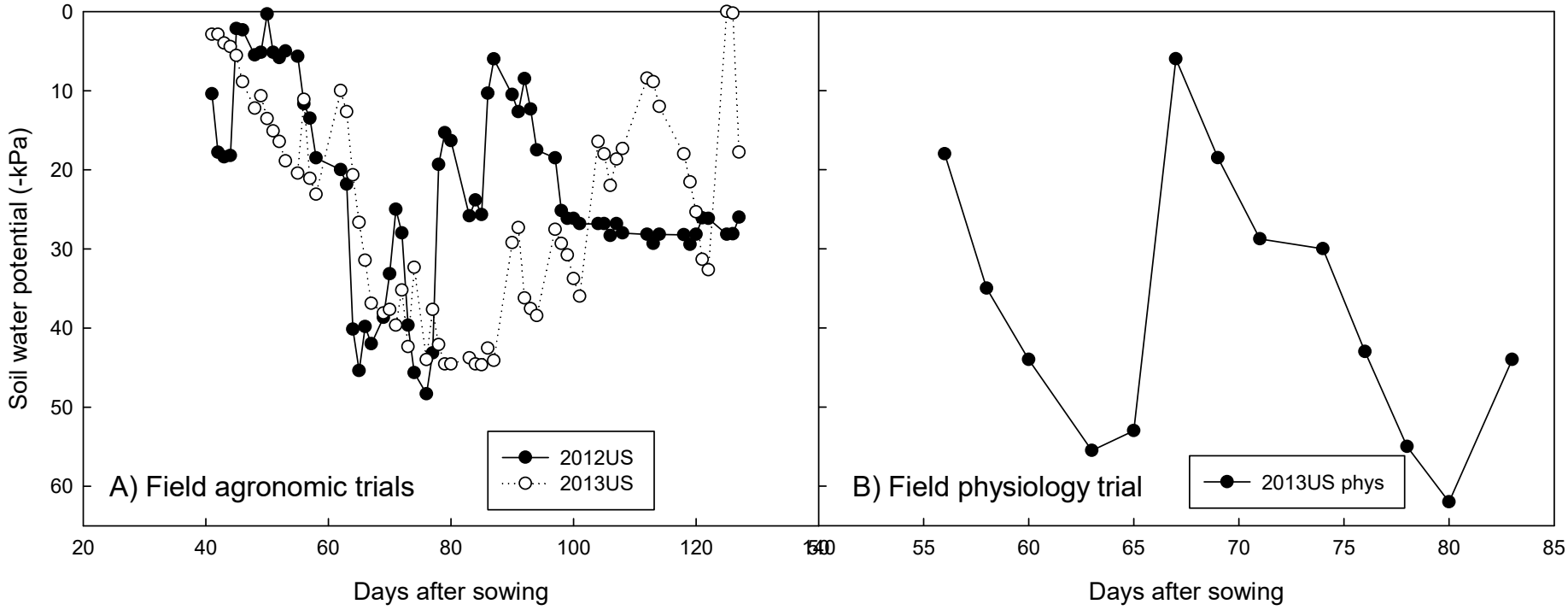
Supp Table 17. Significant loci identified for different traits under field conditions in the Kali Aus population

SN	Trait	Chr	Marker	Position (Mbp)	Mean of lines with K allele	Mean of lines with M allele	Kali Aus	MTU1010	P value (Q)	R^2
1	GY 2012LNS	1	id1000556	0.66	3444.5	5890.51	3232.63	4450.93	0.0052	0.603
2	Plas Forks 15-30 cm	1	id1019332	31.83	0.603	-9.463	-0.948	1.821	0.0054	0.890
3	RLD 15-30 cm	4	id4000641	1.05	0.672	0.995	0.717	0.756	0.0416	0.283
4	Plas RLD 45-60 cm	4	id4002562	6.48	2.661	-1.305	-3.555	-0.911	0.0089	0.771
5	Plas Forks 45-60 cm	4	id4002562	6.48	1.351	-5.717	-11.543	-4.972	0.0027	0.831
6	Plas % LR 15-30	4	id4003973	13.46	-3.533	0.913	0.77	1.696	0.0096	0.675
7	GY 2013US	4	id4005867	19.93	40.19	12.9	5.08	19.88	0.0281	0.021
8	Ave root diam 0-15 cm	5	id5000015	0.04	0.191	0.153	0.172	0.191	0.0048	0.079
9	Plas % LR 15-30 cm	5	id5010661	23.66	-0.433	-0.433	2.42	5.534	0.042	0.409
10	GY 2012US	7	id7001156	6.99	121	899.35	556.63	273.1	0.0083	0.786
11	Plas RDW 30-45 cm	7	id7001156	6.99	9.43	23.265	8.882	10.465	0.0384	0.745

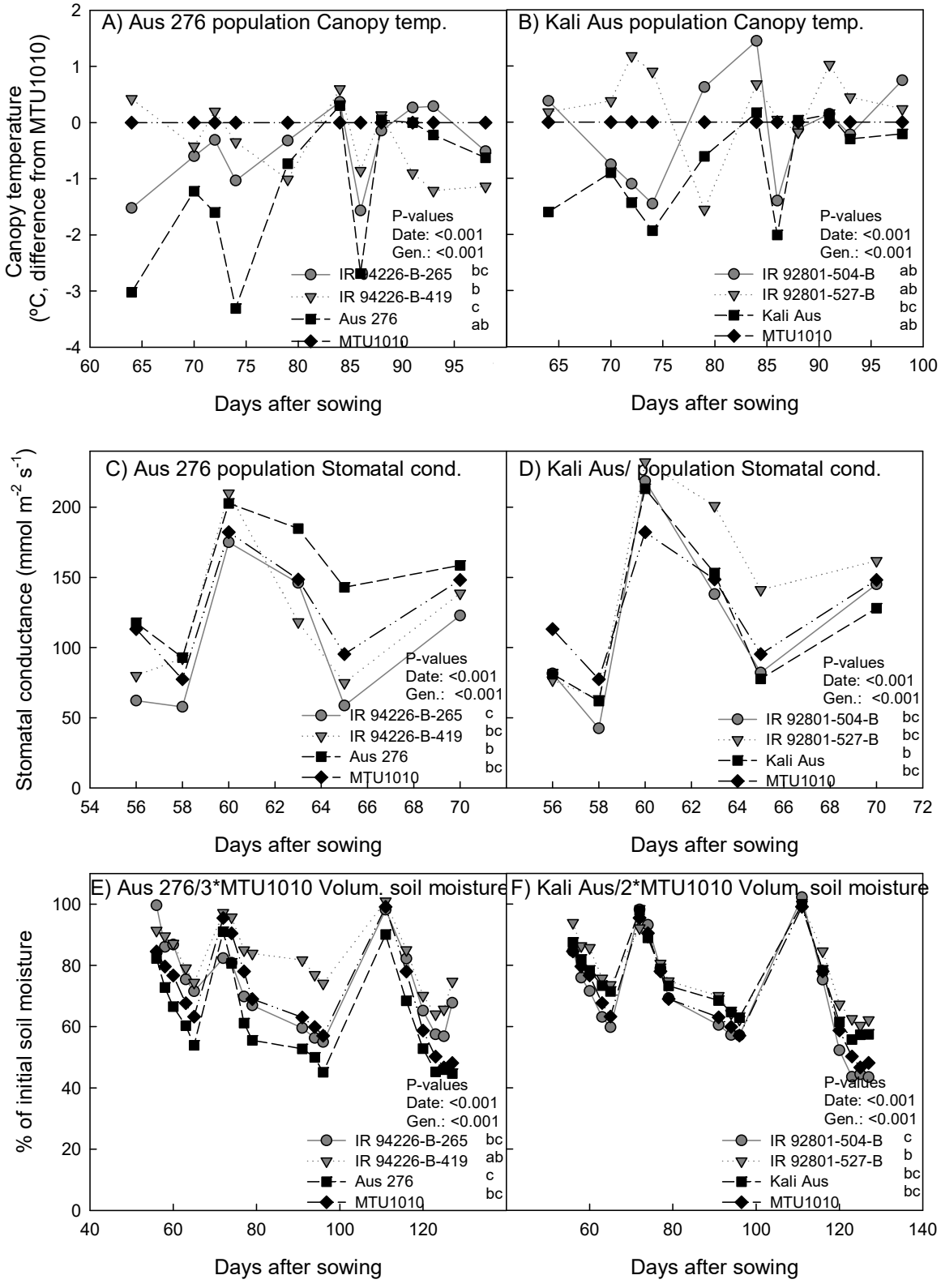
RDW: root dry weight (g), RLD: root length density (cm cm^{-3}), Ave root diam: average root diameter (mm), % LR: % lateral roots, GY: grain yield (kg ha^{-1}), US: upland stress, LNS: lowland non-stress, chr: chromosome, K: Kali Aus, M: MTU1010, R^2: phenotypic variance

Supp. Table 18. Composition of the modified Yoshida nutrient solutions used in the Rhizoscope study.

Salt	Concentration
$(NH_4)_2SO_4$	0.5 mM
$MgSO_4.7H_2O$	1.6 mM
$Ca(NO_3)_2.4H_2O$	1.2 mM
KNO_3	0.7 mM
$MnSO_4.H_2O$	10 µM
$(NH_4)_6Mo_7O_{24}.4H_2O$	0.16 µM
$ZnSO_4.7H_2O$	0.7 µM
$CuSO_4.5H_2O$	0.8 µM
H_3BO_3	22.6 µM
$FeSO_4$	100 µM
Na2EDTA	100 µM
Control (P) KH_2PO_4	0.4 mM
Stress (P/8) KH_2PO_4	0.05 mM



Supp. Fig. 1. Soil water potential measured by tensiometers in field studies at the soil depth of 30 cm in (A) the 2012 and 2013 direct-seeded upland stress agronomic trials (2012US and 2013US) and (B) in the physiology trial (2013US phys). Values shown are means of readings from three replicate tensiometers.



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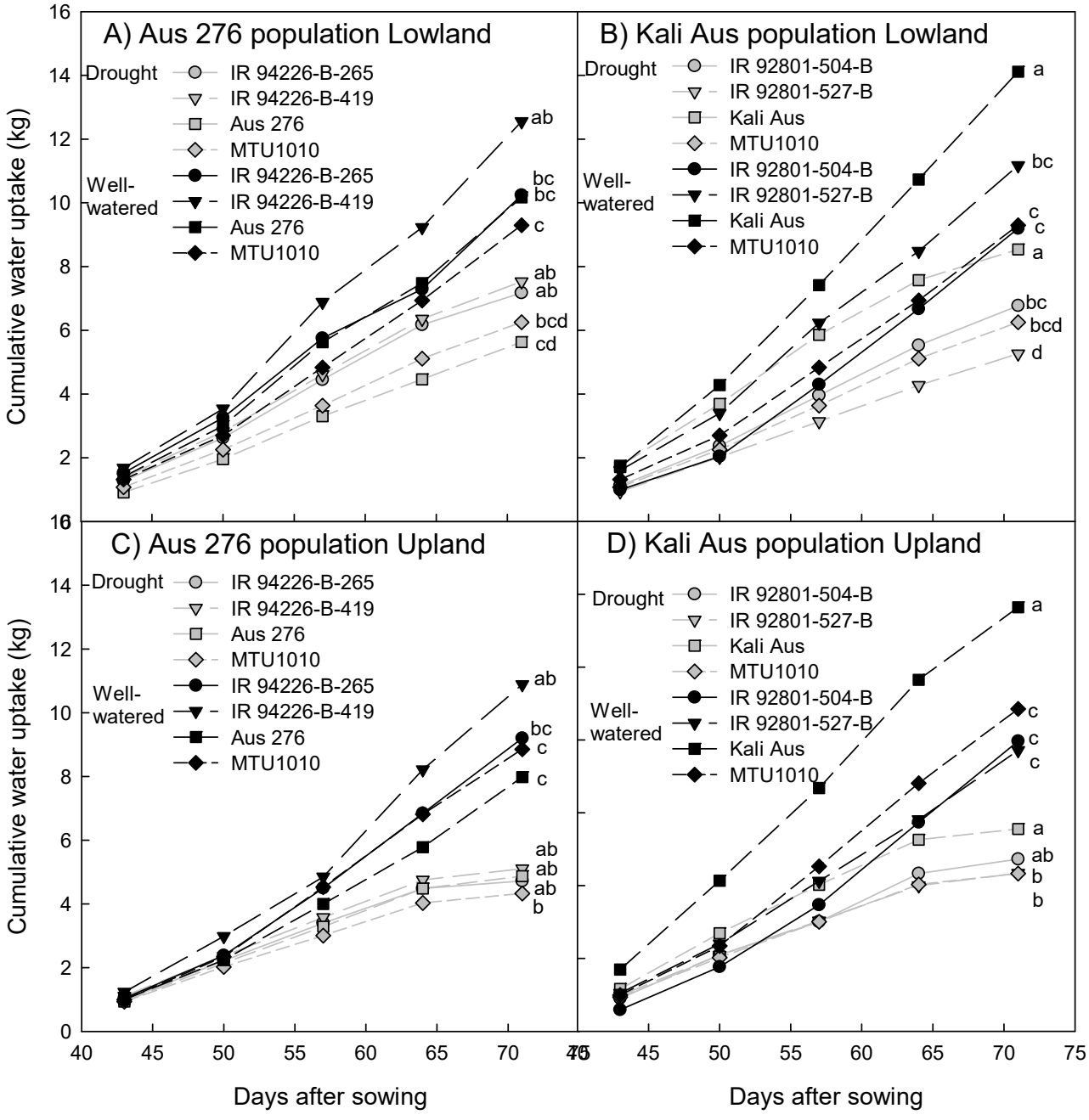
198 **Supp. Fig 2.** Functional comparison of the parents with the root plastic, yield stable genotypes in the field
199 physiology study. A-B) canopy temperature, C-D) stomatal conductance, and E-F) volumetric soil moisture the
200 depth of 30 cm in the Aus 276 and Kali Aus populations, respectively. Values shown are means, n=3. The two
201 populations are shown separately for clarity, but significance levels are the result of a common statistical
202 analysis since the genotypes from both populations were grown together in the same field randomization.



Supp. Fig 3. Cumulative water uptake in the lysimeter experiment for the genotypes showing highest yield stability across field studies (A) Aus 276 population lowland treatments, B) Kali Aus population lowland treatments, C) Aus 276 population upland treatments, D) Kali Aus population upland treatments. Black lines indicate well-watered treatments and gray lines indicate drought stress treatments. The data were pooled for drought (DS) and rewatered (RW) treatments and for the well-watered control treatments for these graphs since there were no differences in protocol for those treatments during the time frame shown here. Letters indicate significance groups based on an analysis of the total water uptake within each treatment (n=6 for WW treatments and n=8 for drought stress treatments) that included only the 7 genotypes shown here. Significance levels for genotype were: Lowland well-watered = 0.014, Lowland drought <0.001, Upland well-watered <0.001, and Upland drought = 0.244.