

Table 1 Suppl. Nutrient solution.

Chemical reagent name	Mother liquor [g dm ⁻³]	Normal nitrogen [mg dm ⁻³]	Low nitrogen [mg dm ⁻³]
KNO ₃	102	510	30.6
MgSO ₄ ·7H ₂ O	98	490	490
KH ₂ PO ₄	28	140	140
Ca(NO ₃) ₂ ·4H ₂ O	236	118	0
FeSO ₄ ·7H ₂ O	2.799	13.995	13.995
EDTA-2Na	3.722	18.61	18.61
MnCl ₂ ·4H ₂ O	3.62	0.905	0.905
ZnSO ₄ ·7H ₂ O	0.44	0.11	0.11
CuSO ₄ ·5H ₂ O	0.16	0.04	0.04
H ₃ BO ₃	5.72	1.43	1.43
Na ₂ MoO ₄ ·4H ₂ O	0.18	0.045	0.045
KCl	75.5	0	354.85
CaCl ₂	111	499.5	555

Table 2 Suppl. Correlation analysis of four low nitrogen tolerance indices among the association panel of 304 accessions. PH - plant height, LL - leaf length, LW - leaf width, SFM - shoot fresh mass, LNT - low nitrogen tolerance index. ** - significant differences between treatments at $P < 0.01$.

Trait	LNT-LL	LNT-LW	LNT-SFM
LNT-PH	0.631**	0.496**	0.580**
LNT-LL		0.480**	0.433**
LNT-LW			0.418**

Table 3 Suppl. The summary of plausible candidate genes. For explanation of abbreviations see Table 2 Suppl.

Trait	SNP	Chr	Loc	Candidate genes	Site_start [bp]	Site_end[bp]	Distance [Mb]	Orthologous genes		
LNT-PH	Bn-A04-p5182164	A04	4051087	BnaA04g07450	6341432	6344580	2.18	AT3G17820	GLN1.3	glutamine synthetase 1.3
LNT-SFM	Bn-A07-p9091839	A07	10553921	BnaA07g09690	9373485	9376599	1.12	AT1G27080	NRT1.6	nitrate transporter 1.6
LNT-PH; LNT-LL	Bn-A09-p31416695	A09	29117784	BnaA09g47380	31936048	31940164	2.69	AT1G12110	NRT1.1	nitrate transporter 1.1



Fig. 1 Suppl. The hydroponic cultivation at low nitrogen and normal nitrogen conditions.

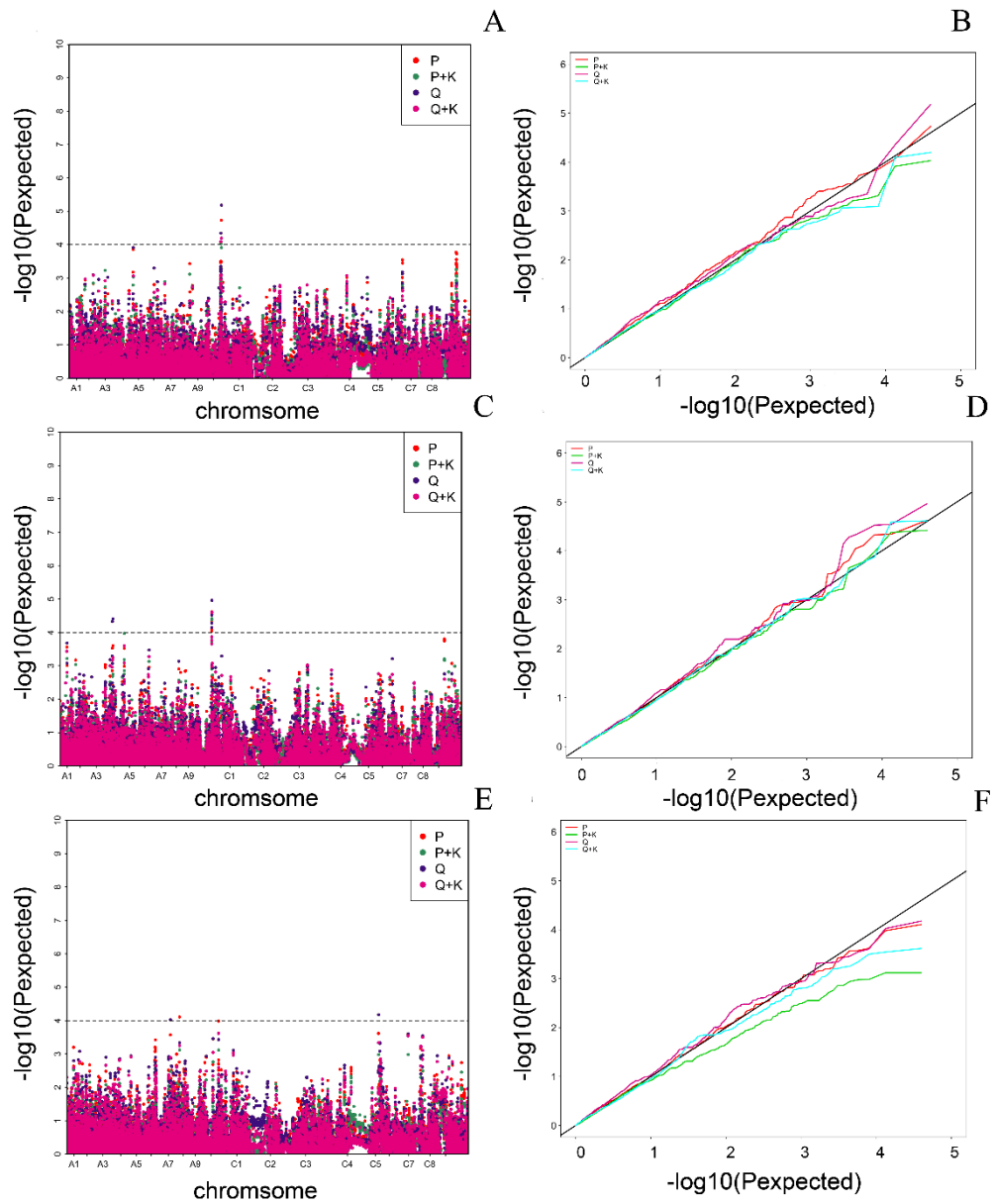


Fig. 2 Suppl. Manhattan plots and quantile-quantile plots generated from genome-wide association analysis for low nitrogen tolerance; related-traits using P, P+K, Q and Q+K models. A - LNT-LL, B - LNT-LL, C - LNT-PH, D - LNT-PH, E - LNT-SFM, F - LNT-SFM. The abbreviations are explained in Table 2 Suppl. A, C, and E are manhattan plots and B, D, and F are quantile-quantile plots. The grey horizontal line depicts significance threshold ($P < 0.0001$ or $-\text{Log}_{10}P > 4.0$).