**Table S7** Auxin-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene id | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma11g15910 | -1.23 | -2.10 | Auxin response factor 4, ARF4 (Arabidopsis thaliana) |
| Glyma13g40310 | -3.18 | -3.83 | Auxin response factor 4, ARF4 (Arabidopsis thaliana) |
| Glyma16g02650 | 1.35 | - | Auxin response factor 7, ARF7 (Oryza sativa subsp. japonica) |
| Glyma07g15640 | -1.16 | -0.74 | Auxin response factor 19, ARF19 (Oryza sativa subsp. japonica) |
| Glyma13g07250 | -4.40 | -4.61 | 2-oxoglutarate-dependent dioxygenase, DAO (Oryza sativa subsp. japonica) |
| Glyma13g07280 | -1.38 | -1.38 | 2-oxoglutarate-dependent dioxygenase, DAO (Oryza sativa subsp. japonica) |
| Glyma16g07550 | -2.09 | -1.34 | Auxin-binding protein, ABP19a (Prunus persica) |
| Glyma15g19510 | 1.37 | 2.05 | Auxin-binding protein, ABP19a (Prunus persica) |
| Glyma07g04340 | 2.60 | 1.13 | Auxin-binding protein, ABP19a (Prunus persica) |
| Glyma06g37401 | 2.58 | -3.59 | Probable indole-3-acetic acid-amido synthetase GH3.5 (Glycine max) |
| Glyma02g13910 | - | 1.33 | Probable indole-3-acetic acid-amido synthetase, GH3.1 (Arabidopsis thaliana) |
| Glyma01g39780 | 1.13 | - | Probable indole-3-acetic acid-amido synthetase, GH3.1 (Arabidopsis thaliana) |
| Glyma09g20580 | - | -1.12 | Auxin efflux carrier component 3, PIN3 (Arabidopsis thaliana) |
| Glyma02g42290 | 0.83 | 2.17 | Auxin transporter-like protein 1, AUX1 (Medicago truncatula) |
| Glyma13g20641 | - | 1.89 | Auxin-responsive protein, SAUR32 (Arabidopsis thaliana) |
| Glyma13g20611 | - | 1.41 | Auxin-responsive protein, SAUR32 (Arabidopsis thaliana) |
| Glyma10g06370 | - | 1.10 | Auxin-responsive protein, SAUR32 (Arabidopsis thaliana) |
| Glyma16g02370 | 1.34 | - | Auxin-responsive protein, SAUR32 (Arabidopsis thaliana) |
| Glyma12g04000 | 1.40 | 1.06 | Auxin-responsive protein, SAUR40 (Arabidopsis thaliana) |
| Glyma08g47580 | - | 1.12 | Auxin-responsive protein, SAUR71 (Arabidopsis thaliana) |
| Glyma08g01350 | - | 1.26 | Auxin-responsive protein, SAUR71 (Arabidopsis thaliana) |
| Glyma13g22750 | -1.50 | - | Auxin-responsive protein, IAA11 (Arabidopsis thaliana) |
| Glyma03g32451 | - | 1.32 | Auxin-responsive protein, IAA13 (Arabidopsis thaliana) |
| Glyma20g35270 | -1.07 | - | Auxin-responsive protein, IAA14 (Arabidopsis thaliana) |
| Glyma04g07040 | - | -1.22 | Auxin-responsive protein IAA29-like (Glycine max) |
| Glyma13g20600 | - | 1.29 | Auxin-induced protein 6B (Glycine max) |
| Glyma09g35300 | - | 1.17 | Auxin-induced protein 10A5 (Glycine max) |
| Glyma20g35280 | -1.14 | - | Auxin-induced protein 22B, AUX22B (Vigna radiata var. radiata) |
| Glyma19g34370 | - | 1.31 | Auxin-induced protein 22E, AUX22E (Vigna radiata var. radiata) |
| Glyma02g16090 | - | 1.50 | Auxin-induced protein 22D, AUX22D (Vigna radiata var. radiata) |
| Glyma10g03710 | - | 1.19 | Auxin-induced protein 22D, AUX22D (Vigna radiata var. radiata) |
| Glyma06g11741 | -2.67 | -2.80 | Auxin-induced protein 5NG4-like protein (Glycine soja) |

**Table S8** Ethylene-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene ID | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma18g48741 | -1.02 | - | Ethylene-responsive transcription factor 1, ERF1 (Nicotiana tabacum ) |
| Glyma03g26520 | - | 1.18 | Ethylene-responsive transcription factor 1, ERF1 (Solanum lycopersicum) |
| Glyma10g04210 | - | 1.07 | Ethylene-responsive transcription factor 1B, ERF1B (Arabidopsis thaliana) |
| Glyma15g08370 | - | 1.29 | Ethylene-responsive transcription factor 4, ERF4 (Nicotiana sylvestris) |
| Glyma12g26836 | - | 1.21 | Ethylene-responsive transcription factor 9, ERF9 (Arabidopsis thaliana) |
| Glyma04g43040 | -1.04 | - | Ethylene-responsive transcription factor, ERF012 (Arabidopsis thaliana ) |
| Glyma03g31940 | - | 1.42 | Ethylene-responsive transcription factor 15, ERF15 (Arabidopsis thaliana) |
| Glyma09g08330 | - | 1.85 | Ethylene-responsive transcription factor, ERF017 (Arabidopsis thaliana) |
| Glyma13g17250 | - | 1.91 | Ethylene-responsive transcription factor, ERF017 (Arabidopsis thaliana) |
| Glyma17g05240 | - | 2.24 | Ethylene-responsive transcription factor, ERF017 (Arabidopsis thaliana) |
| Glyma15g19910 | - | 2.51 | Ethylene-responsive transcription factor, ERF017 (Arabidopsis thaliana) |
| Glyma05g03540 | - | 1.24 | Ethylene-responsive transcription factor, ERF026 (Arabidopsis thaliana) |
| Glyma09g36840 | - | 1.03 | Ethylene-responsive transcription factor, ERF042 (Arabidopsis thaliana) |
| Glyma01g43450 | - | 1.47 | Ethylene-responsive transcription factor, ERF061 (Arabidopsis thaliana) |
| Glyma13g18400 | - | 1.49 | Ethylene-responsive transcription factor, ERF098 (Arabidopsis thaliana) |
| Glyma07g33511 | - | 1.15 | Ethylene-responsive transcription factor, ERF109 (Arabidopsis thaliana) |
| Glyma16g27950 | - | 1.12 | Ethylene-responsive transcription factor, ERF110 (Arabidopsis thaliana) |
| Glyma20g30835 | - | 1.00 | Ethylene-responsive transcription factor, ERF110 (Arabidopsis thaliana) |
| Glyma02g07310 | - | 1.06 | Ethylene-responsive transcription factor, ERF114 (Arabidopsis thaliana) |
| Glyma13g01930 | - | 1.08 | Ethylene-responsive transcription factor, RAP2-4 (Arabidopsis thaliana) |
| Glyma08g15350 | 1.25 | - | Ethylene-responsive transcription factor, ABR1 (Arabidopsis thaliana ) |
| Glyma01g35010 | - | 1.34 | Ethylene-responsive transcription factor, TINY (Arabidopsis thaliana) |
| Glyma14g05355 | 1.69 | 2.12 | 1-aminocyclopropane-1-carboxylate oxidase, ACO1 (Prunus mume) |
| Glyma05g37410 | - | 1.02 | 1-aminocyclopropane-1-carboxylate synthase, ACS1 (Glycine max) |
| Glyma04g42460 | - | 1.21 | 1-aminocyclopropane-1-carboxylate oxidase 5, At1g77330 (Arabidopsis thaliana) |
| Glyma04g10270 | 1.26 | - | Serine/threonine-protein kinase, CTR1 (Arabidopsis thaliana) |
| Glyma06g10241 | -1.73 | -2.36 | Serine/threonine-protein kinase, CTR1 (Arabidopsis thaliana) |
| Glyma03g41220 | 1.05 | 1.15 | Protein EIN4 (Arabidopsis thaliana) |

**Table S9** Jasmonic acid-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene ID | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma06g37401 | 2.58 | -3.59 | Jasmonic acid-amido synthetase JAR1, GH3.5 (Oryza sativa subsp. japonica) |
| Glyma04g03740 | -1.06 | -1.13 | Allene oxide synthase 1, chloroplastic, AOS1 (Solanum lycopersicum) |
| Glyma17g05770 | - | 2.11 | 12-oxophytodienoate reductase 3, OPR3 (Solanum lycopersicum) |
| Glyma13g16950 | - | 1.60 | 12-oxophytodienoate reductase 3, OPR3 (Solanum lycopersicum) |
| Glyma07g04630 | - | 2.54 | Protein TIFY 10b, TIFY 10B (Oryza sativa subsp. indica) |
| Glyma11g04130 | - | 1.18 | Protein TIFY 10b, TIFY10B (Oryza sativa subsp. japonica) |
| Glyma12g35370 | - | 1.06 | Protein GRIM REAPER, GRI (Arabidopsis thaliana) |

**Table S10** Cytokinin-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene id | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma20g27190 | - | 1.24 | cytokinin metabolic process |
| Glyma06g24300 | -5.62 | -5.51 | cytokinin-activated signaling pathway GO:0009736 |
| Glyma07g16810 | - | 1.27 | response to cytokinin |
| Glyma10g42030 | 1.23 | 1.19 | response to cytokinin |
| Glyma10g40220 | -1.05 | - | cytokinin metabolic process |
| Glyma19g06751 | - | -1.04 | Two-component response regulator ORR21 |

**Table S11** Abscisic acid-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene id | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma15g40070 | - | 1.63 | 9-cis-epoxycarotenoid dioxygenase NCED1, chloroplastic (Phaseolus vulgaris) |
| Glyma04g37440 | -2.16 | -1.42 | HVA22-like protein e, HVA22E (Arabidopsis thaliana) |
| Glyma06g17610 | - | 1.13 | HVA22-like protein e, HVA22E (Arabidopsis thaliana) |
| Glyma01g12970 | -1.40 | -1.26 | Abscisic acid receptor PYL1, PYL1 (Arabidopsis thaliana); abscisic acid-activated signaling pathway |
| Glyma16g02910 | 0.89 | 0.79 | Abscisic acid receptor PYL9，PYL9 (Arabidopsis thaliana) |
| Glyma01g41260 | 1.22 | 0.92 | Serine/threonine-protein kinase SRK2A (Physcomitrella patens subsp. Patens) |
| Glyma05g09460 | -0.45 | - | Serine/threonine-protein kinase SAPK10-like (Glycine max) |
| Glyma06g47220 | 1.16 | 1.23 | ABSCISIC ACID-INSENSITIVE 5-like protein 2, DPBF3 (Arabidopsis thaliana); KO id：K14432, Plant hormone signal transduction, ABF |
| Glyma05g25200 | -1.41 | - | bZIP transcription factor bZIP9 isoform 2 (Glycine max); KO id：K14432, Plant hormone signal transduction, ABF |
| Glyma13g26470 | -3.09 | -2.57 | E3 ubiquitin-protein ligase KEG, KEG (Arabidopsis thaliana); negative regulation of abscisic acid-activated signaling pathway |
| Glyma16g24720 | -3.41 | -3.20 | Cytochrome P450 716B1, CYP716B1 (Picea sitchensis); abscisic acid 8'-hydroxylase 3-like (Glycine max) |
| Glyma06g17371 | -2.13 | -1.13 | Dual specificity protein phosphatase PHS1, PHS1 (Arabidopsis thaliana); response to abscisic acid |
| Glyma10g36140 | 1.46 | 1.31 | ABC transporter G family member 25, ABCG25 (Arabidopsis thaliana); response to abscisic acid; The ABCG25 and ABCG40 ABA-transporters catalyze ATP-dependent efflux of ABA from vascular tissues and uptake by target tissues, respectively. |
| Glyma20g31480 | - | 1.14 | ABC transporter G family member 25, ABCG25 (Arabidopsis thaliana); response to abscisic acid |
| Glyma19g38890 | 2.47 | 2.43 | Calcium-dependent protein kinase 1, CPK1 (Arabidopsis thaliana); abscisic acid-activated signaling pathway |
| Glyma20g31510 | 1.35 | - | Calcium-dependent protein kinase 4, CPK4 (Arabidopsis thaliana); abscisic acid-activated signaling pathway; Calcium-dependent-protein kinases (CPK’s) are a plant-specific family of kinases that are important sensors of calcium and are involved in ABA signaling. |
| Glyma09g04530 | 1.11 | 0.74 | Protein LlR18B, LLR18B (Lupinus luteus); abscisic acid-activated signaling pathway |

**Table S12** Gibberellin-related genes differentially expressed between two K efficiency types at normal K+ and low K+ conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Gene id | LK | CK | Annotation |
| (log2FC) | (log2FC) |
| Glyma13g33290 | - | 1.73 | Gibberellin 2-beta-dioxygenase 1, GA2OX1 (Pisum sativum); gibberellin catabolic process |
| Glyma15g10070 | -1.16 | - | Gibberellin 2-beta-dioxygenase, GA2OX1 (Phaseolus coccineus) |
| Glyma07g36450 | - | 1.90 | Gibberellin 2-beta-dioxygenase 2, GA2OX (Pisum sativum); gibberellin catabolic process |
| Glyma02g01330 | - | 1.33 | Gibberellin 2-beta-dioxygenase 2, GA2OX2 (Pisum sativum); gibberellin catabolic process |
| Glyma07g16810 | - | 1.27 | Probable glutathione S-transferase, HSP26-A (Glycine max); response to gibberellin |
| Glyma01g40820 | - | 1.56 | Beta-amyrin 11-oxidase, CYP88D6 (Glycyrrhiza uralensis); gibberellin biosynthetic process |
| Glyma15g15110 | 1.23 | 0.92 | DELLA protein RGL1-like (Glycine max) |
| Glyma06g19721 | -1.05 | - | Snakin-2, SN2 (Solanum tuberosum); Gibberellin regulated protein |
| Glyma14g09620 | -1.17 | - | Snakin-1, SN1 (Solanum tuberosum); Gibberellin regulated protein |
| Glyma17g37760 | -1.36 | - | Snakin-2, SN2 (Solanum tuberosum); Gibberellin regulated protein |