**Table S1** Fixed parameters of the mathematical model

| Category | Parameter | Value | Units | Source |
|---|---|---|---|---|
| Leaf thickness | $th_{max}$ | 0.084 | cm | This study |
| | $th_{min}$ | 0.026 | cm | This study |
| | $m_{th}$ | 592.0194 | $\mu$ mol m$^{-2}$ s$^{-1}$ | This study |
| Critical surface | $S_c$ | 22.445 | cm$^2$ | This study |
| Phloem tube length | $\ell_1$ | 8.999 | cm | This study |
| | $\ell_2$ | 0.321 | cm | This study |
| | $m_L$ | 0.192 | cm$^3$ | This study |
| Phloem tube number | $n_{max}$ | 7494.676 | dimension-less | This study |
| | $n_{min}$ | 13.028 | dimension-less | This study |
| | $a_n$ | 9677.612 | $(cm^3)^2$ | This study |
| | $u_n$ | 0 | cm$^3$ | This study |
| Phloem tube resistance | $\eta$ | 108.0 | g cm$^{-1}$ h$^{-1}$ | Minchin et al., 1993 |
| | $T$ | 295.0 | K | This study |
| | $R$ | $1.078 \cdot 10^{15}$ | g cm$^2$ h$^{-2}$ mol$^{-1}$ K$^{-1}$ | Gas constant |
| Water density | $d_p$ | 0.9250 | cm$^3$ H$_2$O cm$^{-3}$ plant | This study |

| | | | | |
|---|---|---|---|---|
| Soil volume | $V_{soil}$ | 0.135 | $\ell$ | This study |
| Phosphate uptake | $U_{max}S_{max}$ | 33.297 | $\mu g\ h^{-1}$ | This study |
| | $m_U$ | $1.479 \cdot 10^4$ | $\mu g\ l^{-1}$ | This study |
| | $m_{as}$ | 0.160 | $cm^3$ | This study |
| Respiration | $c_l^{su}$ | 0.035 | $\mu g$ sugar $\mu g^{-1}$ sugar loaded | Cannell & Thornley, 2000 |
| | $c_e$ | 0.053 | $\mu g$ sugar $\mu g^{-1}$ phosphate taken up | Cannell & Thornley, 2000 |