A

V

III

III

IV

V

B

II

II

I

III

C

D

E

F

I

G

II

II

I

H

I

J

K

L

M

N

O

Supplemental figure 1 (online only). Confocal micrographs from tobacco expressing ER-targeted GFP under the Arabidopsis *SUC2* promoter. Fluorescence from the GFP-specific channel, indicative for phloem loading or retrieval activity, is visualized green, autofluorescence from xylem and chlorophyll magenta. Source leaf showing promoter activity in all vein classes (A), as do mature cotyledons (B). One-day old, dark-germinated seedlings with GFP-specific fluorescence (arrows) in the future mid veins and the hypocotyls. Note unspecific fluorescence in the root (C). Embryo before germination with unspecific fluorescence from remnants of the seed coat (dart, D). First GFP-fluorescence indicative for phloem loading appears at the base of the cotyledons (E) and spreads acropetally in the mid vein (F). Functional maturation of the class II veins as indicated by GFP occurs basipetally (G). Hypocotyl region showing CCs in the future vascular strands as well as magenta chlorophyll and blue xylem autofluorescence (H). Stem cross section showing promoter activity in external and internal phloem (I). Sink/source transition leaf with GFP localized to the CCs of the mid vein (J). Longitudinal section from the petiole of a sink leaf showing GFP expression in the transport phloem (arrows). Chloroplasts and xylem show magenta and pale green autofluorescence, respectively (L). One day after anthesis, petals and styles show companion-specific fluorescence (K and M, respectively). Cross sections through roots reveal GFP-specific fluorescence in CCs marked by aniline blue staining of callose depositions in their neighbor cells (N, O). Scale: A-I, L: 200µm, J: 50µm, K, M-N: 25µm, O: 10µm.

Supplemental movies

Movie 1. Cortical ER-network in companion cells from AtSUC2-ER-GFP tobacco (3-D stack).

Movie 2. Time-lapse movie showing the dynamics of companion cell ER from AtSUC2-ER-GFP tobacco. Images were captured every 12 sec.

Movie 3. Time-lapse movie showing the dynamics of phloem parenchyma from wild type tobacco stained with $DiOC_6$. Images were captured every 5 sec.