**Analysis of cell wall composition by high-performance anion-exchange chromatography with pulsed amperometry detection**

Arabidopsis seedlings were lyophilized and ball-milled in a Retsch mixer mill. All samples were extracted three times with 70 % ethanol and three times with 1:1 (v:v) chloroform:methanol in the Retsch mill, washed with acetone and dried in a vacuum concentrator. Starch was removed from the resulting alcohol-insoluble residue (AIR) as described by Pettolino et al.  with minor modifications. Approximately 6 mg AIR were soaked with 100 μl 10 mM Tris-maleate buffer and incubated for 30 min at room temperature. Samples were boiled for 5 min to gelatinize starch granules. After equilibration to 40 °C, 100 μl of α-amylase solution containing 2 U α-amylase from porcine pancreas (Sigma-Aldrich, A3176) per mg AIR were added and samples incubated for 1 h. Another 50 μl of the same α-amylase solution was added and samples were incubated for 30 min at 40°C. To precipitate polysaccharides, 1 ml of cold absolute ethanol was added, and samples were incubated at -20°C overnight. After centrifugation for 5 min at 1500 g, de-starched AIR was washed three times with 0.5 ml of cold absolute ethanol and dried in a vacuum concentrator.

For analysis of the cell wall monosaccharide composition, 1–2 mg de-starched AIR was weighed in 2-mL tubes with screw caps and used for cell wall hydrolysis according to the ‘one-step two-step’ protocol described by Yeats et al. Briefly, neutral cell wall sugars and uronic acids from non-crystalline cell wall matrix polymers were hydrolyzed in 4% (w/v) sulfuric acid by autoclaving at 121°C for 60 min. A second set of samples was pretreated with 72 % (w/w) sulfuric acid for 1 h to induce cellulose swelling. Samples were than diluted to 4% (w/v) sulfuric acid and hydrolyzed as described above to obtain monosaccharides from matrix polymers and cellulose. After cooling to room temperature, all samples were centrifuged to remove any insoluble material and diluted 30-fold in ultrapure water while adding 50 μM ribose as an internal standard. Monosaccharide quantification was performed via high-performance anion-exchange chromatography with pulsed amperometric detection (HPAEC-PAD) using a biocompatible Knauer Azura HPLC system and an Antec Decade Elite SenCell detector heated to 40 °C. Monosaccharides were separated on a Thermo Fisher Dionex CarboPac PA20 BioLC analytical column (3 x 150 mm) equipped with a CarboPac PA20 BioLC guard column (3 x 30 mm) in a solvent gradient of (A) water, (B) 10 mM NaOH and (C) 700 mM NaOH at 0.4 mL/min flow rate. The gradient program was as follows (solvent % in A): 0 to 25 min: 20 % B; 25 to 28 min: 20 % to 0 % B, 0 % to 70 % C; 28 to 33 min: 70 % C; 33 to 35 min: 70 % to 100 % C; 35 to 38 min: 100 % C; 38 to 42 min: 0 % to 20 % B, 100 % to 0 % C; 42 to 60 min: 20 % B. To calculate cellulose amounts, glucose quantified in matrix polymer hydrolysates was subtracted from glucose in matrix + cellulose hydrolysates as detailed in Yeats et al.

**Analysis of pectin methyl-esterefication**

The degree of pectin methyl-esterification was analyzed as described by Lionetti et al. with minor modifications. One mg destarched AIR was saponified in 0.2 ml 250 mM NaOH for 1 h at room temperature and neutralized with 1 M HCl. After centrifugation for 2 minutes at 16000 g, the supernatant was diluted 1:10 with ultrapure water to 50 μl and incubated with an equal volume of 0.1 M sodium phosphate buffer (pH 7.5) containing 0.03 units alcohol oxidase from *Pichia pastoris* (Sigma-Aldrich, A2404) for 15 minutes at room temperature with shaking. After addition of 100 μl 0.02 M 2,4-pentanedione in 2 M ammonium acetate and 0.5 M acetic acid, samples were incubated at 68 °C for 10 min, briefly cooled on ice and then transferred to 96-well microtiter plates. Absorbance was measured at 412 nm in a Tecan infinite 200Pro microplate reader and calibrated against a 0–350 μM formaldehyde standard curve. All samples and standards were measured in technical duplicates. The degree of pectin methyl-esterification was calculated as the molar ratio of methanol to uronic acid determined via HPAEC-PAD analysis.