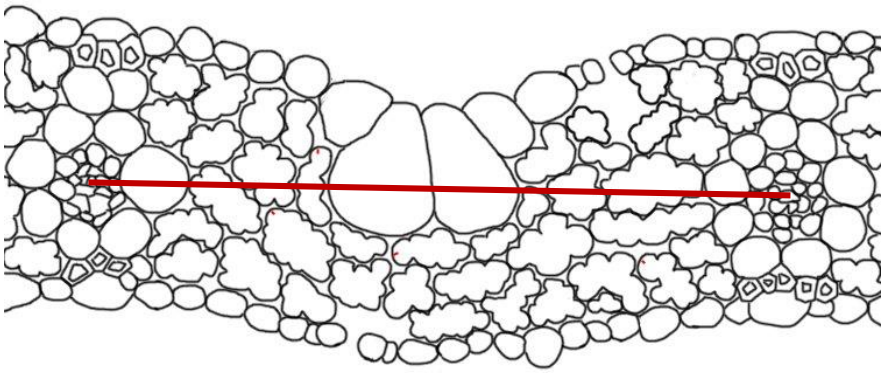
A



B

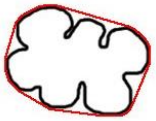
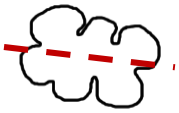
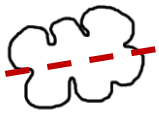
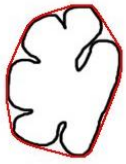
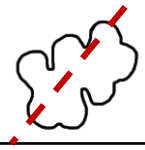
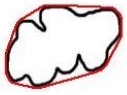
| Cell perimeter | Convex hull perimeter | Lobing (cell perimeter/ convex hull perimeter) | Longest axis (Feret's diameter) | Feret Angle | Adjusted if FeretAngle > 90 | Final angle |
|---|---|---|---|---|---|---|
|  |  | 1.33 |  | 172° |  | 8° |
|  |  | 1.25 |  | 84° |  | 84° |
|  |  | 1.33 |  | 128° |  | 52° |
|  |  | 1.28 |  | 24° |  | 24° |

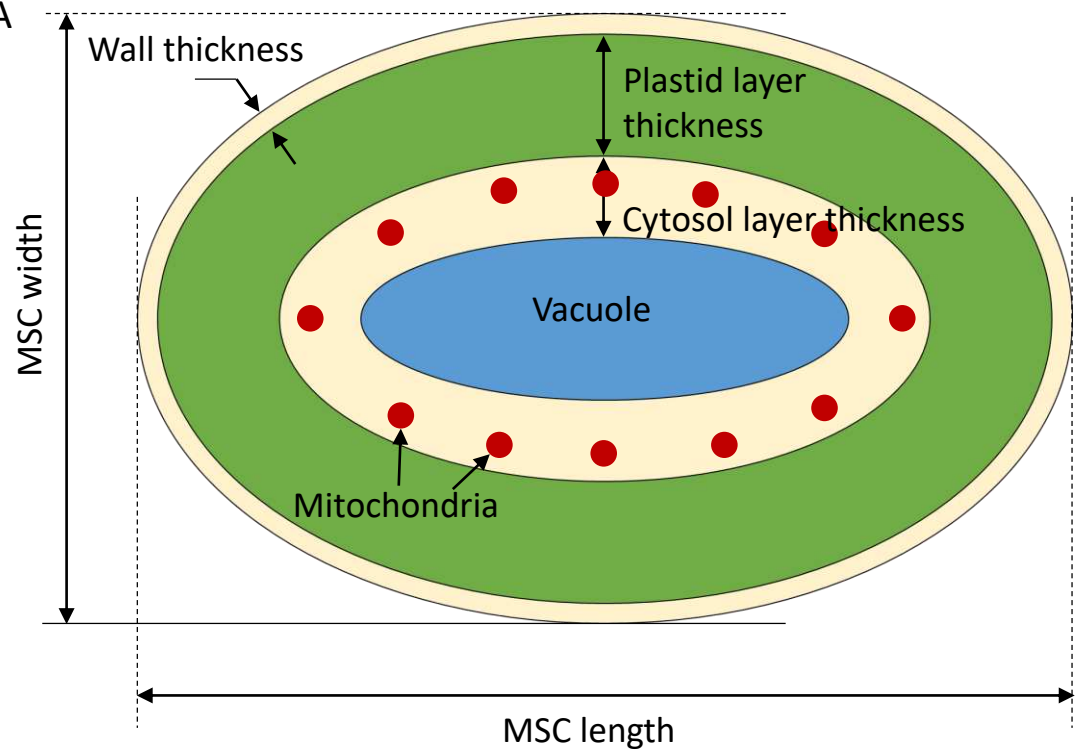
**Figure S1: Measurement of mesophyll cell lobing and orientation**

**A)** A line was drawn between the two minor veins in each image. The angle of this line was measured and considered horizontal or 0°.

**B)** Cell perimeter and convex hull perimeter were measured in ImageJ. Lobing is calculated as cell perimeter/convex hull perimeter.

The FeretAngle measurement (0-180 degrees) is the angle between the Feret's diameter and a line parallel to the x-axis of the image. The horizontal angle was subtracted from this angle so that a cell angle of 0° is parallel to the line between the minor veins. If the FeretAngle is >180°, the angle was adjusted (180-FeretAngle) so that all angles were between 0 and 90° for ease of comparison. A cell with an angle of 90°is aligned with its longest axis vertical (or perpendicular to the line between the minor veins).

A




B

| Layer No. | Parameter | Value |
|---|---|---|
| Small cells | MSC width | 15 um |
| | MSC length | 23 um |
| | Wall thickness | 0.5 um |
| | Plastid layer thickness | 3 um |
| | Cytosol layer thickness | 2.5 um |
| | Distance between mitochondria | 1 |
| | Mitochondria radius | 0.2 |
| Large cells | MSC width | 19 um |
| | MSC length | 37 um |
| | Wall thickness | 0.5 um |
| | Plastid layer thickness | 3.14 um |
| | Cytosol layer thickness | 2.23 um |
| | Distance between mitochondria | 1 |
| | Mitochondria radius | 0.2 |

**Figure S2: Measurements of large and small cells used in leaf tissue models**
**A)** Detailed representation of each cell in the leaf tissue model. **B)** Different parameter measurements used for small and large cells in leaf tissue models

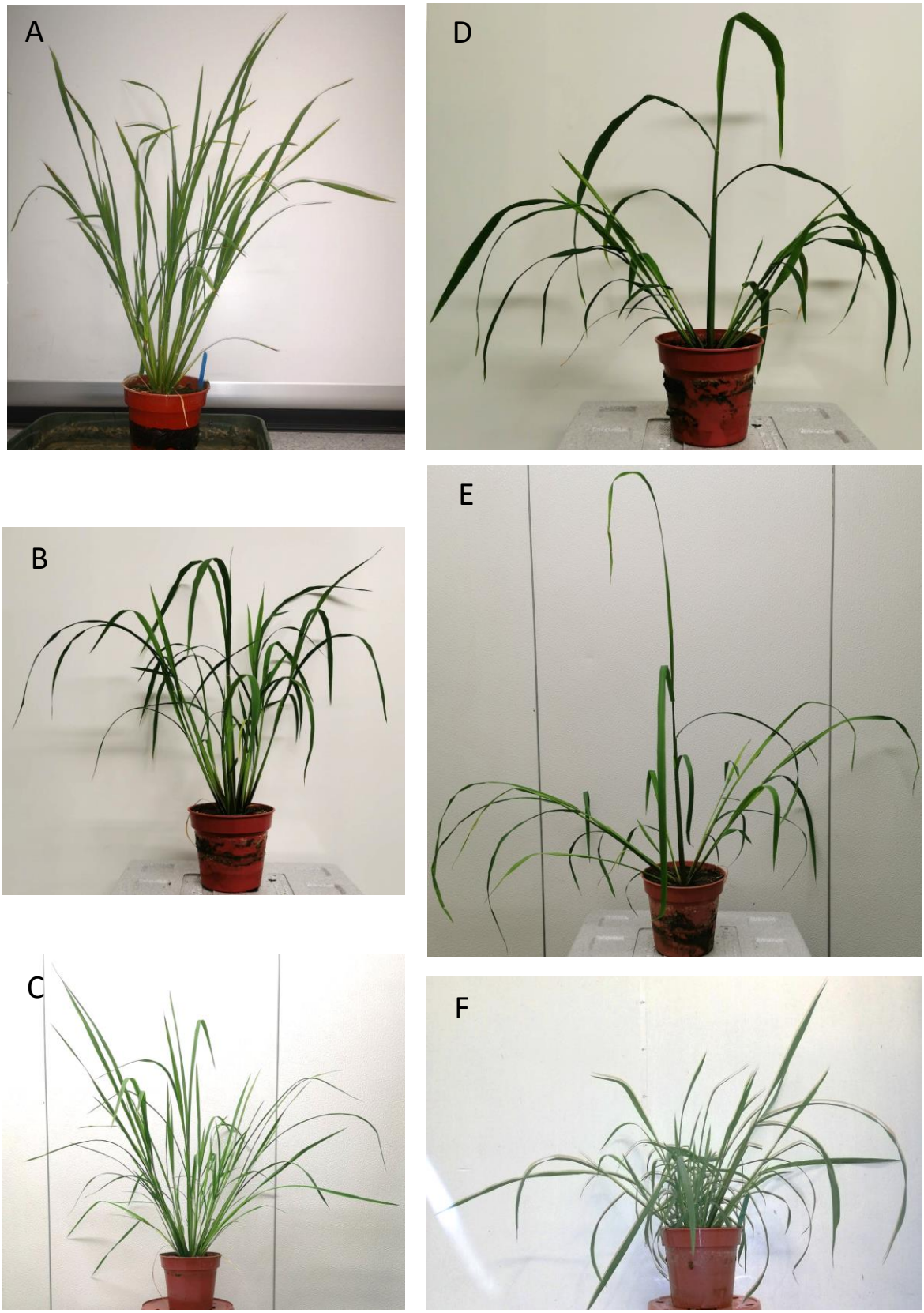



**Figure S3: Six different varieties of rice used in Figures 2-6 and Supplementary Figure 4 show a range of plant structure and size**

Plants pictured at 35 days old.

A) *Oryza sativa* (MR220), B) *Oryza sativa* (MRQ76), C) *Oryza sativa* (Malinja), D) *Oryza latifolia*, E) *Oryza punctata*, F) *Oryza meridionalis*

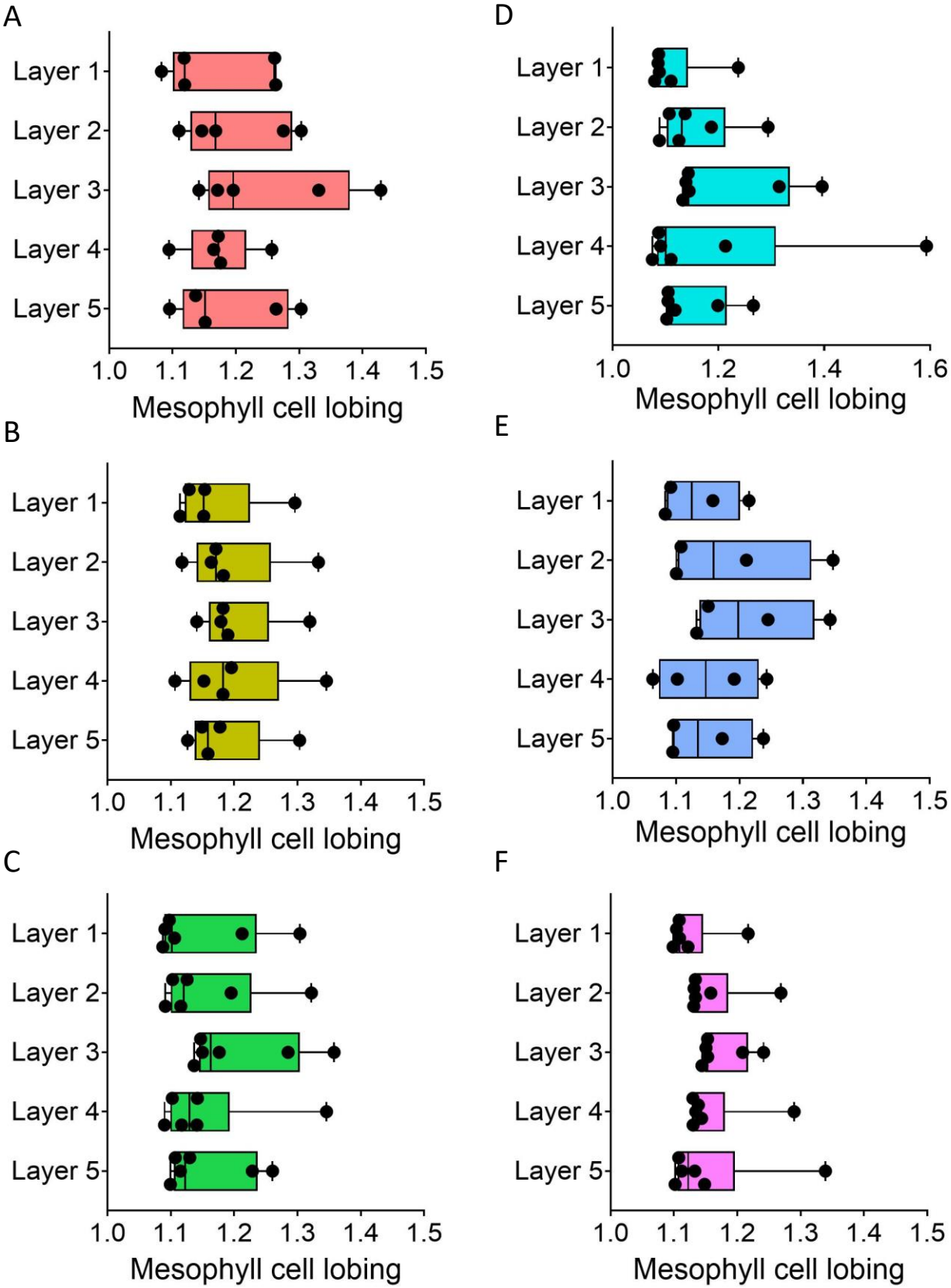



**Figure S4: Layer 1 mesophyll cells always have the lowest lobing value across a range of varieties** Mesophyll cell lobing from the middle of leaf 6 of 6 rice varieties – **A)** *O.s ativa* MR220, **B)** *O. sativa* MRQ76, **C)** *O. sativa* Malinja, **D)** *O. latifolia*, **E)** *O. punctata*, **F)** *O. meridionalis*. Note the different x axis scale in panel D. Whiskers show min-max, average line represents the mean. Cell lobing does not significantly vary across the abaxial/adaxial gradient. One way ANOVA, $p > 0.05$, n= 4-6.