

**Supplementary Table S1 45 spectral absorption features and wavelength position variables
acquired from leaf spectral reflectance**

Number	Parameter	Explanations
1	VIS- λ_1	starting wavelength(nm) of visible band;
2	VIS- λ_2	ending wavelength(nm) of visible band;
3	VIS- λ_p	the absorption position (P) marks the wavelength at the deepest absorption in the region of visible wavelength, λ_p is the corresponding wavelength;
4	VIS-DEP	the absorption depth (DEP) is the depth of the feature minimum relative to the hull in the region of visible wavelength;
5	VIS-Area	the absorption area (Area) is the area of the absorption feature that is the product of DEP and WID in the region of visible wavelength. The width of absorption (WID) is full wavelength width at half DEP (nm);
6	VIS-symmetry	the symmetry of an absorption feature is derived as the ratio of the area left of the absorption center to the area right in the region of visible wavelength;
7	VIS-cslope	the slope of L in Figure 1 in the region of visible wavelength;
8	VIS-fwhm- X_1	wavelength of left shoulder at the position of the full width half maximum in the region of visible wavelength;
9	VIS-fwhm- X_2	wavelength of right shoulder at the position of the full width half maximum in the region of visible wavelength;
10	VIS-fwhm-Y	the corresponding reflectance of X_1 and X_2 in the region of visible wavelength;
11	VIS-fwhm- $\Delta \lambda$	The width (W) defines the full width half maximum. $\Delta \lambda$ which represent the value of W is calculated by X_2-X_1 ;
12	VIS-SAI	spectrum absorption index in the region of visible wavelength;
13	SW1- λ_1	starting wavelength(nm) of short wavelength 1230nm - 1650nm;
14	SW1- λ_2	ending wavelength(nm) of short wavelength 1230nm - 1650nm;
15	SW1- λ_p	the absorption position (P) marks the wavelength at the deepest absorption in the region of short wavelength 1230nm - 1650nm;
16	SW1-DEP	the absorption depth (DEP) is the depth of the feature minimum relative to the hull in the region of short wavelength 1230nm - 1650nm;
17	SW1-Area	the absorption area (Area) is the area of the absorption feature that is the product of DEP and WID in the region of short wavelength 1230nm - 1650nm;
18	SW1-symmetry	the symmetry of an absorption feature is derived as the ratio of the area left of the absorption center to the area right in the region of short wavelength 1230nm - 1650nm;
19	SW1-cslope	the slope of L in Figure 1 in the region of short wavelength 1230nm - 1650nm;
20	SW1-fwhm- X_1	wavelength of left shoulder at the position of the full width half maximum in the region of short wavelength 1230nm - 1650nm;
21	SW1-fwhm- X_2	wavelength of right shoulder at the position of the full width half

22	SW1-fwhm- $\Delta \lambda$	maximum in the region of short wavelength 1230nm - 1650nm; the width (W) defines the full width half maximum. $\Delta \lambda$ which represent the value of W is calculated by X_2-X_1 ;
23	SW1-fwhm- P	the absorption position (P) marks the wavelength at the deepest absorption in the region of short wavelength 1230nm - 1650nm;
24	SW1-SAI	spectrum absorption index in the region of short wavelength 1230nm - 1650nm;
25	SW2- λ_1	starting wavelength (nm) of short wavelength 1800nm-2200nm;
26	SW2- λ_2	ending wavelength(nm) of short wavelength 1800nm-2200nm;
27	SW2- λ_P	the absorption position (P) marks the wavelength at the deepest absorption in the region of short wavelength 1800nm-2200nm;
28	SW2-DEP	the absorption depth (DEP) is the depth of the feature minimum relative to the hull in the region of short wavelength 1800nm-2200nm;
29	SW2-Area	the absorption area (Area) is the area of the absorption feature that is the product of DEP and WID in the region of short wavelength 1800nm-2200nm;
30	SW2-symmetry	the symmetry of an absorption feature is derived as the ratio of the area left of the absorption center to the area right in the region of short wavelength 1800nm-2200nm;
31	SW2-cslope	the slope of L in Figure 1 in the region of short wavelength 1800nm- 2200nm;
32	SW2-fwhm- X_1	wavelength of left shoulder at the position of the full width half maximum in the region of short wavelength 1800nm-2200nm;
33	SW2-fwhm- X_2	wavelength of right shoulder at the position of the full width half maximum in the region of short wavelength 1800nm-2200nm;
34	SW2-fwhm-Y	the corresponding reflectance of X_1 and X_2 in the region of short wavelength 1800 nm-2200nm;
35	SW2-fwhm- $\Delta \lambda$	the width (W) defines the full width half maximum. $\Delta \lambda$ which represent the value of W is calculated by X_2-X_1 ;
36	SW2-SAI	spectrum absorption index in the region of short wavelength 1800 nm- 2200nm;
37	R_0	the minimum spectral reflectance of the green edge;
38	C	Gaussian fitting parameters for spectral reflectance in the green band;
39	λ_g	the corresponding wavelength of green peak reflectance;
40	F_C	spectral half-width coefficient from 500nm to λ_0 ;
41	R_s	the maximum or “shoulder” spectral reflectance when the IG model represents the red edge;
42	R_{02}	the minimum spectral reflectance of the red edge;
43	λ_0	the corresponding wavelength of the minimum spectral reflectance when the IG model represents the red edge;
44	σ	Gaussian function standard deviation coefficient;
45	Rep	Red edge position;