Suplementary material

Table S1. Flooding effects on chlorophyll fluorescecnce traits

		Fv/Fm		Fq'/Fm'		rETR		NPQ		qP		qN		qL		ϕno		ϕnpq	
At the beginning	Day 0	0.81 ± 0.01		0.50 ± 0.03		5495.93 ± 452.56		0.76 ± 0.22		0.70 ± 0.02		0.46 ± 0.08		0.42 ± 0.01		0.29 ± 0.02		0.208 0.04853 8644	
		Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples
Treatment 1	After 1st flood	0.80 ± 0.01	0.79 ± 0.01	0.55 ± 0.03	0.46 ± 0.06	5915.30 ± 160.94	4913.83 ± 815.23	0.38 ± 0.07	0.87 ± 0.36	0.74 ± 0.02	0.67 ± 0.06	0.31 ± 0.04	0.47 ± 0.10	0.43 ± 0.001	0.41 ± 0.04	0.33 ± 0.003	0.30 ± 0.02	0.12 ± 0.02	0.24 ± 0.08
	At the end (recovery)	0.69 ± 0.02	0.70 ± 0.05	0.31 ± 0.01	0.32 ± 0.03	3222.93 ± 70.62	3556.73 ± 252.89	1.69 ± 0.05	1.42 ± 0.12 *	0.64 ± 0.03	0.63 ± 0.03	0.72 ± 0.01	0.68 ± 0.02 *	0.51 ± 0.04	0.48 ± 0.06	0.26 ± 0.01	0.29 ± 0.02	0.43 ± 0.01	0.39 ± 0.02 *
Treatment 2	Before 2nd flood (recovery)	0.78 ± 0.01	0.78 ± 0.01	0.42 ± 0.05	0.47 ± 0.03	4455.10 ± 338.41	5323.10 ± 200.84 *	1.07 ± 0.19	0.70 ± 0.13 *	0.64 ± 0.04	0.69 ± 0.02	0.57 ± 0.05	0.45 ± 0.05	0.41 ± 0.02	0.43 ± 0.01	0.29 ± 0.004	0.32 ± 0.004 **	0.29 ± 0.05	0.21 ± 0.03
	After 2nd flood	0.75 ± 0.003	0.72 ± 0.03	0.34 ± 0.04	0.38 ± 0.05	3575.47 ± 423.07	4256.17 ± 466.12	1.55 ± 0.28	1.12 ± 0.23	0.60 ± 0.04	0.69 ± 0.03	0.68 ± 0.06	0.60 ± 0.06	0.43 ± 0.03	0.51 ± 0.04	0.27 ± 0.02	0.30 ± 0.01 *	0.40 ± 0.06	0.32 ± 0.06
	At the end (recovery)	0.69 ± 0.02	0.69 ± 0.01	0.31 ± 0.01	0.33 ± 0.01	3222.93 ± 70.62	3586.03 ± 186.95 *	1.69 ± 0.05	1.31 ± 0.12 **	0.64 ± 0.03	0.64 ± 0.03	0.72 ± 0.01	0.66 ± 0.03 *	0.51 ± 0.04	0.49 ± 0.05	0.26 ± 0.01	0.30 ± 0.01 *	0.29 ± 0.05	0.37 ± 0.02 *
Treatment 3	After flood	0.75 ± 0.003	0.74 ± 0.01	0.34 ± 0.04	0.43 ± 0.05	3575.47 ± 423.07	4507.00 ± 535.69	1.55 ± 0.28	0.95 ± 0.29	0.60 ± 0.04	0.70 ± 0.03 *	0.68 ± 0.06	0.54 ± 0.09	0.43 ± 0.03	0.50 ± 0.02 *	0.27 ± 0.02	0.30 ± 0.02	0.40 ± 0.06	0.27 ± 0.06
	At the end (recovery)	0.69 ± 0.02	0.69 ± 0.02	0.31 ± 0.01	0.35 ± 0.04	3222.93 ± 70.62	3900.57 ± 333.31 *	1.69 ± 0.05	1.19 ± 0.22 *	0.64 ± 0.03	0.68 ± 0.01	0.72 ± 0.01	0.63 ± 0.05	0.51 ± 0.04	0.54 ± 0.02	0.26 ± 0.01	0.30 ± 0.02 *	0.29 ± 0.05	0.35 ± 0.05

* $p < 0.05$; ** $p < 0.01$

Table S2. Flooding effects on multispectral traits

		Red		**Green**		**Blue**		**Hue**		**Saturation**		**Value**	
At the beginning	Day 0	2967.00 ± 129.19		4431.33 ± 164.97		2439.33 ± 137.73		105.63 ± 1.32		0.45 ± 0.01		0.067 ± 0.003	
		Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples
Treatment 1	After 1st flood	2763.00 ± 206.37	3059.33 ± 74.10	4112.67 ± 331.63	4358.00 ± 165.64	2336.67 ± 62.07	2496.67 ± 47.90 *	107.87 ± 3.67	106.90 ± 2.19	0.44 ± 0.03	0.43 ± 0.03	0.063 ± 0.005	0.067 ± 0.002
	At the end (recovery)	3787.00 ± 262.81	3960.33 ± 512.16	4471.67 ± 263.04	4967.33 ± 488.58	3115.67 ± 100.86	3305.00 ± 224.85	101.90 ± 5.51	103.83 ± 8.26	0.35 ± 0.03	0.35 ± 0.03	0.071 ± 0.005	0.076 ± 0.008
Treatment 2	Before 2nd flood (recovery)	3038.00 ± 230.44	3251.33 ± 424.86	4357.67 ± 331.80	4525.00 ± 448.85	2665.33 ± 151.37	2895.67 ± 343.58	112.80 ± 5.89	111.43 ± 1.19	0.41 ± 0.04	0.39 ± 0.02	0.067 ± 0.005	0.069 ± 0.007
	After 2nd flood	3175.33 ± 114.82	3579.33 ± 274.86	4349.67 ± 219.48	4349.67 ± 241.79	2717.33 ± 220.36	3016.00 ± 194.19	109.07 ± 3.74	101.27 ± 11.40	0.40 ± 0.02	0.34 ± 0.04	0.067 ± 0.003	0.068 ± 0.004
	At the end (recovery)	3787.00 ± 262.81	3991.33 ± 142.70	4471.67 ± 263.04	4769.33 ± 224.48	3115.67 ± 100.86	3254.67 ± 152.66	101.90 ± 5.51	97.37 ± 3.51	0.35 ± 0.03	0.35 ± 0.01	0.071 ± 0.005	0.074 ± 0.003
Treatment 3	After flood	3175.33 ± 114.82	3205. 00 ± 260.58	4349.67 ± 219.48	4150.67 ± 292.67	2717.33 ± 220.36	2800.67 ± 144.58	109.07 ± 3.74	108.07 ± 0.47	0.40 ± 0.02	0.35 ± 0.01	0.067 ± 0.003	0.064 ± 0.005
	At the end (recovery)	3787.00 ± 262.81	3757.33 ± 162.85	4471.67 ± 263.04	4253.67 ± 111.79	3115.67 ± 100.86	3131.67 ± 39.27	101.90 ± 5.51	98.17 ± 6.94	0.35 ± 0.03	0.31 ± 0.02	0.071 ± 0.005	0.068 ± 0.003

Table S3. Flooding effects on multispectral traits

		SpcGrn		FarRed		Nir		ChlIdx		AriIdx	
At the beginning	Day 0	4922.33 ± 175.90		7046.33 ± 176.79		19529.33 ± 264.45		1.79 ± 0.07		1.25 ± 0.10	
		Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples
Treatment 1	After 1st flood	4571.00 ± 372.95	4788.67 ± 193.33	6781.00 ± 387.93	6986.66 ± 236.14	19876.00 ± 328.656	19429.33 ± 560.26	1.96 ± 0.22	1.83 ± 0.01	1.51 ± 0.24	1.38 ± 0.03
	At the end (recovery)	4739.67 ± 286.43	5297.67 ± 467.07	8089.67 ± 512.50	8335.33 ± 751.73	18658.00 ± 759.95	19417.33 ± 618.01	1.45 ± 0.10	1.42 ± 0.17	1.65 ± 0.15	1.45 ± 0.11
Treatment 2	Before 2nd flood (recovery)	4794.33 ± 357.78	4958.00 ± 463.03	6969.00 ± 523.09	7427.67 ± 517.50	19949.33 ± 325.38	20277.67 ± 55.05	1.92 ± 0.18	1.78 ± 0.19	1.38 ± 0.10	1.43 ± 0.24
	After 2nd flood	4724.67 ± 249.24	4632.00 ± 235.65	7258.33 ± 142.11	8116.00 ± 634.05	19684.67 ± 26.39	19281.33 ± 385.16	1.79 ± 0.09	1.44 ± 0.18 *	1.53 ± 0.22	1.86 ± 0.05
	At the end (recovery)	4739.67 ± 286.43	5063.33 ± 246.46	8089.67 ± 512.50	8436.00 ± 69.42	18658.00 ± 759.95	18571.67 ± 165.18	1.45 ± 0.10	1.28 ± 0.01	1.65 ± 0.15	1.55 ± 0.17
Treatment 3	After flood	4724.67 ± 249.24	4466.00 ± 297.07	7258.33 ± 142.11	7370.67 ± 247.95	19684.67 ± 26.39	19600.67 ± 429.82	1.79 ± 0.09	1.74 ± 0.12	1.53 ± 0.22	1.82 ± 0.28
	At the end (recovery)	4739.67 ± 286.43	4491.00 ± 120.93	8089.67 ± 512.50	8518.67 ± 276.15	18658.00 ± 759.95	19237.00 ± 251.48	1.45 ± 0.10	1.37 ± 0.03	1.65 ± 0.15	2.08 ± 0.10 *

Table S4. List of analyzed traits with abbreviations. indication if it is measured or calculated trait. wavelength for measurement or equation for calculation. device and softvare. and the reference if appropriate.

Trait	Abbreviation	Trait group	Measured or calculated	Wavelength/equation	Device and softvare	Reference
Minimum Fluorescence of Dark-adapted Leaves	F_0	Chlorophyll fluorescecnce traits (CFT)	measured	see description in Material nd Methods section	CropReporter. DA	
Maximum Fluorescence of Dark-adapted Leaves	F_m		measured	see description in Material nd Methods section	CropReporter. DA	
Steady-state Fluorescence Yield	$F_{s'}$		measured	see description in Material nd Methods section	CropReporter. DA	
Maximum Chlorophyll Fluorescence of Light-adapted Leaves	$F_{m'}$		measured	see description in Material nd Methods section	CropReporter. DA	
Minimum fluorescence yield of illuminated plant	$F_{o'}$		estimated	see description in Material nd Methods section	CropReporter. DA	
Maximum Efficiency of Photosystem Two	F_v/F_m		calculated	Fv/Fm = (Fm-F0)/Fm	CropReporter. DA	Kitajima and Butler. 1975
Effective Quantum Yield of Photosystem Two	$F_{q'}/F_{m'}$		calculated	Fq'/Fm' = (Fm' - Fs')/Fm'	CropReporter. DA	Genty et al.. 1989
Electron Transport Rate	ETR		calculated	ETR = Fq'/Fm'×PPFD×(0.5)	CropReporter. DA	Genty et al.. 1989
Non-Photochemical Quenching	NPQ		calculated	$NPQ = (F_m - F_{m'})/F_{m'}$	CropReporter. DA	Bilger and Björkman. 1990
Coefficient of photochemical quenching	qP		calculated	qP = (Fm′ – Fs)/Fv	CropReporter. DA	Schreiber et al.. 1986
Coefficient of non-photochemical quenching	qN		calculated	qN = 1 – (Fm′ – Fo′)/(Fm – Fo).	CropReporter. DA	Schreiber et al.. 1986
Estimation of 'open' reaction centers on basis of a lake model	qL		calculated	qL = ((Fm' - Fs') × Fo')) /((Fm' - Fo') × Fs'))	CropReporter. DA	Kramer et al.. 2004
Quantum yield of non-regulated non-photochemical energy loss in PSII	ϕnq		calculated	ϕnq = 1/(NPQ + 1 + qL(Fm/Fo – 1))	CropReporter. DA	Genty et al.. 1996
Quantum yield of regulated non-photochemical energy loss in PSII	ϕnpq		calculated	ϕnpq = 1 - ϕpsII – 1/(NPQ + 1 + qL(Fm/Fo – 1))	CropReporter. DA	Genty et al.. 1996
Reflectance in Red	R_{Red}	Multispectral traits (MST)	measured	640nm	CropReporter. DA	
Reflectance in Green	R_{Green}		measured	550nm	CropReporter. DA	
Reflectance in Blue	R_{Blue}		measured	475nm	CropReporter. DA	
Reflectance in Specific green	$R_{SpcGreen}$		measured	510-590nm	CropReporter. DA	
Reflectance in Far Red	R_{FarRed}		measured	710nm	CropReporter. DA	
Reflecatnce in Near Infra Red	R_{NIR}		measured	769nm	CropReporter. DA	
Reflectance Specific to Chlorophyll	R_{Chl}		measured	730nm	CropReporter. DA	
Reflectance Specific to Anthocyanins	R_{Anth}		measured	550nm	CropReporter. DA	

Hue (0-360°)	HUE		calculated	HUE = 60 × (0 + (R_{Green} - R_{Blue}) / (max-min)). if max = R_{Red}; HUE = 60 × (2 + (R_{Blue} - R_{Red}) / (max-min)). if max = R_{Green}; HUE = 60 × (4 + (R_{Red} - R_{Green}) / (max-min)) if max = R_{Blue}; 360 was added in case HUE<0	CropReporter. DA	
Saturation (0-1)	SAT		calculated	SAT = (max – min) / (max + min) if VAL > 0.5. or SAT = (max – min) / (2.0 – max – min) if VAL < 0.5. where max and min are selected from the R_{Red}. RG_{reen}. R_{Blue}	CropReporter. DA	
Value (0-1)	VAL		calculated	VAL = (max + min) / 2; where max and min are selected from the R_{Red}. R_{Green}. R_{Blue}	CropReporter. DA	
Anthocyanin index	ARI		calculated	ARI = $(R_{550})^{-1}$ - $(R_{700})^{-1}$	CropReporter. DA	Gitelson et al.. 2001
Chlorophyll index	CHI		calculated	CHI = $(R_{700})^{-1}$ – $(R_{769})^{-1}$	CropReporter. DA	Gitelson et al.. 2003

Table S5. Flooding effects on elements and mineral composition

		mg NO3/kg		% N		% P		%K		%Ca		% Mg		mg Fe/kg DW		mg Zn/kg DW		mg Mn/kg DW		mg Cu/kg DW	
At the beginning	Day 0	221.08 ± 160.23		2.21 ± 0.22		0.32 ± 0.01		2.99 ± 0.24		319.61 ± 39.56		46.70 ± 3.72		17.89 ± 7.30		24.68 ± 1.83		72.13 ± 6.24		3.04 ± 0.51	
		Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples	Control	Flooded samples
Treatment 1	After 1st flood	139.16 ± 69.27	111.63 ± 77.08	2.15 ± 0.41	1.99 ± 0.20	0.35 ± 0.04	0.23 ± 0.02 **	3.01 ± 0.17	2.19 ± 0.07 **	240. 15 ± 20.01	233.03 ± 36.52	40.00 ± 3.5	32.80 ± 5.30	72.09 ± 20.69	63.46 ± 9.72	22.22 ± 2.38	15.43 ± 4.23 *	57.34 ± 2.23	56.34 ± 14.74	2.69 ± 0.15	2.04 ± 0.31*
	At the end (recovery)	188.69 ± 204.14	64.32 ± 7.07	0.94 ± 0.05	0.97 ± 0.08	0.20 ± 0.02	0.21 ± 0.04	2.55 ± 0.13	1.96 ± 0.42	142.27 ± 16.83	165.12 ± 14.42	19.90 ± 1.81	19.50 ± 2.36	36.13 ± 3.25	39.01 ± 6.55	15.41 ± 1.32	13.07 ± 2.06	27.70 ± 1.12	38.01 ± 3.84	3.64 ± 1.15	6.98 ± 8.76
Treatment 2	Before 2nd flood (recovery)	284.70 ± 76.67	214.84 ± 16.36	1.64 ± 0.24	1.34 ± 0.09	0.28 ± 0.02	0.25 ± 0.04	2.98 ± 0.24	2.05 ± 0.24	217.42 ± 22.07	204.85 ± 22.38	35.97 ± 2.66	28.09 ± 2.80 *	44.64 ± 4.41	45.21 ± 8.92	19.25 ± 0.82	15.49 ± 2.51	41.67 ± 4.73	51.41 ± 7.29	2.28 ± 0.06	1.96 ± 0.14 *
	After 2nd flood	68.53 ± 14.01	154.85 ± 123.03	1.34 ± 0.13	1.11 ± 0.07	0.23 ± 0.02	0.28 ± 0.07	2.68 ± 0.07	1.60 ± 0.14 **	185.63 ± 11.92	174.19 ± 11.89	27.3 ± 3.10	18.90 ± 0.40	43.41 ± 2.12	33.44 ± 3.54	15.23 ± 2.37	12.08 ± 1.19	38.44 ± 2.88	38.93 ± 3.54	2.02 ± 0.23	1.89 ± 0.20
	At the end (recovery)	188.69 ± 204.14	74.49 ± 29.75	0.94 ± 0.05	0.94 ± 0.02	0.20 ± 0.02	0.19 ± 0.03	2.55 ± 0.13	1.73 ± 0.32	142.27 ± 16.83	174.71 ± 6.10*	19.90 ± 1.81	19.10 ± 0.91	36.13 ± 3.25	34.89 ± 2.66	15.41 ± 1.32	11.68 ± 0.99 *	27.70 ± 1.12	37.27 ± 4.28	3.64 ± 1.15	2.04 ± 0.39
Treatment 3	After flood	68.53 ± 14.01	69.86 ± 12.10	1.34 ± 0.13	1.22 ± 0.05	0.23 ± 0.02	0.24 ± 0.00	2.68 ± 0.07	1.85 ± 0.11 * *	185.63 ± 11.92	179.85 ± 9.07	27.3 ± 3.10	22.40 ± 1.70	43.41 ± 2.12	40.81 ± 3.38	15.23 ± 2.37	13.97 ± 2.69	27.70 ± 1.12	38.09 ± 3.72	2.02 ± 0.23	1.97 ± 0.06
	At the end (recovery)	188.69 ± 204.14	246.38 ± 336.35	0.94 ± 0.05	0.86 ± 0.05	0.20 ± 0.02	0.18 ± 0.02	2.55 ± 0.13	1.64 ± 0.11	142.27 ± 16.83	143.19 ± 27.29	19.90 ± 1.81	19.20 ± 3.03	36.13 ± 3.25	30.33 ± 3.71	15.41 ± 1.32	11.57 ± 1.11 *	27.70 ± 1.12	35.64 ± 5.90	3.64 ± 1.15	1.48 ± 0.10

* $p < 0.05$. ** $p < 0.01$