Supplementary Materials:

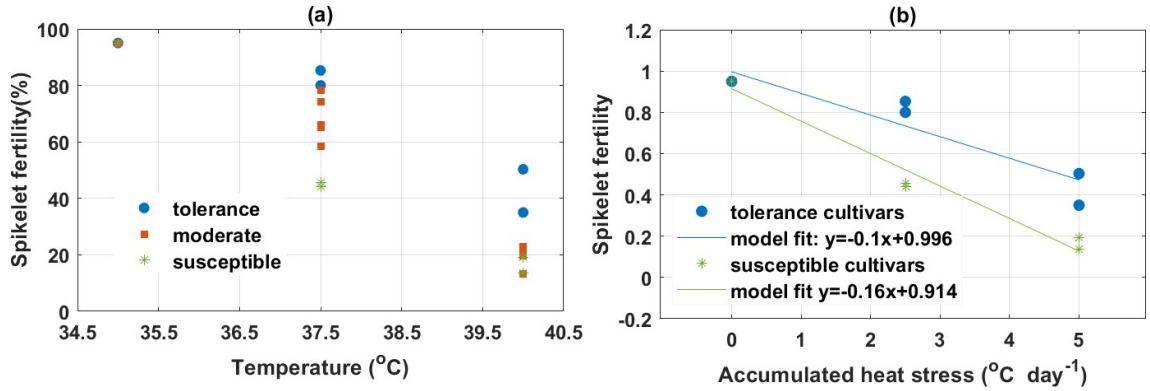

Figure S1: The measured response of spikelet fertility (%) to hourly temperature during anthesis for heat tolerant, moderate and susceptible cultivars as measured from Matsui et al. (2001), and (b) the modeled relationship between spikelet fertility (S_h, 0-1) to accumulated heat stress for heat tolerant and sensitive cultivars as simulated with main text equations (Eq(3) – Eq(4)). Red circles indicate observed values for heat tolerant cultivar and blue 'x' those for heat sensitive cultivars. Goodness of fit as shown.

Table S1: Data sources and experiments conducted in SPAR units used to evaluate different model versions. Experiments included three cultivars subjected to treatments with different day/night air temperature (T), CO_2 concentration, and/or paddy water temperatures. Some experiments were repeated with separate planting dates as indicated.

Subspecies	Variety	Day/night	Year	CO_2	T[1]	Planting date	Data sources
		hours		(ppm)	(°C)		
indica	IR30[3]	14/10	1987	330	31/31/27	Jan 22	[39, 41, 68]
			1987	330	31/31/27	June 23	
			1987	660	31/31/27	Jan 22	
			1987	660	31/31/27	June 23	
			1987[2]	160; 250; 330; 500; 600; 900	31/31/27	Jan 22; June 23	
			1989	330	28/21/25		[37, 38]
			1989	660	25/18/21		
			1989	660	28/21/25	July 14	
			1989	660	34/27/31		
			1989	660	37/30/34		
			1990	330	28/21/25	June 8	
			1990	660	28/21/25		
tropical japonica	Cocodrie[3]	15/9	2000	350	28/28	June 29	[54]
			2000	700	24/24		
			2000	700	28/28		
			2000	700	32/32		
			2000	700	36/36		
	Jefferson[3]	15/9	2000	350	28/28	June 29	
			2000	700	24/24		
			2000	700	28/28		
			2000	700	32/32		
			2000	700	36/36		

[1]Expressed as average daily day/night air temperature and paddy water temperature where available.
[2]Data were used to assess C x T interactions.
[3]Planting densities were 235 plants m^{-2} for IR30 and 36 plants m^{-2} for Cocodrie and Jefferson. Facilities used to grow IR30 were direct sown into a large 2 m^{-2} soil bin while Cocodrie and Jefferson studies were sown into pots.

Table S2: Calibration values for cultivars IR30, Cocodrie, Jefferson, Wells, and CLXL753. Values for IR30, Cocodrie, and Jefferson were obtained from the 1988 experiment at University of Florida, and Cocodrie from the 28 and 24°C ambient CO_2 treatments conducted at USDA-ARS (Table 1). Values for Wells and CLXL753 were obtained from a single year with multiple planting dates in 2013 in Arkansas. Leaf gas exchange parameters V_{cmax}, J_{max}, and T_P were obtained from Li et al. [36] and assumed constant for all cultivars.

Coefficient	Cultivar			
	IR30	Cocodrie/Jefferson*	Wells	CXL753
DVR_J	0.0180556	0.025	0.0158537	0.0158537
DVR_I	0.0180556	0.025	0.0158537	0.0158537
DVR_P	0.0134615	0.0152174	0.0125000	0.0125000
DVR_R	0.0285714	0.0344828	0.02500000	0.02500000
SPGF (number kg^{-1})	41000	41000	41348	50000
Base cardinal temperature for leaf area growth (°C)	12	10	10	10
Critical temperature for spikelet fertility (°C)	33.5	33	33.7	34.2
V_{cmax} (μmol m^{-2} s^{-1})	132 – 47**			
J_{max} (μmol m^{-2} s^{-1})	146 – 50**			
T_P (μmol m^{-2} s^{-1})	0.25 – 9.6**			

* Same calibration values were obtained for Cocodrie and Jefferson cultivars.
** Value varies with rice developmental stage.

Table S3: Correlation coefficients from linear regression between simulated yield versus cumulative growing season solar radiation and for different phenological stage durations for the five cultivars.

Cultivars	Variables	ORYZA-V1	ORYZA-V2	ORYZA-V3
CLXL753	Solar radiation	0.39	0.73**	0.72**
	Duration from emergency to maturity	0.45	0.32	0.36
	Duration from emergency to flowering	0.61**	0.73**	0.78**
	Duration from flowering to maturity	-0.30	-0.69**	-0.74**
Wells	Solar radiation	0.30	0.58*	0.56*
	Duration from emergency to maturity	0.36	0.15	0.09
	Duration from emergency to flowering	0.53*	0.62**	0.58*
	Duration from flowering to maturity	-0.31	-0.79**	-0.80**
IR30, Cocodrie, Jefferson***	Solar radiation	0.26	0.25	0.22
	Duration from emergency to maturity	-0.07	-0.20	-0.32
	Duration from emergency to flowering	-0.26	-0.38	-0.41
	Duration from flowering to maturity	0.13	0.08	-0.02

* Correlation was significant with $p < 0.05$.
** Correlation was significant with $p < 0.01$.
*** IR30, Cocodrie, and Jefferson results were combined for this assessment.