Supplementary Table S2. Seed set ratio of maize, *indica* rice, *japonica* rice, sorghum, and pearl millet under different temperature levels during flowering.

Plant species	Temperature (°C)	Seed set (%)	Reference
maize	36.0	84.5	Ref. 1
	36.0	72.3	
	36.0	82.8	
	36.0	75.3	
	40.0	17.9	
	40.0	16.3	
	40.0	58.1	
	40.0	3.0	
	40.0	18.5	Ref. 2
	40.0	25.6	
	40.0	23.1	
	40.0	8.3	
	40.0	7.5	
	40.0	13.2	
	40.0	32.7	
	40.0	21.7	
	40.0	15.0	
	40.0	75.3	Ref. 3
	40.0	67.4	
	40.0	69.8	
	40.0	56.6	
	40.0	62.8	
	40.0	70.1	
	40.0	68.1	
	40.0	59.4	
	34.0	76.8	Ref. 4
	34.0	80.3	
	36.0	84.2	
	36.0	73.9	
	38.0	47.8	
	38.0	64.0	
	40.0	16.3	
	40.0	27.6	
	38.4	34.9	Ref. 5
	38.4	47.4	
	38.4	33.0	
	38.4	34.1	
	38.4	67.3	
	38.4	63.4	
	38.4	35.3	
	38.4	24.9	
	38.4	63.5	
	38.4	45.1	
	38.4	48.6	
	38.4	19.1	
	38.4	35.6	
	38.4	27.6	
	38.4	25.4	
	38.4	60.0	
	38.4	67.4	
	38.4	43.3	
	38.4	69.3	
	38.4	59.6	
	38.4	25.4	

38.4	29.3	
38.4	65.0	
38.4	28.0	
38.4	51.9	
38.4	61.7	
38.4	56.8	
38.4	56.1	
38.4	38.9	
38.4	53.0	
38.4	43.4	
38.4	64.5	
38.4	41.0	
38.4	23.7	
38.4	39.1	
38.4	81.4	
38.4	30.6	
38.4	52.4	
38.4	59.0	
38.4	27.0	
38.4	52.9	
38.4	48.9	
38.4	62.4	
38.4	73.2	
38.4	46.7	
38.4	79.2	Ref. 6
38.4	81.5	
38.4	77.8	
38.4	75.0	
41.0	71.1	
41.0	65.9	
41.0	27.8	
41.0	28.3	
35.6	69.7	Ref. 7
39.4	75.1	
42.3	19.6	
35.0	89.6	Ref. 8
35.0	95.9	
35.0	93.4	
35.0	92.6	
35.0	96.9	
35.0	94.7	
35.0	92.8	
35.0	88.9	
35.0	76.2	
35.0	75.2	
35.0	55.8	
35.0	60.3	
35.0	76.0	
35.0	95.7	
35.0	80.6	
35.0	84.0	
35.0	79.4	
35.0	69.5	
35.0	86.5	
35.0	96.1	
35.0	77.4	
35.0	92.5	
35.0	88.7	

	35.0	59.7	
	35.0	72.3	
	35.0	76.7	
	35.0	72.2	
	35.0	95.8	
	35.0	96.5	
	35.0	95.7	
indica	30.0	93.2	Ref. 9
	30.0	75.4	
	30.0	80.0	
	30.0	79.3	
	30.0	76.9	
	30.0	81.5	
	30.0	77.3	
	30.0	71.9	
	30.0	75.4	
	30.0	83.0	Ref. 10
	30.0	82.8	
	30.0	75.2	
	30.0	84.7	
	30.0	87.4	
	30.0	72.3	
	30.0	70.2	
	30.0	75.6	
	31.0	93.0	
	31.0	88.2	
	31.0	83.4	
	31.0	69.5	
	31.0	70.3	
	31.0	73.4	
	31.0	91.8	
	31.0	86.5	
	31.0	80.7	
	31.0	66.4	
	33.0	83.3	Ref. 11
	33.0	87.9	
	33.0	80.0	
	33.0	64.7	
	33.0	69.1	
	33.0	60.7	
	33.0	83.3	
	33.0	87.9	
	33.0	80.0	
	33.0	64.7	
	33.0	69.1	
	33.0	60.7	
	34.0	89.6	
	34.0	87.7	
	34.0	89.6	
	34.0	87.7	
	30.0	94.4	Ref. 12, Ref. 13
	30.0	87.4	
	30.0	83.9	
	30.0	88.5	
	30.0	93.2	
	30.0	90.3	
	29.0	81.5	Ref. 14
	29.0	84.6	

32.0	76.1	Ref. 15
32.0	81.1	
32.0	79.7	
32.0	85.3	
32.0	82.1	
32.0	92.5	
32.0	91.4	
32.0	77.0	
32.0	80.4	
32.0	71.8	
32.0	84.6	
32.0	74.8	
32.0	87.3	
32.0	77.7	
32.0	82.5	
32.0	87.0	
32.0	80.6	
32.0	90.4	
32.0	89.3	
32.0	73.8	
32.0	70.2	
32.0	77.7	
32.0	77.7	
32.0	77.1	
30.0	91.5	Ref. 16
30.0	86.6	
30.0	83.1	
30.0	90.0	
30.0	94.0	
30.0	87.1	
30.0	76.1	
30.0	76.1	
30.0	75.1	
30.0	74.6	
30.0	72.6	
30.0	74.6	
32.0	79.1	Ref. 17
32.0	80.5	
32.0	79.1	
32.0	80.5	
32.0	57.4	
32.0	58.8	
32.0	56.0	
32.0	85.4	
32.0	87.5	
32.0	83.3	
32.0	72.0	Ref. 18
32.0	75.9	
32.0	81.6	
32.0	81.8	
32.0	73.0	
32.0	75.8	
32.0	75.4	
32.0	76.4	
32.0	89.0	
32.0	90.9	
30.0	92.2	Ref. 19
30.0	83.9	

	35.0	76.9	Ref. 20
	35.0	73.8	
	35.0	72.2	
	35.0	78.8	
	35.0	81.0	
	35.0	76.7	
	35.0	86.9	
	35.0	10.4	
	38.0	64.1	
	38.0	44.4	
	38.0	57.8	
	38.0	54.7	
	38.0	52.8	
	38.0	1.7	
	38.0	5.1	
	38.0	65.0	
	40.0	51.5	
	41.0	17.2	
	41.0	21.9	
	41.0	5.0	
	41.0	16.9	
	41.0	16.6	
	41.0	0.2	
	41.0	0.0	
	41.0	0.2	
	29.0	89.2	
	29.0	91.8	
	29.0	94.8	
japonica	28.0	71.5	Ref. 21
	28.0	61.0	
	28.0	81.2	
	28.0	85.1	
	28.0	78.6	
	29.0	94.5	
	29.0	95.0	
	29.0	94.0	
	26.0	99.0	Ref. 22
	26.0	98.1	
	26.0	99.8	
	26.0	98.8	
	26.0	97.5	
	26.0	100.0	
	36.0	85.6	Ref. 23
	36.0	89.5	
	36.0	82.1	
	36.0	92.2	
	36.0	94.9	
	36.0	89.3	
	36.0	38.8	
	36.0	36.9	
	36.0	65.5	
	36.0	65.8	
	36.0	34.6	
	36.0	32.3	
	36.0	46.0	
	36.0	45.8	
	36.0	86.0	

36.0	86.4
37.0	40.5
37.0	20.9
37.0	44.9
37.0	49.8
37.0	50.6
37.0	30.1
37.0	46.2
37.0	48.4
37.0	52.3
37.0	60.6
37.0	66.9
37.0	68.2
37.0	74.4
37.5	78.2
37.5	74.3
37.5	65.2
37.5	65.9
37.5	58.4
37.5	45.7
37.5	44.1
38.0	40.0
38.0	37.7
38.0	42.7
38.0	33.5
38.0	25.2
38.0	41.3
38.0	58.2
38.0	63.9
38.0	52.2
38.0	78.0
38.0	82.6
38.0	73.9
38.0	17.5
38.0	47.7
38.0	71.3
38.0	24.5
38.0	12.1
38.0	19.1
38.0	15.4
38.0	4.6
38.0	12.7
38.0	29.0
38.0	9.7
38.0	20.2
38.0	9.3
38.0	3.8
38.0	20.9
38.0	80.1
38.0	30.3
38.0	74.1
38.0	72.6
38.0	79.1
38.0	41.8
38.0	70.1
38.0	42.3
38.0	44.8
38.0	27.4

38.0	38.8
38.0	43.8
38.0	22.4
38.0	15.0
38.0	56.1
38.0	54.8
38.0	16.5
38.0	12.9
38.0	81.2
38.0	77.5
38.0	66.4
38.0	83.0
38.0	73.9
38.0	63.9
38.0	83.0
38.0	73.9
38.0	63.9
38.0	82.0
38.0	77.2
38.0	72.1
38.0	85.7
38.0	81.3
38.0	28.2
39.0	13.6
39.0	71.5
39.0	26.5
39.0	5.3
39.0	29.8
39.0	17.8
39.0	24.5
39.0	8.5
39.0	9.7
39.0	3.9
39.0	8.3
39.0	9.7
39.0	5.5
39.0	4.7
39.0	2.5
39.0	3.0
39.0	0.6
39.0	2.0
39.0	1.9
39.0	5.8
39.0	24.0
39.0	12.1
39.0	10.7
39.0	13.2
39.0	16.8
39.0	21.9
39.0	25.8
39.0	37.0
39.0	43.9
39.0	32.9
39.0	34.3
39.0	31.5
39.0	65.1
39.0	66.5
39.0	63.7

	39.0	53.9	
	39.0	55.3	
	39.0	52.5	
	39.0	82.6	
	39.0	84.0	
	39.0	81.9	
	40.0	35.0	
	40.0	50.3	
	40.0	19.8	
	40.0	22.9	
	40.0	22.2	
	40.0	13.2	
	40.0	19.9	
	40.0	19.2	
	40.0	13.7	
	40.0	48.9	
	40.0	52.3	
	40.0	45.4	
	40.0	57.9	
	40.0	62.1	
	40.0	53.9	
	40.0	27.3	
	40.0	29.4	
	40.0	25.4	
	40.0	38.1	
	40.0	40.2	
	40.0	36.8	
	40.0	21.5	
	40.0	25.8	
	40.0	17.8	
	40.0	30.5	
	40.0	36.0	
	40.0	24.9	
	40.0	17.6	
	40.0	23.4	
	40.0	11.8	
	40.0	16.3	
	40.0	18.1	
	40.0	13.7	
	40.0	12.3	
	40.0	14.2	
	40.0	10.0	
	40.0	30.8	
	40.0	31.6	
	40.0	28.5	
	41.0	28.0	
	41.0	32.4	
sorghum	32.0	98.7	Ref. 24
	32.0	99.6	
	32.0	98.5	
	32.0	89.4	
	32.0	99.2	
	32.0	95.6	
	32.0	95.4	
	32.0	93.5	
	35.0	87.3	
	35.0	95.1	
	35.0	75.0	

35.0	78.1	
35.0	80.9	
35.0	85.6	
35.0	88.6	
35.0	93.4	
35.0	93.0	
35.0	76.5	
35.0	88.0	
35.0	85.2	
38.0	60.3	
38.0	81.8	
38.0	51.8	
38.0	58.6	
38.0	61.0	
38.0	81.6	
38.0	40.9	
38.0	73.7	
38.0	60.8	
38.0	78.8	
38.0	62.1	
38.0	50.0	
38.0	51.5	
38.0	37.6	
38.0	65.8	
38.0	29.2	
40.0	0.0	
40.0	21.0	
32.0	87.9	Ref. 25
32.0	86.5	
32.0	83.7	
32.0	82.8	
32.0	90.3	
32.0	81.5	
32.0	80.1	
32.0	85.7	
32.0	83.2	
32.0	85.7	
32.0	92.3	Ref. 26
36.0	79.5	
40.0	1.4	
30.0	100.0	Ref. 27
30.0	100.0	
30.0	84.8	
36.0	76.3	
38.0	46.9	
40.0	24.8	
40.0	78.3	
42.0	6.8	
42.0	10.4	
43.0	52.2	
43.0	8.3	
38.0	79.3	Ref. 28
38.0	83.8	
38.0	73.2	
38.0	53.3	
38.0	64.2	
38.0	83.1	
38.0	45.6	

	38.0	85.5	
	38.0	74.4	
	38.0	79.0	
	38.0	86.6	
	38.0	45.0	
	38.0	31.0	Ref. 29
pearl millet	42.0	54.1	Ref. 30
	42.0	64.1	
	42.0	72.5	
	42.0	67.3	
	42.0	79.2	
	42.0	74.7	
	42.0	81.9	
	42.0	70.7	
	42.0	65.5	
	42.0	49.2	
	42.0	76.6	
	42.0	49.1	
	42.0	41.5	
	42.0	45.1	
	44.0	35.2	
	44.0	49.8	
	44.0	55.9	
	44.0	52.7	
	44.0	57.6	
	44.0	54.5	
	44.0	60.8	
	44.0	53.9	
	44.0	35.6	
	44.0	37.9	
	44.0	30.9	
	44.0	35.1	
	44.0	39.1	
	44.0	37.1	
	38.6	74.9	Ref. 31
	38.7	74.9	
	38.9	74.9	
	39.0	74.9	
	39.1	74.0	
	39.2	72.8	
	39.4	72.8	
	39.5	72.3	
	39.6	72.8	
	39.6	71.9	
	39.7	73.2	
	39.8	74.5	
	39.9	74.0	
	39.9	72.3	
	40.1	73.6	
	40.1	72.3	
	40.2	71.9	
	40.3	73.2	
	40.4	72.8	
	40.5	71.9	
	40.6	71.1	
	40.7	71.1	
	40.8	71.9	
	40.9	72.3	

41.0	68.9
41.0	69.8
41.1	70.6
41.1	72.3
41.2	72.3
41.3	73.6
41.3	71.9
41.5	71.9
41.5	73.2
41.6	72.8
41.6	69.8
41.8	69.4
41.9	71.1
42.0	71.1
42.1	69.8
42.2	66.4
42.4	62.6
42.6	59.1
42.7	56.2
42.8	51.5
42.9	48.9
43.1	45.1
43.3	42.1
43.4	40.4
43.6	37.4
43.9	36.2
44.2	36.6
44.4	33.2
44.6	28.5
44.9	25.5
45.0	26.8
45.2	23.8
45.3	23.8
45.4	23.0
45.6	22.1
45.7	21.3
45.9	20.4
46.1	21.3

References

1. Wang, Y., et al. Flowering dynamics, pollen, and pistil contribution to grain yield in response to high temperature during maize flowering. *Environ. Exp. Bot.* **158**, 80-88 (2019). doi: 10.1016/j.envexpbot.2018.11.007

2. Liu, X., Gu, M., Lv, X., Sheng, D., Wang, X., Wang, P., Huang, S. High temperature defense-pathways mediate lodicule expansion and spikelet opening in maize tassels. J. Exp. Bot. 74, 3684-3699 (2023). doi: 10.1093/jxb/erad115; PMID: 36967717

3. Wang, Y., et al. Reduction in seed set upon exposure to high night temperature during flowering in maize. *Physiol. Plant.* **169**, 73-82 (2020). doi: 10.1111/ppl.13049

4. Wang, Y., Impa, S.M., Sunkar, R., Jagadish, S.V.K. The neglected other half-role of the pistil in plant heat stress responses. *Plant Cell Environ.* **44**, 2200-2210 (2021). doi: 10.1111/pce.14067

5. Li, S., et al. Identification and analysis of heat resistance of different germplasm resources of maize at flowering stage. *Nutr. Diabetes* **9**, 28-37 (2019). doi: 10.1117/12.2513310

6. Mu, X., et al. Leaf photosynthetic fluorescence characteristics, pollination set and yield

components of different tolerant/sensitive maize varieties in response to high flowering temperatures. *Chin. J. Eco-Agric.* **30**, 57-71 (2022). doi: 10.12357/cjea.20210313

7. Sheng, D., Wang, Y., Huang, S., Tao, H., Wang, P. Effect of high temperature on maize plant morphology and function, yield composition and grain nutrients. *Journal of Maize Science* **28**, 86-92 (2020). doi: 10.13597/j.cnki.maize.science.20200513
8. Yu, K., et al. Screening and comprehensive evaluation of heat-tolerance of maize hybrids in flowering stage. *Journal of Maize Science* **24**, 62-71 (2016). doi: 10.13597/j.cnki.maize.science.20160213
9. Chen, J., et al. Physiological mechanism underlying the effect of high temperature during anthesis on spikelet-opening of photo-thermo-sensitive genic male sterile rice lines. *Sci. Rep.* **10**, 2210 (2020). doi: 10.1038/s41598-020-59183-0
10. Coast, O., et al. High night temperature induces contrasting responses for spikelet fertility, spikelet tissue temperature, flowering characteristics and grain quality in rice. *Funct. Plant. Biol.* **42**, 149-161 (2015). doi: 10.1071/FP14104
11. Fu, G., et al. Heat stress is more damaging to superior spikelets than inferiors of rice (*Oryza sativa* L.) due to their different organ temperatures. *Front. Plant Sci.* **7**, 1637 (2016). doi: 10.3389/fpls.2016.01637
12. Jagadish, S.V.K., Murty, M.V.R., Quick, W.P. Rice responses to rising temperatures–challenges, perspectives and future directions. *Plant Cell Environ.* **38**, 1686-1698 (2015). doi: 10.1111/pce.12430
13. Jagadish, S.V.K., et al. Physiological and proteomic approaches to address heat tolerance during anthesis in rice (*Oryza sativa* L.). *J. Exp. Bot.* **61**, 143-156 (2010). doi: 10.1093/jxb/erp289
14. Madan, P., et al. Effect of elevated CO_2 and high temperature on seed-set and grain quality of rice. *J. Exp. Bot.* **63**, 3843-3852 (2012). doi: 10.1093/jxb/ers077
15. Shi, W., et al. Source-sink dynamics and proteomic reprogramming under elevated night temperature and their impact on rice yield and grain quality. *New Phytol.* **197**, 825-837 (2013). doi: 10.1111/nph.12088
16. Shi, W., et al. High day- and night-time temperatures affect grain growth dynamics in contrasting rice genotypes. *J. Exp. Bot.* **68**, 5233-5245 (2017). doi: 10.1093/jxb/erx344
17. Wu, C., et al. Heat-induced phytohormone changes are associated with disrupted early reproductive development and reduced yield in rice. *Sci. Rep.* **6**, 34978 (2016).
18. Wu, C.S., et al. Enclosed stigma contributes to higher spikelet fertility for rice (*Oryza sativa* L.) subjected to heat stress. *The Crop Journal* **19**, 335-349 (2019). doi: 10.1016/j.cj.2018.11.011
19. Yan, H., et al. High temperature induced glume closure resulted in lower fertility in hybrid rice seed production. *Front. Plant Sci.* **7**, 1960 (2017). doi: 10.3389/fpls.2016.01960
20. Tetsuo, S., Shouichi, Y. High temperature-induced sterility in indica rices at flowering. *Japanese Journal of Crop Science* **47**, 6-17 (1978). doi: 10.1626/jcs.47.6
21. Endo, M., et al. High temperatures cause male sterility in rice plants with transcriptional alterations during pollen development. *Plant Cell Physiol.* **50**, 1911-1922 (2009). doi: 10.1093/pcp/pcp135
22. Ishimaru, T., et al. A genetic resource for early-morning flowering trait of wild rice Oryza officinalis to mitigate high temperature-induced spikelet sterility at anthesis. *Ann. Bot.* **106**, 515-520 (2010). doi: 10.1093/aob/mcq124; PMID: 20566680
23. Koike, S., et al. Cleistogamy decreases the effect of high temperature stress at flowering in rice. *Plant Prod. Sci.* **18**, 111-117 (2015). doi: 10.1626/pps.18.111

24. Chiluwal, A., et al. Deterioration of ovary plays a key role in heat stress-induced spikelet sterility in sorghum. *Plant Cell Environ.* **43**, 448-462 (2020). doi: 10.1111/pce.13673

25. Nguyen, C. T., et al. Genetic variability in high temperature effects on seed-set in sorghum. *Funct. Plant. Biol.* **40**, 439-448 (2013). doi: 10.1071/FP12264; PMID: 32481120

26. Prasad, P. V. V., Boote, K. J., Allen, L. H. Adverse high temperature effects on pollen viability, seed-set, seed yield and harvest index of grain-sorghum [*Sorghum bicolor* (L.) Moench] are more severe at elevated carbon dioxide due to higher tissue temperatures. *Agr. Forest. Meteorol.* **139**, 237-251 (2006). doi: 10.1016/j.agrformet.2006.07.003

27. Prasad, P. V., Djanaguiraman, M., Perumal, R., Ciampitti, I. A. Impact of high temperature stress on floret fertility and individual grain weight of grain sorghum: sensitive stages and thresholds for temperature and duration. *Front. Plant. Sci*. **6**, 820 (2015). doi: 10.3389/fpls.2015.00820

28. Singh, V., et al. Genotypic differences in effects of short episodes of high-temperature stress during reproductive development in sorghum. *Crop Sci.* **56**, 1561-1572 (2016). doi: 10.2135/cropsci2015.09.0545

29. Singh, V., et al. Sorghum genotypes differ in high temperature responses for seed set. *Field Crop. Res.* **171**, 32-40 (2015). doi: 10.1016/j.fcr.2014.11.003

30. Jukanti, A. K., Manga, V. K., Bhatt, R. K., Pathak, R. Differential response of pearl millet genotypes to high temperature stress at flowering. *J. Environ. Biol*. **38**, 791-797 (2017). doi: 10.22438/jeb/38/5/MRN-432

31. Gupta, S. K., et al. Seed set variability under high temperatures during flowering period in pearl millet (*Pennisetum glaucum* L. (R.) Br.). *Field Crop. Res*. **171**, 41-53 (2015). doi: 10.1016/j.fcr.2014.11.005