

## Supplemental material

**Table S1.** The information of 38 varieties.

Variety	Cross parents	Regions of adaption	Year of release
Jigu19	Ai88×Qingfenggu	Shanxi, Shandong, Henan, Shaanxi	2004
03-992	Yugu2×Chengnong2	Hebei, Liaoning, Neimongol, Shanxi, Shaanxi, Gansu	2010
Ji0515	9024-6×Jigu25	Hebei, Shandong, Henan	2010
Yugu1	Riben60/Tulong	Beijing, Tianjin, Hebei, Shanxi, Neimongol	1984
Chaogu15	Tiegu7×Chaogu9	Hebei, Liaoning, Neimongol, Shaanxi	2009
Henggu10	Zheng9188×Jigu15	Hebei, Shandong, Henan	2011
Ji9050	Zheng737qing×86-509	Hebei, Shandong, Henan	2002
Jigu31	Jigu19×Jigu25	Hebei, Shandong, Henan	2017
Baogu20	201094×528	Hebei, Shandong, Henan, Liaoning	2019
Henggu11	201075×An2491	Hebei, Shandong, Henan, Liaoning	2018
Yugu21	Jigu19×SK325	Henan, Hebei, Shandong	2013
Heng201101	Yugu18×M1	Hebei, jilin	2018
Heng2015-1	Jigu15	Hebei, jilin	2018
Heng2015-2	Henggu12×Henggu13	Hebei	2019
Henggu13	Yugu15×Jigu31	Hebei, Shandong, Henan, Liaoning, Jilin	2018
Heng1475	(Henggu12×Yugu18) ×kn2009-2	Hebei	2019
Heng2011-2	Jigu17×Henggu15	Hebei, jilin	2018
Henggu16	Shagu×K721-1	Hebei, jilin	2018

Henggu17	Shagu×K720-3	Hebei, jilin	2018
Zhonggu8	Jigu20×Q31	not clear	not clear
Yugu18	Yugu1×Bao282	Hebei, Shandong, Henan	2012
Henggu2018-2	Henggu11× (Hengyan5×SR3522)	Hebei	2019
Henggu2018-3	(Hengyan5×SR3522) ×M1508	Hebei	2019
Canggu9	Heng968×K492	Hebei	2018
Jigu42	An4585 ×(Shi98622×1310 - 2)	Hebei, Henan, Shandong, Xinjiang, Liaoning, Jilin, Neimongol, Shanxi, Shaanxi, Heilongjiang	2018
Henggu2018-1	Henggu11×Ji0506	Hebei	2018
Jigu39	An09-8525×[An4585×( Jigu24×2010-M1445)]	Hebei, Henan, Shandong, Shanxi, Xinjiang, Beijing, Liaoning, Jilin	2018
Zhonggu2	Yugu1×Ai88	Beijing, Tianjin, Hebei, Shanxi, Neimongol	2015
Zhonggu10	Zhonggu2 × Chuang877	Beijing, Tianjin, Hebei, Shanxi, Neimongol	2020
Jigu168	Yugu18×1310-2	Hebei, Liaoning, Neimongol, Shaanxi	2020
Jigu22	Yugu9×Jigu25	Hebei, Shandong, Henan	not clear
Daqitoubai	landrace	not clear	not clear
QisiqueZhang	landrace	not clear	not clear
Gushanggu	landrace	not clear	not clear
206085	landrace	not clear	not clear
K1174	landrace	not clear	not clear
K549	landrace	not clear	not clear

M1508	landrace	not clear	not clear
-------	----------	-----------	-----------

**Table S2.** The recorded dates of sowing, booting and harvest.

Year	Sowing date	Booting date	Harvest date
2011	20 June	5 August	27 September
2012	21 June	5 August	29 September
2013	23 June	6 August	30 September
2014	19 June	3 August	25 September
2015	21 June	4 August	27 September
2017	19 June	5 August	25 September
2018	18 June	3 August	23 September
2019	16 June	4 August	25 September
2020	23 June	6 August	29 September

**Table S3.** The maximum, minimum, mean and coefficient of variation of thousand grain weight of different varieties in nine seasons.

Treatment	Year	Maximum	Minimum	Mean	Coefficient of Variation (%)
WW	2011	3.22	2.66	2.854	7.95
	2012	2.93	2.40	2.62	8.51
	2013	2.87	2.66	2.794	3.49
	2014	2.92	2.69	2.82	3.21
	2015	2.93	2.67	2.84	3.82
	2017	2.79	2.49	2.62	4.04
	2018	2.77	2.32	2.51	7.33
	2019	3.11	2.90	2.79	10.65
	2020	3.15	2.83	2.99	4.52
WS	2011	3.21	2.56	2.81	8.94
	2012	2.88	2.37	2.55	8.96
	2013	2.68	2.39	2.58	4.42
	2014	2.89	2.35	2.68	6.60
	2015	2.92	2.64	2.79	4.26
	2017	2.68	2.48	2.55	2.94
	2018	2.75	2.25	2.46	7.96
	2019	2.52	2.36	2.62	10.36
	2020	3.11	2.81	2.96	4.67

**Table S4.** The maximum, minimum, mean and coefficient of variation of abortive grain rate weight of different varieties in nine seasons.

Treatment	Year	Maximum	Minimum	Mean	Coefficient of Variation (%)
WW	2011	18.53	5.22	14.22	39.02
	2012	20.79	13.07	15.32	23.94
	2013	23.10	17.54	20.03	11.19
	2014	27.23	14.61	22.77	19.02
	2015	19.84	15.48	17.65	8.75
	2017	28.26	18.40	23.14	14.45
	2018	24.90	15.59	19.43	17.12
	2019	13.09	11.19	11.93	8.51
	2020	13.09	11.53	12.48	5.44
WS	2011	23.34	12.45	17.31	22.65
	2012	18.76	13.63	16.00	15.92
	2013	23.44	8.77	19.03	31.31
	2014	36.15	10.99	18.86	47.21
	2015	21.56	16.67	18.65	9.78
	2017	29.63	20.84	24.24	14.03
	2018	20.42	15.40	17.32	11.02
	2019	19.01	15.40	16.75	11.74
	2020	11.67	9.35	10.60	9.18

**Table S5.** The maximum, minimum, mean and coefficient of variation of harvest index of different varieties in nine seasons

Treatment	Year	Maximum	Minimum	Mean	Coefficient of Variation (%)
WW	2011	0.58	0.45	0.54	9.78
	2012	0.52	0.43	0.47	7.99
	2013	0.62	0.46	0.54	12.07
	2014	0.57	0.43	0.49	9.41
	2015	0.44	0.42	0.43	1.94
	2017	0.54	0.48	0.52	4.30
	2018	0.48	0.38	0.44	8.65
	2019	0.50	0.46	0.48	4.31
	2020	0.55	0.53	0.54	1.51
WS	2011	0.53	0.44	0.49	8.29
	2012	0.65	0.45	0.53	17.14
	2013	0.53	0.41	0.49	9.89
	2014	0.49	0.35	0.41	14.63
	2015	0.54	0.46	0.49	6.00
	2017	0.52	0.45	0.48	5.43
	2018	0.50	0.40	0.45	8.21
	2019	0.45	0.34	0.40	14.10
	2020	0.56	0.45	0.50	10.89

**Table S6.** The major meteorological factors during the nine seasons at different growing stages of foxtail millet

Meteorological factors	Year	Whole Stage	Vegetative Stage	Reproductive Stage
Accumulated temperature (°C)	2011	2449.90	1337.70	1112.20
	2012	2481.60	1345.00	1136.60
	2013	2581.40	1314.20	1267.20
	2014	2497.10	1326.35	1170.75
	2015	2502.95	1320.53	1182.43
	2017	2546.00	1350.00	1196.00
	2018	2603.40	1396.10	1207.30
	2019	2616.60	1408.40	1208.20
	2020	2541.00	1312.90	1228.10
Minimum temperature (°C)	2011	21.16	22.91	19.34
	2012	21.17	23.18	19.17
	2013	22.41	23.10	21.64
	2014	20.82	22.46	19.23
	2015	20.95	22.39	19.53
	2017	21.46	22.77	20.20
	2018	22.30	23.92	20.69
	2019	22.06	23.70	20.41
	2020	21.60	22.16	21.03
Maximum temperature (°C)	2011	29.68	32.20	27.10
	2012	30.31	32.23	28.30
	2013	31.17	31.49	30.85
	2014	30.24	31.67	28.88
	2015	30.59	31.85	29.37
	2017	31.40	32.90	29.94
	2018	31.70	33.81	29.66
	2019	32.04	34.50	29.58
	2020	31.07	31.80	30.34
Diurnal temperature range (°C)	2011	8.52	9.27	7.76
	2012	9.14	9.14	9.13
	2013	8.76	8.31	9.21
	2014	9.42	9.19	9.64
	2015	9.64	9.45	9.83
	2017	9.94	10.13	9.74
	2018	9.41	9.85	8.97
	2019	9.99	10.80	9.17
	2020	9.47	9.64	9.31
Reference evaporation (mm)	2011	393.55	256.24	137.31
	2012	422.07	253.73	168.35

	2013	419.15	230.59	188.56
	2014	429.27	239.81	189.46
	2015	455.33	251.86	203.46
	2017	514.67	292.71	221.95
	2018	511.89	296.15	215.74
	2019	493.78	288.57	205.21
	2020	487.74	281.94	205.80
Sunshine duration (hr/d)	2011	4.66	6.48	2.84
	2012	5.81	6.64	4.97
	2013	4.92	5.08	4.76
	2014	6.29	6.52	6.056
	2015	6.53	6.40	6.66
	2017	7.47	7.08	7.87
	2018	6.67	7.33	6.02
	2019	6.43	6.92	5.93
	2020	7.46	8.50	6.43
Relatively humidity (%)	2011	75.38	68.00	82.76
	2012	73.92	70.63	77.20
	2013	72.78	73.35	72.20
	2014	71.59	70.29	72.90
	2015	74.87	72.98	76.77
	2017	74.68	70.12	79.24
	2018	72.88	70.06	75.69
	2019	64.82	60.14	69.49
	2020	69.82	66.22	73.41

**Table S7.** Component matrix for the principal component axes under well-watered (WW) treatment.

Meteorological factors	Principal Components				
	1	2	3	4	5
TGW	-0.002	0.019	-0.223	-0.216	-0.058
AGR	0.033	0.012	0.048	0.248	-0.034
HI	-0.006	0.132	-0.157	-0.076	0.290
AT-WhS	-0.027	0.128	0.070	-0.003	-0.037
AT-VS	-0.026	-0.039	0.200	-0.037	-0.052
AT-RS	-0.014	0.187	-0.062	0.023	-0.008
ET <sub>0</sub> -WhS	0.136	0.034	0.026	0.036	0.133
ET <sub>0</sub> -VS	0.132	0.008	0.052	-0.013	0.273
ET <sub>0</sub> -RS	0.11	0.051	-0.004	0.073	-0.028
Shr-WhS	0.189	-0.023	-0.069	0.010	0.077

Shr-VS	0.169	-0.027	-0.086	-0.094	0.254
Shr-RS	0.154	-0.015	-0.04	0.074	-0.056
RH-WhS	0.044	-0.018	0.019	0.239	0.238
RH-VS	-0.002	0.029	0.004	0.256	0.029
RH-RS	0.075	-0.059	0.028	0.137	0.362
DTR-WhS	0.122	-0.068	0.005	-0.034	-0.161
DTR-VS	0.097	-0.075	0.057	-0.109	0.010
DTR-RS	0.085	-0.024	-0.056	0.069	-0.269
Tmin-WhS	-0.077	0.190	0.078	0.027	0.132
Tmin-VS	-0.108	0.030	0.232	0.033	-0.030
Tmin-RS	-0.023	0.226	-0.052	0.016	0.187
Tmax-WhS	0.020	0.101	0.063	-0.001	-0.003
Tmax-VS	0.001	-0.027	0.170	-0.052	-0.008
Tmax-RS	0.029	0.164	-0.072	0.050	-0.001

TGW, though grain weight; AGR, abortive growth rate; HI, harvest index; AT, average temperature; ET<sub>0</sub>, the reference evapotranspiration; Shr, sunshine duration; RH, relative humidity; DTR, the diurnal temperature range; Tmin, daily minimum temperature; Tmax, daily maximum temperature; WhS, whole growth stage; VS, vegetative stage; RS, reproductive stage.

**Table S8.** Component matrix for the principal component axes under water-stress (WS) treatment.

Meteorological factors	Principal Components				
	1	2	3	4	5
TGW	0.006	-0.106	-0.009	-0.277	-0.041
AGR	0.077	0.025	-0.074	0.32	0.018
HI	0.003	0.004	0.100	-0.100	0.351
AT-WhS	-0.018	0.045	0.130	0.029	-0.029
AT-VS	-0.030	0.180	-0.041	0.063	-0.031
AT-RS	-0.001	-0.079	0.190	-0.011	-0.012
ET <sub>0</sub> -WhS	0.114	0.076	0.033	-0.028	0.124
ET <sub>0</sub> -VS	0.066	0.160	0.009	-0.106	0.196
ET <sub>0</sub> -RS	0.133	-0.018	0.048	0.050	0.029
Shr-WhS	0.172	-0.008	-0.026	-0.073	0.072
Shr-VS	0.083	0.059	-0.014	-0.257	0.141
Shr-RS	0.186	-0.049	-0.027	0.064	0.01
RH-WhS	0.044	0.017	-0.006	0.108	0.301

RH-VS	0.046	-0.077	0.048	0.172	0.171
RH-RS	0.027	0.106	-0.057	0.007	0.325
DTR-WhS	0.153	-0.003	-0.085	0.044	-0.105
DTR-VS	0.072	0.117	-0.093	-0.051	-0.037
DTR-RS	0.163	-0.138	-0.031	0.128	-0.125
Tmin-WhS	-0.098	0.081	0.205	-0.012	0.103
Tmin-VS	-0.101	0.175	0.045	0.112	0.029
Tmin-RS	-0.053	-0.011	0.236	-0.087	0.113
Tmax-WhS	0.023	0.06	0.103	0.019	0.011
Tmax-VS	-0.012	0.177	-0.031	0.031	-0.009
Tmax-RS	0.047	-0.084	0.168	0.002	0.02

---

TGW, though grain weight; AGR, abortive growth rate; HI, harvest index; AT, average temperature; ET<sub>0</sub>, the reference evapotranspiration; Shr, sunshine duration; RH, relative humidity; DTR, the diurnal temperature range; Tmin, daily minimum temperature; Tmax, daily maximum temperature; WhS, whole growth stage; VS, vegetative stage; RS, reproductive stage.