



Supplementary files

# Agro-Morphological and Biochemical Characterization of Korean Sorghum (*Sorghum bicolor* (L.) Moench) Landraces

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**Figure S1.** Representative sorghum seed samples.

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**Figure S1.** Representative sorghum seed samples.

**Table S1.** Qualitative agronomic properties of sorghum genotypes cultivated in Korea.

IT-Number	Collection province	Endosperm type	Panicle type	Panicle density	Seed color
28365	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
100010	Gyeongsangnam-do	Glutinous	Extremely spreading	Medium	White
100018	Gyeongsangnam-do	Glutinous	Extremely spreading	Medium	White
100024	Jeollanam-do	Glutinous	Extremely spreading	Dense	Orange
100045	Gangwon-do	Glutinous	Spreading	Dense	Brown
100046	Gangwon-do	Glutinous	Spreading	Dense	Brown
100047	Gangwon-do	Glutinous	Compact	Dense	Orange
100073	Jeollanam-do	Glutinous	Extremely spreading	Dense	Orange
100074	Chungcheongbuk-do	Glutinous	Compact	Dense	Orange
100090	Jeollanam-do	Common	Extremely spreading	Medium	Orange
100143	Jeollanam-do	Glutinous	Spreading	Dense	Yellow
100177	Jeollanam-do	Glutinous	Extremely spreading	Dense	Orange
103099	Jeollanam-do	Glutinous	Medium	Dense	Brown
103452	Jeollabuk-do	Glutinous	Extremely spreading	Dense	Yellow
103496	Jeollabuk-do	Glutinous	Extremely spreading	Dense	Orange
103970	Jeollabuk-do	Glutinous	Spreading	Dense	Brown
104574	Gangwon-do	Glutinous	Half broom corn	Dense	Yellow
104594	Gangwon-do	Glutinous	Medium	Dense	Brown
104963	Gyeongsangnam-do	Glutinous	Extremely spreading	Dense	Yellow
113294	Jeollabuk-do	Glutinous	Spreading	Dense	Orange
134976	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
158264	Gangwon-do	Glutinous	Compact	Dense	Orange
158265	Gangwon-do	Glutinous	Compact	Dense	Orange
162843	Jeollabuk-do	Common	Compact	Medium	Orange
162877	Jeollabuk-do	Glutinous	Compact	Dense	White
180549	Jeollabuk-do	Glutinous	Extremely spreading	Dense	Orange

180614	Gyeongsangnam-do	Glutinous	Compact	Dense	Orange
185760	Gangwon-do	Glutinous	Compact	Dense	Mixed
185796	Gyeongsangnam-do	Glutinous	Half broom corn	Dense	Brown
185807	Jeollanam-do	Glutinous	Spreading	Dense	Mixed
185812	Jeollanam-do	Glutinous	Spreading	Dense	Orange
185813	Jeollabuk-do	Glutinous	Spreading	Dense	Orange
185816	Chungcheongnam-do	Glutinous	Spreading	Dense	Orange
195442	Gangwon-do	Glutinous	Compact	Dense	Orange
208560	Jeollanam-do	Glutinous	Extremely spreading	Dense	White
208562	Chungcheongnam-do	Glutinous	Extremely spreading	Dense	Yellow
208566	Gyeongsangbuk-do	Glutinous	Extremely spreading	Dense	Brown
208567	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
208568	Jeollanam-do	Glutinous	Extremely spreading	Dense	Orange
208901	Incheon	Glutinous	Extremely spreading	Dense	Orange
221619	Gangwon-do	Glutinous	Extremely spreading	Dense	Orange
230297	Gangwon-do	Glutinous	Compact	Dense	Orange
235850	Gangwon-do	Glutinous	Compact	Dense	Orange
235856	Gangwon-do	Glutinous	Spreading	Dense	Orange
251882	Gangwon-do	Glutinous	Compact	Dense	Orange
262553	Gangwon-do	Glutinous	Compact	Dense	Orange
262554	Gangwon-do	Glutinous	Compact	Dense	Orange
262557	Gangwon-do	Glutinous	Compact	Dense	Orange
262566	Chungcheongbuk-do	Glutinous	Medium	Dense	Orange
262570	Gangwon-do	Glutinous	Compact	Dense	Orange
262576	Chungcheongbuk-do	Glutinous	Compact	Dense	Orange
264998	Chungcheongbuk-do	Glutinous	Compact	Dense	Orange
270343	Gangwon-do	Glutinous	Compact	Dense	Orange
270346	Gangwon-do	Glutinous	Compact	Dense	Orange
270349	Gangwon-do	Common	Compact	Dense	Brown

270366	Gangwon-do	Glutinous	Compact	Dense	White
278444	Gangwon-do	Glutinous	Compact	Dense	Orange
278445	Gangwon-do	Glutinous	Compact	Dense	Orange
286399	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
286403	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
286412	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
286423	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
286424	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
286446	Gangwon-do	Glutinous	Compact	Dense	Orange
286448	Gyeonghi-do	Glutinous	Extremely spreading	Dense	Mixed
297192	Incheon	Glutinous	Medium	Dense	Orange
300032	Gangwon-do	Glutinous	Compact	Dense	Orange
300088	Gangwon-do	Glutinous	Compact	Dense	Orange
320893	Chungcheongnam-do	Glutinous	Compact	Medium	Orange
320897	Gangwon-do	Glutinous	Compact	Dense	Orange
320898	Gangwon-do	Glutinous	Extremely spreading	Dense	Orange
322510	Gangwon-do	Glutinous	Compact	Dense	Orange
322513	Gangwon-do	Glutinous	Compact	Dense	Orange
322530	Chungcheongbuk-do	Glutinous	Compact	Medium	Orange
322531	Gangwon-do	Glutinous	Compact	Dense	Orange
322533	Chungcheongnam-do	Glutinous	Compact	Dense	Orange
322546	Gangwon-do	Glutinous	Compact	Dense	Orange
322549	Gangwon-do	Glutinous	Spreading	Dense	Orange
322554	Gangwon-do	Glutinous	Compact	Medium	Orange
322555	Gangwon-do	Glutinous	Compact	Dense	Orange
322558	Gangwon-do	Glutinous	Medium	Dense	Orange
322570	Gangwon-do	Glutinous	Compact	Medium	Orange
322571	Gangwon-do	Glutinous	Compact	Medium	Orange
322572	Gangwon-do	Glutinous	Compact	Dense	Orange

322578	Gangwon-do	Glutinous	Compact	Dense	Orange
322580	Gyeonghi-do	Glutinous	Compact	Medium	Orange
322613	Gangwon-do	Glutinous	Medium	Dense	White
322621	Gangwon-do	Glutinous	Compact	Dense	Orange
322622	Gangwon-do	Glutinous	Compact	Dense	Orange
329008	Gangwon-do	Glutinous	Compact	Dense	Orange
329026	Gangwon-do	Glutinous	Compact	Dense	Orange
329047	Gangwon-do	Glutinous	Extremely spreading	Dense	Yellow
329048	Gangwon-do	Glutinous	Extremely spreading	Dense	Yellow
329049	Gangwon-do	Glutinous	Extremely spreading	Dense	Yellow
329050	Gangwon-do	Glutinous	Extremely spreading	Dense	Orange
329053	Gyeongsangbuk-do	Glutinous	Compact	Medium	Red
329056	Gangwon-do	Glutinous	Compact	Medium	Orange
329063	Gyeongsangbuk-do	Glutinous	Compact	Dense	Red
329064	Gangwon-do	Glutinous	Compact	Dense	Red
329074	Gangwon-do	Glutinous	Compact	Dense	Orange
329076	Gyeonghi-do	Glutinous	Compact	Dense	Orange
329077	Gyeonghi-do	Glutinous	Compact	Dense	Yellow
329078	Gyeonghi-do	Glutinous	Compact	Dense	Orange
329082	Chungcheongbuk-do	Glutinous	Compact	Dense	Orange
329085	Gangwon-do	Glutinous	Extremely spreading	Dense	White
329089	Gangwon-do	Common	Compact	Dense	Orange
329090	Gangwon-do	Glutinous	Compact	Dense	Orange
329108	Gangwon-do	Glutinous	Extremely spreading	Dense	Orange
329120	Gangwon-do	Glutinous	Compact	Dense	Orange
329124	Gangwon-do	Glutinous	Compact	Dense	Orange
331874	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
331878	Gyeongsangbuk-do	Glutinous	Medium	Loose	Orange
331882	Gangwon-do	Glutinous	Compact	Dense	Orange

331889	Gyeonghi-do	Glutinous	Compact	Dense	Orange
331894	Gangwon-do	Glutinous	Compact	Dense	Orange
331896	Gangwon-do	Glutinous	Compact	Dense	Orange
331899	Gangwon-do	Glutinous	Compact	Dense	Red
331904	Gangwon-do	Glutinous	Compact	Dense	Orange
331907	Gangwon-do	Glutinous	Spreading	Dense	Orange
331921	Gangwon-do	Glutinous	Compact	Dense	Yellow
331922	Gangwon-do	Glutinous	Medium	Medium	Orange
331936	Gangwon-do	Glutinous	Medium	Dense	Yellow
331937	Gangwon-do	Glutinous	Compact	Dense	Orange
331938	Gangwon-do	Glutinous	Compact	Medium	Orange
331962	Gangwon-do	Glutinous	Compact	Dense	Orange
331963	Gangwon-do	Glutinous	Compact	Dense	Orange
331978	Jeollabuk-do	Glutinous	Spreading	Dense	Red
331988	Gangwon-do	Glutinous	Extremely spreading	Dense	Yellow
332014	Gangwon-do	Glutinous	Spreading	Dense	Orange
332024	Gyeonghi-do	Glutinous	Compact	Dense	Orange
332042	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
332046	Gyeonghi-do	Glutinous	Compact	Dense	Orange
340260	Gangwon-do	Glutinous	Spreading	Dense	Yellow
340261	Jeollabuk-do	Glutinous	Spreading	Dense	Yellow
K276521	Gyeongsangbuk-do	Glutinous	Spreading	Medium	White
231310	Gyeongsangbuk-do	Glutinous	Compact	Dense	Orange
Nampungchal	Korea	Glutinous	Compact	Dense	Orange
Wheatland	USA	Common	Compact	Loose	Orange
Sodamchal	Korea	Glutinous	Medium	Medium	Orange

**Table S2.** Statistical data of analysis of variance indicating the variation in biochemical and agronomical traits between sorghum genotypes.

Traits	Variable	Df	Sum of squares	Mean of squares	F-value	p-value
Biochemical	TTC	138	3584672.095	25975.885	803.380	< 0.0001
	TPC	138	1348.238	9.770	960.802	< 0.0001
	DPPH	138	20307.520	147.156	1668.727	< 0.0001
	FRAP	138	6879.263	49.850	375.984	< 0.0001
	ABTS	138	39256.241	284.466	475.357	< 0.0001
Agronomical	Stem height	138	962133.083	6971.979	114.187	< 0.0001
	Stem thickness	138	2672.580	19.367	9.048	< 0.0001
	Panicle length	138	14073.127	101.979	21.637	< 0.0001
	Panicle width	138	195797.135	1418.820	16.128	< 0.0001
	One-thousand seeds weight	138	4007.725	29.041	425.371	< 0.0010

Df: Degree of freedom; DPPH: 1,1-Diphenyl-2-picrylhydrazyl radical scavenging activity; FRAP: ferric reducing antioxidant power, TPC: Total phenolic content, TTC: Total tannin content.



**Table S3.** Variation of metabolite contents and antioxidant activities in sorghum landraces according to the collection area.

Variable	Values	CB	CN	GB	GG	GN	GW	IN	JB	JN
TTC (mg CE/g)	Minimum	140.50	132.16	93.95	201.95	61.32	0.12	178.53	26.24	45.76
	Maximum	343.04	300.13	409.72	428.95	350.38	388.25	231.28	415.58	377.60
	Mean	226.18 <sup>abc</sup>	217.92 <sup>abc</sup>	247.92 <sup>ab</sup>	273.73 <sup>a</sup>	148.34 <sup>c</sup>	234.40 <sup>ab</sup>	204.91 <sup>abc</sup>	181.65 <sup>bc</sup>	157.86 <sup>c</sup>
	CV (%)	28.15	28.33	37.28	25.08	71.04	35.12	12.87	66.70	64.40
TPC (mg GAE/g)	Minimum	5.21	4.64	2.25	5.76	2.86	1.17	4.04	1.57	2.44
	Maximum	7.18	6.45	9.08	9.31	4.70	10.23	6.89	8.62	8.83
	Mean	6.11 <sup>abc</sup>	5.53 <sup>bcd</sup>	5.99 <sup>abc</sup>	7.39 <sup>a</sup>	3.48 <sup>c</sup>	6.39 <sup>ab</sup>	5.47 <sup>bcd</sup>	4.30 <sup>de</sup>	4.59 <sup>cde</sup>
	CV (%)	11.24	11.58	27.98	17.65	18.96	25.19	26.15	40.97	37.20
ABTS (mg TE/g)	Minimum	20.75	23.05	9.79	25.67	4.92	1.84	20.33	1.64	8.03
	Maximum	35.39	34.42	39.22	41.50	25.11	67.60	32.24	41.89	31.51
	Mean	26.18 <sup>abc</sup>	26.01 <sup>abc</sup>	26.78 <sup>abc</sup>	32.20 <sup>a</sup>	13.00 <sup>d</sup>	28.77 <sup>ab</sup>	26.28 <sup>abc</sup>	19.07 <sup>bcd</sup>	17.89 <sup>cd</sup>
	CV (%)	17.53	18.68	22.81	18.46	54.74	32.69	22.67	53.74	36.33
DPPH (mg AAE/g)	Minimum	9.92	9.58	5.10	17.68	2.44	0.89	7.25	0.48	3.08
	Maximum	16.86	16.25	27.77	27.00	9.86	31.99	21.80	23.80	17.41
	Mean	13.54 <sup>bcd</sup>	14.30 <sup>bcd</sup>	14.80 <sup>bc</sup>	22.10 <sup>a</sup>	5.75 <sup>c</sup>	17.84 <sup>ab</sup>	14.53 <sup>bc</sup>	8.84 <sup>cde</sup>	7.92 <sup>de</sup>
	CV (%)	21.28	19.18	36.95	14.56	55.20	34.86	50.06	73.03	47.68
FRAP (mg AAE/g)	Minimum	7.16	8.75	3.57	9.81	1.76	0.63	7.84	0.63	2.27
	Maximum	10.76	17.02	16.31	17.68	9.28	20.38	12.16	21.56	13.07
	Mean	8.75 <sup>abc</sup>	11.35 <sup>ab</sup>	10.09 <sup>abc</sup>	12.60 <sup>a</sup>	4.66 <sup>d</sup>	10.92 <sup>abc</sup>	10.00 <sup>abc</sup>	7.70 <sup>bcd</sup>	6.85 <sup>cd</sup>
	CV (%)	13.73	29.10	26.54	24.20	58.00	35.06	21.61	71.11	44.08

Different superscript letters across a row indicate significantly different means ( $p < 0.05$ ).

ABTS: 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium radical cation scavenging activity; CB: Chungcheongbuk-do; CN: Chungcheongnam-do; DPPH: 1,1-Diphenyl-2-picrylhydrazyl radical scavenging activity; FRAP: ferric reducing antioxidant power; GB: Gyeongsangbuk-do; GG: Gyeonggi-do; GN: Gyeongsangnam-do; GW: Gangwon-do; IN: Incheon; JB: Jeollabuk-do; JN: Jeollanam-do; TPC: Total phenolic content; TTC: Total tannin content.

**Table S4.** Variation of metabolite contents and antioxidant activities in sorghum landraces according to seed color and seed weight.

Variable	Values	Seed color						Seed weight		
		Brown	Mixed	Orange	Red	White	Yellow	Large	Medium	Small
TTC (mg CE/g)	Minimum	46.94	164.88	45.76	153.66	0.12	61.32	76.45	0.12	0.48
	Maximum	383.50	267.16	428.95	409.72	140.75	415.58	428.95	415.58	383.50
	Mean	158.53 <sup>a</sup>	216.66 <sup>a</sup>	240.03 <sup>a</sup>	247.04 <sup>a</sup>	62.34 <sup>b</sup>	238.29 <sup>a</sup>	243.99 <sup>a</sup>	217.25 <sup>a</sup>	208.98 <sup>a</sup>
	CV (%)	83.34	19.28	31.16	35.36	81.71	40.59	34.05	42.69	48.84
TPC (mg GAE/g)	Minimum	2.44	3.62	2.31	4.62	1.17	3.60	2.25	1.57	1.17
	Maximum	10.23	9.31	9.08	7.43	3.24	8.89	9.00	9.31	10.23
	Mean	4.22 <sup>b</sup>	6.19 <sup>a</sup>	6.25 <sup>a</sup>	6.16 <sup>a</sup>	2.31 <sup>c</sup>	6.87 <sup>a</sup>	6.22 <sup>a</sup>	5.94 <sup>ab</sup>	5.46 <sup>b</sup>
	CV (%)	55.93	38.08	20.87	17.80	29.15	25.87	24.29	30.76	37.27
ABTS (mg TE/g)	Minimum	7.68	18.23	7.39	17.80	1.64	14.86	4.92	1.64	2.56
	Maximum	67.60	41.50	43.88	28.95	24.44	41.89	43.88	41.89	67.60
	Mean	19.14 <sup>b</sup>	30.27 <sup>a</sup>	28.05 <sup>a</sup>	23.62 <sup>ab</sup>	8.17 <sup>c</sup>	29.69 <sup>a</sup>	27.34 <sup>a</sup>	26.28 <sup>a</sup>	24.90 <sup>a</sup>
	CV (%)	98.13	31.45	23.65	16.50	88.71	26.97	28.77	34.96	53.53
DPPH (mg AAE/g)	Minimum	3.08	7.27	1.75	15.01	0.48	6.24	1.75	0.48	0.89
	Maximum	31.99	27.00	27.77	20.54	5.38	27.55	26.28	27.77	31.99
	Mean	9.26 <sup>b</sup>	15.65 <sup>ab</sup>	16.45 <sup>a</sup>	17.87 <sup>a</sup>	2.80 <sup>c</sup>	19.31 <sup>a</sup>	17.10 <sup>a</sup>	15.47 <sup>a</sup>	12.46 <sup>b</sup>
	CV (%)	102.75	53.18	33.70	10.96	64.37	34.88	36.18	45.76	55.14
FRAP (mg AAE/g)	Minimum	2.26	8.01	2.12	6.84	0.63	5.39	1.76	0.63	0.89
	Maximum	20.38	16.80	17.68	10.77	5.54	21.56	17.68	21.56	20.38
	Mean	6.31 <sup>b</sup>	12.66 <sup>a</sup>	10.63 <sup>a</sup>	9.26 <sup>ab</sup>	2.16 <sup>c</sup>	12.45 <sup>a</sup>	10.60 <sup>a</sup>	10.09 <sup>ab</sup>	8.75 <sup>b</sup>
	CV (%)	90.48	28.46	27.46	15.08	72.96	36.90	31.98	41.97	47.97

Different superscript letters across a row in a category indicate significantly different means ( $p < 0.05$ ).

ABTS: 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium radical cation scavenging activity;

DPPH: 1,1-Diphenyl-2-picrylhydrazyl radical scavenging activity; FRAP: ferric reducing antioxidant power;

TPC: Total phenolic content; TTC: Total tannin content.