

Comparative Influences of Environmental Factors on Growth Characteristics and Active compounds of *Hovenia dulcis* From Different Cultivation Regions in Korea

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Table S1. Growth characteristics of *Hovenia dulcis* in 17 different cultivation sites

	Length of the fruit bunch	Width of the fruit bunch	No. of peduncles per fruit	Length of peduncle	Width of peduncle	Diameter of peduncle	Fresh weight of peduncle	No. of seeds per peduncle	Sugar contents of peduncle	Fresh weight of 10 peduncle
	(mm)	(mm)	(ea)	(mm)	(mm)	(mm)	(g)	(ea)	(°Bx)	(g)
1	53.52 ± 6.02 ^{abc}	45.53 ± 2.31 ^{abc}	5.89 ± 1.07 ^{bc}	16.45 ± 1.37 ^{cd}	35.89 ± 2.97 ^{ab}	5.08 ± 0.45 ^{bcd}	1.24 ± 0.14 ^b	2.78 ± 0.38 ^{cde}	37.19 ± 3.12 ^{abcd}	11.65 ± 0.34 ^{cd}
2	44.42 ± 3.23 ^{bc}	49.64 ± 4.29 ^{ab}	7.67 ± 0.33 ^b	19.51 ± 2.95 ^{abcd}	38.82 ± 2.08 ^{ab}	5.09 ± 0.49 ^{bcd}	1.11 ± 0.40 ^{bc}	0.56 ± 0.69 ^f	43.01 ± 1.63 ^a	11.32 ± 3.20 ^{cd}
3	45.95 ± 5.16 ^{abc}	50.64 ± 1.50 ^{ab}	6.44 ± 1.64 ^{bc}	18.59 ± 0.99 ^{abcd}	34.93 ± 5.27 ^{ab}	5.61 ± 0.05 ^{abcd}	1.16 ± 0.26 ^{bc}	2.89 ± 0.19 ^{bcde}	39.50 ± 1.86 ^{abcd}	11.82 ± 2.13 ^{cd}
4	48.00 ± 4.36 ^{abc}	37.05 ± 7.74 ^c	4.22 ± 0.19 ^c	16.46 ± 3.44 ^{cd}	22.83 ± 4.29 ^c	4.25 ± 1.65 ^d	0.68 ± 0.24 ^c	3.11 ± 0.51 ^{abcd}	37.60 ± 3.54 ^{abcd}	8.31 ± 2.05 ^d
5	63.75 ± 12.13 ^{ab}	45.33 ± 2.35 ^{abc}	5.22 ± 0.38 ^c	17.35 ± 1.20 ^{bcd}	36.49 ± 3.37 ^{ab}	4.45 ± 1.25 ^{cd}	1.34 ± 0.26 ^b	3.00 ± 0.67 ^{abcd}	37.91 ± 1.64 ^{abcd}	12.90 ± 1.47 ^{bc}
6	47.39 ± 0.27 ^{abc}	41.87 ± 3.57 ^{bc}	5.67 ± 0.33 ^{bc}	15.50 ± 1.53 ^d	33.94 ± 3.83 ^{ab}	5.17 ± 0.32 ^{bcd}	1.14 ± 0.09 ^{bc}	1.89 ± 0.19 ^e	41.95 ± 1.72 ^{ab}	11.46 ± 1.78 ^{cd}
7	54.03 ± 5.71 ^{abc}	53.80 ± 3.48 ^a	10.00 ± 1.86 ^a	17.13 ± 0.99 ^{bcd}	40.84 ± 1.09 ^a	5.17 ± 0.84 ^{bcd}	1.17 ± 0.03 ^{bc}	2.67 ± 0.88 ^{cde}	36.24 ± 4.55 ^{abcd}	11.13 ± 0.58 ^{cd}
8	48.44 ± 19.93 ^{abc}	41.51 ± 9.44 ^{bc}	5.44 ± 2.01 ^{bc}	20.41 ± 1.52 ^{abc}	35.52 ± 7.10 ^{ab}	5.77 ± 1.71 ^{abcd}	1.20 ± 0.37 ^{bc}	2.78 ± 0.51 ^{cde}	40.51 ± 3.51 ^{abc}	11.90 ± 1.91 ^c
9	56.57 ± 8.13 ^{abc}	52.22 ± 8.14 ^{ab}	5.11 ± 0.51 ^c	18.81 ± 1.99 ^{abcd}	35.23 ± 6.05 ^{ab}	5.26 ± 0.64 ^{bcd}	1.08 ± 0.31 ^{bc}	3.89 ± 0.69 ^{ab}	37.63 ± 2.66 ^{abcd}	11.35 ± 1.01 ^{cd}
10	52.49 ± 7.55 ^{abc}	54.10 ± 8.43 ^a	6.22 ± 1.50 ^{bc}	22.44 ± 3.16 ^a	34.93 ± 5.10 ^{ab}	5.51 ± 0.58 ^{abcd}	1.16 ± 0.33 ^{bc}	2.33 ± 0.58 ^{cde}	42.70 ± 1.15 ^a	12.79 ± 1.81 ^{bc}
11	55.12 ± 10.48 ^{abc}	54.50 ± 4.63 ^a	4.33 ± 1.20 ^c	20.60 ± 0.95 ^{abc}	36.37 ± 1.96 ^{ab}	5.91 ± 0.57 ^{abc}	1.12 ± 0.10 ^{bc}	2.22 ± 0.69 ^{de}	33.01 ± 1.49 ^d	12.35 ± 0.29 ^{bc}
12	62.35 ± 20.88 ^{ab}	54.27 ± 3.89 ^a	4.78 ± 0.51 ^c	21.68 ± 4.20 ^{ab}	41.79 ± 5.96 ^a	6.10 ± 0.21 ^{ab}	2.51 ± 0.36 ^a	4.00 ± 0.33 ^a	33.71 ± 1.14 ^{cd}	25.19 ± 3.44 ^a
13	52.17 ± 4.10 ^{abc}	57.00 ± 6.85 ^a	5.67 ± 1.33 ^{bc}	22.45 ± 3.05 ^a	38.17 ± 4.33 ^{ab}	5.64 ± 0.99 ^{abcd}	1.52 ± 0.38 ^b	2.73 ± 0.84 ^{cde}	36.24 ± 3.08 ^{abcd}	15.84 ± 2.85 ^b
14	52.11 ± 4.33 ^{abc}	55.79 ± 4.56 ^a	6.44 ± 1.71 ^{bc}	22.26 ± 0.88 ^a	35.31 ± 1.86 ^{ab}	5.95 ± 0.51 ^{abc}	1.31 ± 0.29 ^b	3.00 ± 0.58 ^{abcd}	36.18 ± 0.71 ^{abcd}	13.13 ± 1.76 ^{bc}
15	52.29 ± 8.49 ^{abc}	54.50 ± 10.81 ^a	5.78 ± 0.69 ^{bc}	21.30 ± 2.08 ^{ab}	40.24 ± 9.25 ^{ab}	6.86 ± 0.44 ^a	1.50 ± 0.12 ^b	2.44 ± 0.19 ^{cde}	38.00 ± 1.76 ^{abcd}	14.69 ± 1.12 ^{bc}
16	64.83 ± 6.45 ^a	51.79 ± 5.94 ^{ab}	6.56 ± 1.50 ^{bc}	19.32 ± 4.18 ^{abcd}	38.74 ± 3.36 ^{ab}	4.63 ± 0.41 ^{bcd}	1.19 ± 0.36 ^{bc}	2.56 ± 0.19 ^{cde}	32.74 ± 10.88 ^d	12.20 ± 1.09 ^c
17	42.46 ± 12.51 ^c	42.30 ± 3.83 ^{bc}	4.44 ± 0.77 ^c	17.47 ± 1.61 ^{bcd}	31.27 ± 2.29 ^b	5.36 ± 0.20 ^{abcd}	1.41 ± 0.05 ^b	3.33 ± 0.58 ^{abc}	35.39 ± 3.06 ^{bcd}	14.57 ± 0.90 ^{bc}

Different letters in each column with different alphabets are statistically differences ($p < 0.05$) among the treatments according to Duncan's test

Table S2. Soil properties data of 17 different cultivation sites of *Hovenia dulcis*

	OM	TN	Avail. P ₂ O ₅	Exchangeable cation			
				K ⁺	Ca ²⁺	Mg ²⁺	Na ⁺
	(%)	(%)	(mg/kg)	----- (cmol ⁺ /kg) -----			
1	4.53±0.04 ^{bcd}	0.22±0.08 ^{cdefg}	304.22±82.85 ^{efgh}	0.40±0.10 ^c	8.03±4.80 ^{defg}	1.27±0.56 ^{bcd}	0.01±0.01 ^d
2	5.10±0.79 ^{bcd}	0.30±0.06 ^{bcd}	138.35±40.70 ^{gh}	0.85±0.06 ^{bc}	8.25±0.99 ^{cdefg}	2.57±0.13 ^{abcd}	0.08±0.01 ^{ab}
3	3.85±0.73 ^{bcd}	0.22±0.08 ^{cdefg}	758.99±84.25 ^{cdef}	0.86±0.30 ^{bc}	7.50±2.12 ^{defg}	1.37±0.19 ^{bcd}	0.04±0.02 ^{cd}
4	10.53±0.59 ^a	0.48±0.09 ^{ab}	870.18±122.47 ^{cde}	0.65±0.37 ^{bc}	5.08±1.96 ^{fg}	1.35±1.03 ^{bcd}	0.03±0.02 ^{cd}
5	7.47±2.70 ^{ab}	0.42±0.09 ^{abc}	1800.40±445.38 ^{ab}	1.02±0.22 ^b	14.06±3.48 ^{bc}	1.90±1.26 ^{bcd}	0.02±0.00 ^d
6	4.28±1.79 ^{bcd}	0.26±0.13 ^{cdefg}	1000.64±577.46 ^{cd}	0.82±0.35 ^{bc}	8.65±4.37 ^{cdefg}	2.04±1.16 ^{bcd}	0.02±0.01 ^{cd}
7	6.91±1.99 ^b	0.38±0.09 ^{abcd}	1855.04±337.64 ^a	1.64±0.57 ^a	10.72±2.54 ^{cdef}	3.07±1.45 ^{ab}	0.04±0.02 ^{cd}
8	3.03±0.51 ^{cde}	0.17±0.04 ^{defg}	1225.00±701.86 ^c	0.49±0.11 ^{bc}	11.44±5.83 ^{cde}	0.68±0.17 ^e	0.06±0.05 ^{bc}
9	6.40±1.04 ^{bc}	0.36±0.05 ^{abcde}	1145.11±267.80 ^{cd}	0.82±0.19 ^{bc}	8.03±1.62 ^{defg}	2.01±0.50 ^{bcd}	0.04±0.01 ^{cd}
10	4.11±1.18 ^{bcd}	0.25±0.12 ^{cdefg}	696.13±612.50 ^{cdefg}	0.88±0.02 ^{bc}	10.45±2.24 ^{cdef}	2.08±0.75 ^{bcd}	0.11±0.02 ^a
11	2.62±0.71 ^{de}	0.14±0.02 ^{fg}	117.10±24.85 ^{gh}	0.33±0.05 ^c	7.48±0.98 ^{defg}	1.21±0.02 ^{cde}	0.06±0.02 ^{bc}
12	10.25±2.78 ^a	0.55±0.17 ^a	1273.28±283.71 ^{bc}	0.97±0.47 ^b	17.57±2.70 ^{ab}	3.91±1.08 ^a	0.03±0.02 ^{cd}
13	5.26±3.52 ^{bcd}	0.28±0.21 ^{bcd}	241.47±158.25 ^{fgh}	0.80±0.30 ^{bc}	2.78±2.32 ^g	1.23±1.05 ^{bcd}	0.03±0.02 ^{cd}
14	2.52±1.44 ^{de}	0.16±0.10 ^{efg}	54.26±30.59 ^h	0.35±0.13 ^c	5.69±2.49 ^{efg}	0.81±0.47 ^{de}	0.02±0.00 ^d
15	1.29±0.29 ^e	0.09±0.01 ^g	117.37±28.07 ^{gh}	0.73±0.11 ^{bc}	7.73±1.86 ^{defg}	2.17±1.50 ^{bcd}	0.06±0.03 ^{bc}
16	5.85±2.66 ^{bcd}	0.33±0.16 ^{bcd}	783.35±27.65 ^{cdef}	0.68±0.34 ^{bc}	11.92±5.04 ^{cd}	1.17±0.31 ^{de}	0.04±0.01 ^{cd}
17	5.49±2.61 ^{bcd}	0.30±0.14 ^{bcd}	553.50±38.03 ^{defgh}	0.61±0.28 ^{bc}	20.14±2.50 ^a	3.03±1.68 ^{abc}	0.03±0.01 ^{cd}

Different letters in each column with different alphabets are statistically differences ($p < 0.05$) among the treatments according to Duncan's test

Table S3. Soil properties data of 17 different cultivation sites of *Hovenia dulcis*

	CEC	pH	EC	Sand	Silt	Clay
	(cmol ⁺ /kg)	(1:5)	(ds/m)	------(%)-----		
1	16.93±4.80 ^{abcd}	6.04±0.57 ^{bcdef}	0.12±0.05 ^c	75.14±1.31 ^{abc}	13.53±1.67 ^h	11.33±2.65 ^{def}
2	17.04±3.56 ^{abcd}	5.53±0.14 ^{efg}	0.16±0.01 ^{bc}	73.73±1.96 ^{bcd}	12.29±1.06 ^h	13.98±3.02 ^{bcd}
3	16.35±1.34 ^{abcd}	4.69±0.32 ^h	0.38±0.21 ^b	71.38±1.23 ^{de}	16.41±0.77 ^{fg}	12.20±1.62 ^{cde}
4	23.17±1.99 ^a	4.76±0.45 ^{gh}	0.24±0.01 ^{bc}	76.75±1.69 ^{ab}	13.88±1.55 ^h	9.36±0.44 ^{efg}
5	22.39±5.03 ^{ab}	5.53±0.52 ^{efg}	0.61±0.41 ^a	77.07±1.42 ^a	14.16±1.15 ^{gh}	8.77±2.35 ^{efg}
6	15.57±5.77 ^{bcd}	6.00±0.98 ^{bcdef}	0.15±0.05 ^{bc}	76.99±1.42 ^a	9.49±1.08 ⁱ	13.52±0.73 ^{bcd}
7	18.48±4.74 ^{abc}	6.58±0.42 ^{abc}	0.20±0.04 ^{bc}	64.54±3.89 ^{fg}	18.80±1.61 ^{def}	16.66±3.02 ^{ab}
8	16.70±1.39 ^{abcd}	6.99±0.69 ^a	0.18±0.15 ^{bc}	61.78±1.38 ^g	20.23±1.81 ^d	17.99±1.63 ^a
9	19.23±1.01 ^{abc}	5.21±0.25 ^{fgh}	0.23±0.04 ^{bc}	67.14±1.32 ^f	17.16±1.43 ^{ef}	15.70±1.20 ^{abc}
10	18.42±0.80 ^{abc}	5.78±0.28 ^{cdef}	0.22±0.08 ^{bc}	70.38±2.35 ^e	22.50±1.46 ^c	7.13±1.06 ^g
11	14.29±1.04 ^{cd}	5.64±0.31 ^{def}	0.10±0.03 ^c	71.73±1.15 ^{de}	19.52±0.92 ^{de}	8.75±0.83 ^{efg}
12	22.44±5.58 ^{ab}	6.89±0.31 ^a	0.26±0.08 ^{bc}	65.65±2.09 ^f	23.55±1.54 ^{bc}	10.80±0.70 ^{defg}
13	18.43±5.81 ^{abc}	4.43±0.20 ^h	0.19±0.10 ^{bc}	72.37±0.98 ^{cde}	20.01±1.59 ^d	7.62±2.48 ^{fg}
14	14.68±1.39 ^{cd}	6.31±0.20 ^{abcde}	0.08±0.04 ^c	61.66±1.92 ^g	29.21±0.88 ^a	9.13±2.79 ^{efg}
15	11.07±1.33 ^d	6.71±0.25 ^{ab}	0.09±0.01 ^c	71.05±0.97 ^{de}	16.52±0.79 ^{fg}	12.43±1.54 ^{cde}
16	20.04±3.08 ^{abc}	6.49±0.14 ^{abcd}	0.13±0.05 ^{bc}	65.24±1.01 ^f	23.89±1.95 ^{bc}	10.87±2.64 ^{defg}
17	20.38±2.45 ^{abc}	6.95±0.72 ^a	0.22±0.08 ^{bc}	66.18±1.08 ^f	25.61±1.08 ^b	8.21±1.21 ^{fg}

Different letters in each column with different alphabets are statistically differences ($p < 0.05$) among the treatments according to Duncan's test

Table S4. Climate factors of 17 different cultivation sites of *Hovenia dulcis*

Cultivation sites	Annual mean temp	Annual mean max temp.	Annual mean min temp.	Annual max temp.	Annual min temp.	Duration of Sunshine	Precipitation
	(°C)	(°C)	(°C)	(°C)	(°C)	(hr)	(mm)
1	13.30	19.30	8.30	36.20	-9.50	180.10	178.07
2	15.00	20.70	10.40	37.80	-8.20	177.65	157.71
3	15.20	20.50	10.90	36.90	-7.70	183.63	149.88
4	13.30	19.30	8.30	36.20	-9.50	180.10	178.07
5	13.30	19.30	8.30	36.20	-9.50	180.10	178.07
6	13.90	19.60	9.00	35.10	-10.10	187.89	122.46
7	15.10	19.40	11.40	36.90	-10.10	213.10	103.21
8	15.00	20.00	11.00	35.70	-7.30	191.23	151.75
9	14.60	19.80	9.80	35.10	-7.60	185.93	143.02
10	15.10	18.60	12.20	32.60	-7.00	208.74	145.99
11	15.10	18.60	12.20	32.60	-7.00	208.74	145.99
12	12.80	18.90	7.70	34.80	-12.40	173.44	135.40
13	12.60	18.00	8.00	34.90	-10.50	198.78	124.06
14	12.80	18.00	8.00	34.70	-12.60	196.41	134.14
15	12.80	18.00	8.00	34.70	-12.60	196.41	134.14
16	11.00	17.10	5.30	33.90	-20.30	179.36	129.32
17	11.00	17.10	5.30	33.90	-20.30	179.36	129.32