

[10.1071/CP22140](https://doi.org/10.1071/CP22140)

*Crop & Pasture Science*

### Supplementary Material

#### **Effects of cyanogenesis on morphology and estimated leaf flavonoid content in 51 white clover accessions**

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## Data for online supplementary material

**Table S1:** Coefficients of variance (in % with  $\pm$  s.e.m.) for nine growth traits in 25 cyanogenic and 26 acyanogenic white clover accessions.

measured trait	CV of acyanogenic accessions	CV of cyanogenic accessions	P
leaf area	12.82 $\pm$ 2.28	15.18 $\pm$ 1.92	1.00 0
specific leaf area	14.10 $\pm$ 2.27	15.77 $\pm$ 1.56	1.00 0
estimated total flavonoid content	15.93 $\pm$ 1.87	14.91 $\pm$ 1.38	1.00 0
number of leaves	15.92 $\pm$ 1.06	17.88 $\pm$ 1.24	1.00 0
shoot dry weight	37.92 $\pm$ 2.49	41.96 $\pm$ 2.64	1.00 0
root dry weight	64.82 $\pm$ 4.81	70.17 $\pm$ 4.92	0.99 6
root /shoot ratio (dry)	52.82 $\pm$ 4.68	59.45 $\pm$ 6.03	0.97 3

Significance at a probability level

of 0.05. ns - not significant.

**Table S2:** Means of measured growth traits and total leaf flavonoid content (each with  $\pm$  SE) of 51 white clover accessions.

accession ID	shoot FW (mg)	root FW (mg)	root/shoot ratio fresh	shoot DW (mg)	root DW (mg)	root/shoot ratio dry	number of leaves	leaf area (mm <sup>2</sup> )	specific leaf area (mm <sup>2</sup> /mg DW)	leaf flavonoid content (mg of QE/g of DW)
TRIF 166	9401.6 $\pm$ 2943.0	4377.8 $\pm$ 3299.3	0.42 $\pm$ 0.112	1348.2 $\pm$ 280.8	413.6 $\pm$ 167.3	0.254 $\pm$ 0.089	20.8 $\pm$ 1.9	763.12 $\pm$ 124.58	43.25 $\pm$ 8.08	2.11 $\pm$ 0.25
TRIF 229	7785.6 $\pm$ 4176.4	2275 $\pm$ 2042.4	0.31 $\pm$ 0.077	1076.8 $\pm$ 232.0	219.2 $\pm$ 96.4	0.176 $\pm$ 0.049	16.4 $\pm$ 0.9	1223.85 $\pm$ 32.32	65.97 $\pm$ 6.01	2.09 $\pm$ 0.19
TRIF 231	15697.6 $\pm$ 2578.8	5634.2 $\pm$ 1440.1	0.358 $\pm$ 0.026	1962.2 $\pm$ 254.3	614.2 $\pm$ 109.2	0.306 $\pm$ 0.016	21.6 $\pm$ 1.3	1452.55 $\pm$ 114.74	65.65 $\pm$ 2.82	1.95 $\pm$ 0.18
TRIF 246	11177.4 $\pm$ 5950.4	4472.2 $\pm$ 3138.9	0.348 $\pm$ 0.077	1392.2 $\pm$ 372.5	405.8 $\pm$ 156.2	0.224 $\pm$ 0.073	19.6 $\pm$ 1.7	1135.09 $\pm$ 207.32	65.17 $\pm$ 2.81	2.49 $\pm$ 0.17
TRIF 284	13342 $\pm$ 3524.6	8694 $\pm$ 5665.8	0.62 $\pm$ 0.156	1795 $\pm$ 178.6	1311.2 $\pm$ 462.0	0.7 $\pm$ 0.238	23.4 $\pm$ 1.4	1112.68 $\pm$ 109.18	53.34 $\pm$ 4.05	1.72 $\pm$ 0.63
TRIF 285	8314.6 $\pm$ 4282.3	2837.8 $\pm$ 1398.6	0.44 $\pm$ 0.129	1108.4 $\pm$ 185.1	285.6 $\pm$ 60.8	0.312 $\pm$ 0.102	21.4 $\pm$ 1.3	693.89 $\pm$ 24.51	58.94 $\pm$ 10.91	2.05 $\pm$ 0.23
TRIF 286	9411.2 $\pm$ 3941.0	4162.0 $\pm$ 2171.4	0.421 $\pm$ 0.042	1139 $\pm$ 236.0	550.6 $\pm$ 165.9	0.478 $\pm$ 0.094	21 $\pm$ 2.5	951.21 $\pm$ 58.18	50.90 $\pm$ 15.40	1.78 $\pm$ 0.37
TRIF 1155	7195.6 $\pm$ 1109.4	2989.2 $\pm$ 1552.5	0.348 $\pm$ 0.069	780.6 $\pm$ 122.5	259.8 $\pm$ 119.9	0.278 $\pm$ 0.088	17.2 $\pm$ 1.3	827.16 $\pm$ 8.69	57.77 $\pm$ 11.22	1.18 $\pm$ 0.10
TRIF 1156	7421.4 $\pm$ 1345.3	2553.8 $\pm$ 921.3	0.356 $\pm$ 0.073	899.8 $\pm$ 102.6	277 $\pm$ 49.9	0.314 $\pm$ 0.059	16.2 $\pm$ 0.7	1283.32 $\pm$ 94.69	54.07 $\pm$ 8.64	1.88 $\pm$ 0.66
TRIF 1162	8127 $\pm$ 4127.5	4821.2 $\pm$ 3275.1	0.636 $\pm$ 0.118	993 $\pm$ 286.0	669.8 $\pm$ 265.6	0.542 $\pm$ 0.154	17 $\pm$ 1.0	858.33 $\pm$ 288.91	36.12 $\pm$ 4.94	2.38 $\pm$ 0.22
TRIF 1165	9997.8 $\pm$ 5747.8	4806.8 $\pm$ 1785.8	0.638 $\pm$ 0.167	1412.2 $\pm$ 269.2	413.2 $\pm$ 89.1	0.316 $\pm$ 0.061	18.6 $\pm$ 1.1	740.49 $\pm$ 48.37	45.57 $\pm$ 24.87	2.05 $\pm$ 0.47
TRIF 1169	10502.6 $\pm$ 2959.4	5176.6 $\pm$ 2642.9	0.536 $\pm$ 0.139	1668 $\pm$ 304.4	478.6 $\pm$ 164.5	0.252 $\pm$ 0.067	21 $\pm$ 1.3	839.39 $\pm$ 13.20	51.24 $\pm$ 3.81	2.28 $\pm$ 0.11
TRIF 1178	4774.6 $\pm$ 2048.7	2335.6 $\pm$ 1958.1	0.474 $\pm$ 0.164	609.2 $\pm$ 191.5	195 $\pm$ 111.8	0.338 $\pm$ 0.216	17.4 $\pm$ 1.9	654.87 $\pm$ 29.43	49.18 $\pm$ 8.72	1.91 $\pm$ 0.38
TRIF 1179	14301.8 $\pm$ 3368.4	8225.4 $\pm$ 2815.5	0.594 $\pm$ 0.094	2035.8 $\pm$ 276.0	964 $\pm$ 154.2	0.496 $\pm$ 0.089	23 $\pm$ 1.6	1343.72 $\pm$ 24.18	54.66 $\pm$ 9.36	2.23 $\pm$ 0.47
TRIF 1180	9097 $\pm$ 1207.2	4805 $\pm$ 1573.9	0.522 $\pm$ 0.064	1519.6 $\pm$ 148.2	745.4 $\pm$ 121.2	0.486 $\pm$ 0.073	20.4 $\pm$ 1.6	1051.53 $\pm$ 125.33	46.14 $\pm$ 5.35	2.19 $\pm$ 0.56
TRIF 1181	9586.2 $\pm$ 3182.2	4576 $\pm$ 2878.7	0.438 $\pm$ 0.073	1214.2 $\pm$ 266.5	516.2 $\pm$ 212.4	0.358 $\pm$ 0.078	19 $\pm$ 2.0	1047.08 $\pm$ 172.95	54.08 $\pm$ 4.36	1.77 $\pm$ 0.27
TRIF 1183	13126.8 $\pm$ 3688.8	7369 $\pm$ 1593.1	0.578 $\pm$ 0.062	1790.4 $\pm$ 178.9	813.8 $\pm$ 42.4	0.462 $\pm$ 0.027	22.8 $\pm$ 1.2	1013.65 $\pm$ 66.19	45.00 $\pm$ 3.16	2.12 $\pm$ 0.28
TRIF 1194	7126.8 $\pm$ 1890.6	1640.2 $\pm$ 664.9	0.234 $\pm$ 0.032	858.6 $\pm$ 132.0	139 $\pm$ 19.2	0.166 $\pm$ 0.007	16.6 $\pm$ 0.5	1116.78 $\pm$ 84.54	53.88 $\pm$ 7.76	2.15 $\pm$ 0.15
TRIF 1195	8587.8 $\pm$ 2873.3	5317.6 $\pm$ 3121.6	0.634 $\pm$ 0.139	1123.6 $\pm$ 226.2	565.6 $\pm$ 199.1	0.45 $\pm$ 0.085	21.2 $\pm$ 2.0	900.93 $\pm$ 21.26	53.42 $\pm$ 8.02	1.91 $\pm$ 0.50
TRIF 1197	10415.6 $\pm$ 1509.8	3429.6 $\pm$ 1822.2	0.348 $\pm$ 0.103	1240.8 $\pm$ 75.6	332.2 $\pm$ 93.3	0.268 $\pm$ 0.075	21 $\pm$ 1.3	938.27 $\pm$ 15.23	47.86 $\pm$ 6.12	1.95 $\pm$ 0.47

DW: dry weight, QE: Quercetin equivalent.

**Table S2 (continued):** Means of measured growth traits and total leaf flavonoid content (each with  $\pm$  SE) of 51 white clover accessions.

accessionID	shoot FW(mg)	root FW(mg)	root/shoot ratio fresh	shoot DW(mg)	root DW(mg)	root/shoot ratio dry	numberof leaves	leaf area (mm <sup>2</sup> )	specific leaf area (mm <sup>2</sup> /mg DW)	leaf flavonoid content (mg of QE/g of DW)
TRIF 1199	11034 $\pm$ 5367.9	3665.2 $\pm$ 3600.1	0.274 $\pm$ 0.098	1405.4 $\pm$ 350.4	510.8 $\pm$ 278.8	0.296 $\pm$ 0.102	20 $\pm$ 2.0	659.92 $\pm$ 59.59	49.97 $\pm$ 3.11	2.14 $\pm$ 0.40
TRIF 1200	12770.2 $\pm$ 5222.1	4816 $\pm$ 3166.2	0.334 $\pm$ 0.083	1912.6 $\pm$ 407.7	601.8 $\pm$ 201.7	0.268 $\pm$ 0.085	21 $\pm$ 2.1	1085.50 $\pm$ 24.76	52.31 $\pm$ 13.82	2.03 $\pm$ 0.12
TRIF 1213	12427.2 $\pm$ 5372.0	3805 $\pm$ 1967.2	0.332 $\pm$ 0.077	1580.6 $\pm$ 313.2	381.8 $\pm$ 116.1	0.228 $\pm$ 0.069	20.4 $\pm$ 2.4	1015.28 $\pm$ 49.85	53.88 $\pm$ 5.01	2.20 $\pm$ 0.44
TRIF 1231	7616.4 $\pm$ 3350.8	4042 $\pm$ 2825.2	0.578 $\pm$ 0.206	1215.4 $\pm$ 241.4	502.6 $\pm$ 187.1	0.396 $\pm$ 0.092	21.4 $\pm$ 1.9	800.52 $\pm$ 68.53	55.36 $\pm$ 18.88	2.62 $\pm$ 0.18
TRIF 1253	10813.4 $\pm$ 4278.8	4923.0 $\pm$ 1423.6	0.484 $\pm$ 0.074	1452.4 $\pm$ 292.9	568 $\pm$ 106.5	0.4 $\pm$ 0.063	18 $\pm$ 1.6	1099.32 $\pm$ 70.20	51.53 $\pm$ 7.08	1.94 $\pm$ 0.13
TRIF 1254	10070 $\pm$ 3174.6	5323.8 $\pm$ 2379.5	0.56 $\pm$ 0.118	1357.4 $\pm$ 199.4	535.6 $\pm$ 143.2	0.402 $\pm$ 0.090	20.2 $\pm$ 2.1	677.99 $\pm$ 33.96	46.02 $\pm$ 1.36	1.81 $\pm$ 0.23
TRIF 1256	7298.6 $\pm$ 2605.4	1740 $\pm$ 1224.7	0.228 $\pm$ 0.037	773.4 $\pm$ 172.2	175.6 $\pm$ 66.2	0.204 $\pm$ 0.043	17.8 $\pm$ 1.1	802.77 $\pm$ 60.04	45.41 $\pm$ 8.03	1.99 $\pm$ 0.15
TRIF 1257	7679.4 $\pm$ 2448.4	3131.2 $\pm$ 1998.3	0.374 $\pm$ 0.074	974 $\pm$ 148.6	328 $\pm$ 79.6	0.316 $\pm$ 0.059	21 $\pm$ 1.9	890.91 $\pm$ 59.27	68.41 $\pm$ 17.25	2.06 $\pm$ 0.42
TRIF 1258	9427 $\pm$ 2335.3	5780.2 $\pm$ 2287.9	0.618 $\pm$ 0.085	1479.4 $\pm$ 231.6	760 $\pm$ 193.8	0.504 $\pm$ 0.079	19.6 $\pm$ 2.2	928.69 $\pm$ 112.96	45.49 $\pm$ 4.58	2.07 $\pm$ 0.43
TRIF 1260	8139 $\pm$ 1953.7	4355.6 $\pm$ 2262.8	0.51 $\pm$ 0.074	1066.8 $\pm$ 185.5	420.2 $\pm$ 140.3	0.354 $\pm$ 0.089	17.6 $\pm$ 1.3	994.90 $\pm$ 96.46	48.29 $\pm$ 7.01	1.96 $\pm$ 0.20
TRIF 1266	10193.4 $\pm$ 5013.4	3409.4 $\pm$ 2004.3	0.352 $\pm$ 0.085	1356 $\pm$ 340.2	349.2 $\pm$ 115.1	0.262 $\pm$ 0.063	19.4 $\pm$ 2.6	995.96 $\pm$ 65.19	50.97 $\pm$ 7.90	1.96 $\pm$ 0.32
TRIF 1267	9005 $\pm$ 3463.6	4013.4 $\pm$ 2770.9	0.444 $\pm$ 0.118	1258.2 $\pm$ 331.8	412.6 $\pm$ 153.2	0.324 $\pm$ 0.088	17.6 $\pm$ 1.5	1302.11 $\pm$ 174.22	46.50 $\pm$ 10.55	1.93 $\pm$ 0.19
TRIF 1270	9831 $\pm$ 2770.6	3963.4 $\pm$ 3761.1	0.358 $\pm$ 0.115	1304.8 $\pm$ 211.2	331.8 $\pm$ 173.1	0.376 $\pm$ 0.261	18.2 $\pm$ 1.2	1072.18 $\pm$ 232.08	51.76 $\pm$ 2.16	2.39 $\pm$ 0.42
TRIF 1271	7108.6 $\pm$ 1077.9	3961.8 $\pm$ 2022.7	0.546 $\pm$ 0.104	965.6 $\pm$ 133.4	442.4 $\pm$ 115.2	0.442 $\pm$ 0.073	19.6 $\pm$ 1.9	649.04 $\pm$ 15.13	34.36 $\pm$ 6.88	1.93 $\pm$ 0.21
TRIF 1273	6405.4 $\pm$ 2651.9	1896.8 $\pm$ 784.2	0.314 $\pm$ 0.044	782.4 $\pm$ 160.7	157 $\pm$ 39.5	0.2 $\pm$ 0.024	16.2 $\pm$ 0.7	1210.97 $\pm$ 159.66	55.25 $\pm$ 6.86	2.05 $\pm$ 0.15
TRIF 1276	8538.8 $\pm$ 2515.6	3521.4 $\pm$ 1779.3	0.404 $\pm$ 0.091	1162.6 $\pm$ 208.6	286.6 $\pm$ 78.9	0.246 $\pm$ 0.076	15.2 $\pm$ 0.4	1542.43 $\pm$ 115.11	54.56 $\pm$ 8.35	2.47 $\pm$ 0.41
TRIF 1277	9523.8 $\pm$ 7861.0	4498.8 $\pm$ 2528.1	0.568 $\pm$ 0.099	1473.4 $\pm$ 468.5	465.6 $\pm$ 148.2	0.322 $\pm$ 0.057	19.6 $\pm$ 1.3	834.38 $\pm$ 56.59	42.81 $\pm$ 14.07	2.38 $\pm$ 0.73
TRIF 1278	10251.2 $\pm$ 4714.9	3864.6 $\pm$ 2927.2	0.342 $\pm$ 0.057	1407.4 $\pm$ 391.1	396 $\pm$ 207.7	0.216 $\pm$ 0.086	20.6 $\pm$ 2.3	1153.06 $\pm$ 146.36	53.58 $\pm$ 0.61	2.50 $\pm$ 0.70
TRIF 1279	7449.2 $\pm$ 2279.1	2172.6 $\pm$ 949.4	0.284 $\pm$ 0.034	793.8 $\pm$ 127.8	155.4 $\pm$ 42.1	0.172 $\pm$ 0.039	20.6 $\pm$ 2.3	1000.09 $\pm$ 153.17	54.72 $\pm$ 1.47	2.50 $\pm$ 0.70
TRIF 1281	8609.4 $\pm$ 3107.9	2829.6 $\pm$ 1065.4	0.336 $\pm$ 0.049	1126.6 $\pm$ 210.6	304.2 $\pm$ 48.2	0.3 $\pm$ 0.058	16.8 $\pm$ 0.6	982.11 $\pm$ 19.87	42.73 $\pm$ 8.96	2.11 $\pm$ 0.09

DW: dry weight,

QE: Quercetin equivalent.

**Table S2 (continued):** Means of measured growth traits and total leaf flavonoid content (each with  $\pm$  SE) of 51 white clover accessions.

accession ID	shoot FW (mg)	root FW (mg)	root/shoot ratio fresh	shoot DW (mg)	root DW (mg)	root/shoot ratio dry	number of leaves	leaf area (mm <sup>2</sup> )	specific leaf area (mm <sup>2</sup> /mg DW)	leaf flavonoid content (mg of QE/g of DW)
TRIF 1282	14668.4 $\pm$ 4998.8	5965 $\pm$ 2740.1	0.418 $\pm$ 0.062	1464.8 $\pm$ 202.1	555 $\pm$ 180.9	0.446 $\pm$ 0.203	19.8 $\pm$ 0.8	1182.53 $\pm$ 50.78	61.57 $\pm$ 2.92	2.59 $\pm$ 0.16
TRIF 1283	6760.8 $\pm$ 1773.4	4256.4 $\pm$ 2281.7	0.6 $\pm$ 0.115	1082.4 $\pm$ 138.9	410.4 $\pm$ 140.9	0.354 $\pm$ 0.100	16.4 $\pm$ 1.2	767.38 $\pm$ 106.16	33.30 $\pm$ 7.91	3.03 $\pm$ 0.36
TRIF 1284	16646.4 $\pm$ 5413.2	4806.8 $\pm$ 2411.3	0.272 $\pm$ 0.048	2196 $\pm$ 341.7	562.4 $\pm$ 144.0	0.23 $\pm$ 0.055	23 $\pm$ 1.8	1066.30 $\pm$ 143.13	59.05 $\pm$ 10.18	2.47 $\pm$ 0.36
TRIF 1285	6081.8 $\pm$ 3347.9	4333 $\pm$ 1710.1	0.798 $\pm$ 0.163	1103.6 $\pm$ 180.1	405 $\pm$ 84.8	0.374 $\pm$ 0.070	19.4 $\pm$ 0.7	838.61 $\pm$ 29.69	37.91 $\pm$ 7.42	2.08 $\pm$ 0.28
TRIF 1286	14822 $\pm$ 4337.7	3920.2 $\pm$ 737.6	0.29 $\pm$ 0.058	2163.2 $\pm$ 239.5	629.8 $\pm$ 176.4	0.292 $\pm$ 0.067	19.6 $\pm$ 0.7	1255.23 $\pm$ 55.01	52.49 $\pm$ 10.05	2.28 $\pm$ 0.45
TRIF 1287	14183.2 $\pm$ 4703.9	6287.4 $\pm$ 1853.5	0.476 $\pm$ 0.083	1204.4 $\pm$ 166.2	562.4 $\pm$ 131.5	0.578 $\pm$ 0.251	21.2 $\pm$ 1.6	1078.28 $\pm$ 113.37	54.56 $\pm$ 1.51	2.27 $\pm$ 0.16
TRIF 1288	10524 $\pm$ 3291.8	4907.8 $\pm$ 2607.5	0.432 $\pm$ 0.072	1506 $\pm$ 276.4	560.8 $\pm$ 152.7	0.338 $\pm$ 0.061	18.2 $\pm$ 0.9	1687.09 $\pm$ 127.20	48.49 $\pm$ 2.46	2.53 $\pm$ 0.10
TRIF 1291	16165 $\pm$ 2047.6	7218.2 $\pm$ 1907.6	0.446 $\pm$ 0.047	2053.8 $\pm$ 138.1	704.4 $\pm$ 115.5	0.34 $\pm$ 0.0497	18.4 $\pm$ 1.7	1664.86 $\pm$ 34.19	45.67 $\pm$ 6.78	2.11 $\pm$ 0.47
TRIF 1293	15844 $\pm$ 3259.7	4655 $\pm$ 3144.0	0.276 $\pm$ 0.072	2207.8 $\pm$ 317.2	594.8 $\pm$ 119.7	0.256 $\pm$ 0.041	22.2 $\pm$ 1.2	1221.77 $\pm$ 58.54	53.85 $\pm$ 9.27	2.20 $\pm$ 0.25
TRIF 1306	13974.4 $\pm$ 4489.4	6381 $\pm$ 4407.4	0.43 $\pm$ 0.104	1786.8 $\pm$ 324.9	638.4 $\pm$ 245.9	0.302 $\pm$ 0.083	19.8 $\pm$ 1.5	866.35 $\pm$ 32.75	61.09 $\pm$ 4.20	1.90 $\pm$ 0.39
TRIF 1320	10740.2 $\pm$ 5050.1	5718.8 $\pm$ 2794.4	0.556 $\pm$ 0.133	1623.4 $\pm$ 267.3	594.2 $\pm$ 185.2	0.356 $\pm$ 0.059	20 $\pm$ 2.0	1009.56 $\pm$ 38.10	47.35 $\pm$ 7.49	2.04 $\pm$ 0.37

DW: dry weight, QE: Quercetin equivalent